दून विश्वविद्यालय
मोथरोवाला रोड, केदारपुर, पो०ओ० डिफेन्स कालोनी,
देहरादून–248001(उत्तराखण्ड) भारत

DOON UNIVERSITY
Mothrowala Road Kedarpur, P.O. Defence Colony,
Dehradun-248001 (Uttarakhand) INDIA.

Sample Syllabus Structure of Employability/ Entrepreneurship/ Skill Development

Tel.: +91-135-2533136 (O), 2533115 (Telefax) E-mail : regoffice@doonuniversity.ac.in

Programme/Class: P GDegree	Year: 2	Semester: III
Subject: MBA		
Course Code: MBA918	Course Title: **Managing Innovation and Entrepreneurship**	

Course outcomes: On completion of the course, the learner will be able to

- develop understanding of key concepts of entrepreneurship and its application in businessopportunities
- learn creative process and design thinking for innovation
- plan business models and strategies for entrepreneurial venture
- develop insight and learn application of customer value proposition, market research, financing, andIPR for entrepreneurship

Credits: 4	Core Compulsory / Elective: Core Compulsory
Max. Marks: 25+75	Min. Passing Marks: 10+25

Total No. of Lectures-Tutorials-Practical (in hours per week): L-3 T-1 P-0

Unit		**No. of Lectures**
		45
I	Define Entrepreneurship, Entrepreneurship domain, Managers Entrepreneurs and Entrepreneurial Managers, Entrepreneurship and small business Characteristics of Entrepreneurs, Entrepreneurial Orientation, Entrepreneurial Motivation, Models of Entrepreneurial Motivation, Factors influencing Entrepreneurial Behaviour. Entrepreneurial Process Model, 3M Analysis for opportunity screening, New Venture creation process, Process of Enterprise formation	10
II	Importance of creativity management, Creative thinking process, key stages of the creative process, core components of individual creativity, Design thinking, Use of design thinking for innovation, link between creativity and innovation Defining Innovation, types of innovation, innovation lifecycles, sources of innovation, Strategies to encourage innovation Adoption and Diffusion of Innovation, Innovation Paradigms, Theories of Diffusion.	11

III	Approach to innovation and entrepreneurship to small, medium, and large corporations, innovation and entrepreneurship in the context of small and medium enterprises (SMEs) and large corporations, open innovation, process of innovation, radical innovations and incremental innovations Impact of changing environment on innovation and entrepreneurship, role of strategic management in the development of an innovative	12
	and entrepreneurial organization, link between innovation and entrepreneurship with strategy, internal organizational characteristics for innovation and entrepreneurship Disruptive Innovation, Pathways for Disruptive Innovation, Screening Opportunities and Assessing Markets, Causes of Innovation Failure, Customer Development Process, Customer Value Proposition, Market Research	
IV	Innovation and entrepreneurship in domestic and international business, Planning Business Models and Strategy, Developing Entrepreneurial strategy, Strategy development framework, Risk Management in Innovation, Planning and entrepreneurial risk perception Innovations through individuals and teams to meet customer demands, entrepreneurial behaviors for individuals and teams to identify and exploit opportunities, integration of entrepreneurship and marketing for market oriented and customer focused innovations	12

Suggested Readings:

1. Hisrich, Robert D. & Kearney, Claudine, "Managing Innovation and Entrepreneurship", Sage PublicationsLtd., 2014.
2. Mazzarol, Tim and Reboud, Sophie, "Entrepreneurship and Innovation: Theory, Practice and Context", 4th Edition, Springer, 2020.
3. Drucker, P., "Innovation and entrepreneurship", Routledge, 2014.
4. Shukla, M., "Social Entrepreneurship in India: Quarter Idealism and a Pound of Pragmatism", SagePublications Pvt. Limited, 2019.
5. Kumar, A., "Entrepreneurship: Creating and leading an entrepreneurial organization", Pearson Education,2012.

This course can be opted as an elective by the students of following subjects: Open for all

Suggested Continuous Evaluation Methods: In addition to the theoretical inputs the course will be delivered through Assignments, Presentation, Group Discussions and Case Studies. This will instil instudent a sense of problem identification, generating solution, decision making and practical learning.Student learning will be evaluated through Written Tests, Projects and Field Assignments, Quizzes.

Suggested equivalent online courses:

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Further Suggestions:

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E-204 ENTREPRENEURSHIP – 02 Credits

Objective: The aim of this paper is to provide the idea about entrepreneurial processes and skills for creating new business and to facilitate with the knowledge about how entrepreneurship can contribute in Indian Economy.

Contents: Concept and Evolution of Entrepreneurship, Classification and type of entrepreneurs, nature and importance of Entrepreneurs, Approaches to entrepreneurship, Opportunity Assessment in Entrepreneurship: Feasibility Plan Outline, Environmental Assessment in Entrepreneurship, Entrepreneurial Ventures and Financial Analysis, Writing an Effective Business Plan, Financial Sources for Entrepreneurial Ventures: Venture Capital financing, Angel investors and others, Entrepreneurial issues in various cultural context. The Entrepreneurial mind- set in individuals: Entrepreneurial motivation; Entrepreneurial process and strategies: developing Ideas and business opportunities, Business Models; Growth and Social Responsibility: Growth strategies, Harvesting and Exit strategies, The Entrepreneurial mind-set in Organizations: Corporate entrepreneurship; The Social entrepreneur.

READING:

1. Casson, M., Young, B., Basu, A., & Wadson, N. (Ed). (2008). The Oxford Handbook of Entrepreneurship. New York: Oxford University Press.
2. Donald, F. Kuratko., & Jeffrey, S. Hornsby. (2009). New Venture Management: The Entrepreneurship Roadmap. New Delhi: Pearson Education.
3. Hisrich, R. D., Peters, M. P., & Shepherd, D. A. (2010). Entrepreneurship (8th ed.). Irwin: McGraw-Hill.
4. Kaplan, J. M., & Warren, A. (2010). Patterns of Entrepreneurship Management (3rd ed.). Wiley.
5. Khanna, T. (2008). Billions of Entrepreneurs: How China and India Are Reshaping Their Futures and Yours. Harvard Business School Press.
6. Kuratko, D. F., (2009). Entrepreneurship: Theory, Process, Practice (8th ed.). South Western, Cengage Learning.
7. Mullins, J. (2010). The new business road test: What entrepreneurs and executives should do before writing a business plan (3rd ed.). Harlow: Prentice Hall Financial Times.
8. Mullins, J., & Komisar, R. (2009). Getting to Plan B Breaking through to a better business model. Boston: Harvard Business Press.

SDS-402 : Design Management & Entrepreneurship (4 Credits)

Design is inextricably linked to the way in which society, environment & business interact. The outcome of a design project is seen in products, services and processes. The course would explore the process involved in management of these projects and also design as an activity of user-centered, problem-solving process. It would also explore managing all aspects of design at two different levels – corporate & project. There will be an in-depth analysis of design at various layers of a corporate (1. Level of operations, tangible & touch, 2. At the level of tactics, systems & processes 3. At the level of strategy, policy & mission). Along with this the course also focuses on branding and identity. Understanding how branding and brand identity are strategic points of view and not merely advertising activities will form an important part of the course. Exercises that explore designing brand identities that reflect the values of the organization can be explored. Branding as a culture of the product and borrowing from the disciplines of anthropology, history, and sociology to understand products as cultural artifacts will form a part of the course. How brands and branding affect consumers, popular culture the companies themselves will also form a part of the course. The more recent trend of influencers and role of social media will also form a part of the course.

Assessment Criteria

1. Understanding of concepts
2. Ability to relate subject to Design
3. Class Participation
4. Expression & Communication Skills
5. Depth of ideas

References

1. Contemporary research in E-branding, Information Science Reference (2009); Subir Bandyopadhyay, Subir Bandyopadhyay
2. Beyond Branding, Kogan Page (2005), Nicholas Ind
3. Brands and Branding, Economist Books(2003); Rita Clifton
4. Value Proposition Design: How to Create Products and Services Customers Want – Alexander Osterwalder
5. Design Management: Using Design to Build Brand Value and Corporate Innovation - Brigitte Borja de Mozota
6. The Fundamentals of Design Management – Kathryn Best
7. Design Thinking: Integrating Innovation, Customer Experience, and Brand Value - Thomas Lockwood

MMS 534 : PROJECT MANAGEMENT & ENTREPRENEURSHIP DEVELOPMENT (3 CREDITS)

The objectives of this course are to:
1. To make them understand the concepts of Project Management for planning to execution of projects.
2. To make them understand the feasibility analysis in Project Management and network analysis tools for cost and time estimation.
3. To enable them to comprehend the fundamentals of Contract Administration, Costing and Budgeting.
4. Make them capable to analyze, apply and appreciate contemporary project management tools and methodologies in Indian context.

Course Outcomes On completion of this course, the students will be able to:
1.Understand project characteristics and various stages of a project.
2. Understand the conceptual clarity about project organization and feasibility analyses – Market, Technical, Financial and Economic.
3. Analyze the learning and understand techniques for Project planning, scheduling and Execution Control.
4. Apply the risk management plan and analyse the role of stakeholders.
5. Understand the contract management, Project Procurement, Service level Agreements and productivity.
6. Understand the How Subcontract Administration and Control are practiced in the Industry.

UNIT-1 Project – Definition and meaning – types of projects – appraisal of projects – need for project appraisal. Project life cycle. Project Management- Nature, scope, Process, elements, significance. Project planning. project financing

UNIT-2 Project feasibility studies- Project identification market & demand analysis, technical analysis, Project cost estimate, financial appraisal of single/multiple projects; Project scheduling with PERT/CPM, Project Implementation – scope - division of responsibilities, environment factors affecting project implementation.

UNIT-3 Project Monitoring & contract management, Project Appraisal, Project evaluation Review, Risk analysis in project management, need for training programmes for project management, Time value of money- Pay back period , NPV of inflows , IRR concepts

UNIT-4 Entrepreneurship- Definition, classification, nature & importance, growth of entrepreneurs, entrepreneurial development, Development of women entrepreneur's problems of entrepreneurship, Theories of entrepreneurship, Rural entrepreneurship- concept, need, problems, how to develop rural entrepreneurship.

UNIT-5 Entrepreneurial Motivation- Concept & Theories, Role of Government & Financial Institutions in entrepreneurship development, sources of finance, entrepreneurship in economic growth. Need for entrepreneurship development programmes (EDPs), Objectives of EDPs Economic and non economic factors for stimulating entrepreneurship development.

SUGGESTED READINGS:
1. Patel, B. (2010). Project Management. 2nd edition, Vikas Publishing , New Delhi

2. Chandra,P.(2014). Project Management. 8th edition. McGraw-Hill education
3. Rao, P.C.K. (2009). Project Management & Control. 2nd edition, Sultan Chand & Sons, New Delhi
4. Hisrich, R.D & Perts, M.P.(2002), Entrepreneurship. 5th edition Tata McGraw-Hill
5. Khanka, S.S. (2007), Entrepreneurial Development. 4rth Edition. S.Chand & Co.limited, New Delhi

Suggested Continuous Evaluation Methods: In addition to the theoretical inputs the course will be delivered through Assignments, Presentation, and Group Discussions. This will instil in student a sense of decision making and practical learning. Student learning will be evaluated through Written Tests, Projects and Field Assignments, Quizzes.

Programme/Class: B.Com(Hons) Degree	Year: Second	Semester: Third
Course/Paper-9(B)		
Course Code: BCH-303C	Course Title: Entrepreneurship and Small Business Management	
Course outcomes: The objective of this course is to understand the terminologies associated with the field of Entrepreneurship along with their relevance.		
Credits: 3	Compulsory	
Max. Marks: 25+75	Min. Passing Marks:	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 3-0-0		

Unit	**Topics**	**No. of Lectures** **Total=45**
I	**Introduction** Meaning, elements, determinants and importance of entrepreneurship and creative behavior, Entrepreneurship and creative response to the society problems and at work. Dimensions of entrepreneurship; intrapreneurship, technopreneurship, cultural entrepreneurship, international entrepreneurship, enetpreneurship, ecopreneurship, and social entrepreneurship.	9
II	**Types of Business Entities** Entrepreneurship and Micro, small and Medium Enterprises, Concept of business groups and role of business houses and family business in India. The contemporary role models in India business: their values, business philosophy and behavioural orientations. Conflict in family business and its resolution.	9
III	**Entrepreneurial Sustainability** Public and private system of stimulation: support and sustainability of entrepreneurship. Requirement, availability and access to finance, marketing assistance, technology, and industrial accommodation, role of industries/entrepreneur's associations and self-help groups. The concept, role and functions of business incubators, angel investors, venture capital and private equity fund. .	9
IV	**Business Plan Preparation** Sources of business ideas and tests of feasibility, Significance of writing the business plan/ project proposal. Contents of business plan/ project proposal. Designing business processes, location, layout, operation, planning & control: preparation of project report (various aspects of the project report such as size of investment, nature of product, market potential may be covered). Project submission/ presentation and appraisal thereof by external agencies, such as financial/non-financial institutions. .	9
V	**Mobilizing Resources** Mobilizing resources for start-up, Accommodation and utilities.	9

	Preliminary contracts with the vendors, suppliers, bankers, principal customers; contract management; Basic start-up problems	

Suggested Readings:

1. Desai, Vasant, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House
2. Desai, Vasant, "Management of Small Scale Industry", Generic
3. Drucker, Perer, "Innovation and Entrepreneurship", Harper Business; Reprint edition
4. Gupta, C.B. & Srinivasan, N.P., "Entrepreneurship Development", S. Chand
5. Kenneth, P.Van, "Entrepreneurship and Small Business Management"
6. Pareek, Udai& Ven, "Developing Entrepreneurship book on Learning System"
7. Agrawal, R.C., 'UdyamitaVikas"(Hindi)
8. Khanka, S.S. "Entrepreneurship Development", S. Chand & Company

Suggestive digital platforms web links- nptel, epgpathshala**,** swayam**,** startupsusa.org, www.econlib.org

Suggested Continuous Evaluation Methods: Practicals, Assignments, Presentations.

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Suggested equivalent online courses:

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Further Suggestions:

Latest Edition of text books may be used.

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MPHD 01 Research Methodology in Management Course

OBJECTIVES To understand the concept and process of Business research in business environment, to know the use of tools and techniques for exploratory, conclusive and causal research, to understand the concept of measurement in empirical systems and its validity and reliability, to use statistical techniques for analysis of research data and to realize the applications of Business research. The course will also introduce students to the safeguards against errors in both data collection and data analysis and reporting.

UNIT-1

Introduction: Concept of Research, Types of Research, Types of Business Problems Encountered by the Researcher, Process of Research: Steps Involved in Research Process, Research Design: Various Methods of Research Design, Collection of Data: Concept of Sample, Sample Size and Sampling Procedure, Various Types of Sampling Techniques, Determination and Selection of Sample Member, Types of Data: Secondary and Primary, Various Methods of Collection of Data.

UNIT-2

Preparation of Questionnaire and Schedule, Types of Questions, Sequencing of Questions, Check Questions, Length of Questionnaire, Precautions in Preparation of Questionnaire and Collection of Data, Analysis of Data: Coding, Editing and Tabulation of Data, Various Kinds of Charts and Diagrams Used in Data Analysis: Bar and Pie Diagrams and their Significance, Use of SPSS in Data Analysis.

UNIT-3

Rote of statistics: Applications of inferential statistics in managerial decision-making; Measures of central tendency, Measures of Dispersion, Coefficient of Variation (C.V.), Skewness, Kurtosis. , Time series analysis, Components of time series, Trend analysis: Least Square method - Linear and Non- Linear equations.

UNIT-4

Correlation:- Meaning and types of correlation, Karl Pearson and Spearman rank correlation, Regression:- Meaning , Regression equations and their application , Partial and Multiple correlation & regression :- An overview.

UNIT-5

Estimation Theory and Hypothesis Testing: Sampling theory; Formulation of Hypotheses; Application of Z test, t-test, F-test and Chi-Square test using SPSS, Techniques of association of Attributes & Testing.

Suggested Readings:

1. Rubin, L. (2000). *Statistics for Management. 7th ed*. Pearson, New Delhi.
2. Malhotra, N. (2019). *Marketing Research: An Applied Orientation. 7th ed.* Pearson, New Delhi.
3. Gupta, S. P. (2014). *Statistical Methods. 43rd ed*. Sultan Chand.
4. Beri, G. C. (2005). Business Statistics. *2nd ed*. Tata McGraw Hill publishing company limited.
5. Cohen, L., Manion, L. & Morrison, K. (2017). *Research Methods in Education. 8th ed*. Routledge.

IMBA 406- ENTREPRENEURSHIP DEVELOPMENT (2 CREDITS)

UNIT-1 Entrepreneurship- definition, classification, nature & importance, entrepreneur- Types & functions growth of entrepreneurs, entrepreneur Vs Managers Characteristics of successful entrepreneur.

UNIT-2 Women entrepreneurship- Meaning, Characteristics, functions, Growth of women entrepreneur, problems of women entrepreneur, factor influencing women entrepreneur.

UNIT-3 Entrepreneurship Development Programme - Need & objective, Rural entrepreneurship- concept, need, problems, how to develop rural entrepreneurship.

UNIT-4 Entrepreneurial Motivation- Concept, Theories factors entrepreneurial competencies concept, problems of entrepreneurship: entrepreneurial environment.

UNIT-5 Role of Government and financial Institution in entrepreneurship development sources of finance, Institutionalize finance to entrepreneur's role of technical consultancy organization in developing

SUGGESTED READINGS:

1. Hisrich, R.D & Peters, M.P.(2002) *Entrepreneurship 5th edition*, Tata McGraw-Hill
2. Khanka, S.S.(2007), *Entrepreneurial Development. 4rth Edition.* S.Chand & Co. limited, New Delhi
3. Desai, Vasant. (2010). *Small scale industries & entrepreneurship*. 7th edition. Himalaya Publishers.
4. Zimmerer, T.W. & Scarborough, N.M. (2005). *Essentials of Entrepreneurship & small Business Management 4th Edition* Prentice Hall, New Jersey
5. Mohanty, S.K. (2012). Fundamentals of Entrepreneurship. 8th edition, PHI learning Pvt. Ltd., New Delhi.

E-103, BUSINESS COMMUNICATION – 02 Credits

Course Objective: The objective of this paper is to develop and enhance the skill of candidates in such a manner so that they can communicate effectively through either written or oral source. The focus will be on the practical session with emphasis on skill development of the participants.

Course Content: Concept, Significance and Practice of Business Communication, Types & Elements of Communication, Channels of Organizational Communication, Written Communication: Principles, Proposal, Report & Letter Writing. Oral Communication: Meeting, Interviews, Negotiation Skill, Role of Technology in Communication, Barriers and Facilitators, Role Play, Legal aspects of Business Communication; Cross Cultural Issues in Communication.

Practical Sessions: a) Communication as a skill: Negotiation Skill, Presentation Skill, Group Discussion, Personal Interview, Etiquette & Mannerism, Assertiveness Skill b) Issues in Communication: Loaded, Gender free & Cross Cultural Communication.

READINGS:

1. Argenti, P., & Forman, J. (2002). The Power of Corporate Communication: Crafting the Voice and Image of your Business. New Delhi: Tata McGraw Hill.
2. Bovee, C., & Thill, J. (2011). Business Communication Today (11th ed.). Prentice Hall Inc.
3. Post, Emily. (2005). The Etiquette Advantage in Business (2nd ed.). New York: Collins.
4. Sandra, M. O. (2004). Handbook of Corporate Communication and Strategic Public Relations: Pure and Applied. Routledge.

E- 331 Financial Modeling and Business Forecasting– 02 Credits

Course Objective: This course aims to equip the students with the fundamental concepts of financial modeling and business forecasting. Upon the completion of the course, the students should be able to evaluate business problems and determine suitable analytical methods, compare different analytics techniques, analyse and validate the results and gain meaning out of large data. This course also introduces the basic financial modelling.

Course Content

Introduction to Financial Statement Analysis:

- Financial Reporting Mechanics,
- Understanding Income Statement, Balance Sheet,
- Cash Flow Statement,
- Financial Analysis Techniques,
- Inventories, Long Lived Assets,
- Non Current Liabilities,
- Financial Statement Application

Introduction to financial modeling

- Understanding the links between the financial statements
- Understanding circularity
- Setting up and formatting the model
- Selecting model drivers and assumptions

Modeling and projecting the financial statements

- Projecting the income statement
- Projecting the balance sheet
- Projecting the cash flow statement
- Creating the debt and interest schedule
- Revolver modeling

Financial Ratios:

- Du point Analysis
- Peer to peer analysis
- Ratio analysis of industries and preparation of Financial Analysis report on an industry

Equity Research Modeling:

Prepare an Income Statement, Balance sheet, Cash Flow Statement, Geographic Revenue Sheet, Segment Revenue Sheet, Cost Statement, Debt Sheet, Analyze Revenue Drivers

- Forecast Geographic & Segment Revenues, Cost Statement, Debt, Income Statement, Balance Sheet, and Cash Flow Statement.

 Performa Adjustments, Income Statement - Compute Margins, Balance Sheet -Compute Ratios

 Cash Flow Statement Projection, Valuation- Discounted Cash Flow Method (DCF), Valuation – Relative Valuation (Football Field Chart)

 Valuation – Assumptions for Valuation Model, Prepare Valuation Model, Prepare Presentation Sheet, Prepare Company Overview, Sector Overview

Readings

William P. Fox, Mathematical Modeling for Business Analytics, 1 st Edition, Chapman and Hall/CRC, 2017.
"Financial Modeling" by Simon Benninga, MIT Press, 3rd edition, 2008.
Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.
James R. Evans, Business Analytics – Methods, Models and Decisions, 2 nd Edition, Prentice Hall, 2013. S. Christian Albright and Wayne L. Winston, Business Analytics: Data Analysis & Decision Making, 5th Edition, Cengage Learning, 2015.
Johannes Ledolter, Data Mining and Business Analytics with R, John Wiley & Sons, 2013.
Powell S. G. and Baker K. R. Management Science: The Art of Modelling with Spreadsheets, John Wiley & Sons, 3rd Edition, 2010

E – 228 Human Resource Metrics and Analytics

Course Objective

Organizations are increasingly leveraging human resource data for not only managing current human resources more efficiently, but also use analytics for future decisions, from talent acquisition to competency development and from performance management to employee engagement.

The objective of this course is to provide a detailed understanding of various qualitative and quantitative measures (metrics) of human resource activities and processes in organizations, research, and track and compile these measures in to data sets, and use statistical tools for analyzing the data. The course will also familiarize participants in the use of tools to analyze, interpret, and generate reports/ dashboards, for better human resource management decisions.

Course Content

Module 1: HR Metrics: Measuring HR functions and Processes: Concepts, Approaches and Objectives; Tools for compiling HR Data and HR metrics (e.g. Balance Score Card, Employee Surveys, Employment Test Scores, etc.); HR Functional / process related metrics: Workforce planning metrics, HR Deployment metrics, Recruitment metrics; Selection metrics, Performance metrics, Training / Learning metrics, Compensation and Benefits metrics, Employee Relations metrics; Qualitative and Quantitative HR outcome metrics (Attrition, Absenteeism, Job satisfaction, employee engagement, perceptions and attitude, HRD climate, Safety, wellness, and employee health); Social, Demographic and Occupational metrics (Diversity);Methods of data capture and benchmarking; Aligning HR Metrics and Organizational Performance.

Module 2: Analytics: Meaning and scope of analytics in HR; Typical sources of data; Overview of data formats; Quantitative and Qualitative data analysis techniques in HR analytics; Predictive analytics: basic methods and techniques, scenario planning, integration with strategic decisions; Effectiveness and Efficiency – Outcome and Impact analysis; HR Dashboards; HR Analytics and HR Decisions. Data Integrity and Security Issues.

Learning Outcomes

1. Participants will be able to understand various qualitative and quantitative measures of human resource management processes and outcomes in an organization; and the importance of using data-based reasoning to support HR decisions;
2. Participants will be able to identify (research), track, compile, analyze and interpret human resource data in order to make more effective, evidence-based decisions on managing human resources;
3. Participants will be able to develop research and analytical tools for measuring, analyzing, and developing HR decision support scenarios;
4. Participants will be able to apply skills in quantitative and qualitative data analysis using software applications and will be able to do critical analysis of results from HR analytics and communicate (implement) actionable insights.
5. Participants will be able to understand the synergy between HR decisions and outcomes, and organizational performance.

Suggested Readings

1. Bassi, L., Carpenter, R., &McMurrer, D. (2012) HR Analytics Handbook. New York: McBassi& Co.
2. Bucknall, H.,&Wei, Z. (2006). Magic Numbers for Human Resource Management. New Delhi: Wiley.
3. Edwards, M.R., & Edwards, K. (2016) Predictive HR Analytics: Mastering the HR Metric. London: Kogan Page.
4. Fitz-Enz, J., & Mattox-II, J.R. (2014). Predictive Analytics for Human Resources. New Jersey: Wiley.
5. Isson, J.P., & Harriott, J.S. (2016).People Analytics in the Era of Big Data: Changing the way you attract, acquire, develop and retain talent. New Jersey: Wiley.
6. Marr, B. (2018). Data-Driven HR: How to Use Analytics and Metrics to Drive Performance. London: Kogan Page.
7. McBeath, G. (1992).The Handbook of Human Resource Planning: Practical Manpower Analysis Techniques for HR Professionals. Oxford: Wiley-Blackwell.
8. Pease, G. (2015).Optimize Your Greatest Asset - Your People: How to Apply Analytics to Big Data to Improve Your Human Capital Investments. New Jersey: Wiley.
9. Rao, T.V. (2014).HRD Audit: Evaluating the Human Resource Function for Business Improvement (2nded.). New Delhi: Sage.
10. Smith, T. (2013). HR Analytics: The What, Why and How ...Create space Independent Pub.
11. Soundararajan, R. & Singh, K. (2016). Winning on HR Analytics: Leveraging Data for Competitive Advantage. New Delhi: Sage. 151
12. Sundmark, L. (2017).Doing HR Analytics: A Practitioner's Handbook with R Examples. Create space Independent Pub.
13. Waters, S.D., Streets, V.N., McFarlane, L., Johnson-Murray, R. (2018). The Practical Guide to HR Analytics: Using Data to inform, transform, and empower HR Decisions. Virginia: SHRM Society Pub.

5-Year Integrated M.Sc. in Chemistry

[Exit Option after 03 Years with B.Sc. (Hons.) Degree in Chemistry]

Applicable July 2018 Onwards

CURRICULUM

DEPARTMENT OF CHEMISTRY
SCHOOL OF PHYSICAL SCIENCES
DOON UNIVERSITY

CYC−101: Inorg. Chem. I: Atomic Structure & Chemical Bonding

Atomic Structure:

Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and $\psi 2$. Quantum numbers and their significance.

Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of *s*, *p*, *d* and *f* orbitals. Contour boundary and probability diagrams.

Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number.

Periodicity of Elements: *s*, *p*, *d*, *f* block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to *s* & *p*-block.

(a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table; (b) Atomic radii (van der Waals); (c) Ionic and crystal radii; (d) Covalent radii (octahedral and tetrahedral) (e) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy; (f) Electron gain enthalpy, trends of electron gain enthalpy; (g) Electronegativity, Pauling's/ Mulliken's/ Allred Rachow's/ and Mulliken-Jaffé's electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity. Sanderson's electron density ratio.

Chemical Bonding:

(i) ***Ionic bond:*** General characteristics, types of ions, size effects, radius ratio rule and its limitations. Packing of ions in crystals. Born-Landé equation with derivation and importance of Kapustinskii expression for lattice energy. Madelung constant, Born-Haber cycle and its application, Solvation energy.

(ii) ***Covalent bond:*** Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N_2, O_2, C_2, B_2, F_2, CO, NO, and their ions; HCl, BeF_2, CO_2, (idea of s-p mixing and orbital interaction to be given). Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding (σ and π bond approach) and bond lengths.

Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization. Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ionic character from dipole moment and electronegativity difference.

(iii) ***Metallic Bond:*** Qualitative idea of valence bond and band theories. Semiconductors and insulators, defects in solids.

(iv) ***Weak Chemical Forces:*** van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces, Hydrogen bonding (theories of hydrogen bonding, valence bond treatment) Effects of chemical force, melting and boiling points, solubility energetics of dissolution process.

Oxidation-Reduction:

Redox equations, Standard Electrode Potential and its application to inorganic reactions. Principles involved in volumetric analysis to be carried out in class.

First Semester

CYL−101: Titrimetric Analysis Lab

Program: Integrated M.Sc. **Credits**: 02
Type: Core Course **Contact Hours**: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYC−101: Inorg. Chem. I: Atomic Structure & Chemical Bonding*"

(A) Titrimetric Analysis
(

(ii) Preparation of solutions of different Molarity/Normality of titrants

(B) Acid-Base Titrations
(i) Estimation of carbonate and hydroxide present together in mixture.
(ii) Estimation of carbonate and bicarbonate present together in a mixture.
(iii) Estimation of free alkali present in different soaps/detergents

(C) Oxidation-Reduction Titrimetry
(i) Estimation of Fe(II) and oxalic acid using standardized KMnO4 solution.
(ii) Estimation of oxalic acid and sodium oxalate in a given mixture.
(iii) Estimation of Fe(II) with K 2Cr2O7 using internal (diphenylamine, anthranilic acid) and external indicator.

:

i) Calibration and use of apparatus

First Semester

CYC-102: Phys. Chem. I: States of Matter & Ionic Equilibrium

Gaseous State:

Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path and viscosity of gases, including their temperature and pressure dependence, relation between mean free path and coefficient of viscosity, calculation of σ from η; variation of viscosity with temperature and pressure.

Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities.

Behaviour of real gases: Deviations from ideal gas behaviour, compressibility factor, *Z*, and its variation with pressure for different gases. Causes of deviation from ideal behaviour. Van der Waals equation of state, its derivation and application in explaining real gas behaviour, mention of other equations of state (Berthelot, Dietrici); virial equation of state; van der Waals equation expressed in virial form and calculation of Boyle temperature. Isotherms of real gases and their comparison with van der Waals isotherms, continuity of states, critical state, relation between critical constants and van der Waals constants, law of corresponding states.

Liquid state:

Qualitative treatment of the structure of the liquid state; Radial distribution function; physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity, and their determination. Effect of addition of various solutes on surface tension and viscosity.

Explanation of cleansing action of detergents. Temperature variation of viscosity of liquids and comparison with that of gases.

Qualitative discussion of structure of water.

Solid state:

Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method. Analysis of powder diffraction patterns of NaCl, CsCl and KCl. Defects in crystals. Glasses and liquid crystals.

Ionic equilibria:

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect; dissociation constants of mono-, di-and triprotic acids (exact treatment).

Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions; derivation of Henderson equation and its applications; buffer capacity, buffer range, buffer action and applications of buffers in analytical chemistry and biochemical processes in the human body.

Solubility and solubility product of sparingly soluble salts – applications of solubility product principle. Qualitative treatment of acid – base titration curves (calculation of pH at various stages). Theory of acid–base indicators; selection of indicators and their limitations.

Multistage equilibria in polyelectrolyte systems; hydrolysis and hydrolysis constants.

First Semester

CYL−102: Physicochemical Analysis Lab

Program: Integrated M.Sc. **Type:** Core Course
Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYC−102: Phys. Chem. I: States of Matter & Ionic Equilibrium*"

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[1] Surface tension measurements.

a. Determine the surface tension by (i) drop number (ii) drop weight method.
b. Study the variation of surface tension of detergent solutions with concentration.

[2] Viscosity measurement using Ostwald's viscometer.

a. Determination of viscosity of aqueous solutions of (i) polymer (ii) ethanol and (iii) sugar at room temperature.
b. Study the variation of viscosity of sucrose solution with the concentration of solute.

[3] Indexing of a given powder diffraction pattern of a cubic crystalline system.

[4] pH metry

a. Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetate and their mixtures.
b. Preparation of buffer solutions of different pH
i. Sodium acetate-acetic acid ii. Ammonium chloride-ammonium hydroxide
c. pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base.
d. Determination of dissociation constant of a weak acid. *Any other experiment carried out in the class.*

First Semester

CYG-101: Generic Chem.:
Atomic Structure, Bonding, General Organic Chemistry, & Aliphatic Hydrocarbons

Section A: Inorganic Chemistry-1

(30 Lectures)

Atomic Structure:

Review of: *Bohr's theory and its limitations, dual behaviour of matter and radiation, deBroglie's relation, Heisenberg Uncertainty principle. Hydrogen atom spectra. Need of a new approach to Atomic structure*.

What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and ψ^2 , Schrödinger equation for hydrogen atom. Radial and angular parts of the hydogenic wavefunctions (atomic orbitals) and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals (Only graphical representation). Radial and angular nodes and their significance. Radial distribution functions and the concept of the most probable distance with special reference to 1s and 2s atomic orbitals. Significance of quantum numbers, orbital angular momentum and quantum numbers m_l and m_s. Shapes of s, p and d atomic orbitals, nodal planes. Discovery of spin, spin quantum number (s) and magnetic spin quantum number (m_s).

Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations. (14 Lectures)

Chemical Bonding and Molecular Structure *Ionic Bonding*:

General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, BornHaber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

Covalent bonding:

VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.

Concept of resonance and resonating structures in various inorganic and organic compounds.

MO Approach:

Rules for the LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (including idea of s-p mixing) and heteronuclear diatomic molecules such as CO, NO and NO^+ . Comparison of VB and MO approaches. (16 Lectures)

Section B: Organic Chemistry-1

(30 Lectures)

Fundamentals of Organic Chemistry

Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals. Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. Aromaticity: Benzenoids and Hückel's rule.

Stereochemistry

Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; cis - trans nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems). (10 Lectures)

Aliphatic Hydrocarbons

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.

Alkanes: (Upto 5 Carbons). Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: Free radical Substitution: Halogenation.

Alkenes: (Upto 5 Carbons) Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition (alk. $KMnO_4$) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidation.

Alkynes: (Upto 5 Carbons) Preparation: Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides. Reactions: formation of metal acetylides, addition of bromine and alkaline $KMnO_4$, ozonolysis and oxidation with hot alk. $KMnO_4$. (12 Lectures)

GCL−101: Inorg. and Org. Chemical Analysis Lab

Program: Integrated M.Sc. **Semester:** First
Type: *Generic Elective Course* **Credits**: 02
Contact Hours: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYG−101: Generic Chem. : Atomic Structure, Bonding, General Organic Chemistry, Aliphatic Hydrocarbons*"

Section A: Inorganic Chemistry - Volumetric Analysis

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Estimation of oxalic acid by titrating it with $KMnO_4$.
3. Estimation of water of crystallization in Mohr's salt by titrating with KMnO4.
4. Estimation of Fe (II) ions by titrating it with $K_2Cr_2O_7$ using internal indicator.
5. Estimation of Cu (II) ions iodometrically using $Na_2S_2O_3$.

Section B: Organic Chemistry

1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements)
2. Separation of mixtures by Chromatography: Measure the R_f value in each case (combination of two compounds to be given)
   (a) Identify and separate the components of a given mixture of 2 amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography
   (b) Identify and separate the sugars present in the given mixture by paper chromatography.

Second

CYC−151: Org. Chem. I: Basics & Hydrocarbons

Basics of Organic Chemistry

Organic Compounds: Classification, and Nomenclature, Hybridization, Shapes of molecules, Influence of hybridization on bond properties.

Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relative strength.

Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges; Electrophiles and Nucleophiles; Nucleophlicity and basicity; Types, shape and their relative stability of Carbocations, Carbanions, Free radicals and Carbenes.

Introduction to types of organic reactions and their mechanism: Addition, Elimination and Substitution reactions.

Stereochemistry:

Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: cis–trans and, syn-anti isomerism E/Z notations with C.I.P rules.

Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Distereoisomers, meso structures, Racemic mixture and resolution. Relative and absolute configuration: D/L and R/S designations.

Chemistry of Aliphatic Hydrocarbons:

A. Carbon-Carbon sigma bonds

Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity.

B. Carbon-Carbon pi bonds:

Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations.

Reactions of alkenes: Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition), mechanism of oxymercuration-demercuration, hydroborationoxidation, ozonolysis, reduction (catalytic and chemical), syn and antihydroxylation (oxidation). 1,2-and 1,4-addition reactions in conjugated dienes and, DielsAlder reaction; Allylic and benzylic bromination and mechanism, e.g., propene, 1-butene, toluene, ethyl benzene.

Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes.

C. Cycloalkanes and Conformational Analysis

Types of cycloalkanes and their relative stability, Baeyer strain theory, Conformation analysis of alkanes: Relative stability: Energy diagrams of cyclohexane: Chair, Boat and Twist boat forms; Relative stability with energy diagrams.

Aromatic Hydrocarbons

Aromaticity: Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directing effects of the groups.

Semester

Second

CYL−151: Organic Compounds Purification Lab
CYC-152: Phys. Chem. II: Chemical Thermodynamics & its Applications

Chemical Thermodynamics:

Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics.

First law: Concept of heat, *q*, work, *w*, internal energy, *U*, and statement of first law; enthalpy, *H*, relation between heat capacities, calculations of *q*, *w*, *U* and *H* for reversible, irreversible and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions.

Thermochemistry: Heats of reactions: standard states; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications; calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions. Adiabatic flame temperature, explosion temperature.

Second Law: Concept of entropy; thermodynamic scale of temperature, statement of the second law of thermodynamics; molecular and statistical interpretation of entropy. Calculation of entropy change for reversible and irreversible processes.

Third Law: Statement of third law, concept of residual entropy, calculation of absolute entropy of molecules.

Free Energy Functions: Gibbs and Helmholtz energy; variation of S, G, A with T, V, P; Free energy change and spontaneity. Relation between Joule-Thomson coefficient and other thermodynamic parameters; inversion temperature; Gibbs-Helmholtz equation; Maxwell relations; thermodynamic equation of state.

Systems of Variable Composition:

Partial molar quantities, dependence of thermodynamic parameters on composition; GibbsDuhem equation, chemical potential of ideal mixtures, change in thermodynamic functions in mixing of ideal gases.

Chemical Equilibrium:

Criteria of thermodynamic equilibrium, degree of advancement of reaction, chemical equilibria in ideal gases, concept of fugacity. Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient. Coupling of exoergic and endoergic reactions. Equilibrium constants and their quantitative dependence on temperature, pressure and concentration. Free energy of mixing and spontaneity; thermodynamic derivation of relations between the various equilibrium constants *Kp*, *Kc* and *Kx*. Le Chatelier principle (quantitative treatment); equilibrium between ideal gases and a pure condensed phase.

Solutions and Colligative Properties:

Dilute solutions; lowering of vapour pressure, Raoult's and Henry's Laws and their applications. Excess thermodynamic functions.

Thermodynamic derivation using chemical potential to derive relations between the four colligative properties [(i) relative lowering of vapour pressure, (ii) elevation of boiling point, (iii) Depression of freezing point, (iv) osmotic pressure] and amount of solute. Applications in calculating molar masses of normal, dissociated and associated solutes in solution.

CYL−152: Thermochemistry Lab

Program: Integrated M.Sc. **Semester:** Second
Course Title: *Thermochemistry Lab*
Course Code: *CYL−152* **Type:** Core Course
Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYC−152: Phys. Chem. II: Chemical Thermodynamics and Its Applications"*

Thermochemistry

(a) Determination of heat capacity of a calorimeter for different volumes using change of enthalpy data of a known system (method of back calculation of heat capacity of calorimeter from known enthalpy of solution or enthalpy of neutralization).

(b) Determination of heat capacity of the calorimeter and enthalpy of neutralization of hydrochloric acid with sodium hydroxide.

(c) Calculation of the enthalpy of ionization of ethanoic acid.

(d) Determination of heat capacity of the calorimeter and integral enthalpy (endothermic and exothermic) solution of salts.

(e) Determination of basicity/proticity of a polyprotic acid by the thermochemical method in terms of the changes of temperatures observed in the graph of temperature versus time for different additions of a base. Also calculate the enthalpy of neutralization of the first step.

(f) Determination of enthalpy of hydration of copper sulphate.

(g) Study of the solubility of benzoic acid in water and determination of ΔH.

Any other experiment carried out in the class.

Semester

Second

CYG-151: Generic Chem.: Chemical Energetics, Equilibria & Functional Group Organic Chemistry-I

Section A: Physical Chemistry-1

(30 Lectures)

Chemical Energetics (10 Lectures)

Review of thermodynamics and the Laws of Thermodynamics.

Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature – Kirchhoff's equation.

Statement of Third Law of thermodynamics and calculation of absolute entropies of substances.

Chemical Equilibrium: (8 Lectures)

Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between ΔG and ΔG^{o}, Le Chatelier's principle. Relationships between K_p, K_c and K_x for reactions involving ideal gases.

Ionic Equilibria: (12 Lectures)

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.

Semester

Section B: Organic Chemistry-2

(30 Lectures)

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.

Aromatic hydrocarbons: (8 Lectures)

Preparation (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid.

Reactions: (Case benzene): Electrophilic substitution: nitration, halogenation and sulphonation. Friedel-Craft's reaction (alkylation and acylation) (upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene).

Alkyl and Aryl Halides

Alkyl Halides (Upto 5 Carbons): Types of Nucleophilic Substitution (SN_1, SN_2 and SNi) reactions.

Preparation: from alkenes and alcohols.

Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vs substitution.

Aryl Halides: Preparation**:** (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions.

Reactions (Chlorobenzene): Aromatic nucleophilic substitution (replacement by –OH group) and effect of nitro substituent. Benzyne Mechanism: KNH_2/NH_3 (or $NaNH_2/NH_3$).

Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides. (8 Lectures)

Alcohols, Phenols and Ethers (Upto 5 Carbons) ***Alcohols***:

Preparation: Preparation of 1o , 2o and 3o alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters.

Reactions: With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. $KMnO_4$, acidic dichromate, conc. HNO_3). Oppeneauer oxidation

Diols: (Upto 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement.

Phenols: (Phenol case)

Preparation: Cumene hydroperoxide method, from diazonium salts. Reactions: Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer-Tiemann Reaction, Gattermann-Koch Reaction, Houben–Hoesch Condensation, Schotten – Baumann Reaction.

Ethers (aliphatic and aromatic): Cleavage of ethers with HI.

Aldehydes and ketones (aliphatic and aromatic): (Formaldehye, acetaldehyde, acetone and benzaldehyde).

Preparation: from acid chlorides and from nitriles.

Reactions – Reaction with HCN, ROH, $NaHSO_3$, NH_2-G derivatives. Iodoform test. Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction. Meerwein-Pondorff Verley reduction. (14 Lectures)

GCL-151: Basic Physical and Organic Chemistry Lab

Program: Integrated M.Sc. **Semester:** Second
Course Title: *Basic Physical and Organic Chemistry Lab*
Course Code: *GCL−151* **Type:** *Generic Elective Course*
Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYG−151: Generic Chem. : Chemical Energetics, Equilibria & Functional Group Org. Chem. I*"

***Section A: Physical Chemistry* Thermochemistry**

1. Determination of heat capacity of calorimeter for different volumes.
2. Determination of enthalpy of neutralization of HCl with NaOH.
3. Determination of enthalpy of ionization of acetic acid.
4. Determination of integral enthalpy of solution of salts (KNO_3, NH_4Cl).
5. Determination of enthalpy of hydration of copper sulphate.
6. Study of the solubility of benzoic acid in water and determination of ΔH.

Ionic equilibria pH measurements

a) Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.
b) Preparation of buffer solutions: (i) Sodium acetate-acetic acid, and (ii) Ammonium chloride-ammonium hydroxide
Measurement of the pH of buffer solutions and comparison of the values with theoretical values.

Section B: Organic Chemistry

1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.
2. Criteria of Purity: Determination of melting and boiling points.
3. Preparations: Mechanism of various reactions involved to be discussed. Recrystallisation, determination of melting point and calculation of quantitative yields to be done.
   (a) Bromination of Phenol/Aniline
   (b) Benzoylation of amines/phenols
   (c) Oxime and 2,4 dinitrophenylhydrazone of aldehyde/ketone

CYC-201: Inorg. Chem. II: s- and p-Block Elements

General Principles of Metallurgy

Chief modes of occurrence of metals based on standard electrode potentials. Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agent. Electrolytic Reduction, Hydrometallurgy. Methods of purification of metals: Electrolytic Kroll process, Parting process, van Arkel-de Boer process and Mond's process, Zone refining.

Acids and Bases

Brönsted-Lowry concept of acid-base reactions, solvated proton, relative strength of acids, types of acid-base reactions, levelling solvents, Lewis acid-base concept, Classification of Lewis acids, Hard and Soft Acids and Bases (HSAB) Application of HSAB principle.

Chemistry of *s* and *p* Block Elements:

Inert pair effect, Relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group. Allotropy and catenation. Complex formation tendency of *s* and *p* block elements.

Hydrides and their classification ionic, covalent and interstitial. Basic beryllium acetate and nitrate.

Study of the following compounds with emphasis on structure, bonding, preparation, properties and uses.

Boric acid and borates, boron nitrides, borohydrides (diborane) carboranes and graphitic compounds, silanes, Oxides and oxoacids of nitrogen, Phosphorus and chlorine. Peroxo acids of sulphur, interhalogen compounds, polyhalide ions, pseudohalogens and basic properties of halogens.

Noble Gases:

Occurrence and uses, rationalization of inertness of noble gases, Clathrates; preparation and properties of XeF_2, XeF_4 and XeF_6; Nature of bonding in noble gas compounds (Valence bond treatment and MO treatment for XeF_2). Molecular shapes of noble gas compounds (VSEPR theory).

Inorganic Polymers:

Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones and siloxanes. Borazines, silicates and phosphazenes, and polysulphates.

CYL-201: Quantitative Inorganic Analysis and Synthesis Lab

Program: Integrated M.Sc. **Semester:** Third
Course Title: *Quantitative Inorganic Analysis and Synthesis Lab*
Course Code: *CYL−201* **Type:** Core Course
Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYC−201: Inorg. Chem. II: s- and p-Block Elements*"

[A] Iodo / Iodimetric Titrations

(i) Estimation of Cu(II) and $K_2Cr_2O_7$ using sodium thiosulphate solution (Iodimetrically).
(ii) Estimation of (i) *arsenite* and (ii) *antimony in tartar-emetic iodimetrically*
(iii) Estimation of available chlorine in bleaching powder iodometrically.

[B] Inorganic preparations

(i) Cuprous Chloride, Cu_2Cl_2
(ii) Preparation of Manganese(III) phosphate, $MnPO_4.H_2O$
(iii) Preparation of Alumini um potassium sulphate $KAl(SO_4)_2.12H_2O$ (Potash alum) or Chrome alum.

CYC-202: Phys. Chem. III: Phase Equilibria & Chemical Kinetics

Phase

Equilibria:

Concept of phases, components and degrees of freedom, derivation of Gibbs Phase Rule for nonreactive and reactive systems; Clausius-Clapeyron equation and its applications to solidliquid, liquid-vapour and solid-vapour equilibria, phase diagram for one component systems, with applications.

Phase diagrams for systems of solid-liquid equilibria involving eutectic, congruent and incongruent melting points, solid solutions.

Three component systems, water-chloroform-acetic acid system, triangular plots.

Binary solutions: Gibbs-Duhem-Margules equation, its derivation and applications to fractional distillation of binary miscible liquids (ideal and nonideal), azeotropes, lever rule, partial miscibility of liquids, CST, miscible pairs, steam distillation.

Nernst Distribution Law: its derivation and applications.

Chemical Kinetics

Order and molecularity of a reaction, rate laws in terms of the advancement of a reaction, differential and integrated form of rate expressions up to second order reactions, experimental methods of the determination of rate laws, kinetics of complex reactions (integrated rate expressions up to first order only): (i) Opposing reactions (ii) parallel reactions and (iii) consecutive reactions and their differential rate equations (steady-state approximation in reaction mechanisms) (iv) chain reactions.

Temperature dependence of reaction rates; Arrhenius equation; activation energy. Collision theory of reaction rates, Lindemann mechanism, qualitative treatment of the theory of absolute reaction rates.

Catalysis:

Types of catalyst, specificity and selectivity, mechanisms of catalyzed reactions at solid surfaces; effect of particle size and efficiency of nanoparticles as catalysts. Enzyme catalysis, Michaelis-Menten mechanism, acid-base catalysis.

Surface chemistry:

Physical adsorption, chemisorption, adsorption isotherms. nature of adsorbed state.

[1] Levine, I. N. Physical Chemistry 6th Ed., Tata McGraw-Hill (2011).

CYL-202: Chemical Kinetics Lab

Program: Integrated M.Sc. **Semester:** Third
Course Title: *Chemical Kinetics Lab*
Course Code: *CYL−202* **Type:** Core Course
Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYC−202: Phys. Chem. III: Phase Equilibrium and Chemical Kinetics"*

[I] Determination of critical solution temperature and composition of the phenol-water system and to study the effect of impurities on it.

[II] Phase equilibria: Construction of the phase diagram using cooling curves or ignition tube method: (a) simple eutectic and (b) congruently melting systems.

[III] Distribution of acetic/ benzoic acid between water and cyclohexane.

[IV] Study the equilibrium of at least one of the following reactions by the distribution method:

(i) $I_2(aq) + I^- \rightarrow I_3^-(aq)^{2+}$

(ii) $Cu^{2+}(aq) + nNH_3 \rightarrow Cu(NH_3)_n$

[V] Study the kinetics of the following reactions:

(1) Initial rate method: *Iodide-persulphate reaction*
(2) Integrated rate method: (a) *Acid hydrolysis of methyl acetate with hydrochloric acid*, and (b) *Saponification of ethyl acetate*.
(3) Compare the strengths of HCl and H_2SO_4 by studying kinetics of hydrolysis of methyl acetate.

[VI] Adsorption

I. Verify the Freundlich and Langmuir isotherms for adsorption of acetic acid on activated charcoal.

CYC-203: Org. Chem. II: Oxygen Containing Functional Groups

Chemistry of Halogenated Hydrocarbons:

Alkyl Halides: Methods of preparation, nucleophilic substitution reactions – S_N1, S_N2 and S_Ni mechanisms with stereochemical aspects and effect of solvent etc.; nucleophilic substitution vs. elimination.

Aryl Halides: Preparation, including preparation from diazonium salts. nucleophilic aromatic substitution; S_NAr, Benzyne mechanism.

Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

Organometallic compounds of Mg and Li: Use in synthesis of organic compounds.

Alcohols, Phenols, Ethers and Epoxides:

Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Bouvaelt-Blanc Reduction; Preparation and properties of glycols: Oxidation by periodic acid and lead tetraacetate, Pinacol-Pinacolone rearrangement;

Phenols: Preparation and properties; Acidity and factors effecting it, Ring substitution reactions, Reimer–Tiemann and Kolbe's–Schmidt Reactions, Fries and Claisen rearrangements with mechanism

Ethers and Epoxides: Preparation and reactions with acids. Reactions of epoxides with alcohols, ammonia derivatives and $LiAlH_4$

Carbonyl Compounds:

Structure, reactivity and preparation; Nucleophilic additions, Nucleophilic additionelimination reactions with ammonia derivatives with mechanism; Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation, Claisan-Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann and Benzil-Benzilic acid rearrangements, haloform reaction and Baeyer Villiger oxidation, α-substitution reactions, oxidations and reductions (Clemmensen, Wolff-Kishner, $LiAlH_4$, NaBH4, MPV, PDC and PGC);

Addition reactions of unsaturated carbonyl compounds: Michael addition.

Active methylene compounds: Keto-enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate.

Carboxylic Acids and their Derivatives:

Preparation, physical properties and reactions of monocarboxylic acids: Typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids: succinic/phthalic, lactic, malic, tartaric, citric, maleic and fumaric acids; Preparation and reactions of acid chlorides, anhydrides, esters and amides; Comparative study of nucleophilic sustitution at acyl group Mechanism of acidic and alkaline hydrolysis of esters, Claisen condensation, Dieckmann and Reformatsky reactions, Hofmannbromamide degradation and Curtius rearrangement.

Sulphur containing compounds:

Preparation and reactions of thiols, thioethers and sulphonic acids.

CYL-203: Basic Organic Synthesis Lab

Program: Integrated M.Sc. **Semester:** Third
Course Title: *Basic Organic Synthesis Lab*
Course Code: *CYL−203* **Type:** Core Course
Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYC−203: Org. Chem. II: Oxygen Containing Functional Groups"*

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[1] Functional group tests for alcohols, phenols, carbonyl and carboxylic acid group.

[2] Organic preparations:

(i) Acetylation of one of the following compounds: amines (aniline, *o*-, *m*-, *p*-toluidines, and *o*-, *m*-, *p*-anisidine) and phenols (β-naphthol, vanillin, salicylic acid) by any one method: (a) Using conventional method, (b) Using green approach

(ii) Benzolyation of one of the following amines (aniline, *o*-, *m*-, *p*- toluidines and *o*-, *m*-, *p*anisidine) and one of the following phenols (β-naphthol, resorcinol, pcresol) by SchottenBaumann reaction.

(iii) Oxidation of ethanol/ isopropanol (Iodoform reaction).

(iv) Bromination of any one of the following: (a) *Acetanilide by conventional methods*, (b) *Acetanilide using green approach (Bromate-bromide method),* (c) *Nitration of any one of the following: Nitration of Acetanilide/nitrobenzene by conventional method or Nitration of Salicylic acid by green approach (using ceric ammonium nitrate).*

(vi) Selective reduction of *meta* dinitrobenzene to *m*-nitroaniline.

(vii) Reduction of *p*-nitrobenzaldehyde by sodium borohydride.

(viii)Hydrolysis of amides and esters.

(ix) Semicarbazone of any one of the following compounds: acetone, ethyl methyl ketone, cyclohexanone, benzaldehyde.

(x) *S*-Benzylisothiouronium salt of one each of water soluble and water insoluble acids (benzoic acid, oxalic acid, phenyl acetic acid and phthalic acid).

(xi) Aldol condensation using either conventional or green method. (xii) Benzil-Benzilic acid rearrangement.

Note: The above derivatives should be prepared using 0.5-1g of the organic compound. The solid samples must be collected and may be used for recrystallization, melting point and TLC.

[3] Generation of nucleophile from substituted thiophenol(s) and its use in nucleophilic substitution reaction of primary alkyl halide (*Incorporated by approval of Academic Counsel in its 25th meeting under Agenda Item No. 2018:25:26 in May 2018*)

[1] Ahluwalia, V.K. & Dhingra, S. *Comprehensive Practical Organic Chemistry: Qualitative Analysis,* University Press (2000).

CYG-201: Generic Chem.: s- and p-Block Elements, States of Matter and Chemical Kinetics

Section A: Inorganic Chemistry

(30 Lectures)

General Principles of Metallurgy: (4 Lectures)

Chief modes of occurrence of metals based on standard electrode potentials. Ellingham diagrams for reduction of metal oxides using carbon as reducing agent. Hydrometallurgy, Methods of purification of metals (Al, Pb, Ti, Fe, Cu, Ni, Zn): electrolytic, oxidative refining, Kroll process, Parting process, van Arkel-de Boer process and Mond's process. **s- and p-Block Elements**:

Periodicity in s- and p-block elements with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electronegativity (Pauling, Mulliken, and Alfred-Rochow scales). Allotropy in C, S, and P.

Oxidation states with reference to elements in unusual and rare oxidation states like carbides and nitrides), inert pair effect, diagonal relationship and anomalous behaviour of first member of each group.

Compounds of s- and p-Block Elements

Hydrides and their classification (ionic, covalent and interstitial), structure and properties with respect to stability of hydrides of p- block elements.

Concept of multicentre bonding (diborane).

Structure, bonding and their important properties like oxidation/reduction, acidic/basic nature of the following compounds and their applications in industrial, organic and environmental chemistry.

Hydrides of nitrogen (NH_3, N_2H_4, N_3H, NH_2OH) Oxoacids

of P, S and Cl.

Halides and oxohalides: PCl_3, PCl_5, $SOCl_2$ and SO_2Cl_2

Section B: Physical Chemistry-3

(30 Lectures)

Kinetic Theory of Gases

Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation.

Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. van der Waals equation of state for real gases. Boyle temperature (derivation not required). Critical phenomena, critical constants and their calculation from van der Waals equation. Andrews isotherms of CO_2.

Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphic representation – derivation not required) and their importance.

Temperature dependence of these distributions. Most probable, average and root mean square velocities (no derivation). Collision cross section, collision number, collision frequency, collision diameter and mean free path of molecules. Viscosity of gases and effect of temperature and pressure on coefficient of viscosity (qualitative treatment only).

Liquids

Surface tension and its determination using stalagmometer. Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only) **Solids**

Forms of solids. Symmetry elements, unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices. Miller indices. X–Ray diffraction by crystals, Bragg's law. Structures of NaCl, KCl and CsCl (qualitative treatment only). Defects in crystals. Glasses and liquid crystals.

Chemical Kinetics

The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction. Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation.

Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).

GCL-201: Basic Physical and Inorganic Chemistry Lab

Program: Integrated M.Sc. **Semester:** Third
Course Title: *Basic Physical and Inorganic Chemistry Lab*
Course Code: *GCL−201* **Type:** *Generic Elective Course*
Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYG−201: Generic Chem. : s- and p-Block Elements, States of Matter & Chemical Kinetics*"

Section A: Inorganic Chemistry

Semi-micro qualitative analysis using H_2S of mixtures- not more than four ionic species (two anions and two cations and excluding insoluble salts) out of the following:

Cations : NH_4^+, Pb^{2+}, Ag^+, Bi^{3+}, Cu^{2+}, Cd^{2+}, Sn^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Cr^{3+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, K^+

Anions : CO_3^{2-}, S^{2-}, SO_2^-, $S_2O_3^{2-}$, NO_3^-, CH_3COO^-, Cl^-, Br^-, I^-, NO_3^-,SO_4^{2-}, PO_4^{3-}, BO_3^{3-}, $C_2O_4^{2-}$, F^-

(Spot tests should be carried out wherever feasible)

Section B: Physical Chemistry

(I) Surface tension measurement (use of organic solvents excluded).

a) Determination of the surface tension of a liquid or a dilute solution using a stalagmometer.

b) Study of the variation of surface tension of a detergent solution with concentration.

(II) Viscosity measurement (use of organic solvents excluded).

a) Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer.

b) Study of the variation of viscosity of an aqueous solution with concentration of solute.

(III) Chemical Kinetics:

Study the kinetics of the following reactions.

(1) Initial rate method: *Iodide-persulphate reaction*.

(2) Integrated rate method: (a) *Acid hydrolysis of methyl acetate with hydrochloric acid*, (b) *Saponification of ethyl acetate* and *(c) Compare the strengths of HCl and H_2SO_4 by studying kinetics of hydrolysis of methyl acetate*

[1] A.I. Vogel, Quantitative Chemical Analysis, Prentice Hall, 6th Edn. [3] B.D. Khosla, Senior Practical Physical Chemistry, R. Chand & Co.

CYC-251: Inorg. Chem. III: Coordination Chemistry

Coordination Chemistry:

Werner's theory, valence bond theory (inner and outer orbital complexes), electroneutrality principle and back bonding. Crystal field theory, measurement of 10 Dq (Δo), CFSE in weak and strong fields, pairing energies, factors affecting the magnitude of 10 Dq (Δo, Δt). Octahedral vs. tetrahedral coordination, tetragonal distortions from octahedral geometry JahnTeller theorem, square planar geometry. Qualitative aspect of Ligand field and MO Theory.

IUPAC nomenclature of coordination compounds, isomerism in coordination compounds. Stereochemistry of complexes with 4 and 6 coordination numbers. Chelate effect, polynuclear complexes, Labile and inert complexes.

Transition Elements:

General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, ability to form complexes. Stability of various oxidation states and e.m.f. (Latimer & Bsworth diagrams). Difference between the first, second and third transition series.

Chemistry of Ti, V, Cr Mn, Fe and Co in various oxidation states (excluding their metallurgy)

Lanthanoids and Actinoids:

Electronic configuration, oxidation states, colour, spectral and magnetic properties, lanthanide contraction, separation of lanthanides (ion-exchange method only).

Bioinorganic Chemistry:

Metal ions present in biological systems, classification of elements according to their action in biological system. Geochemical effect on the distribution of metals. Sodium / K-pump, carbonic anhydrase and carboxypeptidase. Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, Use of chelating agents in medicine.
Iron and its application in bio-systems, Haemoglobin; Storage and transfer of iron.

Fourth Semester

CYL-251: Inorganic Preparation, Separation and Gravimetric Analysis Lab

Program: Integrated M.Sc. **Semester:** Fourth
Course Title: *Inorganic Preparation, Separation & Gravimetric Analysis Lab*
Course Code: *CYL−251* **Type:** Core Course
Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYC−251: Inorg. Chem. III: Coordination Chemistry*"

Gravimetric Analysis:

i. Estimation of nickel (II) using Dimethylglyoxime (DMG).
ii. Estimation of copper as CuSCN
iii. Estimation of iron as Fe_2O_3 by precipitating iron as $Fe(OH)_3$.
iv. Estimation of Al (III) by precipitating with oxine and weighing as Al(oxine) (aluminium oxinate). 3

Inorganic Preparations:

i. Tetraamminecopper (II) sulphate, $[Cu(NH_3)_4]SO_4.H_2O$
ii. *Cis* and *trans* $K[Cr(C_2O_4)_2.(H_2O)_2]$ Potassium dioxalatodiaquachromate (III)
iii. Tetraamminecarbonatocobalt (III) ion
iv. Potassium tris(oxalate)ferrate(III)

Chromatography of metal ions

Principles involved in chromatographic separations. Paper chromatographic separation of following metal ions:

i. Ni (II) and Co (II)
ii. Fe (III) and Al (III)

1 1986.

CYC-252: Org. Chem. III: Heterocyclic Chemistry

Nitrogen Containing Functional Groups

Preparation and important reactions of nitro and compounds, nitriles and isonitriles.

Amines: Effect of substituent and solvent on basicity; Preparation and properties: Gabriel phthalimide synthesis, Carbylamine reaction, Mannich reaction, Hoffmann's exhaustive methylation, Hofmann-elimination reaction; Distinction between 1°, 2° and 3° amines with Hinsberg reagent and nitrous acid.

Diazonium Salts: Preparation and their synthetic applications.

Polynuclear Hydrocarbons

Reactions of naphthalene phenanthrene and anthracene Structure, Preparation and structure elucidation and important derivatives of naphthalene and anthracene; Polynuclear hydrocarbons.

Heterocyclic Compounds

Classification and nomenclature, Structure, aromaticity in 5-numbered and 6-membered rings containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of: Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis), Pyrimidine, Structure elucidation of indole, Fischer indole synthesis and Madelung synthesis), Structure elucidation of quinoline and isoquinoline, Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis, DoebnerMiller synthesis, Bischler-Napieralski reaction, Pictet-Spengler reaction, Pomeranz-Fritsch reaction
Derivatives of furan: Furfural and furoic acid.

Alkaloids

Natural occurrence, General structural features, Isolation and their physiological action Hoffmann's exhaustive methylation, Emde's modification, Structure elucidation and synthesis of Hygrine and Nicotine. Medicinal importance of Nicotine, Hygrine, Quinine, Morphine, Cocaine, and Reserpine.

Terpenes

Occurrence, classification, isoprene rule; Elucidation of stucture and synthesis of Citral, Neral and α-terpineol.

CYL-252: Organic Qualitative Analysis Lab

Program: Integrated M.Sc. **Semester:** Fourth
Course Title: *Organic Qualitative Analysis Lab*
Course Code: *CYL−252* **Type:** Core Course
Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYC−252: Org. Chem. III: Heterocyclic Chemistry"*

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[1] Detection of extra elements.

[2] Functional group test for nitro, amine and amide groups.

[3] Qualitative analysis of unknown organic compounds containing simple functional groups (alcohols, carboxylic acids, phenols and carbonyl compounds)

[4] Reaction of amines with carbonyl compound derivatives of different polyaromatic hydrocarbons and heterocyclic compounds. (*Incorporated by approval of Academic Counsel in its 25th meeting under Agenda Item No. 2018:25:27 in May 2018*)

CYC-253: Phys. Chem. IV: Electrochemistry

Conductance

Arrhenius theory of electrolytic dissociation. Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Molar conductivity at infinite dilution. Kohlrausch law of independent migration of ions. Debye-Hückel-Onsager equation, Wien effect, Debye-Falkenhagen effect, Walden's rules.

Ionic velocities, mobilities and their determinations, transference numbers and their relation to ionic mobilities, determination of transference numbers using Hittorf and Moving Boundary methods. Applications of conductance measurement: (i) degree of dissociation of weak electrolytes, (ii) ionic product of water (iii) solubility and solubility product of sparingly soluble salts, (iv) conductometric titrations, and (v) hydrolysis constants of salts.

Electrochemistry

Quantitative aspects of Faraday's laws of electrolysis, rules of oxidation/reduction of ions based on half-cell potentials, applications of electrolysis in metallurgy and industry.

Chemical cells, reversible and irreversible cells with examples. Electromotive force of a cell and its measurement, Nernst equation; Standard electrode (reduction) potential and its application to different kinds of half-cells. Application of EMF measurements in determining (i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants, and (iii) pH values, using hydrogen, quinone-hydroquinone, glass and SbO/Sb_2O_3 electrodes. Concentration cells with and without transference, liquid junction potential; determination of activity coefficients and transference numbers. Qualitative discussion of potentiometric titrations (acid-base, redox, precipitation).

Electrical & Magnetic Properties of Atoms and Molecules

Basic ideas of electrostatics, Electrostatics of dielectric media, Clausius-Mosotti equation, Lorenz-Laurentz equation, Dipole moment and molecular polarizabilities and their measurements. Diamagnetism, paramagnetism, magnetic susceptibility and its measurement, molecular interpretation.

[4]

CYL-253: Electrochemistry Lab

Program: Integrated M.Sc. **Semester:** Fourth
Course Title: *Electrochemistry Lab*
Course Code: *CYL−253* **Type:** Core Course
Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYC−253: Phys. Chem. IV: Electrochemistry"*

Conductometry

I. Determination of cell constant
II. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.
III. Perform the following conductometric titrations:
i. Strong acid vs. strong base ii. Weak acid vs. strong base
iii. Mixture of strong acid and weak acid vs. strong base iv. Strong acid vs. weak base

Potentiometry

I Perform the following potentiometric titrations:
i. Strong acid vs. strong base ii. Weak acid vs. strong base iii. Dibasic acid vs. strong base iv. Potassium dichromate vs. Mohr's salt

Fourth Semester

CYG-252: Generic Chem.: Organometallics, Bioinorganic Chemistry, Polymer Hydrocarbons and UV-IR Spectroscopy

Section A: Inorganic Chemistry-4

(30 Lectures)

Chemistry of 3d metals

Oxidation states displayed by Cr, Fe, Co, Ni and Co.

A study of the following compounds (including preparation and important properties); Peroxo compounds of Cr, $K_2Cr_2O_7$, $KMnO_4$, $K_4[Fe(CN)_6]$, sodium nitroprusside, $[Co(NH_3)_6]Cl_3$, $Na_3[Co(NO_2)_6]$. (6 Lectures)

Organometallic Compounds

Definition and Classification with appropriate examples based on nature of metal-carbon bond (ionic, s, p and multicentre bonds). Structures of methyl lithium, Zeiss salt and ferrocene. EAN rule as applied to carbonyls. Preparation, structure, bonding and properties of mononuclear and polynuclear carbonyls of 3d metals. p-acceptor behaviour of carbon monoxide. Synergic effects (VB approach)- (MO diagram of CO can be referred to for synergic effect to IR frequencies). (12 Lectures)

Bio-Inorganic Chemistry

A brief introduction to bio-inorganic chemistry. Role of metal ions present in biological systems with special reference to Na^+, K^+ and Mg^{2+} ions: Na/K pump; Role of Mg^{2+} ions in energy production and chlorophyll. Role of Ca^{2+} in blood clotting, stabilization of protein structures and structural role (bones). (12 Lectures)

Section B: Organic Chemistry-4

(30 Lectures)

Polynuclear and heteronuclear aromatic compounds:

Properties of the following compounds with reference to electrophilic and nucleophilic substitution: Naphthalene, Anthracene , Furan, Pyrrole, Thiophene, and Pyridine. (6 Lectures)

Active methylene compounds:

Preparation: Claisen ester condensation. Keto-enol tautomerism.

Reactions: Synthetic uses of ethylacetoacetate (preparation of non-heteromolecules having upto 6 carbon). (6 Lectures)

Application of Spectroscopy to Simple Organic Molecules

Application of visible, ultraviolet and Infrared spectroscopy in organic molecules. Electromagnetic radiations, electronic transitions, λ_{max} and ε_{max}, chromophore, auxochrome, bathochromic and hypsochromic shifts. Application of electronic spectroscopy and Woodward rules for calculating l max of conjugated dienes and α,β – unsaturated compounds. Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions). (18 Lectures)

GCL-252: Inorg. and Org. Synthesis and Qualitative Analysis Lab

Program: Integrated M.Sc. **Semester:** Fourth
Course Title: *Inorg. & Org. Synthesis and Qualitative Analysis Lab*
Course Code: *GCL−252* **Type:** *Generic Elective Course*
Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYG−252: Generic Chem. : Organometallics, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV−IR Spectroscopy*"

Section A: Inorganic Chemistry

[1] Separation of mixtures by chromatography: Measure the *Rf* value in each case (Combination of two ions to be given).
Paper chromatographic separation of Fe^{3+}, $A1^{3+}$ and Cr^{3+} or
Paper chromatographic separation of Ni^{2+}, Co^{2+}, Mn^{2+} and Zn^{2+}

[2] Preparation of any two of the following complexes and measurement of their conductivity:
(i) tetraamminecarbonatocobalt (III) nitrate
(ii) tetraamminecopper (II) sulphate
(iii) potassium trioxalatoferrate (III) trihydrate
Compare the conductance of the complexes with that of M/1000 solution of NaCl, $MgCl_2$ and $LiCl_3$.

Section B: Organic Chemistry

Systematic Qualitative Organic Analysis of Organic Compounds possessing monofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.

CYC-301: Org. Chem. IV: Biomolecules

Nucleic Acids:

Components of nucleic acids, Nucleosides and nucleotides;

Structure, synthesis and reactions of: Adenine, Guanine, Cytosine, Uracil and Thymine; Structure of polynucleotides.

Amino Acids, Peptides and Proteins:

Amino acids, Peptides and their classification. ***α-Amino Acids:*** Synthesis, ionic properties and reactions. Zwitterions, pK_a values, isoelectric point and electrophoresis;

Study of peptides: determination of their primary structures-end group analysis, methods of peptide synthesis. Synthesis of peptides using N-protecting, C-protecting and C-activating groups -Solid-phase synthesis **Enzymes:**

Introduction, classification and characteristics of enzymes. Salient features of active site of enzymes.

Mechanism of enzyme action (taking trypsin as example), factors affecting enzyme action, coenzymes and cofactors and their role in biological reactions, specificity of enzyme action (including stereospecificity), enzyme inhibitors and their importance, phenomenon of inhibition (competitive, uncompetitive and non-competitive inhibition including allosteric inhibition).

Lipids:

Introduction to oils and fats; common fatty acids present in oils and fats, Hydrogenntion of fats and oils, Saponification value, acid value, iodine number. Reversion and rancidity.

Concept of Energy in Biosystems:

Cells obtain energy by the oxidation of foodstuff (organic molecules).

Introduction to metabolism (catabolism, anabolism).

ATP: The universal currency of cellular energy, ATP hydrolysis and free energy change.

Agents for transfer of electrons in biological redox systems: NAD_+, FAD.

Conversion of Food to Energy: Outline of catabolic pathways of carbohydrate- glycolysis, fermentation, Krebs cycle.

Overview of catabolic pathways of fat and protein.

Interrelationship in the metabolic pathways of protein, fat and carbohydrate.

Caloric value of food, standard caloric content of food types.

Pharmaceutical Compounds: Structure and Importance:

Classification, structure and therapeutic uses of antipyretics: Paracetamol (with synthesis), Analgesics: Ibuprofen (with synthesis), Antimalarials: Chloroquine (with synthesis). An elementary treatment of Antibiotics and detailed study of chloramphenicol, Medicinal values of curcumin (haldi), azadirachtin (neem), vitamin C and antacid (ranitidine).

CYL-301: Biochemistry Lab

Program: Integrated M.Sc. **Semester:** Fifth (5th)
Course Title: *Biochemistry Lab*
Course Code: *CYL−301* **Type:** Core Course
Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYC−301: Org. Chem. IV: Biomolecules"*

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[1] Estimation of glycine by Sorenson's formalin method.

[2] Study of the titration curve of glycine.

[3] Estimation of proteins by Lowry's method.

[4] Study of the action of salivary amylase on starch at optimum conditions.

[5] Effect of temperature on the action of salivary amylase.

[6] Saponification value of an oil or a fat.

[7] Determination of Iodine number of an oil/ fat.

[8] Isolation and characterization of DNA from onion/ cauliflower/peas.

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CYC-302: Phys. Chem. V: Quantum Chemistry & Spectroscopy

Quantum Chemistry

Postulates of quantum mechanics, quantum mechanical operators, Schrödinger equation and its application to free particle and "particle-in-a-box" (rigorous treatment), quantization of energy levels, zero-point energy and Heisenberg Uncertainty principle; wavefunctions, probability distribution functions, nodal properties, Extension to two and three dimensional boxes, separation of variables, degeneracy.

Qualitative treatment of simple harmonic oscillator model of vibrational motion: Setting up of Schrödinger equation and discussion of solution and wavefunctions. Vibrational energy of diatomic molecules and zero-point energy.

Angular momentum: Commutation rules, quantization of square of total angular momentum and z-component.

Rigid rotator model of rotation of diatomic molecule. Schrödinger equation, transformation to spherical polar coordinates. Separation of variables. Spherical harmonics. Discussion of solution.

Qualitative treatment of hydrogen atom and hydrogen-like ions: setting up of Schrödinger equation in spherical polar coordinates, radial part, quantization of energy (only final energy expression). Average and most probable distances of electron from nucleus.

Setting up of Schrödinger equation for many-electron atoms (He, Li). Need for approximation methods. Statement of variation theorem and application to simple systems (particle-in-a-box, harmonic oscillator, hydrogen atom).

Chemical bonding: Covalent bonding, valence bond and molecular orbital approaches, LCAO-MO treatment of H_2^+. Bonding and antibonding orbitals. Qualitative extension to H_2. Comparison of LCAO-MO and VB treatments of H_2 (only wavefunctions, detailed solution not required) and their limitations. Refinements of the two approaches (Configuration Interaction for MO, ionic terms in VB). Qualitative description of LCAO-MO treatment of homonuclear and heteronuclear diatomic molecules (HF, LiH). Localised and non-localised molecular orbitals treatment of triatomic (BeH2, H2O) molecules. Qualitative MO theory and its application to AH2 type molecules.

Molecular Spectroscopy:

Interaction of electromagnetic radiation with molecules and various types of spectra; BornOppenheimer approximation.

Rotation Spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.

Vibrational Spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies. *Vibration-rotation Spectroscopy*: diatomic vibrating rotator, P, Q, R branches.

Raman Spectroscopy: Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion.

principle, electronic

Electronic Spectroscopy: Franck-Condon states, fluorescence and phosphorescence, dissociation and predissociation, calculation of electronic transitions of polyenes using free electron model.

Nuclear Magnetic Resonance (NMR) Spectroscopy: Principles of NMR spectroscopy, Larmor precession, chemical shift and low resolution spectra, different scales, spin-spin coupling and high resolution spectra, interpretation of PMR spectra of organic molecules.

Electron Spin Resonance (ESR) Spectroscopy: Its principle, hyperfine structure, ESR of simple radicals.

Photochemistry

Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws, of photochemistry, quantum yield, actinometry, examples of low and high quantum yields, photochemical equilibrium and the differential rate of photochemical reactions, photosensitised reactions, quenching. Role of photochemical reactions in biochemical processes, photostationary states, chemiluminescence.

transitions, singlet and triplet

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Fifth

CYL-302: Spectroscopic Analysis Lab

Program: Integrated M.Sc. **Semester:** Fifth (5^{th})
Course Title: *Spectroscopic Analysis Lab*
Course Code: *CYL−302* **Type:** Core Course
Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYC−302: Phys. Chem. V: Quantum Chemistry & Spectroscopy"*

UV/Visible spectroscopy

[I] Study the 200-500 nm absorbance spectra of $KMnO_4$ and $K_2Cr_2O_7$ (in 0.1 M H_2SO_4) and determine the λ_{max} values. Calculate the energies of the two transitions in different units (J molecule^{-1}, kJ mol^{-1}, cm^{-1}, eV).

[II] Study the pH-dependence of the UV-Vis spectrum (200-500 nm) of $K_2Cr_2O_7$.

[III] Record the 200-350 nm UV spectra of the given compounds (acetone, acetaldehyde, 2-propanol, acetic acid) in water. Comment on the effect of structure on the UVspectra of organic compounds.

Colourimetry

[I] Verify Lambert-Beer's law and determine the concentration of $CuSO_4$/$KMnO_4$/$K_2Cr_2O_7$ in a solution of unknown concentration

[II] Determine the concentrations of $KMnO_4$ and $K_2Cr_2O_7$ in a mixture.

[III] Study the kinetics of iodination of propanone in acidic medium.

[IV] Determine the amount of iron present in a sample using 1,10-phenathroline.

[V] Determine the dissociation constant of an indicator (phenolphthalein).

[VI] Study the kinetics of interaction of crystal violet/ phenolphthalein with sodium hydroxide.

[VII] Analysis of the given vibration-rotation spectrum of HCl(g)

CYC-351: Inorg. Chem. IV: Organometallic Chemistry

Theoretical Principles in Qualitative Analysis (H_2S Scheme)

Basic principles involved in analysis of cations and anions and solubility products, common ion effect. Principles involved in separation of cations into groups and choice of group reagents. Interfering anions (fluoride, borate, oxalate and phosphate) and need to remove them after Group II.

Organometallic Compounds

Definition and classification of organometallic compounds on the basis of bond type.

Concept of hapticity of organic ligands.

Metal Carbonyls: 18 electron rule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation (direct combination, reductive carbonylation, thermal and photochemical decomposition) of mono and binuclear carbonyls of 3d series. Structures of mononuclear and binuclear carbonyls of Cr, Mn, Fe, Co and Ni using VBT. π-acceptor behaviour of CO (MO diagram of CO to be discussed), synergic effect and use of IR data to explain extent of back bonding.

Zeise's Salt: Preparation and structure, evidences of synergic effect and comparison of synergic effect with that in carbonyls.

Metal Alkyls: Important structural features of methyl lithium (tetramer) and trialkyl aluminium (dimer), concept of multicentre bonding in these compounds. Role of triethylaluminium in polymerisation of ethene (Ziegler – Natta Catalyst). Species present in ether solution of Grignard reagent and their structures, Schlenk equilibrium.

Ferrocene: Preparation and reactions (acetylation, alkylation, metallation, Mannich Condensation). Structure and aromaticity. Comparison of aromaticity and reactivity with that of benzene.

Reaction Kinetics and Mechanism

Introduction to inorganic reaction mechanisms. Substitution reactions in square planar complexes, Trans- effect, theories of trans effect, Mechanism of nucleophilic substitution in square planar complexes, Thermodynamic and Kinetic stability, Kinetics of octahedral substitution, Ligand field effects and reaction rates, Mechanism of substitution in octahedral complexes.

Catalysis by Organometallic Compounds

Study of the following industrial processes and their mechanism:

1. Alkene hydrogenation (Wilkinsons Catalyst)
2. Hydroformylation (Co salts)
3. Wacker Process
4. Synthetic gasoline (Fischer Tropsch reaction)
5. Synthesis gas by metal carbonyl complexes

CYL-351: Inorganic Synthesis and Qualitative Analysis Lab

Program: Integrated M.Sc. **Semester:** Sixth (6^{th})
Course Title: Inorganic *Synthesis & Qualitative Analysis Lab*
Course Code: *CYL−351* **Type:** Core Course
Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYC−351: Inorg. Chem. IV: Organometallic Chemistry*"

Qualitative semimicro analysis of mixtures containing 3 anions and 3 cations. Emphasis should be given to the understanding of the chemistry of different reactions. The following radicals are suggested:

CO_3^{2-}, NO_2^-, S^{2-}, SO_3^{2-}, $S_2O_3^{2-}$, CH_3COO^-, F^-, Cl^-, Br^-, I^-, NO_3^-, BO_3^{3-}, $C_2O_4^{2-}$, PO_4^{3-}, NH_4^+, K^+, Pb^{2+}, Cu^{2+}, Cd^{2+}, Bi^{3+}, Sn^{2+}, Sb^{3+}, Fe^{3+}, Al^{3+}, Cr^{3+}, Zn^{2+}, Mn^{2+}, Co^{2+}, Ni^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}

Mixtures should preferably contain one interfering anion, **or** insoluble component ($BaSO_4$, $SrSO_4$, $PbSO_4$, CaF_2 or Al_2O_3) **or** combination of anions e.g. CO_3^{2-} and SO_3^{2-}, NO_2^- and NO_3^-, Cl^- and Br^-, Cl^- and I^-, Br^- and I^-, NO_3^- and Br^-, NO_3^- and I^-. Spot tests should be done whenever possible.

i. Measurement of 10 Dq by spectrophotometric method ii. Verification of spectrochemical series. iii. Controlled synthesis of two copper oxalate hydrate complexes: kinetic vs thermodynamic factors.

iv. Preparation of acetylacetanato complexes of Cu^{2+}/Fe^{3+}. Find the λ_{max} of the complex.

v. Synthesis of ammine complexes of Ni(II) and its ligand exchange reactions (e.g. bidentate ligands like acetylacetone, DMG, glycine) by substitution method.

Sixth Semester

CYC-352: Org. Chem. V: Carbohydrates, Dyes, Polymers and Basics of Org. Spectroscopy

Organic Spectroscopy

General principles Introduction to absorption and emission spectroscopy.

UV Spectroscopy: Types of electronic transitions, λmax, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption; Application of Woodward Rules for calculation of λ_{max} for the following systems: α,β unsaturated aldehydes, ketones, carboxylic acids and esters; Conjugated dienes: alicyclic, homoannular and heteroannular; Extended conjugated systems (aldehydes, ketones and dienes); distinction between *cis* and *trans* isomers.

IR Spectroscopy: Fundamental and non-fundamental molecular vibrations; IR absorption positions of O, N and S containing functional groups; Effect of H-bonding, conjugation, resonance and ring size on IR absorptions; Fingerprint region and its significance; application in functional group analysis.

NMR Spectroscopy: Basic principles of Proton Magnetic Resonance, chemical shift and factors influencing it; Spin – Spin coupling and coupling constant; Anisotropic effects in alkene, alkyne, aldehydes and aromatics, Interpetation of NMR spectra of simple compounds. *Applications of IR, UV and NMR for identification of simple organic molecules*.

Carbohydrates

Occurrence, classification and their biological importance.

Monosaccharides: Constitution and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses; Killiani-Fischer synthesis and Ruff degradation;

Disaccharides: Structure elucidation of maltose, lactose and sucrose.

Polysaccharides: Elementary treatment of starch, cellulose and glycogen.

Dyes

Classification, Colour and constitution; Mordant and Vat Dyes; Chemistry of dyeing.

Synthesis and Applications of:

Azo dyes: Methyl Orange and Congo Red (mechanism of Diazo Coupling);
Triphenyl Methane Dyes : Malachite Green, Rosaniline and Crystal Violet;
Phthalein Dyes : Phenolphthalein and Fluorescein;
Natural dyes : structure elucidation and synthesis of Alizarin and Indigotin;

Edible Dyes with examples.

Polymers

Introduction and classification including di-block, tri-block and amphiphilic polymers; Number average molecular weight, Weight average molecular weight, Degree of polymerization, Polydispersity Index.

Polymerisation reactions: Addition and condensation -Mechanism of cationic, anionic and free radical addition polymerization; Metallocene-based Ziegler-Natta polymerisation of alkenes; Preparation and applications of plastics – thermosetting (phenol-formaldehyde, Polyurethanes) and thermosoftening (PVC, polythene);

Fabrics: Natural and synthetic (acrylic, polyamido, polyester); Rubbers – natural and synthetic: Buna-S, Chloroprene and Neoprene; Vulcanization; Polymer additives; Introduction to liquid crystal polymers; Biodegradable and conducting polymers with examples.

CYL-352: Organic Synthesis & Qualitative Analysis Lab

Program: Integrated M.Sc. **Semester:** Sixth (6^{th})
Course Title: *Organic Synthesis & Qualitative Analysis Lab*
Course Code: *CYL−352* **Type:** Core Course
Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYC−351: Org. Chem. V: Carbohydrates, Dyes, Polymers and Basics of Org. Spectroscopy*"

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[1] Extraction of caffeine from tea leaves.
[2] Preparation of sodium polyacrylate.
[3] Preparation of urea formaldehyde.
[4] Analysis of Carbohydrate: aldoses and ketoses, reducing and non-reducing sugars.
[5] Qualitative analysis of unknown organic compounds containing monofunctional groups (carbohydrates, aryl halides, aromatic hydrocarbons, nitro compounds, amines and amides) and simple bifunctional groups, for e.g. salicylic acid, cinnamic acid, nitrophenols etc.
[6] Identification of simple organic compounds by IR spectroscopy and NMR spectroscopy (Spectra to be provided).
[7] Preparation of methyl orange.

Generic Elective Course: 04 Credits

CYG-101: Generic Chem.:
Atomic Structure, Bonding, General Organic Chemistry, & Aliphatic Hydrocarbons

Section A: Inorganic Chemistry-1

(30 Lectures)

Atomic Structure:

Review of: *Bohr's theory and its limitations, dual behaviour of matter and radiation, deBroglie's relation, Heisenberg Uncertainty principle. Hydrogen atom spectra. Need of a new approach to Atomic structure*.

What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and ψ^2 , Schrödinger equation for hydrogen atom. Radial and angular parts of the hydogenic wavefunctions (atomic orbitals) and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals (Only graphical representation). Radial and angular nodes and their significance. Radial distribution functions and the concept of the most probable distance with special reference to 1s and 2s atomic orbitals. Significance of quantum numbers, orbital angular momentum and quantum numbers m_l and m_s. Shapes of s, p and d atomic orbitals, nodal planes. Discovery of spin, spin quantum number (s) and magnetic spin quantum number (m_s).

Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations. (14 Lectures)

Chemical Bonding and Molecular Structure *Ionic*

Bonding:

General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, BornHaber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

Covalent bonding:

VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.

Concept of resonance and resonating structures in various inorganic and organic compounds.

MO Approach:

Rules for the LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (including idea of s-p mixing) and heteronuclear diatomic molecules such as CO, NO and NO^+ . Comparison of VB and MO approaches. (16 Lectures)

Semester

Section B: Organic Chemistry-1

(30 Lectures)

Fundamentals of Organic Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals. Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. Aromaticity: Benzenoids and Hückel's rule.

Stereochemistry

Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; cis - trans nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems). (10 Lectures)

Aliphatic Hydrocarbons

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.

Alkanes: (Upto 5 Carbons). Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: Free radical Substitution: Halogenation.

Alkenes: (Upto 5 Carbons) Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition (alk. $KMnO_4$) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidation.

Alkynes: (Upto 5 Carbons) Preparation: Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides. Reactions: formation of metal acetylides, addition of bromine and alkaline $KMnO_4$, ozonolysis and oxidation with hot alk. $KMnO_4$. **Chemistry** (12 Lectures)

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(Non- Semester)

Generic Elective Course: 02 Credits

GCL−101: Inorg. and Org. Chemical Analysis Lab

(Non-Semester Specific and for the Students of First, Second, Third or Fourth Semesters)

Program: Integrated M.Sc. **Semester:** Generally chosen at First Semester
Type: *Generic Elective Course* **Credits**: 02
Contact Hours: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYG−101: Generic Chem.: Atomic Structure, Bonding, General Organic Chemistry, Aliphatic Hydrocarbons*"

Section A: Inorganic Chemistry - Volumetric Analysis

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Estimation of oxalic acid by titrating it with $KMnO_4$.
3. Estimation of water of crystallization in Mohr's salt by titrating with KMnO4.
4. Estimation of Fe (II) ions by titrating it with $K_2Cr_2O_7$ using internal indicator.
5. Estimation of Cu (II) ions iodometrically using $Na_2S_2O_3$.

Section B: Organic Chemistry

1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements)
2. Separation of mixtures by Chromatography: Measure the R_f value in each case (combination of two compounds to be given)
   (a) Identify and separate the components of a given mixture of 2 amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography
   (b) Identify and separate the sugars present in the given mixture by paper chromatography.

(Non-

Generic Elective Course: 04 Credits

CYG-151: Generic Chem.: Chemical Energetics, Equilibria & Functional Group Organic Chemistry-I

(Non-Semester Specific and for the Students of First, Second, Third or Fourth Semesters)

Section A: Physical Chemistry-1

(30 Lectures)

Chemical Energetics (10 Lectures)

Review of thermodynamics and the Laws of Thermodynamics.

Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature – Kirchhoff's equation.

Statement of Third Law of thermodynamics and calculation of absolute entropies of substances.

Chemical Equilibrium: (8 Lectures)

Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between ΔG and ΔG^o, Le Chatelier's principle. Relationships between K_p, K_c and K_x for reactions involving ideal gases.

Ionic Equilibria: (12 Lectures)

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.

Section B: Organic Chemistry-2

(30 Lectures)

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.

Aromatic hydrocarbons: (8 Lectures)

Preparation (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid.

Reactions: (Case benzene): Electrophilic substitution: nitration, halogenation and sulphonation. Friedel-Craft's reaction (alkylation and acylation) (upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene).

Alkyl and Aryl Halides

Alkyl Halides (Upto 5 Carbons): Types of Nucleophilic Substitution (SN_1, SN_2 and SNi) reactions.

Preparation: from alkenes and alcohols.

Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vs substitution.

Aryl Halides: Preparation**:** (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions.
Reactions (Chlorobenzene): Aromatic nucleophilic substitution (replacement by –OH group) and effect of nitro substituent. Benzyne Mechanism: KNH_2/NH_3 (or $NaNH_2/NH_3$).

Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides. (8 Lectures)

Alcohols, Phenols and Ethers (Upto 5 Carbons) ***Alcohols***:

Preparation: Preparation of 1o , 2o and 3o alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters.

Reactions: With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. $KMnO_4$, acidic dichromate, conc. HNO_3). Oppeneauer oxidation

Diols: (Upto 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement.

Phenols: (Phenol case)

Preparation: Cumene hydroperoxide method, from diazonium salts. Reactions: Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer-Tiemann Reaction, Gattermann-Koch Reaction, Houben–Hoesch Condensation, Schotten – Baumann Reaction.

Ethers (aliphatic and aromatic): Cleavage of ethers with HI.

Aldehydes and ketones (aliphatic and aromatic): (Formaldehye, acetaldehyde, acetone and benzaldehyde).

Preparation: from acid chlorides and from nitriles.

Reactions – Reaction with HCN, ROH, $NaHSO_3$, NH_2-G derivatives. Iodoform test. Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction. Meerwein-Pondorff Verley reduction. (14 Lectures)

Generic Elective Course: 02 Credits

(Non-

GCL-151: Basic Physical and Organic Chemistry Lab

(Non-Semester Specific and for the Students of First, Second, Third or Fourth Semesters)

Program: Integrated M.Sc. **Semester:** Generally chosen at 2nd Sem
Course Title: *Basic Physical and Organic Chemistry Lab*
Course Code: *GCL−151* **Type:** *Generic Elective Course*
Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYG−151: Generic Chem. : Chemical Energetics, Equilibria & Functional Group Org. Chem. I*"

***Section A: Physical Chemistry* Thermochemistry**

1. Determination of heat capacity of calorimeter for different volumes.
2. Determination of enthalpy of neutralization of HCl with NaOH.
3. Determination of enthalpy of ionization of acetic acid.
4. Determination of integral enthalpy of solution of salts (KNO_3, NH_4Cl).
5. Determination of enthalpy of hydration of copper sulphate.
6. Study of the solubility of benzoic acid in water and determination of ΔH.

Ionic equilibria pH measurements

a) Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.
b) Preparation of buffer solutions: (i) Sodium acetate-acetic acid, and (ii) Ammonium chloride-ammonium hydroxide
Measurement of the pH of buffer solutions and comparison of the values with theoretical values.

Section B: Organic Chemistry

1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.
2. Criteria of Purity: Determination of melting and boiling points.
3. Preparations: Mechanism of various reactions involved to be discussed. Recrystallisation, determination of melting point and calculation of quantitative yields to be done.
   (a) Bromination of Phenol/Aniline
   (b) Benzoylation of amines/phenols
   (c) Oxime and 2,4 dinitrophenylhydrazone of aldehyde/ketone

Generic Elective Course: 04 Credits

CYG-201: Generic Chem.: s- and p-Block Elements, States of Matter and Chemical Kinetics

Section A: Inorganic Chemistry

(30 Lectures)

General Principles of Metallurgy: (4 Lectures)

Chief modes of occurrence of metals based on standard electrode potentials. Ellingham diagrams for reduction of metal oxides using carbon as reducing agent. Hydrometallurgy, Methods of purification of metals (Al, Pb, Ti, Fe, Cu, Ni, Zn): electrolytic, oxidative refining, Kroll process, Parting process, van Arkel-de Boer process and Mond's process. **s- and p-Block Elements**:

Periodicity in s- and p-block elements with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electronegativity (Pauling, Mulliken, and Alfred-Rochow scales). Allotropy in C, S, and P.

Oxidation states with reference to elements in unusual and rare oxidation states like carbides and nitrides), inert pair effect, diagonal relationship and anomalous behaviour of first member of each group.

Compounds of s- and p-Block Elements

Hydrides and their classification (ionic, covalent and interstitial), structure and properties with respect to stability of hydrides of p- block elements.

Concept of multicentre bonding (diborane).

Structure, bonding and their important properties like oxidation/reduction, acidic/basic nature of the following compounds and their applications in industrial, organic and environmental chemistry.

Hydrides of nitrogen (NH_3, N_2H_4, N_3H, NH_2OH) Oxoacids

of P, S and Cl.

Halides and oxohalides: PCl_3, PCl_5, $SOCl_2$ and SO_2Cl_2

(26 Lectures)

Section B: Physical Chemistry-3

(30 Lectures)

Kinetic Theory of Gases

Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation.

Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. van der Waals equation of state for real gases. Boyle temperature (derivation not required). Critical phenomena, critical constants and their calculation from van der Waals equation. Andrews isotherms of CO_2.

Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphic representation – derivation not required) and their importance.

Temperature dependence of these distributions. Most probable, average and root mean square velocities (no derivation). Collision cross section, collision number, collision frequency, collision diameter and mean free path of molecules. Viscosity of gases and effect of temperature and pressure on coefficient of viscosity (qualitative treatment only).

Liquids

Surface tension and its determination using stalagmometer. Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only) **Solids**

Forms of solids. Symmetry elements, unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices. Miller indices. X–Ray diffraction by crystals, Bragg's law. Structures of NaCl, KCl and CsCl (qualitative treatment only). Defects in crystals. Glasses and liquid crystals.

Chemical Kinetics

The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction. Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation.

Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).

Skill Enhancement Course

(Non- Semester)

Generic Elective Course: 02 Credits

GCL-201: Basic Physical and Inorganic Chemistry Lab

(Non-Semester Specific and for the Students of First, Second, Third or Fourth Semesters)

Program: Integrated M.Sc. **Semester:** Generally it is chosen at 3rd Sem
Course Title: *Basic Physical and Inorganic Chemistry Lab*
Course Code: *GCL−201* **Type:** *Generic Elective Course*
Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYG−201: Generic Chem. : s- and p-Block Elements, States of Matter & Chemical Kinetics"*

Section A: Inorganic Chemistry

Semi-micro qualitative analysis using H_2S of mixtures- not more than four ionic species (two anions and two cations and excluding insoluble salts) out of the following:

Cations : NH_4^+, Pb^{2+}, Ag^+, Bi^{3+}, Cu^{2+}, Cd^{2+}, Sn^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Cr^{3+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, K^+

Anions : CO_3^{2-}, S^{2-}, SO_2^-, $S_2O_3^{2-}$, NO_3^-, CH_3COO^-, Cl^-, Br^-, I^-, NO_3^-,SO_4^{2-}, PO_4^{3-}, BO_3^{3-}, $C_2O_4^{2-}$, F-

(Spot tests should be carried out wherever feasible)

Section B: Physical Chemistry

(I) Surface tension measurement (use of organic solvents excluded).

a) Determination of the surface tension of a liquid or a dilute solution using a stalagmometer.

b) Study of the variation of surface tension of a detergent solution with concentration.

(II) Viscosity measurement (use of organic solvents excluded).

a) Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer.

b) Study of the variation of viscosity of an aqueous solution with concentration of solute.

(III) Chemical Kinetics:

Study the kinetics of the following reactions.

(1) Initial rate method: *Iodide-persulphate reaction.*

(2) Integrated rate method: (a) *Acid hydrolysis of methyl acetate with hydrochloric acid,* (b) *Saponification of ethyl acetate* and *(c) Compare the strengths of HCl and H_2SO_4 by studying kinetics of hydrolysis of methyl acetate*

Generic Elective Course: 04 Credits

CYG- 202: Generic Chem.: Chemistry of d-Block Elements, Quantum Chemistry & Spectroscopy

(Non-Semester Specific and for the Students of First, Second, Third or Fourth Semesters)

Section A: Inorganic Chemistry-3

(30 Lectures)

Transition Elements (3d series)

General group trends with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties, ability to form complexes and stability of various oxidation states (Latimer diagrams) for Mn, Fe and Cu.

Lanthanoids and actinoids: Electronic configurations, oxidation states, colour, magnetic properties, lanthanide contraction, separation of lanthanides (ion exchange method only).

Coordination Chemistry

Valence Bond Theory (VBT): Inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu (coordination numbers 4 and 6). Structural and stereoisomerism in complexes with coordination numbers 4 and 6.

Drawbacks of VBT. IUPAC system of nomenclature.

Crystal Field Theory

Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry. Factors affecting the magnitude of D. Spectrochemical series. Comparison of CFSE for Oh and Td complexes, Tetragonal distortion of octahedral geometry. Jahn-Teller distortion, Square planar coordination.

Section B: Physical Chemistry-4

(30 Lectures)

Quantum Chemistry & Spectroscopy

Spectroscopy and its importance in chemistry. Wave-particle duality. Link between spectroscopy and quantum chemistry. Electromagnetic radiation and its interaction with matter. Types of spectroscopy. Difference between atomic and molecular spectra. BornOppenheimer approximation: Separation of molecular energies into translational, rotational, vibrational and electronic components.

Postulates of quantum mechanics, quantum mechanical operators.

Free particle. Particle in a 1-D box (complete solution), quantization, normalization of wavefunctions, concept of zero-point energy.

Rotational Motion: Schrödinger equation of a rigid rotator and brief discussion of its results (solution not required). Quantization of rotational energy levels.

Microwave (pure rotational) spectra of diatomic molecules. Selection rules. Structural information derived from rotational spectroscopy.

Vibrational Motion: Schrödinger equation of a linear harmonic oscillator and brief discussion of its results (solution not required). Quantization of vibrational energy levels. Selection rules, IR spectra of diatomic molecules. Structural information derived from vibrational spectra. Vibrations of polyatomic molecules. Group frequencies. Effect of hydrogen bonding (inter- and intramolecular) and substitution on vibrational frequencies.

Electronic Spectroscopy: Electronic excited states. Free Electron model and its application to electronic spectra of polyenes. Colour and constitution, chromophores, auxochromes, bathochromic and hypsochromic shifts.

Photochemistry

Laws of photochemistry. Lambert-Beer's law. Fluorescence and phosphorescence. Quantum efficiency and reasons for high and low quantum yields. Primary and secondary processes in photochemical reactions. Photochemical and thermal reactions. Photoelectric cells. (6 Lectures)

(Non-

Generic Elective Course: 02 Credits

GCL-202: Basic Spectroscopic Analysis Lab

(Non-Semester Specific and for the Students of First, Second, Third or Fourth Semesters)

Program: Integrated M.Sc. **Semester:** Non-Semester Specific
Course Code: *GCL−202* **Type:** Generic Elective Course
Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYG−202: Generic Chem.: Chemistry of d-Block Elements, Quantum Chemistry and Spectroscopy"*

Section A: Inorganic Chemistry

[1] Estimation of the amount of nickel present in a given solution as bis(dimethylglyoximato) nickel(II) or aluminium as oxinate in a given solution gravimetrically.

[2] Estimation of (i) Mg^{2+} or (ii) Zn^{2+} by complexometric titrations using EDTA.

[3] Estimation of total hardness of a given sample of water by complexometric titration.

[4] To draw calibration curve (absorbance at λ_{max} vs. concentration) for various concentrations of a given coloured compound and estimate the concentration of the same in a given solution. [5] Determination of the composition of the Fe^{3+} - salicylic acid complex / Fe^{2+} - phenanthroline complex in solution by Job's method.

[6] Determination of concentration of Na^{+} and K^{+} using Flame Photometry.

Section B: Physical Chemistry

UV/Visible spectroscopy

[I] Study the 200-500 nm absorbance spectra of $KMnO_4$ and $K_2Cr_2O_7$ (in 0.1 M H2SO4) and determine the λ_{max} values. Calculate the energies of the two transitions in different units (J molecule-1 , kJ mol^{-1} , cm^{-1} , eV).

[II] Study the pH-dependence of the UV-Vis spectrum (200-500 nm) of $K_2Cr_2O_7$.

[III] Record the 200-350 nm UV spectra of the given compounds (acetone, acetaldehyde, 2propanol, acetic acid) in water. Comment on the effect of structure on the UV spectra of organic compounds. **Colourimetry**

[I] Verify Lambert-Beer's law and determine the concentration of $CuSO_4$/$KMnO_4$/$K_2Cr_2O_7$ in a solution of unknown concentration

[II] Analyse the given vibration-rotation spectrum of HCl(g)

Skill Enhancement Course

(Non- Semester)

Generic Elective Course: 04 Credits

CYG- 203: Generic Chem.: Molecules of Life

(Non-Semester Specific and for the Students of First, Second, Third or Fourth Semesters. Generally it is offered for or chosen by the students of 3 rd Semester)

Unit 1: Carbohydrates (10 Periods)

Classification of carbohydrates, reducing and non-reducing sugars, General Properties of Glucose and Fructose, their open chain structure. Epimers, mutarotation and anomers. Determination of configuration of Glucose (Fischer proof). Cyclic structure of glucose. Haworth projections.

Cyclic structure of fructose. Linkage between monosachharides, structure of disacharrides (sucrose, maltose, lactose) and polysacharrides (starch and cellulose) excluding their structure elucidation.

Unit 2: Amino Acids, Peptides and Proteins (12 Periods)

Classification of Amino Acids, Zwitterion structure and Isoelectric point. Overview of Primary, Secondary, Tertiary and Quaternary structure of proteins. Determination of primary structure of peptides, determination of N-terminal amino acid (by DNFB and Edman method) and C-terminal amino acid (by thiohydantoin and with carboxypeptidase enzyme). Synthesis of simple peptides (upto dipeptides) by N-protection (t-butyloxycarbonyl and phthaloyl) & Cactivating groups and Merrifield solid phase synthesis.

Unit 3: Enzymes and correlation with drug action (12 Periods)

Mechanism of enzyme action, factors affecting enzyme action, Coenzymes and cofactors and their role in biological reactions, Specificity of enzyme action(Including stereospecifity) , Enzyme inhibitors and their importance, phenomenon of inhibition(Competitive and Non competitive inhibition including allosteric inhibtion). Drug action-receptor theory. Structure –activity relationships of drug molecules, binding role of –OH group,-NH_2 group, double bond and aromatic ring,

Unit 4: Nucleic Acids (10 Periods)

Components of Nucleic acids: Adenine, guanine, thymine and Cytosine (Structure only), other components of nucleic acids, Nucleosides and nucleotides (nomenclature), Structure of polynucleotides; Structure of DNA (Watson-Crick model) and RNA(types of RNA), Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation.

Unit 5: Lipids (08 Periods)

Introduction to lipids, classification. Oils and fats: Common fatty acids present in oils and fats, Omega fatty acids, Trans fats, Hydrogenation, Saponification value, Iodine number. Biological importance of triglycerides, phospholipids, glycolipids, and steroids (cholesterol).

Unit 6: Concept of Energy in Biosystems (8 Periods)

(Non-

Calorific value of food. Standard caloric content of carbohydrates, proteins and fats. Oxidation of foodstuff (organic molecules) as a source of energy for cells. Introduction to Metabolism (catabolism, anabolism),

ATP: the universal currency of cellular energy, ATP hydrolysis and free energy change. *Conversion of food into energy*. Outline of catabolic pathways of Carbohydrate- Glycolysis, Fermentation, Krebs Cycle. Overview of catabolic pathways of Fats and Proteins. Interrelationships in the metabolic pathways of Proteins, Fats and Carbohydrates.

Generic Elective Course: 02 Credits

GCL-203: Basic Biochemistry Lab

(Non-Semester Specific and for the Students of First, Second, Third or Fourth Semesters)

Program: Integrated M.Sc. **Semester:** Commonly offered at 3rd Semester
Course Code: *GCL−203* **Type:** Generic Elective Course
Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYG−203: Generic Chem.: Molecules of Life"*

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[1] Separation of amino acids by paper chromatography
[2] To determine the concentration of glycine solution by formylation method.
[3] Study of titration curve of glycine
[4] Action of salivary amylase on starch
[5] Effect of temperature on the action of salivary amylase on starch.
[6] To determine the saponification value of an oil/fat.
[7] To determine the iodine value of an oil/fat
[8] Differentiate between a reducing/ nonreducing sugar.
[9] Extraction of DNA from onion/cauliflower
[10] To synthesise aspirin by acetylation of salicylic acid and compare it with the ingredient of an aspirin tablet by TLC. Suggested Readings:

[1] Furniss, B.S.; Hannaford, A.J.; Rogers, V.; Smith, P.W.G.; Tatchell, A.R. Vogel's Textbook of Practical Organic Chemistry, ELBS.
[2] Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry, Universities Press.

Skill Enhancement Course

(Non- Semester)

Generic Elective Course: 04 Credits

CYG-252: Generic Chem.: Organometallics, Bioinorganic Chemistry, Polymer Hydrocarbons and UV-IR Spectroscopy

(Non-Semester Specific and for the Students of First, Second, Third or Fourth Semesters)

Section A: Inorganic Chemistry-4

(30 Lectures)

Chemistry of 3d metals

Oxidation states displayed by Cr, Fe, Co, Ni and Co.

A study of the following compounds (including preparation and important properties);

Peroxo compounds of Cr, $K_2Cr_2O_7$, $KMnO_4$, $K_4[Fe(CN)_6]$, sodium nitroprusside, $[Co(NH_3)_6]Cl_3$, $Na_3[Co(NO_2)_6]$. (6 Lectures)

Organometallic Compounds

Definition and Classification with appropriate examples based on nature of metal-carbon bond (ionic, s, p and multicentre bonds). Structures of methyl lithium, Zeiss salt and ferrocene. EAN rule as applied to carbonyls. Preparation, structure, bonding and properties of mononuclear and polynuclear carbonyls of 3d metals. p-acceptor behaviour of carbon monoxide. Synergic effects (VB approach)- (MO diagram of CO can be referred to for synergic effect to IR frequencies). (12 Lectures)

Bio-Inorganic Chemistry

A brief introduction to bio-inorganic chemistry. Role of metal ions present in biological systems with special reference to Na^+, K^+ and Mg^{2+} ions: Na/K pump; Role of Mg^{2+} ions in energy production and chlorophyll. Role of Ca^{2+} in blood clotting, stabilization of protein structures and structural role (bones). (12 Lectures)

Section B: Organic Chemistry-4

(30 Lectures)

Polynuclear and heteronuclear aromatic compounds:

Properties of the following compounds with reference to electrophilic and nucleophilic substitution: Naphthalene, Anthracene , Furan, Pyrrole, Thiophene, and Pyridine. (6 Lectures)

Active methylene compounds:

(Non-

Preparation: Claisen ester condensation. Keto-enol tautomerism.

Reactions: Synthetic uses of ethylacetoacetate (preparation of non-heteromolecules having upto 6 carbon). (6 Lectures)

Application of Spectroscopy to Simple Organic Molecules

Application of visible, ultraviolet and Infrared spectroscopy in organic molecules.

Electromagnetic radiations, electronic transitions, λ_{max} and ε_{max}, chromophore, auxochrome, bathochromic and hypsochromic shifts. Application of electronic spectroscopy and Woodward rules for calculating l max of conjugated dienes and α,β – unsaturated compounds. Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions). (18 Lectures)

Generic Elective Course: 02 Credits

GCL-252: Inorg. and Org. Synthesis and Qualitative Analysis Lab

(Non-Semester Specific and for the Students of First, Second, Third or Fourth Semesters)

Program: Integrated M.Sc. **Semester:** Commonly offered at 4th Semester

Course Title: *Inorg. & Org. Synthesis and Qualitative Analysis Lab*

Course Code: *GCL−252* **Type:** *Generic Elective Course*

Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)

Corresponding Theory Course: To be offered in combination with the theory course titled "*CYG−252: Generic Chem. : Organometallics, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV−IR Spectroscopy*"

Section A: Inorganic Chemistry

[1] Separation of mixtures by chromatography: Measure the *Rf* value in each case (Combination of two ions to be given).

Paper chromatographic separation of Fe^{3+}, $A1^{3+}$ and Cr^{3+} or

Paper chromatographic separation of Ni^{2+}, Co^{2+}, Mn^{2+} and Zn^{2+}

[2] Preparation of any two of the following complexes and measurement of their conductivity:

(i) tetraamminecarbonatocobalt (III) nitrate

(ii) tetraamminecopper (II) sulphate

(iii) potassium trioxalatoferrate (III) trihydrate

Compare the conductance of the complexes with that of M/1000 solution of NaCl, $MgCl_2$ and $LiCl_3$.

Section B: Organic Chemistry

Systematic Qualitative Organic Analysis of Organic Compounds possessing monofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.

Generic Elective Course: 04 Credits

CYG- : Generic Chem.: Solutions, Phase Equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry-II

(Non-Semester Specific and for the Students of First, Second, Third or Fourth Semesters)

Section A: Physical Chemistry-2

(30 Lectures)

Solutions

Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions. Vapour pressure-composition and temperaturecomposition curves of ideal and non-ideal solutions. Distillation of solutions. Lever rule. Azeotropes.

Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids. Immiscibility of liquids- Principle of steam distillation. Nernst distribution law and its applications, solvent extraction.

Phase Equilibrium

Phases, components and degrees of freedom of a system, criteria of phase equilibrium. Gibbs Phase Rule and its thermodynamic derivation. Derivation of Clausius – Clapeyron equation and its importance in phase equilibria. Phase diagrams of one-component systems (water and 83 sulphur) and two component systems involving eutectics, congruent and incongruent melting points (lead-silver, $FeCl_3$-H_2O and Na-K only).

Conductance

Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Kohlrausch law of independent migration of ions. Transference number and its experimental determination using Hittorf and Moving boundary methods. Ionic mobility. Applications of conductance measurements: determination of degree of ionization of weak electrolyte, solubility and solubility products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt. Conductometric titrations (only acidbase).

Electrochemistry

Reversible and irreversible cells. Concept of EMF of a cell. Measurement of EMF of a cell. Nernst equation and its importance. Types of electrodes. Standard electrode potential. Electrochemical series. Thermodynamics of a reversible cell, calculation of thermodynamic properties: ΔG, ΔH and ΔS from EMF data.

Calculation of equilibrium constant from EMF data. Concentration cells with transference and without transference. Liquid junction potential and salt bridge.

pH determination using hydrogen electrode and quinhydrone electrode.

Potentiometric titrations -qualitative treatment (acid-base and oxidation-reduction only).

Section B: Organic Chemistry-3

(30 Lectures)

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.

Carboxylic acids and their derivatives:

Carboxylic acids (aliphatic and aromatic):

Preparation: Acidic and Alkaline hydrolysis of esters.

Reactions: Hell – Vohlard - Zelinsky Reaction.

Carboxylic acid derivatives (aliphatic): (Upto 5 carbons)

Preparation: Acid chlorides, Anhydrides, Esters and Amides from acids and their interconversion.

Reactions: Comparative study of nucleophilicity of acyl derivatives. Reformatsky Reaction, Perkin condensation.

Amines and Diazonium Salts

Amines (Aliphatic and Aromatic): (Upto 5 carbons)

Preparation: from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction.

Reactions: Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO_2, Schotten – Baumann Reaction. Electrophilic substitution (case aniline): nitration, bromination, sulphonation.

Diazonium salts:

Preparation: from aromatic amines.

Reactions: conversion to benzene, phenol, dyes.

Amino Acids, Peptides and Proteins: *Preparation of Amino Acids*: Strecker synthesis using Gabriel's phthalimide synthesis. Zwitterion, Isoelectric point and Electrophoresis.
Reactions of Amino acids: ester of –COOH group, acetylation of $–NH_2$ group, complexation with Cu^{2+} ions, ninhydrin test.
Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins.
Determination of Primary structure of Peptides by degradation Edmann degradation (Nterminal) and C-terminal (thiohydantoin and with carboxypeptidase enzyme). Synthesis of simple peptides (upto dipeptides) by N-protection (t-butyloxycarbonyl and phthaloyl) & Cactivating groups and Merrifield solid-phase synthesis.

Carbohydrates:
Classification, and General Properties, Glucose and Fructose (open chain and cyclic structure), Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose, Mutarotation, ascending and descending in monosaccharides. Structure of disacharrides (sucrose, cellobiose, maltose, lactose) and polysacharrides (starch and cellulose) excluding their structure elucidation.

Generic Elective Course: 02 Credits

Phase Equilibria, Electrochemistry and Qualitative Org. Analysis Lab

(Non-Semester Specific and for the Students of First, Second, Third or Fourth Semesters)

Program: Integrated M.Sc. **Semester:** Non-Semester Specific
Course Code: *GCL–……* **Type:** Generic Elective Course
Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYG–……: Generic Chem.: Solutions, Phase Equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry-II*

Section A: Physical Chemistry

Distribution
Study of the equilibrium of one of the following reactions by the distribution method:
$I_2(aq) + I^-(aq) \rightleftharpoons I_3^-(aq)$

$Cu^{2+}(aq) + xNH_2(aq) \rightleftharpoons [Cu(NH_3)_x]^{2+}$

Phase equilibria

[a] Construction of the phase diagram of a binary system (simple eutectic) using cooling curves.

[b] Determination of the critical solution temperature and composition of the phenol water system and study of the effect of impurities on it.

[c] Study of the variation of mutual solubility temperature with concentration for the phenol water system and determination of the critical solubility temperature.

Conductance

[d] Determination of cell constant

[e] Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.

[f] Perform the following conductometric titrations:

(i) Strong acid vs. strong base

(ii) Weak acid vs. strong base

Potentiometry

Perform the following potentiometric titrations:

[g] Strong acid vs. strong base

[h] Weak acid vs. strong base

[i] Potassium dichromate vs. Mohr's salt

Section B: Organic Chemistry

[I] Systematic Qualitative Organic Analysis of Organic Compounds possessing monofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.

[II]

[1] Separation of amino acids by paper chromatography

[2] Determination of the concentration of glycine solution by formylation method.

[3] Titration curve of glycine

[4] Action of salivary amylase on starch

[5] Effect of temperature on the action of salivary amylase on starch.

[6] Determination of the saponification value of an oil/fat. [7] Determination of the iodine value of an oil/fat [8] Differentiation between a reducing/nonreducing sugar.

[9] Extraction of DNA from onion/ cauliflower

Skill Enhancement Course

(Non- Semester)

kill Enhancement Course

CYS-201: Fuel Chemistry

Semester Specific and for the students of 3rd or 4th

Review of energy sources (renewable and non-renewable). Classification of fuels and their calorific value. Gross calorific value, net calorific value, determination of calorific value using Bomb calorimeter.

Coal:

Uses of coal (fuel and nonfuel) in various industries, its composition, proximate analysis, ultimate analysis, determination of % of carbon, hydrogen, nitrogen, sulphur, ash and oxygen. Carbonization of coal. Coal gas, producer gas and water gas—composition and uses. Fractionation of coal tar, requisites of a good metallurgical coke, Coal gasification (Hydro gasification and Catalytic gasification), Coal liquefaction and Solvent Refining.

Petroleum Industry:

Composition of crude petroleum, Refining and different types of petroleum products, Fractional Distillation (Principle and process), Cracking (Thermal and catalytic cracking), knocking, octane number, unleaded petrol, Reforming, Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels.

Lubricants:

Classification of lubricants, lubricating oils (conducting and non-conducting), Solid and semisolid lubricants, synthetic lubricants. Properties of lubricants (viscosity index, cloud point, pore point, flash point, fire point) and their determination.

(Non-

CYS-251: Pesticide Chemistry

Semester Specific and for the students of 3rd or 4th Semester)

General introduction to pesticides (natural and synthetic), benefits and adverse effects, changing concepts of pesticides, structure activity relationship, synthesis and technical manufacture and uses of representative pesticides in the following classes: Organochlorines (DDT, Gammexene,); Organophosphates (Malathion, Parathion); Carbamates (Carbofuran and carbaryl); Quinones (Chloranil), Anilides (Alachlor and Butachlor).

Practicals:

[1] To calculate acidity/alkalinity in given sample of pesticide formulations as per BIS specifications.

[2] Preparation of simple organophosphates, phosphonates and thiophosphates

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Skill Enhancement Course

CYS-255: Chemistry of Cosmetics and Perfumes

(Non-Semester Specific and for the students of 3rd or 4th Semester)

A general study including preparation and uses of the following:

Hair dye, hair spray, shampoo, suntan lotions, face powder, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams), antiperspirants and artificial flavours. Essential oils and their importance in cosmetic industries with reference to Eugenol, Geraniol, sandalwood oil, eucalyptus, rose oil, 2-phenyl ethyl alcohol, Jasmone, Civetone, Muscone.

Practicals

[1] Preparation of talcum powder.

[2] Preparation of shampoo.

[3] Preparation of enamels.

[4] Preparation of hair remover.

[5] Preparation of face cream.

[6] Preparation of nail polish and nail polish remover.

Skill Enhancement Course

(Non- Semester)

CYS-: IT Skills for Chemists

Semester Specific and for the students of 3rd or 4th

Mathematics

Fundamentals, mathematical functions, polynomial expressions, logarithms, the exponential function, units of a measurement, interconversion of units, constants and variables, equation of a straight line, plotting graphs.

Uncertainty in experimental techniques: Displaying uncertainties, measurements in chemistry, decimal places, significant figures, combining quantities.

Uncertainty in measurement: types of uncertainties, combining uncertainties. Statistical treatment. Mean, standard deviation, relative error. Data reduction and the propagation of errors. Graphical and numerical data reduction. Numerical curve fitting: the method of least squares (regression).

Algebraic operations on real scalar variables (e.g., manipulation of van der Waals equation in different forms). Roots of quadratic equations analytically and iteratively (e.g. pH of a weak acid). Numerical methods of finding roots (Newton-Raphson, binary –bisection, e.g., pH of a weak acid not ignoring the ionization of water, volume of a van der Waals gas, equilibrium constant expressions).

Differential calculus: The tangent line and the derivative of a function, numerical differentiation (e.g., change in pressure for small change in volume of a van der Waals gas, potentiometric titrations).

Numerical integration (Trapezoidal and Simpson's rule, e.g., entropy/enthalpy change from heat capacity data).

Computer programming:

Constants, variables, bits, bytes, binary and ASCII formats, arithmetic expressions, hierarchy of operations, inbuilt functions. Elements of the BASIC language. BASIC keywords and commands. Logical and relative operators. Strings and graphics. Compiled versus interpreted languages. Debugging. Simple programs using these concepts. Matrix addition and multiplication. Statistical analysis.

BASIC programs for curve fitting, numerical differentiation and integration (Trapezoidal rule, Simpson's rule), finding roots (quadratic formula, iterative, Newton-Raphson method).

HANDS ON:

Introductory writing activities:

Introduction to word processor and structure drawing (ChemSketch) software. Incorporating chemical structures, chemical equations, expressions from chemistry (e.g. MaxwellBoltzmann distribution law, Bragg's law, van der Waals equation, etc.) into word processing documents.

Handling numeric data:

(Non-

Spreadsheet software (Excel), creating a spreadsheet, entering and formatting information, basic functions and formulae, creating charts, tables and graphs. Incorporating tables and graphs into word processing documents. Simple calculations, plotting graphs using a spreadsheet (Planck's distribution law, radial distribution curves for hydrogenic orbitals, gas kinetic theory-Maxwell-Boltzmann distribution curves molecular weight), spectral data, pressure-volume curves of van der Waals gas (van der Waals isotherms), data from phase equilibria studies. Graphical solution of equations.

Numeric modelling:

Simulation of pH metric titration curves. Excel functions LINEST and Least Squares. Numerical curve fitting, linear regression (rate constants from concentration-time data, molar extinction coefficients from absorbance data), numerical differentiation (e.g. handling data from potentiometric and pH metric titrations, pKa of weak acid), integration (e.g. entropy/enthalpy change from heat capacity data).

Statistical analysis: Gaussian distribution and Errors in measurements and their effect on data sets. Descriptive statistics using Excel. Statistical significance testing: The t test. The F test.

Presentation:

Presentation graphics

as function of temperature and

Chemical Technology and Society

(Non-Semester Specific and for the students of 3rd or 4th

Chemical Technology:

Basic principles of distillation, solvent extraction, solid-liquid leaching and liquid-liquid extraction, separation by absorption and adsorption. An introduction into the scope of different types of equipment needed in chemical technology, including reactors, distillation columns, extruders, pumps, mills, emulgators. Scaling up operations in chemical industry. Introduction to clean technology.

Society:

Exploration of societal and technological issues from a chemical perspective. Chemical and scientific literacy as a means to better understand topics like air and water (and the trace materials found in them that are referred to as pollutants); energy from natural sources (i.e. solar and renewable forms), from fossil fuels and from nuclear fission; materials like plastics and polymers and their natural analogues, proteins and nucleic acids, and molecular reactivity and interconversions from simple examples like combustion to complex instances like genetic engineering and the manufacture of drugs.

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Skill Enhancement Course

Business Skills for Chemists

(Non-Semester Specific and for the students of 3rd or 4th Semester)

Business Basics

Key business concepts: Business plans, market need, project management and routes to market.

Chemistry in Industry

Current challenges and opportunities for the chemistry-using industries, role of chemistry in India and global economies.

Making money

Financial aspects of business with case studies

Intellectual property

Concept of intellectual property, patents.

Reference:

www.rsc.org

Cheminformatics

Semester Specific and for the students of 3rd or 4th

Introduction to Chemoinformatics:

History and evolution of chemoinformatics, Use of chemoinformatics, Prospects of chemoinformatics, Molecular Modelling and Structure elucidation.

Representation of molecules and chemical reactions:

Nomenclature, Different types of notations, SMILES coding, Matrix representations, Structure of Molfiles and Sdfiles, Libraries and toolkits, Different electronic effects, Reaction classification.

Searching chemical structures:

Full structure search, sub-structure search, basic ideas, similarity search, three dimensional search methods, basics of computation of physical and chemical data and structure descriptors, data visualization.

Applications:

Prediction of Properties of Compounds; Linear Free Energy Relations; Quantitative StructureProperty Relations; Descriptor Analysis; Model Building; Modeling Toxicity; StructureSpectra correlations; Prediction of NMR, IR and Mass spectra; Computer Assisted Structure elucidations; Computer Assisted Synthesis Design, Introduction to drug design; Target Identification and Validation; Lead Finding and Optimization; Analysis of HTS data; Virtual Screening; Design of Combinatorial Libraries; Ligand-Based and Structure Based Drug design; Application of Chemoinformatics in Drug Design. Hands-on Exercises

Skill Enhancement Course

(Non- Semester)

Intellectual Property Rights (IPR)

Semester Specific and for the students of 3rd or 4th

Introduction to Intellectual Property:

Historical Perspective, Different Types of IP, Importance of protecting IP.

Copyrights:

Introduction, How to obtain, Differences from Patents.

Trade Marks:

Introduction, How to obtain, Different types of marks – Collective marks, certification marks, service marks, Trade names, etc.

Differences from Designs.

Patents:

Historical Perspective, Basic and associated right, WIPO, PCT system, Traditional Knowledge, Patents and Healthcare – balancing promoting innovation with public health, Software patents and their importance for India.

Geographical Indications:

Definition, rules for registration, prevention of illegal exploitation, importance to India.

Industrial Designs:

Definition, How to obtain, features, International design registration.

Layout design of integrated circuits:

Circuit Boards, Integrated Chips, Importance for electronic industry.

Trade Secrets:

Introduction and Historical Perspectives, Scope of Protection, Risks involved and legal aspects of Trade Secret Protection.

Different International Agreements:

(a) Word Trade Organization (WTO):

(i) General Agreement on Tariffs & Trade (GATT), Trade Related Intellectual Property Rights (TRIPS) agreement

(ii) General Agreement on Trade related Services (GATS)

(iii) Madrid Protocol

(iv) Berne Convention

(v) Budapest Treaty

(b) Paris Convention

WIPO and TRIPS, IPR and Plant Breeders Rights, IPR and Biodiversity

IP Infringement Issue and Enforcement

Role of Judiciary, Role of law enforcement agencies – Police, Customs etc. Economic Value of Intellectual Property – Intangible assets and their valuation, Intellectual Property in the Indian Context – Various laws in India Licensing and technology transfer.

Suggested Readings:

[1] N.K. Acharya: Textbook on intellectual property rights, Asia Law House (2001). [2] Manjula Guru & M.B. Rao, Understanding Trips: Managing Knowledge in Developing Countries, Sage Publications (2003).

[3] P. Ganguli, Intellectual Property Rights: Unleashing the Knowledge Economy, Tata McGraw-Hill (2001).

Analytical Clinical Biochemistry

Semester Specific and for the students of 3rd or 4th

Basic understanding of the structures, properties and functions of carbohydrates, lipids and proteins:

Review of concepts studied in the core course:

Carbohydrates: Biological importance of carbohydrates, Metabolism, Cellular currency of energy (ATP), Glycolysis, Alcoholic and Lactic acid fermentations, Krebs cycle. Isolation and characterization of polysachharides.

Proteins: Classification, biological importance; Primary and secondary and tertiary structures of proteins: α-helix and β- pleated sheets, Isolation, characterization, denaturation of proteins.

Enzymes: Nomenclature, Characteristics (mention of Ribozymes), Classification; Active site, Mechanism of enzyme action, Stereospecificity of enzymes, Coenzymes and cofactors, Enzyme inhibitors, Introduction to Biocatalysis: Importance in "Green Chemistry" and Chemical Industry.

Lipids: Classification. Biological importance of triglycerides and phosphoglycerides and cholesterol; Lipid membrane, Liposomes and their biological functions and underlying applications.

Lipoproteins.

Properties, functions and biochemical functions of steroid hormones.

Biochemistry of peptide hormones.

Structure of DNA (Watson-Crick model) and RNA, Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation, Introduction to Gene therapy.

Enzymes: Nomenclature, classification, effect of pH, temperature on enzyme activity, enzyme inhibition.

Biochemistry of Disease: A diagnostic approach by blood/ urine analysis.

Blood: Composition and functions of blood, blood coagulation. Blood collection and preservation of samples. Anaemia, Regulation, estimation and interpretation of data for blood sugar, urea, creatinine, cholesterol and bilirubin.

Urine: Collection and preservation of samples. Formation of urine. Composition and estimation of constituents of normal and pathological urine.

Practicals:

Identification and estimation of the following:

[1] Carbohydrates – qualitative and quantitative.
[2] Lipids – qualitative.
[3] Determination of the iodine number of oil.
[4] Determination of the saponification number of oil.
[5] Determination of cholesterol using Liebermann- Burchard reaction.
[6] Proteins – qualitative.
[7] Isolation of protein.
[8] Determination of protein by the Biuret reaction.

[9] Determination of nucleic acids

Green Methods in Chemistry

Semester Specific and for the students of 3rd or 4th

Tools of Green chemistry, Twelve principles of Green Chemistry, with examples.

The following Real world Cases in Green Chemistry should be discussed:

[1] A green synthesis of ibuprofen which creates less waste and fewer byproducts (Atom economy).

[2] Surfactants for Carbon Dioxide – replacing smog producing and ozone depleting solvents with CO_2 for precision cleaning and dry cleaning of garments.

[3] Environmentally safe antifoulant.

[4] CO_2 as an environmentally friendly blowing agent for the polystyrene foam sheet packaging market.

[5] Using a catalyst to improve the delignifying (bleaching) activity of hydrogen peroxide. [6] A new generation of environmentally advanced preservative: getting the chromium and arsenic out of pressure treated wood.

[7] Rightfit pigment: synthetic azopigments to replace toxic organic and inorganic pigments.

[8] Development of a fully recyclable carpet: cradle to cradle carpeting.

Skill Enhancement Course

Pharmaceutical Chemistry

(Non-Semester Specific and for the students of 3rd or 4th Semester)

Drugs & Pharmaceuticals

Drug discovery, design and development; Basic Retrosynthetic approach. Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, antiinflammatory agents (Aspirin, paracetamol, lbuprofen); antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Diazepam),Cardiovascular (Glyceryl trinitrate), antilaprosy (Dapsone), HIV-AIDS related drugs (AZT- Zidovudine).

Fermentation

Aerobic and anaerobic fermentation. Production of (i) Ethyl alcohol and citric acid, (ii) Antibiotics; Penicillin, Cephalosporin, Chloromycetin and Streptomycin, (iii) Lysine, Glutamic acid, Vitamin B2, Vitamin B12 and Vitamin C.

Practicals

[1] Preparation of Aspirin and its analysis.

[2] Preparation of magnesium bisilicate (Antacid).

Discipline Specific Elective Courses: (Credit: 06 each)

(Students opt any 4 papers from the following list in the 3rd Year of Integrated M.Sc. Program)

1.	Polymer Chemistry	(04 Credits) + Lab (02 Credits)
2.	Inorganic Materials of Industrial Importance	(04 Credits) + Lab (02 Credits)
3.	Novel Inorganic Solids	(04 Credits) + Lab (02 Credits)
4.	Research Methodology for Chemistry	(05 Credits) + Tutorials (01 Credit)
5.	Applications of Computers in Chemistry	(04 Credits) + Lab (02 Credits)
6.	Molecular Modelling & Drug Design	(04 Credits) + Lab (02 Credits
7.	Industrial Chemicals & Environment	(04 Credits) + Lab (02 Credits)
11.		

Note: Universities may include more options or delete some from this list

Dissertation

Disc

:

ipline Specific Elective Course: 04 Credits

CYD-302: Discipline Specific Elective Polymer Chemistry

(Non-Semester Specific and for the Students of 5th or 6th Semester)

Introduction and History of Polymeric Materials:

Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers.

Functionality and its Importance:

Criteria for synthetic polymer formation, classification of polymerization processes, Relationships between functionality, extent of reaction and degree of polymerization.
Bifunctional systems, Poly-functional systems.

Kinetics of Polymerization:

Mechanism and kinetics of step growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations, Mechanism and kinetics of copolymerization, polymerization techniques.

Crystallization and Crystallinity:

Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point.

Nature and Structure of Polymers:

Structure Property relationships.

Determination of Molecular Weight of Polymers (*Mn*, *Mw*, etc) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance.

Polydispersity index.

Glass Transition Temperature (Tg) and Determination of Tg, Free volume theory, WLF equation, Factors affecting glass transition temperature (Tg).

Polymer Solution: Criteria for polymer solubility, Solubility parameter, Thermodynamics of polymer solutions, entropy, enthalpy, and free energy change of mixing of polymers solutions, Flory- Huggins theory, Lower and Upper critical solution temperatures.

Properties of Polymers (Physical, thermal, Flow & Mechanical Properties).

Brief introduction to preparation, structure, properties and application of the following polymers: polyolefins, polystyrene and styrene copolymers, poly(vinyl chloride) and related polymers, poly(vinyl acetate) and related polymers, acrylic polymers, fluoro polymers, polyamides and related polymers. Phenol formaldehyde resins (Bakelite, Novalac), polyurethanes, silicone polymers, polydienes,

Polycarbonates, Conducting Polymers, [polyacetylene, polyaniline, poly(p-phenylene sulphide polypyrrole, polythiophene)].

Discipline Specific Elective Course: 02 Credits

DCL-302: Polymer Chemistry Lab

(Non-Semester Specific and for the Students of 5th or 6th Semester)

Program: Integrated M.Sc. **Semester:** Non-Semester Specific

Course Title: *Polymer Chemistry Lab*

Course Code: *DCL−302* **Type:** Discipline Specific Elective

Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)

Corresponding Theory Course: To be offered in combination with the theory course titled "*CYD−302: Discipline Specific Elective: Polymer Chemistry*"

[A] Polymer Synthesis

(1) Free radical solution polymerization of styrene (St) / Methyl Methacrylate (MMA) / Methyl Acrylate (MA) / Acrylic acid (AA). *a. Purification of monomer*

b. Polymerization using benzoyl peroxide (BPO) / 2,2'-azo-bis-isobutylonitrile (AIBN)

(2) Preparation of nylon 66/6

1. Interfacial polymerization, preparation of polyester from isophthaloyl chloride (IPC) and phenolphthalein *a. Preparation of IPC*

b. Purification of IPC

c. Interfacial polymerization

(3) Redox polymerization of acrylamide

(4) Precipitation polymerization of acrylonitrile

(5) Preparation of urea-formaldehyde resin

(6) Preparations of novalac resin/resold resin.

(7) Microscale Emulsion Polymerization of Poly(methylacrylate).

[B] Polymer Characterization

(1) Determination of molecular weight by viscometry:

(a) Polyacrylamide-aq.$NaNO_2$ solution, (b) (Poly vinyl proplylidine (PVP) in water

(2) Determination of the viscosity-average molecular weight of poly(vinyl alcohol) (PVOH) and the fraction of "head-to-head" monomer linkages in the polymer.

(3) Determination of molecular weight by end group analysis: Polyethylene glycol (PEG) (OH group).

(4) Testing of mechanical properties of polymers.

(5) Determination of hydroxyl number of a polymer using colorimetric method.

[C] Polymer Analysis

(1) Estimation of the amount of HCHO in the given solution by sodium sulphite method

(2) Instrumental Techniques

(3) IR studies of polymers

(4) DSC analysis of polymers

(5) Preparation of polyacrylamide and its electrophoresis

*at least 7 experiments to be carried out.

Disc

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ipline Specific Elective Course: 04 Credits

CYD-303: Discipline Specific Elective
Inorganic Materials of Industrial Importance

(Non-Semester Specific and for the Students of 5th or 6th Semester)

Silicate Industries:

Glass: Glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.

Ceramics: Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications, superconducting and semiconducting oxides, fullerenes carbon nanotubes and carbon fibre.

Cements: Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.

Fertilizers:

Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate.

Surface Coatings:

Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Oil paint, Vehicle, modified oils, Pigments, toners and lakes pigments, Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, additives, Metallic coatings (electrolytic and electroless), metal spraying and anodizing.

Batteries:

Primary and secondary batteries, battery components and their role, Characteristics of Battery. Working of following batteries: Pb acid, Li-Battery, Solid state electrolyte battery. Fuel cells, Solar cell and polymer cell.

Alloys:

Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys. Manufacture of Steel (removal of silicon decarbonization, demanganization, desulphurization dephosphorisation) and surface treatment (argon treatment, heat treatment, nitriding, carburizing). Composition and properties of different types of steels.

Catalysis:

General principles and properties of catalysts, homogenous catalysis (catalytic steps and examples) and heterogenous catalysis (catalytic steps and examples) and their industrial applications, Deactivation or regeneration of catalysts.

Phase transfer catalysts, application of zeolites as catalysts.

Chemical explosives:

Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX). Introduction to rocket propellants.

YD-303: Industrial Inorganic Materials Lab

(Non-Semester Specific and for the Students of 5th or 6th Semester)

Program: Integrated M.Sc. **Semester:** Non Semester Specific
Course Title: *Industrial Inorganic Materials Lab*
Course Code: *DCL−303* **Type:** Discipline Specific Elective
Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYD−303: Discipline Specific Elective: Inorganic Materials of Industrial Importance"*

1. Determination of free acidity in ammonium sulphate fertilizer.
2. Estimation of Calcium in Calcium ammonium nitrate fertilizer.
3. Estimation of phosphoric acid in superphosphate fertilizer.
4. Electroless metallic coatings on ceramic and plastic material.
5. Determination of composition of dolomite (by complexometric titration).
6. Analysis of (Cu, Ni); (Cu, Zn) in alloy or synthetic samples.
7. Analysis of Cement.
8. Preparation of pigment (zinc oxide).

CYD-304: Discipline Specific Elective Novel Inorganic Solids

(Non-Semester Specific and for the Students of 5th or 6th Semester)

Synthesis and Modification of Inorganic Solids:

Conventional heat and beat methods, Co-precipitation method, Sol-gel methods, Hydrothermal method, Ion-exchange and Intercalation methods.

Inorganic Solids of Technological Importance:

Solid electrolytes – Cationic, anionic, mixed Inorganic pigments – coloured solids, white and black pigments.

Molecular material and fullerides, molecular materials & chemistry – one-dimensional metals, molecular magnets, inorganic liquid crystals.

Nanomaterials:

Overview of nanostructures and nanomaterials: classification.

Preparation of gold and silver metallic nanoparticles, self-assembled nanostructures-control of nanoarchitecture-one dimensional control. Carbon nanotubes and inorganic nanowires.

Bioinorganic nanomaterials, DNA and nanomaterials, natural and antisical nanomaterials, bionano composites.

Introduction to Engineering Materials for Mechanical Construction:

Composition, mechanical and fabricating characteristics and applications of various types of cast irons, plain carbon and alloy steels, copper, aluminum and their alloys like duralumin, brasses and bronzes cutting tool materials, super alloys thermoplastics, thermosets and composite materials.

Composite Materials:

Introduction, limitations of conventional engineering materials, role of matrix in composites, classification, matrix materials, reinforcements, metal-matrix composites, polymer-matrix composites, fibre-reinforced composites, environmental effects on composites, applications of composites.

Speciality Polymers:

Conducting polymers - Introduction, conduction mechanism, polyacetylene, polyparaphenylene and polypyrole, applications of conducting polymers, Ion-exchange resins and their applications. Ceramic & Refractory: Introduction, classification, properties, raw materials, manufacturing and applications.

Discipline Specific Elective Course: 02 Credits

DCL-304: Materials Chemistry Lab

(Non-Semester Specific and for the Students of 5th or 6th Semester)

Program: Integrated M.Sc. **Semester:** Non Semester Specific

Course Title: *Materials Chemistry Lab*

Course Code: *DCL–304* **Type:** Discipline Specific Elective

Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)

Corresponding Theory Course: To be offered in combination with the theory course titled "*CYD–304: Discipline Specific Elective: Novel Inorganic Solids"*

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1. Determination of cation exchange method
2. Determination of total difference of solids.
3. Synthesis of hydrogel by co-precipitation method.
4. Synthesis of silver and gold metal nanoparticles.

CYD-352: Discipline Specific Elective
Research Methodology for Chemistry

(Non-Semester Specific and for the Students of 5th or 6th Semester)

Literature Survey:

Print: Sources of information: Primary, secondary, tertiary sources; Journals: Journal abbreviations, abstracts, current titles, reviews, monographs, dictionaries, text-books, current contents, Introduction to Chemical Abstracts and Beilstein, Subject Index, Substance Index, Author Index, Formula Index, and other Indices with examples.

Digital: Web resources, E-journals, Journal access, TOC alerts, Hot articles, Citation index, Impact factor, H-index, E-consortium, UGC infonet, E-books, Internet discussion groups and communities, Blogs, Preprint servers, Search engines, Scirus, Google Scholar, ChemIndustry, Wiki- Databases, ChemSpider, Science Direct, SciFinder, Scopus.

Information Technology and Library Resources: The Internet and World Wide Web. Internet resources for chemistry. Finding and citing published information.

Methods of Scientific Research and Writing Scientific Papers:

Reporting practical and project work. Writing literature surveys and reviews. Organizing a poster display. Giving an oral presentation.

Writing scientific papers – justification for scientific contributions, bibliography, description of methods, conclusions, the need for illustration, style, publications of scientific work. Writing ethics. Avoiding plagiarism.

Chemical Safety and Ethical Handling of Chemicals:

Safe working procedure and protective environment, protective apparel, emergency procedure and first aid, laboratory ventilation. Safe storage and use of hazardous chemicals, procedure for working with substances that pose hazards, flammable or explosive hazards, procedures for working with gases at pressures above or below atmospheric – safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratory chemicals, procedure for laboratory disposal of explosives, identification, verification and segregation of laboratory waste, disposal of chemicals in the sanitary sewer system, incineration and transportation of hazardous chemicals.

Data Analysis:

The Investigative Approach: Making and Recording Measurements. SI Units and their use. Scientific method and design of experiments.

Analysis and Presentation of Data: Descriptive statistics. Choosing and using statistical tests. Chemometrics. Analysis of variance (ANOVA), Correlation and regression, Curve fitting, fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals, General polynomial fitting, linearizing transformations, exponential function fit, *r* and its abuse. Basic aspects of multiple linear regression analysis.

Electronics:

Basic fundamentals of electronic circuits and their components used in circuits of common instruments like spectrophotometers, typical circuits involving operational amplifiers for electrochemical instruments. Elementary aspects of digital electronics.

CYD-305: Discipline Specific Elective:
Applications of Computers in Chemistry

(Non-Semester Specific and for the Students of 5th or 6th Semester)

Basics:

Constants, variables, bits, bytes, binary and ASCII formats, arithmetic expressions, hierarchy of operations, inbuilt functions. Elements of the BASIC language. BASIC keywords and commands. Logical and relative operators. Strings and graphics. Compiled versus interpreted languages. Debugging. Simple programs using these concepts. Matrix addition and multiplication. Statistical analysis.

Numerical methods:

Roots of equations: Numerical methods for roots of equations: Quadratic formula, iterative method, Newton-Raphson method, Binary bisection and Regula-Falsi.

Differential calculus: Numerical differentiation.

Integral calculus: Numerical integration (Trapezoidal and Simpson's rule), probability distributions and mean values.

Simultaneous equations: Matrix manipulation: addition, multiplication. Gauss-Siedal method.

Interpolation, extrapolation and curve fitting: Handling of experimental data.

Conceptual background of molecular modelling: Potential energy surfaces. Elementary ideas of molecular mechanics and practical MO methods.

Lab:

Computer programs based on numerical methods for

[1] Roots of equations: (e.g. volume of van der Waals gas and comparison with ideal gas, pH of a weak acid).

[2] Numerical differentiation (e.g., change in pressure for small change in volume of a van der Waals gas, potentiometric titrations).

[3] Numerical integration (e.g. entropy/ enthalpy change from heat capacity data), probability distributions (gas kinetic theory) and mean values.

[4] Matrix operations. Application of Gauss-Siedel method in colourimetry. [5] Simple exercises using molecular visualization software.

Discipline Specific Elective Course: 0 Credits
2

DCL-305: Computational Chemistry Lab

(Non-Semester Specific and for the Students of 5th or 6th Semester)

Program: Integrated M.Sc. **Semester:** Non Semester Specific
Course Title: *Computational Chemistry Lab*
Course Code: *DCL−305* **Type:** Discipline Specific Elective
Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYD−305: "Discipline Specific Elective: Applications of Computers in Chemistry"*

Computer programs based on numerical methods for

1. Roots of equations: (e.g., volume of van der Waals gas and comparison with ideal gas, pH of a weak acid).
2. Numerical differentiation (e.g., change in pressure for small change in volume of a van der Waals gas, potentiometric titrations).
3. Numerical integration (e.g., entropy/ enthalpy change from heat capacity data), probability distributions (gas kinetic theory) and mean values.
4. Matrix operations. Application of Gauss-Siedel method in colourimetry.
5. Simple exercises using molecular visualization software.

Discipline Specific Elective Course: 04 Credits

CYD-306: Molecular Modelling and Drug Design

(Non-Semester Specific and for the Students of 5th or 6th Semester)

Introduction to Molecular Modelling:

Introduction. Useful Concepts in Molecular Modelling: Coordinate Systems. Potential Energy Surfaces. Molecular Graphics. Surfaces. Computer Hardware and Software. The Molecular Modelling Literature.

Force Fields:

Fields. Bond Stretching. Angle Bending. Introduction to nonbonded interactions. Electrostatic interactions. van der Waals Interactions. Hydrogen bonding in Molecular Mechanics. Force Field Models for the Simulation of Liquid Water.

Energy Minimization and Computer Simulation:

Minimization and related methods for exploring the energy surface. Non-derivative method, First and second order minimization methods. Computer simulation methods. Simple thermodynamic properties and Phase Space. Boundaries. Analyzing the results of a simulation and estimating Errors.

Molecular Dynamics & Monte Carlo Simulation:

Molecular Dynamics Simulation Methods. Molecular Dynamics using simple models. Molecular Dynamics with continuous potentials. Molecular Dynamics at constant temperature and pressure. Metropolis method. Monte Carlo simulation of molecules. Models used in Monte Carlo simulations of polymers.

Structure Prediction and Drug Design:

Structure prediction - Introduction to comparative Modeling. Sequence alignment. Constructing and evaluating a comparative model. Predicting protein structures by 'Threading', Molecular docking. Structure based de novo ligand design, Drug Discovery – Chemoinformatics – QSAR.

2

DCL-306: Molecular Modelling Lab

(Non-Semester Specific and for the Students of 5th or 6th Semester)

Program: Integrated M.Sc. **Semester:** Non Semester Specific
Course Title: *Molecular Modelling Lab*
Course Code: *DCL−306* **Type:** Discipline Specific Elective
Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYD−306: "Discipline Specific Elective: Molecular Modelling and Drug Design*

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[1] Compare the optimized C-C bond lengths in ethane, ethene, ethyne and benzene. Visualize the molecular orbitals of the ethane σ bonds and ethene, ethyne, benzene and pyridine π bonds.

[2] (a) Perform a conformational analysis of butane. (b) Determine the enthalpy of isomerization of *cis* and *trans* 2-butene.

[3] Visualize the electron density and electrostatic potential maps for LiH, HF, N2, NO and CO and comment. Relate to the dipole moments. Animate the vibrations of these molecules.

[4] (a) Relate the charge on the hydrogen atom in hydrogen halides with their acid character. (b) Compare the basicities of the nitrogen atoms in ammonia, methylamine, dimethylamine and trimethylamine.

[5] (a) Compare the shapes of the molecules: 1-butanol, 2-butanol, 2-methyl-1-propanol, and 2-methyl-2-propanol. Note the dipole moment of each molecule. (b) Show how the shapes affect the trend in boiling points: (118 ºC, 100 ºC, 108 ºC, 82 ºC, respectively).

[6] Build and minimize organic compounds of your choice containing the following functional groups. Note the dipole moment of each compound: (a) alkyl halide (b) aldehyde (c) ketone (d) amine (e) ether (f) nitrile (g) thiol (h) carboxylic acid (i) ester (j) amide.

Discipline Specific Elective Course: 0 Credits

[7] (a) Determine the heat of hydration of ethylene. (b) Compute the resonance energy of benzene by comparison of its enthalpy of hydrogenation with that of cyclohexene.

[8] Arrange 1-hexene, 2-methyl-2-pentene, (*E*)-3-methyl-2-pentene, (*Z*)-3-methyl-2-pentene, and 2,3-dimethyl-2-butene in order of increasing stability.

[9] (a) Compare the optimized bond angles H_2O, H_2S, H_2Se. (b) Compare the HAH bond angles for the second row dihydrides and compare with the results from qualitative MO theory.

Note: Software: ChemSketch, ArgusLab (www.planaria-software.com), TINKER 6.2 (dasher.wustl.edu/ffe), WebLab Viewer, Hyperchem, or any similar software.

Discipline Specific Elective Course: 04 Credits

CYD-351: Discipline Specific Elective: Industrial Chemicals & Environment

(Non-Semester Specific and for the Students of 5th or 6th Semester)

Industrial Gases and Inorganic Chemicals

Industrial Gases: Large scale production, uses, storage and hazards in handling of the following gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, sulphur dioxide and phosgene.

Inorganic Chemicals: Manufacture, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate.

Industrial Metallurgy

Preparation of metals (ferrous and nonferrous) and ultrapure metals for semiconduct or technology.

Environment and its segments

Ecosystems. Biogeochemical cycles of carbon, nitrogen and sulphur.

Air Pollution: Major regions of atmosphere. Chemical and photochemical reactions in atmosphere.

Air pollutants: types, sources, particle size and chemical nature; Photochemical smog: its constituents and photochemistry. Environmental effects of ozone, Major sources of air pollution.

Pollution by SO_2, CO_2, CO, NO*x*, H_2S and other foul smelling gases. Methods of estimation of CO, NO*x*, SO*x* and control procedures.

Effects of air pollution on living organisms and vegetation. Greenhouse effect and Global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens, removal of sulphur from coal. Control of particulates.

Water Pollution: Hydrological cycle, water resources, aquatic ecosystems, Sources and nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems.

Water purification methods. Effluent treatment plants (primary, secondary and tertiary treatment).

Industrial effluents from the following industries and their treatment: electroplating, textile, tannery, dairy, petroleum and petrochemicals, agro, fertilizer, etc. Sludge disposal.

Industrial waste management, incineration of waste. Water treatment and purification (reverse osmosis, electro dialysis, ion exchange). Water quality parameters for waste water, industrial water and domestic water.

Energy & Environment

Sources of Energy: Coal, petrol and natural gas. Nuclear Fusion / Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel, etc.

Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management.

Biocatalysis

Introduction to biocatalysis: Importance in "Green Chemistry" and Chemical Industry.

Discipline Specific Elective Course: 02 Credits

DCL-351: Environmental and Industrial Chemistry Lab

(Non-Semester Specific and for the Students of 5th or 6th Semester)

Program: Integrated M.Sc. **Semester:** Non Semester Specific
Course Title: *Environmental and Industrial Chemistry Lab*
Course Code: *DCL−351* **Type:** Discipline Specific Elective
Credits: 02 **Contact Hours**: 04 × 15 (04 Hr/Week)
Corresponding Theory Course: To be offered in combination with the theory course titled "*CYD−351: Discipline Specific Elective: Industrial Chemicals and Environment"*

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[1] Determination of dissolved oxygen in water.

[2] Determination of Chemical Oxygen Demand (COD)

[3] Determination of Biological Oxygen Demand (BOD)

[4] Percentage of available chlorine in bleaching powder.

[5] Measurement of chloride, sulphate and salinity of water samples by simple titration method ($AgNO_3$ and potassium chromate).

[6] Estimation of total alkalinity of water samples (CO_3^{2-}, HCO_3^-) using double titration method.

[7] Measurement of dissolved CO_2.

[8] Study of some of the common bio-indicators of pollution.

[9] Estimation of SPM in air samples.

[10] Preparation of borax/ boric acid.

7th Semester of Integrated M.Sc. or 1st Semester of 02 Year-M.Sc.

CYC-401: Structure and Reactivity of Organic Molecules

(Core Course: 03 Credits and 45 contact hours)

Conformational Analysis of Cyclic Systems:

Cyclohexane and its derivatives (mono-, di- and tri-substituted), fused (decalins) and bridged bicyclic systems, dynamic stereochemistry, conformational rigidity and mobility, quantitative correlation between conformation and reactivity, effect of conformation on the reduction of cyclic ketones, nucleophilic addition to carbonyl group (Cram, Karabatsos, Felkin-Ahn models, Cieplak effect), nucleophilic substitution on cyclohexane substrates, cyclohexane epoxide formation and opening. elimination reactions of cyclohexyl halides, acetate esters and related compounds, deamination of 2amino-cyclohexanols, elimination vs substitution competition and neighboring group participation reactions of acyclic and cyclic molecules.

Physical Organic Chemistry:

Basic concepts, thermodynamic and kinetic requirements, rate and equilibrium constants, reaction coordinate diagram, transition state (activated complex), nature of activated complex, Hammond postulate, reactivity vs selectivity principle, Curtin Hammett principle, microscopic reversibility, kinetic vs thermodynamic control.

Methods for Elucidating Mechanism:

Kinetic analyses of simple and complex reactions, steady state and saturation kinetics, isotope effects - primary and secondary isotope effects, steric and equilibrium isotope effects, solvent isotope effects, heavy atom isotope effects, substituent effects origin (inductive, field, resonance, steric, solvent and polarizability). Hammett linear free energy relationship, substituent parameter (sigma), reaction constant (rho), use of Hammett plot for mechanism determination, deviation from linearity, inductive vs resonance effects -Taft parameters, nucleophilicity and nucleofugality, factors affecting nucleophilicity (basicity/acidity, solvation, polarizability and shape), Swain-Scott parameters, Edwards and Ritchie correlations, solvent effects bulk and specific solvent effects, Grunwald-Winstein plots, Bronsted relationships, experiments for identifying mechanism (example Cannizzaro reaction), product and intermediate identification, common intermediate detection (example Ritter reaction and Beckmann fragmentation), trapping and competition experiments, isotope labeling, crossover experiments.

Catalysis:

Binding in transition state vs ground state, electrophilic catalysis, acid and base catalysis, nucleophilic, covalent, Bronsted acid base catalysis (general and specific, Bronsted catalysis law, Leffler law), Libido rule.

7th Semester

1st Semester of 02 Year
of Integrated M.Sc.
or
-M.Sc.

CYC-402: Thermodynamics and Interfaces

(Core Course: 03 Credits and 45 contact hours)

Unit 1: Classical Thermodynamics

Thermodynamic treatment of phase equilibria, thermodynamic properties of solutions, chemical potential, chemical potential of real gases and fugacity, thermodynamic function of mixing, thermodynamic treatment of ideal and non-ideal solutions, concept of activity, excess thermodynamic functions. Thermodynamic equilibria in one and two component systems.

Unit 2: Statistical Thermodynamics

Concept of microstates and ensembles, microcanonical, canonical and grand canonical ensemble, average distribution, partition functions and its relation with thermodynamics properties, MaxwellBoltzmann, Bose-Einstein, Fermi-Dirac statistics, Molecular partition functions, translational, vibrational, and rotational partition functions. Ideal monoatomic and diatomic gases and their thermodynamic properties.

Unit 3: Thermodynamics of Surfaces and Interphases:

: Surface and interfacial phenomenon, macromolecules, adsorption of gases by solids, BET theorem, determination of surface area of solids, adsorption from solution, electrical phenomenon of interphases.

Unit 4: Thermodynamics of Ionic Systems:

Thermodynamics of reversible and irreversible electrochemical systems, thermodynamic foundation of theory of ionic interaction and calculation of energy of ionic interaction, interpretation of electrical conductance of electrolytes, thermodynamic treatment of diffusion potential.

7th Semester

1st Semester of 02 Year
of Integrated M.Sc.
or
-M.Sc.

CYC-403: Solid State Chemistry

(Core Course: 03 Credits and 45 contact hours) **Unit**

1: Symmetry in the Crystalline State:

Crystal symmetry, elements of translation-screw axis and glide planes, symmetry in a cube, crystal classes, stereographic projection of crystal systems, space symmetry and space groups, representation of monoclinic and orthorhombic space groups.

Unit 2: X-Ray Diffraction:

Crystal planes and directions, Bragg's law in reciprocal space and Ewald sphere, structure factor, integrated intensity and systematic absences/presences, indexing and simulation of powder X-ray diffraction patterns for simple systems.

Unit 3: Crystal Chemistry:

Hard sphere model, structures derived from HCP and CCP packing, crystal structures of various compositions, derived structures and polytypes, non-stoichiometry in solids, atomic order/disorder in solids, single crystals, polycrystals, quasicrystals, amorphous / glassy solids.

Unit 4: Bonding in Solids:

Bonding in molecular solids - polymorphism, bonding in extended solids ionic, covalent and metallic. Band theory of solids classification of semiconductors, metals and insulators, free electron theory, Bloch's theorem, concept of density of state and elementary band theory, band structures of one-, two- and three-dimensional solids, selected metals and insulators.

Unit 5: Properties of solids:

Thermal, electrical, magnetic and dielectric properties of solids.

7th Semester

1st Semester of 02 Year

-M.Sc.

CYC-404: Structure and Properties of Metal Complexes

(Core Course: 03 Credits and 45 contact hours)

Unit I: Stereochemistry and bonding in main group compounds

VSEPR theory, Walsh diagrams (tri- and penta-atomic molecules) dr - pr bonds, bent rule and energetics of hybridization, some simple reactions of covalently bonded molecules, stereoisomerism in inorganic complexes, isomerism arising out of ligand and ligand conformation, chirality and nomenclature of chiral complexes.

Unit II: Metal-ligand bonding and molecular orbital theory (MOT):

Limitations of crystal field theory, d-orbitals splitting in linear, trigonal, octahedral, square planar, tetrahedral and square pyramidal complexes, Jahn-Teller distortion, nephelauxetic series, composition of ligand group orbitals, molecular orbital diagrams of octahedral, tetrahedral, square planar complexes including both σ and π bonding.

Unit III: Metal-ligand equlilbria in solution

Stepwise and overall formation constants and their interaction, trends in stepwise constants, factors affecting the stability of metal complexes with references to the nature of metal ion and ligand, chelate effect and its thermodynamic origin, determination of binary formation constants by pH-metry an spectrophotometry.

Unit IV: Electronic spectra of coordination compounds:

Spectroscopic ground states, correlation and spin-orbit coupling in free ions for 1" series of transition metals, Orgel and Tanabe Sugano diagrams for transition metal complexes (d'- d states), calculation of Dq, B and B parameters, effect of distortion on d-orbital energy levels.

Unit V: Magnetic properties of transition metal complexes:

Fundamental equations in molecular magnetism, magnetic susceptibility and magnetic moment, diamagnetic and paramagnetic behaviour of transition metal complexes, spin-orbit coupling effects (LS coupling and j-j coupling), orbital angular moment and its quenching in octahedral and tetrahedral complexes, temperature independent paramagnetism (TIP) of complexes, spin cross over, ferromagnetic, anti-ferromagnetic, ferrimagnetic behaviour of transition metal compounds, effect of temperature on their magnetic properties.

7th Semester of Integrated M.Sc. or 1st Semester of 02 Year-M.Sc.

CYC-405: Instrumental Methods of Analysis-I

(Core Course: 03 Credits)

Unit I: Introduction: Brief Introduction of Qualitative Analysis and Quantitative Analysis, Outlines of Various Types of Analytical. Methods of Analysis: Classical Methods and Instrumental Methods. Properties used in various instrumental methods. Basic components of an instrument. Data domains and Types of Analytical Data Domains (Analog Domains, Digital Domains, Time Domains). Selection of An Analytical Mmethod: Precision, Accuracy, Sensitivity, Dynamic Range, Selectivity, Efficiency.

Unit II: Separation Techniques.

Chromatography: Introduction, Gas chromatography, liquid chromatography, supercritical fluids, Importance of column technology (packing, capillaries), Separation based on increasing number of factors (volatility, solubility, interactions with stationary phase, size, electrical field), Detection: simple vs. specific (gas and liquid). Detection as a means of further analysis (use of tags and coupling to IR and MS), Electrophoresis (plates and capillary) and use with DNA analysis. *Immunoassays and DNA techniques*

Unit III: Molecular spectroscopy:

Infrared spectroscopy:

Interactions of light with molecules: Absorption and Scattering. Means of excitation (light sources), separation of spectrum (wavelength dispersion, time resolution), detection of the signal (heat, differential detection), interpretation of spectrum (qualitative, mixtures, resolution), Fourier Transform (FTIR) and its advantages. Samples preparation methods and results expected. Applications and sample analysis-, Portable IR instrument- and rapid detection.

UV-Visible/ Near IR - Emission, Absorption, Fluorescence and Photoaccoustic. Excitation sources (lasers, time resolution), wavelength dispersion (gratings, prisms, interference filters, laser, resolution), Detection of signal (photocells, photomultipliers, diode. arrays), sensitivity and S/N ratio, Single and Double Beam instruments, Interpretation (quantification, mixtures, absorption vs. fluorescence and the use of time, photoacoustic, fluorescent tags).

Unit IV: Atomic Spectroscopy:

Atomic absorption, atomic emission, and atomic fluorescence. Excitation and getting sample into gas phase (flames, electrical discharges, plasmas), Wavelength separation and resolution (simultaneous/scanning, signal noise), Interpretation (errors due to molecular and ionic species, matrix effects, other interferences).

Unit V: Electroanalytical Methods: Potentiometry & Voltammetry (dependence on technique), Detection of radiation

Unit VI: Thermal Methods: TGA, DSC and DTA

or

1st Semester of 02 Year-M.Sc.

CYC-406: Inorganic Chemistry Lab-I

(Core Course: 02 Credits and 60 Contact Hours)

[1] Semi-micro qualitative analysis involving 6 radicals including interfering radicals.
[2] Determination of haraness of water by complexometric titration with EDTA.
[3] Gravimetric estimation of nickel using dimethyl glyoxime.
[4] Determination of metal ions by gravimetric-cum-volumetric analysis: Fe(II) gravimetrically and Ca(II) volumetrically.
[5] Determination of Cu(II) gravimetrically and Zn(II) volumetrically
[6] Experiment related to gravimetric determination and separation of two metal ions in a binary mixture.
[7] Synthesis of following coordination compound(s) and metal content determination:
(i) $[Cu(NH_3)_4.H_2O]SO_4$, (ii) $[Fe(acac)_3]$, (iii) $[Mn(acac)_3]$, (iv) $Mn\ C_2O_4)_3$.

Note: Minimum five experiments must be done and some experiments would require more than one turn

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7th Semester of Integrated M.Sc.
or
1st Semester of 02 Year-M.Sc.

CYC-407: Organic Chemistry Lab-I

(Core Course: 02 Credits and 60 Contact Hours)

[1] Separation of organic mixtures by TLC and PTLC.
[2] Synthesis of derivatives for carbonyl, amino and active methylene compounds.
[3] Diels-Alder reaction between anthracene and maleic anhydride.
[4] Oxidation of hydroquinone to p-benzoquinone.
[5] Oxidation of benzoin to benzyl.
[6] Conversion of benzyl to quinoxaline.
[7] Reduction of Camphor.
[8] Aldol condensation (benzaldehyde + acetone or cinnamaldehyde + acetone) [9] Synthesis of 2-iodobenzoic acid by Sandmeyer reaction.
[10] Synthesis of binapthol by green reaction.
[11] Knoevenagel condensation between aldehyde (4-diethylaminobenzaldehyde) and malonic acid, cyanoacetic acid or malononitrile.
[12] Friedel-Crafts reaction: synthesis of l ,*4-di-tert-butyl-2,5*-dimethoxy benzene.
[13] Preparation and purification of *cis*- and trans-stilbenes by Wittig reaction.
[14] Bromination of acetanilide.

Note: Minimum five experiments must be done and some would require more two-three turns.

7th Semester of Integrated M.Sc.
or
1st Semester of 02 Year-M.Sc.

CYC-408: Physical Chemistry Lab-I

(Core Course: 02 Credits and 60 Contact Hours)

[1] To study the variation in miscibility of phenol in water with temperature and to find out the critical solution temperature (CST) and also to investigate the effect of impurities on CST.

[2] determine the cell potentials for different electrochemical cells and also to measure different thermodyamic parameters.

[6] Determination of isotherm for three component system.

[7] To determine the magnetic susceptibility of solids.

[8] To determine refractive index of dielectric layer using SPR

Note: Minimum five experiments must be done and some would require more two-three turns.

8th Semester of Integrated M.Sc.
or
2nd Semester of 02 Year-M.Sc.

CYC-451: Pericyclic and Organic Photochemistry

(Core Course: 03 Credits)

Unit I: Pericyclic Reactions

Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3-butadiene, 1,3,5-hexatriene and allyl system. Classification of pericyclic reactions. Woodward-Hoffmann correlation diagrams. Conservation of orbital symmetry, State correlation diagrams, aromatic transition state (ATS) theory, generalized orbital symmetry (GOS) rule. Frontier Molecular Orbital (FMO) and Perturbation Molecular Orbital (PMO) approach.

Electrocyclic reaction; conrotatory and disrotatory motions, orbital correlation diagrams for 4n, 4n+2 and allyl systems, torquoselectivity.

Cycloaddition: antarafacial and suprafacialaddition, 4n and 4n+2 systems, 2+2 addition of ketenes , 1,3 dipolar cycloaddition, Diels-Alder Reaction and its variants, Cheleotropic and ene reactions.

Sigmatropic rearrangements: Suprafacial and Antarafacial shifts of H, [1,3], [1,5] shifts. Sigmatropic shifts involving carbon moieties, [3,3] shifts, Claisen rearrangement, aromatic Claisen rearrangement, Cope rearrangement, Oxy-cope rearrangement, Aza cope rearrangement, Carroll rearrangement, [5,5] shifts, [2,3] shifts. Curtius and Schmidt rearrangements.

Unit II: Organic Photochemistry:

Quantum yields, intersystem crossing, photosensitization and energy transfer reactions. Photochemistry of olefins and carbonyl compounds, photo oxygenation and photo fragmentation, Photochemistry of aromatic compounds: isomerisation, additions and substitutions. Singlet molecular oxygen reactions. Patterno-Buchi reaction, Di-pimethane rearrangement, Bartons reaction and PhotoFries rearrangement. Norrish I and II reactions.

Semester of Integrated M.Sc.
or
Semester of 02 Year-M.Sc.
8th

CYC-452: Reagents and Reactions in Organic Chemistry

(Core Course: 03 Credits)

Unit I: Reagents in Organic Synthesis

Use of the following reagents in organic synthesis and functional group transformations; complex metal hydrides organolithium, lithium dimethylcuprate, lithium diisopropylamide (LDA), organomagnesium (Grignard), organozinc, organocopper (Gilman & Normant) reagents in synthesis, dicyclohexylcarbodiimide, 1,3-dithiane (reactivity Umpoloung), trimethylsilyl iodide, tri-*n*-butyltin hydride, Woodward and pervost hydroxylation, osmium tetroxide, DDQ, selenium dioxide, Phase transfer catalysts, crown ethers and Merrifield resin, Peterson's synthesis, Wilkinson's catalyst, Baker yeast,

Unit II: Single bond [C—X (X = C, O, N)] formations

Various models (Cram, Cram chelation and Felkin-Anh models) of stereochemical aspects of nucleophilic additions to carbonyls chemistry of enolates (kinetic and thermodynamic) and examines, enolates, lithium and boron enolates in aldol and Michael reactions, alkylation and acylation of enolates, mechanism of aldol (Mukiyama aldol), Stobbe, Darzen, Acyloin condensations, epoxidations (Prilezhaev, Sharpless, Jacobsen and Shi), Metal catalysed C-C bond formations (Ullmann, BuchwaldHartwig, Sonogashira, Heck, Suzuki, Stille, Nozaki-Hiyama and Kumada reactions).

Unit III: Multiple bond [C—X (X = C, N)] formations

Phosphorus, nitrogen and sulfur ylids, Wittig reaction, Wittig-Honer reaction, Tebbe olefination, Julia olefination, Robinson annulation, Mannich reaction, Peterson olefination, Shapiro reaction, βeliminations (Hoffman & ester pyrolysis), Cope elimination, selenoxide elimination, Cotey-Winter reaction, olefins from epoxides, olefin metathesis (Schrock's catalyst, Grubb's catalyst, ring closing metathesis, enyne metathesis, Thorpe reaction, Corey-Fuchs reaction, Ohira-Bestmann modification.

CYC-453: Kinetics and Photochemistry

(Core Course: 03 Credits)

Unit 1: Theories

Theoretical calculation of energy of activation using potential energy surface diagram, absolute reaction rate theory, comparison between gas phase and solution reactions

Unit 2: Types of Reactions

Kinetics of chain reactions, detections of radical and kinetics of HBr, H_2O_2 reactions, explosion limits, elementary idea of unimolecular reactions, application of following to the reaction kinetics— solvent effect, kinetic isotope effect and salt effect, experimental technique for studying the fast reaction kinetics, kinetics of homogenous and heterogenous catalysis, kinetics of polymerization.

Unit 3: Electron Transfer Dynamics

Electron transfer in homogeneous systems, theory of electron transfer processes, electron tunneling, experimental results, electron transfer in heterogeneous systems, electrode- solution interface, rate of charge transfer in electrode reactions, study of kinetics of electrode processes.

Unit 4: Photochemistry

Quantum efficiencies of photochemical and photophysical processes, experimental techniques for continuous photolysis, Primary and secondary photochemical processes, Franck-Condon principle and its applications, rates of absorption and emission, lifetimes of electronically excited states and their fate, quenching of excited states species-dynamic and static quenching, radiationless transition and pre-dissociation, energy transfer processes. Radiation chemistry-Interaction with matter, dosimetry, and generation of free radicals and intermediated, comparison between photo- and radiation chemistry.

CYC-454: Structure and Properties of Metal Complexes

(Core Course: 03 Credits)

Unit I: Reaction Mechanism of Transition Metal Complexes:

Energy profile of a reaction, reactivity of metal complexes, inert and labile complexes, kinetic application of valence bond and crystal field theories, kinetics of octahedral substitution, acid hydrolysis factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, direct and indirect evidences in favour of conjugate mechanism, anation reactions, reactions without metal ligand bond cleavage. Substitution reactions in square planer complexes, the trans effect.

Unit II: Electron Transfer Reactions

Outer- and inner-sphere mechanisms, factors affecting electron transfer reaction rates, cross reactions and Marcus- Hush theory, solvated electron.

Unit III: Photochemistry of Metal Complexes

Introduction to inorganic photochemistry, photochemically excited states and excited state processes for transition metal complexes, photochemical tractions of coordination compounds, types of photochemical reactions in transition metal complexes substitution, decomposition, rearrangement and redox reactions, applications of photochemical inorganic reactions in synthesis, catalysts, biological processes and inlasers.

Unit IV: Inorganic biochemistry:

Metalloproteins and enzymes – role of metal ions in active sites, structure and functions of metalloproteins and enzymes containing Mg, Ca, V, Mn, Fe, Co, Ni, Cu and Zn ions, detailed structure and mechanistic studies of the following—Mn- photosystem-II, catalase, pseudocatalase, oxygen carriers, haemoglobin, myoglobin, non-porphyrin oxygen carriers, hemerythrin, hemocyanin, Feribonucleotide reductase, cytochrome c oxidases, cytochrome P-450s, hydrogenase, nitrogen fixation, Cu-blue copper protein, tyrosinase, galactose oxidase, superoxide dismutases, Zn-carbonicanhydrase, carboxypeptidase, alcohol dehydrogenase, biological importance of Vitamin B12 and coenzyme.

Unit IV: Chemical toxicity and Metallotherapy:

Toxic chemicals in the environment, toxic effects of arsenic, cadmium, lead, mercury, carbon monoxide, cyanide and other carcinogens, metal containing drugs in therapy, interaction of heavy metal ions with DNA, DNA cleavage, structure-activity relationship and mode of action.

Semester of Integrated M.Sc.

or

2nd Semester of 02 Year-M.Sc.

8th

CYC-455: Instrumental Method of Analysis-II

(Core Course: 03 Credits)

Unit I: Vibrational Spectroscopy

Symmetry and shapes of AB_2, AB_3, AB_4, AB_5 and AB_6, modes of bonding of ambidentate ligands, ethylenediamine and diketonate complexes, application of resonance Raman Spectroscopy particularly for the study of active sites of metalloproteins as myoglobin and haemoglobin.

Unit II: Electron Spin Resonance Spectroscopy

Principle, presentation of the spectrum, hyperfine coupling, hyperfine splitting in various structures, factors affecting magnitude of g, zero field splitting and Kramer's degeneracy, applications to transition metal complexes having one and more than one unpaired electron, applications to inorganic free radicals, study of electron exchange reactions.

Unit III: NMR spectroscopy:

Principle and Instrumentation.

Unit IV: Mossbauer Spectroscopy

Basic principles, spectral display, isomer shift, factors affecting the magnitude of isomer shift, quadrupole and magnetic hyperfine interaction, applications of technique to the study of bonding and structure of Fe^{2+}, Fe^{3+}; Sn^{2+} and Sn^{4+} compounds; detection of oxidation stated nature of M-L bond.

Unit IV: Mass Spectrometry

Principle and instrumentation, Ionization technique (electron impact, chemical ionization, electrospray, electrical discharge, laser desorption, fast atom bombardment), Separation of ions on basis of mass to charge ratio, Magnetic, Time of flight, Electric quadrupole. Resolution, time and multiple separations, Detection and interpretation (how this is linked to excitation), interpretation of mass spectrum, effect of isotopes on appearance of mass spectrum; applications- finger print application, molecular weight determination.

Unit V:

Principles and Applications of XRD, XPS and PES.

8th

Semester of Integrated M.Sc.

or

2nd Semester of 02 Year-M.Sc.

CYC-456: Inorganic Chemistry Lab-II

(Core Course: 02 Credits and 64 Contact Hours)

[1] Comparison of electronic spectra of $[Ni(H_2O)_6]^{2+}$, $[Ni(NH_3)_6]^{2+}$ and $[Ni(en)_3]^{2+}$ and qualitative verification of the spectrochemical series, and quantitative estimation of nickel by spectrophotometry.

[2] Synthesis and spectrophotometric study of copper complexes:

(i) Synthesis of bis(salicylaldimaide)copper(II) and cis-bis (glycinato)copper(II)

(ii) Record the spectra bis(salicylaldimaide)copper(II) and cis- bis (glycinato)copper(II), and

(iii) Record spectra of Cu^{2+} in water, NH_3, ethylene diamine and glycine, and arrange the ligands in order of increasing field strength and

(iv) Quantitative estimation of copper by spectrophotometry or some other available technique.

[3] (i) Study of the complex formation between Fe(III) and thiocyanate/salicylic acid/sulphosalycylic acid or between Ni(II) and o-phenanthroline, and

(ii) Spectrophotometric determination of formation of constant of the complex (Job's method and molar ratio method).

[4] Synthesis of potassium tris(oxalate)aluminate, potassium tris(oxalate)chromate and potassium tris(oxalate)ferrate, and their characterization by metal determination, some spectroscopic methods, magnetic moment determination, and photochemical behaviour of iron complex.

[5] Synthesis and characterization of $[Co(en)_3]Cl_3$. Separation of its optical isomers and determination of their optical rotation by using a polarimeter.

Note: Minimum five experiments must be done and some experiments would require two-three turns.

Semester of Integrated M.Sc.

or

2nd Semester of 02 Year-M.Sc.

CYC-457: Organic Chemistry Lab-II

(Core Course: 02 Credits and 60 Contact Hours)

[7] Synthesis of α -bromo cinnamic acid or phenyl acetylene from benzaldehyde, (formation of cinnamic acid, bromination and elimination reactions).

[8] Preparation of *meso*-stilbene dibromide and its conversion to diphenylacetylene.

[9] Fisher indole synthesis.

Note: Minimum five experiments must be done and some experiments would require two-three turns.

Suggested Readings

[1] Arthur, I. V.," *Quantitative Organic Analysis,"* Pearson.

[2] Furniss, B.S., Handford, A. J., Smith P. W. G. & Tatchell A. R., *"Vogel's Text Book of Practical Organic Chemistry"* 5th Ed. Longman (1996).

[3] Leonard J., Lygo B. & Procter G., *"Advanced Practical Organic Chemistry"*, Champan and Hall. (1995)

[4] Mann, F. G. & Saunders, B.C. *"Practical Organic Chemistry"*, Pearson. (2009)

[5] Furniss, B.S., Handford, A. J., Smith P. W. G. & Tatchell A. R., *"Practical Organic Chemistry"* 5th Ed., Pearson (2012).

Synthesis of ω-nitrostyrene from an aromatic aldehyde and nitromethane [5] Synthesis of chalcone from an aromatic aldehyde and acetophenone. [6] Extraction of oils from ground nuts using soxhlet apparatus

8th Semester of Integrated M.Sc. or

2nd Semester of 02 Year-M.Sc.

CYC-458: Physical Chemistry Lab-II

(Core Course: 02 Credits and 60 Contact Hours)

[1] To study the kinetics of H cayalyzed hydrolysis of an ester.
[2] To study the kinetics of saponification of ester.
[3] To study the kinetics of metal catalyzed decomposition of hydrogen peroxide.
[4] To study the kinetics of inversion of sucrose using polarimeter
[5] Determinationof equilibrium constant of KI_3 complex by distribution method.
[6] Verification of Beer-Lambert's law using potassium permanganate solution.
[7] To study the quenching of fluorescence and organic dye(s).
[8] To study the effect of ionic strength on reaction rate.
[9] Determination of pK_1 and pK_2 of an acid using pH meter.

Note: Some experiments require two-three turns.

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9th Semester of Integrated M.Sc.
or
3rd Semester of 02 Year-M.Sc.

Frontiers in Bioinorganic Chemistry

(Discipline Specific Elective Course: 03 Credits and 45 Contact Hours)

Unit I: Homeostatic mechanism:

Cellular components and pathways in the context of metal ions, homeostatic mechanism in cell - prokaryotes to eukaryotes to human. Evolutionary pathway metals, metallocofactorsand prosthetic groups.

Unit II: Metal ion transport and assembly of metaUoproteins: Details of the metal transport in Yeast and in higher organisms, proteins involved in uptake and efflux, assembly of metals in protein, photoactivation, heme synthesis, covalent and non-covalent interactions of heme with protein, assembly of heme in heme proteins- cytochrome c vs cytochrome b5, heme chaperoning and role of CCME, identification of a protein as heme protein, heme oxygenase, reconstitution of hemeproteins with modified heme/other cofactors and their application in biocatalysis and electron transfer.

Unit III: Molybdenum and tungsten in biology:

Hyperthennophilic and thermophilic bacteria, Mo and W containing enzymes, mechanism of catalytic activity- nitrogenase, sulfite oxidase, nitrate reductase, acetylene hydratase, xanthine oxidase, DMSO reductase, structural and functional modeling of Mo and W sites and their applications as biocatalysis.

Unit IV: Iron in Biosystem:

Non-heme-iron-sulphur proteins, other non-heme iron proteins-lipoxygenase and its implication in cancer research, nitrile hydratase and its application to industry, structural and functional modeling of heme and non-heme metal-sites and their applications in biochemistry, heme- catalytic mechanism of nitric oxide synthease and heme oxygenase.

Unit V: Metal ions and diseases:

Role in Alzheimer's disease- aggregation of proteins, role of copper, zinc and iron, application of radiochemistry for the identification of metal ions, metal binding in prion protein-binding of copper and manganese, manganism- occupational exposure, manganese toxicity, effect on calcium channel, proteomics of manganese toxicity, inorganic NO-donor and their applications.

Unit VI: Biomineralization:

Biomineralization in the context of bone, teeth and mollusk cells, application into materials science and biomimetic engineering, bioorganometallic chemistry- introduction and applications.

9th Semester of Integrated M.Sc.
or
3rd Semester of 02 Year-M.Sc.

Frontiers in Bioinorganic Chemistry

(Discipline Specific Elective Course: 03 Credits and 45 Contact Hours)

Unit I: Basics of photochemistry:

Absorption, excitation, photochemical laws, quantum yield, electronically excited states life times-measurements of the times, flash photolysis, stopped flow techniques, energy dissipation by radiative and non-radiative processes, absorption spectra, Franck-Condon principle, photochemical stages-primary and secondary processes.

Unit II: Properties of excited states:

Structure, dipole moment, acid-base strengths, reactivity, photochemical kineticscalculation of rates of radfative processes, bimolecular deactivation - quenching.

Unit III: Excited states of metal complexes:

Excited states of metal complexes: comparison with organic compounds, electronically excited states of metal complexes, charge-transfer spectra, charge transfer excitations methods for obtaining charge-transfer spectra.

Unit IV: Ligand field photochemistry:

Photosubstitution, photooxidation and photoreduction liability and selectivity, zero vibrational levels of ground state and excited state, energy content of excited state, zero-zero spectroscopic energy, development of the equations for redox potentials of the excited states.

Unit V: Redox reactions by excited metal complexes:

Energy transfer under conditions of weak interaction and strong interaction-exciplex formation; conditions of the excited states to be useful as redox reactants, excited electron transfer, metal complexes as attractive candidates (,2'-bipyridine and I,10phennonthroline complexes), illustration of reducing and oxidizing character of Ru(ll)bipyramidal complex, comparison with Fe(bipy)3; role of orbit coupling- life time of these complexes, application of redox processes of electronically excited states for catalytic purposes, transformation of low energy reactants into high energy products, chemical energy into light.

Unit VI: Metal complex sensitizers:

Metal complex sensitizer, electron relay, metal colloid systems, semiconductor supported metal or oxide systems, water photolysis, nitrogen fixation.

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9th Semester of Integrated M.Sc.

or

3rd Semester of 02 Year-M.Sc.

Supramolecular Chemistry

(Discipline Specific Elective Course: 03 Credits and 45 Contact Hours)

Unit I: Fundamentals of supramolecular chemistry:

Definitions, brief overview and examples; types of non-covalent interactions CH-bonding, electrostatic (ion-ion, ion-dipole, dipole-dipole), hydrophobic and steric, pi-pi, van der Waals), concepts of host-guest complexation with examples from ionophore chemistry, complexation of ions, molecular baskets, chalices and cages- podands, crown ethers, cryptands, calixarenes, macrocyclic effect, complexation of neutral molecules, selfassembly, molecular boxes and capsules, self-complementary species and self-replication.

Unit II: Supramolecular chemistry and biological processes:

Cation binding (biological relevance, affinity and selectivity, artificial ionophores, natural and artificial cation channels). Anion and neutral molecule binding -relevance factors affecting affinity and selectivity, anion and neutral molecule binding in biology, artificial hosts for anions, katapinands, guanidinium receptors, receptors based upon Lewis acid-base concepts, enantio-selective anion recogmt10n, cyclodextrins, anion binding based upon iondipole interactions, simultaneous anion-cation binding, neutral molecule recognition and binding.

Unit III: Synthesis of supramolecules:

Synthesis of macrocycles, synthesis of receptors for cations anions, and neutral molecules, non-covalent synthesis, metal directed self-assembly of complex supramolecular architecture-rotaxanes, catenanes.

Unit IV: Physical methods in supramolecular chemistry:

Spectroscopy in supramolecular chemistry, determination of stoichiometry, stability constants, and geometry of complexes, binding constant determination, dynamics of supramolecular systems (solid state *vs* solution behaviour).

9th Semester of Integrated M.Sc.
or
3rdSemester of 02 Year-M.Sc.

Advanced Quantum Chemistry

(Discipline Specific Elective Course: 03 Credits and 45 Contact Hours)

Unit 1: Introduction

Vector Interpretation of Wave function, Hermitian Operator, The Generalized Uncertainty principle, The quantum Mechanical Virial Theorem, Solution of harmonic oscillator (Operator approach), Second quantization (Boson and Fermion), Quantum theory of angular momentum, One electron Atom, Spin angular momentum.

Unit 2: Approximate solutions to the Schrodinger Equation:

The Variation method (Time independent and Time Dependent), Time independent perturbation theory (non – degenerate and degenerate), Time dependent perturbation theory.

Unit 3: Electron Spin and Many - Electron Systems

The Antisymmetry Principle, Spin angular momenta and their Operators, The Orbital Approximation (Slater determinant, Pauli exclusion principle), Two electron wave functions.

Unit 4: The Hartree-Fock Self-Consistent Field Method

The generation of Optimized orbitals, Koopman's Theorem (The Physical Significance of Orbital Energies), The electron correlation energy, Density matrix analysis of the Hartree-Fock Approximation, Natural orbitals, The matrix solution of the Hartree- Fock Equations (Roothaan's equations).

Unit 5: Introduction to Molecular Structure

The Born - Oppenheimer Approximation, Solution of the Nuclear Equation, Molecular Hartree- Fock Calculations. Electronic Structure of Linear Molecule: The MO - LCAO Approximation, The Hydrogen Molecule Ion, H_2^+ , The Hydrogen molecule, Molecular Configuration - Interactions, The Valence Bond Method, Molecular Perturbation Calculations. Electronic Structure of Non-linear Molecule: The AHn molecule: Methane, Ammonia and Water, Hybrid Orbitals: The Ethylene and Benzene Molecules.

Unit 6: Semiempirical Molecular Orbital Methods I - PI Electron Systems

The H¨uckel Approximation for Conjugated Hydrocarbons, The Pariser-Parr-Pople Method. Semiempirical Molecular Orbital Methods II - All valence – Electron systems: The Extended H¨uckel Method, The CNDO Method.

9th Semester of Integrated M.Sc.
or
3rdSemester of 02 Year-M.Sc.

Solid State Chemistry and Applications

(Discipline Specific Elective Course: 03 Credits and 45 Contact Hours)

Unit 1: Crystal structure of inorganic compounds

Overview of close packing, packing efficiency, interstitial sites, limiting radius ratios, method of determination of ionic radii. Ionic crystals containing two or three different elements– FeO, ZnO, CdS, fluorite, antifluorite, nickel-arsenide, CaC_2, CdI_2 and TiO_2, $FeTiO_3$, $MgAl_2O_4$, Fe_2NiO_4, garnets, $BaTiO_3$ and $KNiF_3$. Non-ionic crystals– SiC, (BN)x, giant molecules, layer structures, crystals composed of discrete molecules.

Unit 2: Defect structures

Thermodynamic defects and their consequences, solid electrolytes, non-stoichiometric compounds, Fcenters and applications of defects in non-stoichiometric compounds.

Unit 3: Methods to synthesize solid-state materials

Ceramic method, solid-state reaction and its kinetics, hydrothermal, sol-gel, co-precipitation (precursor), vapour phase transport methods. Different methods to grow single crystals.

Unit 4: Amorphous Inorganic Materials

Glasses, refractories, materials obtained from organometallic chemical vapour deposition (MOCVD). New materials: Conducting polymers, carbon nanotubes, carbon nanorods and fullerenes. Electronic materials: Insulating, semiconducting and superconducting materials, ferroelectrics and dielectrics.

Unit 5: Intercalation chemistry:

Introduction, intercalation reactions in graphite, layered double hydroxides, layered sulfides, applications of intercalation chemistry. Mesoporous materials and their catalytic applications: Various types of mesoporous materials (oxides, sulphides), tailoring of pore size, applications of mesoporous materials in heterogeneous catalysis.

Unit 6: Structural characterization of metal complexes by physical methods:

Extended X-ray absorption spectroscopic (EXAFS), X-ray photoelectron spectroscopic (XPS), X-ray absorption near edge spectroscopic (XANES), electron spin spectrometric (ESR), electron spectroscopy for chemical analysis (ESCA) studies, soild state NMR, HMBC, HMQC, Mössbauer spectroscopic studies of metal complexes, thermal methods (TG, DTA and DSC), atomic force microscopy (AFM) and transmission electron microscopy (TEM).

9th Semester of Integrated M.Sc.
or
3rdSemester of 02 Year-M.Sc.

Advanced Surface and Colloidal Chemistry

(Discipline Specific Elective Course: 03 Credits and 45 Contact Hours)

Unit 1: Surfactants and Interfacial Phenomena

Classification, micellization, c.m.c. and its determination. Shape and structure of micelles, effect of additives on micellization, thermodynamics of micellization, solubilization and applications, effect of electrolytes on solubilization. Macro and micro emulsions, dispersion and aggregation of solids by surfactants.

Unit 2: Membranes and their Applications

Artificial and natural membranes, Donnan membrane equilibrium, transport of electrolytes, membrane potential and ion selective electrodes.

Unit 3: Adsorption on solids and porous materials

Model for multilayer adsorption, BET isotherm and application to different types of adsorbents, adsorption by porous, non-porous and microporous solids. Estimation of specific surface area and pore size distribution. Special problems encountered with very narrow pore size material and adsorption from liquid phase.

Unit 4: Colloid systems and their properties

Origin of the charges, electro-kinetic phenomena, electrophoresis, electro-osmosis, sedimentation and streaming potential. The concept of electrical double layer and various models to explain its structure and properties, DLVO theory and stability of colloids. Smoluchowski theory of kinetics of coagulation and distribution of colloids aggregates. Organic and inorganic gels and clay colloids.

Unit 5: Macromolecules

Concepts of mass and number average molecular weights, methods of determining molecular weights (osmometry, viscometry, diffusion and light scattering method), sedimentation, fractional properties of macromolecules, statistical distribution of end-to-end dimension, calculation of average dimension of various chain structures.

9th Semester of Integrated M.Sc.
or
3rdSemester of 02 Year-M.Sc.

Environmental Pollutants and Analysis

(Discipline Specific Elective Course: 03 Credits and 45 Contact Hours)

Introduction:

Environmental Segments (Atmosphere, Hydrosphere, Lithosphere, Biosphere), Natural Cycles of the environment (The Hydrologic, Oxygen, Nitrogen, Phosphate and Sulphur Cycle), Commonly Used Terms

Environmental Chemistry of Water

Properties of water, The Characteristics Of Bodies Of Water, Alkalinity of water, Source and nature of acidity, Major aquatic chemical processes, Oxidation - reduction reactions in water, pE-pH diagram, Complexation, Redox Reactions Mediated By Bacteria, Nitrogen Transformation by Bacteria

Water Pollution

Synthetic Organic pollutants, Soaps and Detergents, Pesticides, Polychlorinated dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs), Polychlorinated Biphenyls, Elemental Pollutants, Other inorganic pollutants, Eutrophication and Algal Nutrients, Acid Mine drainage, Accumulation of Salts in water, Oxygen sag curve, Regulation of water quality, Secondary standards

Water Treatment Operations:

Municipal water treatment for raw water, Treatment of raw water for industrial use, Waste Water Treatment, Basic processes of water treatment, Primary treatment of waste water, Secondary treatment for municipal waste water, Trickling filters, Rotating biological contactor, Activated sludge process, The significant processes that occur in biological waste treatment, Oxidation ponds.

Advanced Waste Water Treatment:

Removal of Suspended Solids Removal of dissolved solids, Phosphate removal (chemical treatment) Phosphate removal (biological treatment), Removal of dissolved organic compounds,

Analysis of Major Constituents in Water

Water Sampling and Storage, Water Quality Measurement, Oxygen demand pH, Acidity and Alkalinity

Analysis of common ions at low concentrations in water:

Ultraviolet and Visible Spectrometry, Spectrophotometric instrumentation, Analysis by direct absorption, Analysis after formation of derivative, Examples of The Use Of Other Techniques.

Analysis of trace pollutants in water:

Bio Concentration, Accumulation in sediments, Biomagnification, Degradation, Gas liquid Chromatography (GC) Detectors, Extraction procedures or sample preparation

Analysis of trace pollutants in water (continued)

High Performance Liquid Chromatography (HPLC), Analysis of Metal Ions present at trace levels, Sample containers and storage, Chelation ion liquid chromatography, Speciation of Chromium by ion chromatography, Mass spectrometric detector for GC for the determination of ultratrace levels of (ng l^{1}) polychlorinated organic compounds

The Atmosphere and Atmospheric Chemistry

Importance of the atmosphere, Physical characteristics of the atmosphere, Major regions of the atmosphere, Evolution of the atmosphere, Earth's Radiation, Balance Carbon Dioxide In the atmosphere, Water vapour in the atmosphere, Ions and radicals in the atmosphere, Reactions involving hydroxyl and hydroperoxyl radicals, Atmospheric reactions of oxygen, Atmospheric reactions of nitrogen.

Air Pollutants:

Carbon Oxides, Sources of CO pollution, Carbon Dioxide and Global Warming, Sulphur Dioxide:

Sources and Removal, Nitrogen oxides in the atmosphere, Acid rain, Particles in the atmosphere.

Organic *Air* Pollutants:

Natural source of hydrocarbons, Oxygen-containing organic compounds, Organohalide compounds, Chlorofluow carbons and depletion of ozone layer, CFC substitutes, Consequences of ozone depletion, Photo chemical smog, Chemical reactions involved in smog formation in the atmosphere, Organo nitrogen compounds, Organic particles in the atmosphere, Nitrogen oxides in the atmosphere, Acid rain, Particles in the atmosphere.

Atmospheric Analysis-Gases:

Introduction Determination oftime-weighted average concentrations, Determination of inorganic gaseous pollutants, Determination low-concentrations of organic pollutants, Desorption of the analyte, Determination of instantaneous concentrations, Chemiluminescence and fluorescence, Infrared spectrometry for carbon monoxide, Electrochemical sensors minimization, Gas detector tubes, Gas solid chromatography, Sampling, Gas-solid chromatographic analysis.

Atmospheric analysis of particulates:

Measurement and Characterisation of the particulate content, Sampling methods, Determination of totaJ organic content in the gas sample, Analysis of particulates after dissolution, Direct analysis of particulates, Drawbacks of the direct analysis.

Soil Formation

Introduction, Kinds of Rocks and Formation of Soil, Mineral components in soil

Soil properties:

Exchangeable cations and cation exchange capacity, Acid - Base ion exchange reaction in soils, Profile and Its Importance, Micro and macro-nutrients in soil, Nitrogen phosphorous and potassium in soil, Wastes and pollutants in soil.

Analysis of Soils, Sediments and Biological Specimens:

Sampling, Sample Preparation, Extraction of the analyte and determination, Sample preparation, Plant materials, Biological tissues and fluids.

Toxicological Chemistry:

Toxic chemicals and toxicity, Kinetic phase and dynamic phase, Physiological responses to toxicants, Teratogenesis, mutagenesis and carcinogenesis, Toxicity of metals, inorg. compounds & org. compounds, Toxicity of some inorganic compounds

Toxicology of some organic compounds:

Benzene formaldehyde & acetaldehyde, polycyclic aromatic hydrocarbons (PAHs), phenols, Nitrosamines, lsocyanates and methyl isocyanates, Organophosphates and arbates, Inhibition by carbamate insecticide, Organochlorine compounds & PCBs, Dioxins andpolychlorinated biphenyls, Polychlorinated biphenyls

Reactions and Fate of Hazardous Wastes:

Segregation of hazardous wastes, Transport of hazardous wastes, Reactions of hazardous waste

Hazard waste reduction and minimisation and physical methods of treatment of hazardous wastes:

Hazardous waste treatment technologies, Physical treatment methods

Chemical Methods of Treatment of Hazardous Wastes:

Chemical oxidation and reduction, Ozonolysis, Acid-base neutralization, Chemical precipitation, Hydrolysis, Ion exchange, Thermal treatment methods, Performance of hazardous wastes incinerators, Advantages of incineration, Disadvantages of incineration, Wet air oxidation, Photolysis, Biological treatment of hazardous wastes, Land treatment, Preparation of wastes for disposal.

9th Semester of Integrated M.Sc.
or
3rdSemester of 02 Year-M.Sc.

Macromolecules and Nanomaterials

(Discipline Specific Elective Course: Credits and Contact Hours) **Unit 1: Surfactant Aggregation:**

Micelles**,** Surface active agents, Classification of surface-active agents, Micellization, Hydrophobic interaction, Critical micellar concentration (cmc), Factors affecting concentration of surfactants, Counter-ion binding of micelle, Thermodynamics of micellization, Phase separation and Mass action models, Solubilization Emulsions, Mechanism of fonnation of microemulsion and their stability, Physical techniques, Applications.

Unit 2: Functional Polymers:

Smart materials -uses of smart materials in sensing devices and communication networks, conducting polymers: Electrically conducting polymers and their uses. Photoconductive polymers. Liquid crystal polymers - smectic, nematic and cholesteric structures. Ionic exchange polymers: Cationic and anionic exchange polymers and their uses. Eco- friendly polymers, Membrane separation. Filtration- micro, ultra and nanofiltration. Liquid separation- dialysis, electro osmosis and reverse osmosis, Fire retarding polymers, photonic polymers. fnter penetrating networks (IPN), polymers, Polymers in biomedical applications - artificial organs and controlled drug delivery.

Unit 3: Nanomaterials:

Definition, historical perspective and effects of nanoscience and nanotechnology on various fields. Synthesis of nanoparticles by chemical routes and characterization techniques: Thermodynamics and kinetics of nucleation; Growth of polyhedral particles by surface reaction, Ostwald ripening, size distribution; TEM; SEM; AFM; Light scattering; *XPS.* Properties of nanostructured materials: Preparation by sol-gel and hydrothermal methods, Optical properties; magnetic properties; chemical properties. Overview of applied chemistry of Nanomaterials.

9th Semester of Integrated M.Sc. or
3rd Semester of 02 Year-M.Sc.

Green Chemistry

(Discipline Specific Elective Course: 03 Credits and Contact Hours)

Unit I: Introduction to Green Chemistry

What is Green Chemistry? Need for Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry.

Unit II: Principles of Green Chemistry and Designing a Chemical synthesis

Twelve principles of Green Chemistry with their explanations and examples; Designing a Green Synthesis using these principles; Prevention of Waste/ byproducts; maximum incorporation of the materials used in the process into the final products (Atom Economy); prevention/ minimization of hazardous/ toxic products; designing safer chemicals - different basic approaches to do so; selection of appropriate auxiliary substances (solvents, separation agents), green solvents, solventless processes, immobilized solvents and ionic liquids; energy requirements for reactions - use of microwaves, ultrasonic energy; selection of starting materials; avoidance of unnecessary derivatization - careful use of blocking/protecting groups; use of catalytic reagents (wherever possible) in preference to stoichiometric reagents; designing of biodegradable products; prevention of chemical accidents; strengthening/development of analytical techniques to prevent and minimize the generation of hazardous substances in chemical processes.

Examples of Green Synthesis/ Reactions:

1. ***Green Synthesis of the Compounds:*** such as adipic acid, catechol, BHT, methyl methacrylate, urethane, aromatic amines (4-aminodiphenylamine), benzyl bromide, acetaldehyde, disodium iminodiacetate (alternative to Strecker synthesis), citral, ibuprofen, paracetamol, furfural.

2. ***Microwave Assisted Reactions in Water:*** Hofmann Elimination, Hydrolysis (of benzyl chloride, benzamide, n-phenyl benzamide, methylbenzoate to benzole acid), Oxidation (of toluene, alcohols). *Microwave Assisted Reactions in Organic Solvents:* Esterification, Fries rearrangement, Orthoester Claisen Rearrangement, Diels-Alder Reaction, Decarboxylation. *Microwave Assisted Solid State Reactions:* Deacetylation, Deprotection. Saponification of esters, Alkylation of reactive methylene compounds, reductions, synthesis of nitriles from aldehydes; anhydrides from dicarboxylic acid; pyrimidine and pyridine derivatives; 1,2-dihydrotriazine derivatives; benzimidazoles.
3. ***Ultrasound Assisted Reactions:*** Esterification, saponification, substitution reactions, Alkylations, oxidation, reduction, coupling reaction, Cannizaro reaction, Strecker synthesis, Reformatsky reaction.

4. **Selective Methylation of Active Methylene Group using Dimethylcarbonate:** Solidstate polymerization of amorphous polymers using diphenylcarbonate; Use of "Clayan", a nonmetallic oxidative reagent for various reactions; Free Radical Bromination; Role of Tellurium in organic syntheses; Biocatalysis in organic syntheses.

Unit III: Future Trends in Green chemistry

Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Combinatorial green chemistry; Proliferation of solventless reactions; oncovalent derivatization; Green chemistry in sustainable development.

Suggested Readings:

[1] V.K. Ahluwalia & M.R. Kidwai: New Trends in Green Chemistry, *Anamalaya Publishers* (2005).

[2] P.T. Anastas & J.K. Warner: Oxford Green Chemistry- Theory and Practical, University Press (1998).

[3] A.S. Matlack: Introduction to Green Chemistry, Marcel Dekker (2001).

[5] M.C. Cann & M.E. Connely: Real-World cases in Green Chemistry, American Chemical Society, Washington (2000).

M. Tech. (Computer Science and Engineering)

CURRICULUM

(w.e.f. 2022-23)

DEPARTMENT OF COMPUTER SCIENCE

Syllabus

(Semester I – Semester IV)

SEMESTER I

CSC-411: Parallel and Distributed Computing **L | T | P (3 | 0 | 1)**

Introduction: Parallel Computing Architectures, Paradigms, Issues, & Technologies, architectures, topologies, organizations, Parallel Programming Using Shared Memory, memory coherence, race conditions and deadlock detection, synchronization, multithreaded programming, Parallel Programming using Message Passing, synchronous/asynchronous messaging, partitioning and load-balancing.

Advanced Processors and Interconnects: Multicore Processors and High-bandwidth Networks, Parallel and distributed architectures, Distributed and parallel algorithms, Fundamental problems in parallel and distributed computing, fundamental concepts and reasoning principles for parallel and distributed computer systems.

Distributed Programming Algorithms: Fundamental issues and concepts, synchronization, mutual exclusion, termination detection, clocks, event ordering, locking, CORBA, JavaRMI, Web Services, shared spaces.

Clusters of Computers: Server Clusters, High Availability, and Disaster Recovery, synchronization, fault tolerance, coordination and consensus, Virtual Machines and Virtualized Datacenters.

Peer-to-Peer Computing: P2P systems, Familiarity with concurrent programming primitives (semaphores, locks, monitors), Overlay networks, and Content Distribution.

Computational Grids and Applications: National or global computing Grids and Applications.

: Combinatorics and Graph Theory **L | T | P (3 | 0 | 1)**

Elementary Concepts in Combinatorics: Basic counting principles, Binomial theorem; Bijective proofs, Combinatorial identities, Permutations of multisets, Multinomial Theorem, Combinations of Multiset, Sterling's Formula, Generalization of Binomial coefficient, Pigeon hole principle and resolution refutation lower bound. Double counting, Matching and Hall's theorem, Inclusion exclusion principle, Inclusion exclusion principle. Solving recurrence relations using generating functions, Partition Number, Catalan Numbers, Sterling numbers of the 2nd kind, Difference Sequences.

Graph Theory: Matchings, Path Cover, Connectivity, Vertex Coloring, Edge Coloring, Other Coloring Problems, Perfect graphs, Planar Graphs, Other special classes of Graphs. Network flow, Introduction to Minor Theory,

The Probabilistic Method: Basics, Markov, Chebishey Inequalities, Lovaz Local Lemma, Linearity of Expectation; The deletion method; The entropy function; Random walks and randomized algorithm for CNF formulas, Random graph.

Spectral Graph theory: Basic properties of graph spectrum; Cheeger's inequality and approximation of graph expansion; Expander graphs and applications to super concentrators and pseudo randomness; Error correcting codes and expander codes; Small set expansion, Unique Games Conjecture and Hardness of approximation.

Additive Combinatorics: Sum product theorem, Szemeredi-Trotter theorem, Kakeya set problem and applications to randomness extractors.

SEMESTER II

CSC-461: Advanced Algorithms **L | T | P (3 | 0 | 1)**

Course Outline:

Review of Analysis Techniques, Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations, Master method; Amortized Analysis: Aggregate, Accounting and Potential Methods.

Advanced Data Structures: Red Black Trees, B-Tree, Augmenting Data Structure, Priority Queues, Binomial Heap, Fibonacci Heap, Mergeable Heaps, Data Structure for Disjoint Sets and Union-Find Algorithm.

String Matching Algorithms: Naïve String Matching, Rabin-Karp, String matching with finite automata, Knuth-Morris-Pratt (KMP) Algorithm, Boyer–Moore algorithm.

Number Theoretic Algorithms: Factorization, GCD, Modular Arithmetic, Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing; Integer factorization.

Graph Algorithms: Bellman-Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching.

Probabilistic algorithms; Randomizing deterministic algorithms, Randomized Quicksort, Algorithms for Computational Geometry problems, Convex Hull. Approximation Algorithms, Polynomial Time Approximation Schemes.

CSC-462: Research Methodology **L | T | P (3 | 1 | 0)**

Introduction to Research Methods in science – Philosophy of Science, Research methods and Creative Thinking, Evolutionary Epistemology, Scientific Methods, Hypotheses Generation and Evaluation, Code of Research Ethics, Definition and Objectives of Research, Various Steps in Scientific Research, Research presentations Types of Research – Research Purposes – Research Design – Survey Research – formulation of scientific problems and hypotheses –selection of methods for solving a scientific problem Case Study Research.

How to perform a literature review – Sampling Methods – Data Processing and Analysis strategies - Data Analysis with Statistical Packages – Statistical Analysis – Hypothesis-testing – Generalization and Interpretation.

Research Reports - Structure and Components of Research Report, Types of Report, Layout of Research Report, Mechanism of writing a research report – Requirements of a good dissertation.

SEMESTER III

CSP-462: Research Seminar **L | T | P (0 | 0 | 4)**

All the students, will prepare presentation for research seminar which includes their research topic and literature survey.

Department of Economics

Curriculum of

BSc (Hons)/ BSc (Hons with Research) in Economics

(With effect from Academic Session 2022-23)

School of Social Sciences
Doon University
Dehradun-248001

Department of Economics

Semester-wise Detailed Syllabus of Core Courses

First Semester

SSEI 110 Foundations of Microeconomics-I

Unit-I : Introduction: Scarcity and Choice; difference between microeconomics and macroeconomics, concept of firm and industry Economic models, The Basic Market Model

Unit-II : Demand and Supply: Demand and Supply analysis, Elasticity, classification of commodities: Normal, Inferior and Giffen goods, Consumer Surplus & producer Surplus Indifference curves Price- effect: substitution and income-effects and Revealed Preference Theory

Unit-III : Firm and Production Sector: Production and Cost function, Laws of production, Isoquants and diminishing rate of factor substitution, Elasticity of Substitution, Different concepts of Cost and Revenue, Economies and Diseconomies of Scale

Unit-IV: Market Structure and Factor Market: Perfect market structure and imperfect market structure, characteristics, conditions of equilibrium Factor pricing, Marginal productivity theory, Product Exhaustion Problem

SSEI-111: Foundations of Macroeconomics-I

Unit- I : Introduction: What Macroeconomists Study, use of models in Macroeconomics, Prices: Flexible Versus Sticky, Microeconomic Thinking and Macroeconomic Models, Measuring the Value of Economic Activity: National Income Accounting, GDP and its nuances, CPI and other price deflators, working with macroeconomic data, The Open Economy

Unit-II : Classical Theory: The Economy in the Long Run, National Income: Where It Comes From and Where It Goes, The Factors of Production, The Production Function, The Supply of Goods and Services, How Is National Income Distributed to the Factors of Production?, Factor Prices, What Brings the Supply and Demand for Goods and Services Into Equilibrium?, Equilibrium in the Market for Goods and Services: The Supply and Demand for the Economy's Output, Equilibrium in the Financial Markets: The Supply and Demand for Loanable Funds, Changes in Saving: The Effects of Fiscal Policy

Unit-III : Money and Inflation: The Types of Money, Quantity Theory of Money, Money Demand Function and the Quantity Equation, Money, Prices and Inflation; Interest Rates: Real and Nominal, The Fisher Effect, Cost of inflation, Hyperinflation

Unit- IV : Unemployment: Job Loss, Job Finding, and the Natural Rate of Unemployment, Public Policy and Frictional Unemployment

SSEI- 112: Mathematics for Economics-I

Unit-I : Number System and Set Theory: Real numbers, Integers, Rational & Irrational Numbers, Sets and their Representation, Types of Sets, Subset, Venn diagram, Cartesian Product, Application of Sets, Mathematical logic

Unit-II : Functions & Relations: Meaning, Types of functions, Range and Domain, Explicit, Implicit, Inverse functions, Different types of graphs. Limit, Concept of slope, Graphs, Concept of Simultaneous equations

Unit-III : Differentiation:
Definition, Derivative of a function, Rules of Differentiation, Differentiation with single variable, Second and Higher order derivatives, Properties

Unit IV: Partial and Total Differentiation: Concept, partial derivative, rules of partial differentiation, second order partial derivative, Differentials and total differentials, total derivative, Implicit function rule

Unit-V : Integration: Meaning, Basic rules, Indefinite and Definite integrals, Geometric representation

Unit-VI : Matrix Algebra: Types, Matrix operations Addition, Subtraction and Multiplication. Rank of Matrix. Determinants: Matrix inversion, Crammer's Rule. Vector Spaces: algebraic and geometric properties, scalar products, norms, orthogonality; linear transformations

SSEI-AE 01 English Language, Communication Skills

Unit I: Foundation in Grammar and basic writing skills Sentence structure and Parts of Speech, paragraph and essay writing, Precis writing, Formal Letter.

Activity – Enacting or reading out a play with proper stress, pause, modulation and the required tone. Enhancing the finer nuances of verbal communication.

Unit II – Phonetics and Creative Writing Phonetic Transcription: learning correct pronunciation through sound symbols.

Literature – Study of short story, poetry and learning the art of expression through poetry, play and prose.

SSEI-SE 01 Basics of Computer Applications

Unit I: Introduction to Computers and Peripherals Basic components of computer: CPU, Input-Output devices, Keyboard, Mouse and Scanner, Video Display, Printers and Plotters, data storage and retrieval, hard disk, floppy disk and CDROM. Type of computers and their applications; Computer networking and resource sharing, hardware, software and firmware.

Unit-2: MSWord: Word processing concepts, Use of Templates, Working with word document: Editing text, Find and replace text, Formatting, spell check, Autocorrect, Autotext; Bullets and numbering, Tabs, Paragraph Formatting, Indent, Page Formatting, Header and footer, Tables: Inserting, filling and formatting a table; Inserting Pictures and Video; Mail Merge: including linking with Database; Printing documents Creating Business Documents using the above facilities, Basics of presentations: Slides, Fonts, Drawing, Editing; Inserting: Tables, Images, texts, Symbols, Media; Design; Transition; Animation; and Slideshow. Creating Business Presentations using above facilities, Spreadsheet concepts, Managing worksheets; Formatting, Entering data, Editing, and Printing a worksheet; Handling operators in formula, Project involving multiple spreadsheets, Organizing Charts and graphs generally used Spreadsheet functions: Mathematical, Statistical, Financial, Logical, Date and Time, Lookup and reference

Second Semester

SSEI-120: Foundations of Microeconomics-II

Unit I: Consumer Theory: Recent Developments, Violation of the premises of Indifference Curve Approach: Satiation and Lexico-graphic ordering, Uncertainty and Risks

Unit II: Market Structure: Perfect Competition, Monopoly and its regulation, Price discrimination, Monopolistic Competition, Oligopoly Theories and Models

Unit III: Game Theory: Game theory: Payoff Matrix, Nash Equilibrium, Mixed Strategies, Mixed Strategies, Games of Coordination, Maximin and Minimax Strategies, Prisoners Dilemma and Oligopoly Theory, Instability of a Cartel, Tit-for-Tat Strategy

Unit IV: Managerial Theories of Firm: Firm and firm's objective- profit maximization, Sales maximization, Maris and Williamson's Model, Satisficing Model

Unit V: General Equilibrium and Economic Efficiency: Partial Equilibrium versus General Equilibrium Approach, Walrasian General Equilibrium System, Edgeworth box, Pareto Optimality, Social Welfare function, Welfare maximization,

Unit VI: Market Failure: Externalities and public goods, Provision of the Public Good, Asymmetric: Market for Lemons, Moral Hazards and Adverse selection

SSEI-121: Foundations of Macroeconomics-II

Unit-I Growth Theory: The Economy in the Very Long Run; Capital Accumulation and Population Growth; Golden Rule Level of Capital; Steady State with Population Growth

Unit-II Economic Growth II: Technology, Empirics, and Policy, Technological Progress in the Solow Model; Balanced Growth; Convergence; Beyond the Solow Model: Endogenous Growth Theory; Solow Residual in the Short Run; The Economy in the Short Run with Economic Fluctuations

Unit-III The Model of Aggregate Supply and Aggregate Demand: IS curve, The Keynesian Cross, The Money Market and the LM Curve, the Theory of Liquidity Preference; Aggregate Demand II: Applying the IS–LM Model; The IS–LM Model in the Short Run and Long Run

Unit-IV The Open Economy Revisited: The Mundell–Fleming Model and the Exchange-Rate Regime; The Mundell–Fleming Model; the Phillips Curve, Expected Inflation: Adaptive Expectations; The Taylor Rule; Macroeconomic Policy Debates

SSEI-122: Mathematics for Economics -II

Unit-I: Unconstrained Optimization and Constrained Optimization: Concept of Maxima and Minima, local and global optima, unconstrained optimization with single variable, unconstrained optimization with multiple variables, First order and second order condition for maxima and minima, Concept of Convexity and concavity, Quasi convexity and quasi concavity, Equality constraint,
Constrained optimization with more than one variable, Constrained optimization with one constraint, Lagrange Multiplier Method, First order and second order condition, Envelope Theorem

Unit -II : Linear Programming: General formation of linear programming, graphical method, Simplex method: finding the extreme points, optimal extreme points, duality problem

Unit-III: Mathematical Modelling: Concept of a model, types of models, steps for constructing mathematical models, process, application with examples from economic theory

Unit-IV: Differential equations: First-Order differential equations with constant term and constant coefficient definition and solution

Unit-V: Difference Equation: First-order difference equations with constant term and constant coefficient definition and solution

Unit- VI: Financial Mathematics: Introduction, Simple interest and compound interest, interest rate, investment, time period, net present value, internal rate of return

SSEI-AE 02 Environmental Science

Unit I: Introduction: definition, Objectives, Scope and Importance of Environmental Studies Segments of Environment: Atmosphere, Hydrosphere, Lithosphere and Biosphere .Need for public awareness

Unit II: Natural Resources Renewable and Non-renewable resources, Forest resources, water resources, mineral resources, Food resources, Energy resources, land resources. Role of an individual in conservation of natural resources

Unit III: Ecology and Ecosystem: Introduction and Definition, Structure / Components of Ecosystems, Types of Ecosystems, Functional attributes of an ecosystem Productivity, Food chain relationships, Food Web, Ecological pyramids, Energy flow and Material Cycling

Unit IV: Biodiversity and its Conservation: Introduction and Definition Types of biodiversity**,** Biogeographical classification of India**,** Value of biodiversity, Hot spots of biodiversity**,** Threats to biodiversity, IUCN classification of species**,** Conservation of biodiversity-In-situ and Ex-situ conservation **,** Biosphere Reserves ,National Parks, Wild life Sanctuaries, Zoological Gardens, Botanical GardBanks, Tissue Culture etc.

Unit V: Environmental Pollution: Pollutants ,Types of pollutants, Effects of pollution on the environment, Types of environmental pollution, Air Pollution, Water Pollution ,Soil Pollution,

Noise Pollution, Thermal Pollution, Radioactive Pollution ,Solid waste management (Definition, causes
,effects and control of various pollution) Case studies Disaster management : flood, earthquake, cyclone, landslides

Unit VI: Social Issues and the Environment: Sustainable Development**,** Water Conservation and management, Rain water Harvesting, Climate change, Global warming, Acid Rain, Ozone layer depletion**,** Wastelands, wetland and their reclamation**,** Human population and the environment Environmental laws**,** Case studies

SSEI-SE 01 Applications of Basic Statistical Software (SPSS)

Unit I : Stata basics: Documentation, command syntax, do files, log files, globals, locals, loops and Variable view, Data types, Creating variables in SPSS, export/ Import/ splitting of Data.

Unit II : Data management: types of data, inputting data, data management (viewing data, missing values, transforming data, saving data), manipulating datasets (ordering, merging, appending)

Unit III: Graphics: various graph commands, box and whisker plot, histogram, kernel density plot, two way scatter

Unit IV: Linear regression basics: data description, variable description, summary statistics, OLS regression, specification analysis, prediction, margins.

Third Semester

SSEI 210 Development Economics-I

UNIT I: Development and Underdevelopment: Poverty and Inequality, Absolute and Relative Poverty, Measurement of Poverty, Functional Impact of Poverty, Inequalities of Income, Measurement of Inequalities of Income, Growth and Inequalities; Development Gap, Growth and Development – Modern View, Concept of Economic Development and Structural Change, Indicators of Economic Welfare. Principles in the measurement of income inequalities and Application of Lorentz curve in comparing income inequalities between nations. Effect of poverty and income inequalities on the growth and development (effect on GDP)

UNIT II: Theories of Underdevelopment: Vicious Circles of Poverty, Methods to Break the Vicious Circle, The Big Push Theory, Theory of Critical Minimum Effort, The Low Level Equilibrium Trap Theory, Theory of Social Dualism, Theory of Technological Dualism, Lewis's Model, Ranis and Fei Model, Harris-Todaro Model

UNIT III: Allocation of Resources and Growth Strategies in Developing Countries: Growth Strategy – The strategy of Balanced Growth, The strategy of Unbalanced Growth, Investment Criteria in Developing Countries, Application of Investment Criteria, Choice of Techniques, Private and Social Costs and Benefits, The Concept of Shadow Price, Discounting the Future, Distributional Concerns, Government Regulations, Nature and Scope of Planning - Planning in a Capitalist Economy, Planning in a Socialist Economy, Planning in a Mixed Economy; Democratic, Decentralized and Indicative Planning; Micro level Planning, Plan Models, Totalitarian planning, Planning by inducements

UNIT IV: Political Institutions and the Functioning of the State: The determinants of democracy; alternative institutional trajectories and their relationship with economic performance; within-country differences in the functioning of state institutions; state ownership and regulation; government failures and corruption

SSEI- 211: Statistics-I

Unit-I : Introduction to Statistics: Meaning, Characteristics, Importance, Limitations of Statistics Collection of Data, Classification & Tabulation of Data, Diagrammatic & Graphic Presentation of Data.

Unit-II : Measures of Central Tendency: Types of Averages: Arithmetic Mean, Weighted Arithmetic Mean, Median, Quartiles, Deciles, Percentiles, Mode, Interrelation between Mean, Median & Mode, Geometric Mean & Harmonic Mean

Unit-III : Measures of Dispersion: Range, Quartiles, Inter quartile Range, Mean Deviation, Standard Deviation, Coefficient of Variation & Lorenz Curve Moments, Skewness & Kurtosis

Unit-IV: Measure of Association between Variables: Correlation Analysis-Meaning & types of Correlation, Methods of Correlation- Scatter Diagram, Karl Pearson & Rank Correlation. Regression Analysis: Uses of Regression Analysis, Difference between Regression & Correlation Analysis**.** Regression Equations- X on Y & Y on X, Coefficients of Regression. Difference between Association & Correlation Notation & Terminologies, Consistency of Data, Methods of Association

SSEI 212 Environmental Economics

Unit-I : Introduction: Fundamental concepts in Environmental Economics, The model of supply and demand, Economic criteria for efficiency, Welfare measures Circular flow model and Material Balance Model, Review of microeconomics and welfare economics, Environmental Performance Index

Unit-II: Market Failure: Environmental problems- A Market failure, public good, externalities, relationship between public goods and externalities, property rights and the Coase Theorem, Pareto optimality and market failure in the presence of externality, Market instrument used in India

Unit-III: Environmental Problems and Environmental Policy: Economics of climate change, trade and environment, the market approach- types of market instruments, pollution charges, pigovian taxes, Measuring the benefit of environmental improvement (non – market values and measurement methods, risk assessment and perception

Unit-IV: Environment and Sustainable Development: Sustainable development- a Global objective, SDGs in Indian scenario, Environmental Kuznets Curve, International trade and environmental protection, Sustainable development measurement

Recommended Books:

SSEI-SE 03 Economics Lab

Unit: 1: Simulation Games: The functioning of some concepts in economics are particularly amenable to being replicated and observed in the classroom. Concepts encountered and understood through the following games tend to ingrain themselves in the brain stronger. - Widgets production: (http://w3.marietta.edu/~delemeeg/expernom/s93.html#neral1): The law of diminishing marginal productivity is not as intuitive as the law of diminishing marginal utility, yet can be illustrated by asking students to produce of widgets. - Prisoners' Dilemma: This classic game can illustrate trust and cooperation issues, the difference between single period and repeated games, and the occurrence of sub-optimal results when cooperation would obviously yield better results. There are vast amounts of research using game theory to explain sub-optimal results – in the context of civic consciousness, environment, commons, among others. - Ultimatum game: to illustrate limits of rationality through notions of fairness - Deal or No Deal: A classroom version of the game that has been played on television in several countries can illustrate differing preferences regarding risk, and differing abilities to make calculations of expected utility between players. This is meant to illustrate the ability of the human brain to make calculations and valuations that are not obvious, and also the limits of rationality.

Unit: 2: Nobel – 15 students will present a brief of the works of 15 Nobel Laureates. These presentations will be one component of internal assessment.

3. **Weekly news analysis** – the remaining students will present items of news from the previous week, and an analysis of the event using core micro or macroeconomic theoretical concepts. Students must be able to make connections between political discussions and their economic impacts. This will be one component of internal assessment.

4. **Each student will choose two projects** which should involve gathering primary and/or secondary data (qualitative and/or quantitative), employing concepts studied in any economics core subject to study a certain phenomenon. Students may wish to evaluate certain theories for their validity in various circumstances from

their own data. Once-in two-weeks discussions of these projects will be conducted with each student. These projects may get students to start thinking about their dissertation.

Fourth Semester

SSEI 220 Development Economics-II

Unit 1: Demography and Development: Demographic concepts; birth and death rates, age structure, fertility and mortality; demographic transitions during the process of development; gender bias in preferences and outcomes and evidence on unequal treatment within households; connections between income, mortality, fertility choices and human capital accumulation; migration

Unit 2: Land, Labour and Credit Markets: The distribution of land ownership; land reform and its effects on productivity; contractual relationships between tenants and landlords; land acquisition; nutrition and labor productivity; informational problems and credit contracts; microfinance; inter- linkages between rural factor markets

Unit 3: Poverty and Inequality: Definitions, Measures and Mechanisms Inequality axioms; comparison of commonly used inequality measures; connections between inequality and development; poverty measurement; characteristics of the poor; mechanisms that generate poverty traps, and path dependence of growth processes

Unit 4: Education and Health: Role of health and education in human development; demand for health, Grossman's model of demand for health; public healthcare; rate of return to education: private and social; quality of education; inequalities in access to health and education

SSEI-221: Statistics-II

Unit-I: Elementary Probability Theory & its Distribution: Meaning, Basic Terminologies, Approaches of Probability, Probability Rules & Laws, Baye's Theorem, Probability Distribution-Normal, Binomial& Poisson Distribution.

Unit II: Sampling, Sampling Distribution & Statistical Inference: Principal Steps in a sample survey, Methods of Sampling, Properties of random samples. Standard Error & Sampling Distribution. Defining Hypothesis: Type I & Type II Errors, Power of Hypothesis Test. Estimation of population parameters; properties of estimators, confidence intervals for population parameters. Tests of Significance for Small Samples & Large Samples

(Student's T test, Z test, F Test, Chi- Square, ANOVA-One way & Two Way classification.)

Unit-III: Time Series Analysis: Components, Measurement of Trends by Moving Average and the Least Square Method, Shifting the Trend Origin, Conversion of Trend Values.

Unit-IV: Index Numbers: Meaning, Methods of Index number calculation: Laspeyres' Paasches' Dorbish&Bowley, Fisher's , Marshall Edge worth, Kelly Methods, Chain Index Number, Base Shifting, Consumer Price Index & Wholesale Price Index**.** Test for Perfection- Factor Reversal test, Time reversal test, and Circular test.

SSEI 222 Public Economics

Unit-I: The Economic Basis of Government Activity and Public Economics: Market Failure, information and the role of the Government, Fundamental Theorems of Welfare Economics, Pareto Optimality

Unit-II: Markets: Exchange Economy, Edge worth Box, Competitive Equilibrium, Utility Functions, Marginal Rate of Substitution, Pareto Optimal Allocations and Competitive Equilibrium. Production Economy: Pareto Optimality, Competitive Equilibrium with examples, Production Efficiency

Unit-III: Surplus & Externalities: Consumer and Producer Surplus, Welfare Cost of Intervention, Market Interactions, Externalities and Negotiation, Negotiated Compensation, Negotiation limits, Government Intervention

Unit-IV: Permit Trading, Common Property Resources & Co-ordination Failures: Environmental Pollution and Abatement, Direct Emissions Controls; Renewable Common Property Resources, Static and Dynamic Common Property Problem, Extinction; Co-ordination Game, Co- ordination Game with Uncertainty

Fifth Semester

SSEI 310 Econometrics I

Unit-I: Introduction: Nature, Meaning and Scope of Econometrics, Distinction between Economics and Econometrics, Statistics and Econometrics, Mathematics and Econometrics, Stages of Econometric Research

Unit-II: Review of Statistics: Probability, Sampling and sampling distribution, Estimation of parameters, testing of hypotheses

Unit-III: Classical Linear Regression Model: Two variable case: Concepts and assumptions, Two variable linear regression model: estimation through OLS, Properties of Least Square Estimation

Unit-IV: Multiple Linear Regression Model: Concepts and assumptions, Multiple variable regression- Matrix Approach, Functional forms of regression models, concept of dummy variables, non-linear regression models

Recommended books:

SSEI 311 Indian Economy I

Unit-I: Economic Development since Independence: Major features of the Indian Economy at Independence; Growth and Development of Economy since Independence

Unit-II: Population and Economic Development: Demographic trends and issues, Education, Health and Malnutrition

Unit-III: Growth and Distribution : Trends in poverty, inequality and unemployment, policies for eradicating poverty and generating employment

Unit-IV Policies and Performance in Agriculture: Growth; productivity; agrarian structure and technology; capital formation; trade; Green revolution

SSEI- 312 International Economics

Unit –I: Introduction: Discussion on subject matter of International Economics, Current International Economics Problems, Looking at the Bigger Picture-How Important is Trade or Why should we care about International Trade?
Analytical Tools-Production Possibility Curve(PPC),Community Indifference Curve(CIC), Iso-Quant &Iso-Cost(IQ &IC) Curves, Offer Curve(OC)

Unit –II: Basic Models of Trade: Explaining who sells to whom and why?Theory of absolute advantage Difference in Technique-The Ricardian Trade Model (Theory of comparative advantage and opportunity costs) Difference in Endowment- The Heckscher- Ohlin (H-O) Model, Empirical Testing of H-O Model-Leontief Paradox, Factor Intensity Reversal (FIR), Gains from Trade - Measurement of gains from trade.

Unit –III: Concept of Terms of Trade and Factors affecting Terms of Trade, Hypothesis of Secular Deterioration of Terms of Trade, Trade as an Engine of Economic Growth

Unit –IV: Meaning and Components of Balance of Payments, Equilibrium and disequilibrium in the Balance of Payments, Causes of disequilibrium in the Balance of Payments and Measures to correct adverse Balance of Payments.

Sixth Semester

SSEI 320 Econometrics II

Unit-I : Violations of Classical Assumptions and Remedies: Problems of heteroscedasticity, autocorrelation and multicollinearity: Nature, test, consequences and remedial measures

Unit-II: Specification Analysis: Types of specification errors, consequences of model specification errors, tests and errors of measurement, incorrect specification of the stochastic error term, Model selection criteria

Unit-III: Simultaneous Equation Models: Introduction- structural form, reduced form, recursive form and final form model. The simultaneous equation bias and inconsistency of OLS estimators, The identification problem- order and rank conditions of identification

Unit IV: Simple Application of Least Squares Recursive models and Ordinary Least Squares, ILS, 2SLS, 3SLS

SSEI-322: Indian Economy II

Unit 1: Macroeconomic policies and their impact

Unit 2: Policies and performance in agriculture

Unit 3: Policies and performance in industry and services

Unit 4: Labour and employment

Course Learning Outcomes

Unit-I : Number System, Set Theory and Function: Number system, Set Theory, Linear and non- linear functions, convexity and concavity, building models, application in economic theory

Unit II : Matrices: Operations and Applications: Elementary mathematical operation with matrices, Rank of the matrix, matrix inversion, Application of matrices to the Market Model and National Income Model, Input-Output Analysis

Unit-III: Differentiation and Integration: Rules of Differentiation; Maxima and Minima - unconstrained and constrained, Linear Programming: Basic concept; Formulation of a LP problem; Nature of feasible, basic and optimal solutions; Solution of a LP problem through graphical method; Formulation of the Dual and Its interpretation; Rules of integration, Indefinite and Definite Integrals; Applications in Economic Theory.

Unit IV: Difference and Differential Equations: Differential Equations: Definitions and concepts; Solution of First order and Second order differential equations, Applications of differential equations in Economics. Difference Equations: Definitions and concepts; Solution of First order and Second order difference equations, Applications of difference equations in Economics.

Seventh Semester

SSEI-410 Advanced Microeconomics

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UNIT-I: Factor Pricing: Theories of Distribution: Neo–classical approach - marginal productivity theory; Some additional topics on factor pricing and Income distribution-The Adding-up problem: 'Product Exhaustion' Theorems-Euler's Theorem & Clark-Wicksteed-Walras Theorem

UNIT-II: Managerial Theory of the Firm: Managerial Theory of the Firm-Boumol's theory of Sales Maximisation with and without Advertising Cost, Marris's Model of the Managerial Enterprise and Williamson's Model of Managerial Discretion

UNIT-III: General Equilibrium and Welfare: The Walrasian System; Existence, Uniqueness and Stability of an Equilibrium, Welfare Economics. Pigouvian welfare, Pareto Optimality, Kaldor-Hicks Compensation Criterion, Scitovsky Double Criterion, Social Welfare Function and Maximisation of Social Welfare

UNIT-IV Market Failure: Monopoly power, Externalities in Production and Consumption, Public goods Vs Private goods, Free Rider Problem Coase Theorem, Asymmetric Information: The Market for Lemons and Adverse Selection

Eighth Semester

SSEI-420: Advanced Macroeconomics

Unit-I: Aggregate Demand and Aggregate Supply: Introduction to aggregate demand and Aggregate supply , Wages price and unemployment & Phillips curve analysis .Equilibrium output, consumption function and multiplier .

Unit-II: Equilibrium in the Economy: IS-LM model- money interest and income, Open economy, Balance of payment, Mundell- Fleming model (Exchange rate, types, determination under fixed and flexible exchange rate)

Unit-III: Economic Growth Theories: Neo- classical growth theory model [exogenous growth theory] Endogenous growth theory model –[investment in Human capital] and policy implications of New growth theory.

Unit-IV: Policy Issue: Economic policies -- Monetary and Fiscal and their effect on the equilibrium output—Expectations and reactions .

SSEI-421 Operation Research

Unit-I: Introduction: Definition, role of operation research in decision-making, application in industry, Concept on O.R. model building-Types & Methods

Unit-II: Linear Programming and Advanced Topic of LP: Overview of Linear programming-solutionGraphical and Simplex methods, BIG-M methods computational problems, duality, primal-dual relationsits solution, non-linear programming, Kuhn- Tucker conditions

Unit-III : Deterministic Model: Transportation problem- balanced & unbalanced, North-West Corner method, Vogel's Approximation method, Least-cost Method, Assignment problem

Unit-IV: Queuing Theory and Project Management: Introduction to queuing theory, features of queuing system, Introduction to project management, Network diagram, activity, PERT & CPM, float in network, Introduction to decision theory, decision making with utilities, problems.

Detailed Syllabus of Elective Courses

Third Semester

(Choose one elective course)

SSEI DSE-01 History of Economic Thought

Unit-I Mercantilists and Physiocrats: Historical forces that led to the birth of these schools of thought, their salient features and policies, their influence on economics in subsequent time period

Unit-II Adam Smith and Birth of Economics: Chief contributions; Division of labor and capital; Free Trade; Theory of value: unit cost; Wages; Profits; Rent, The Invisible Hand, Malthus's theory of population; Chief contributions of Ricardo.

Unit-III Karl Marx and Socialism: Characteristics of Marxism, Dialectical Materialism, Theory of Capitalism, Class Struggle, Labour theory of value, Exploitation

Unit-IV John Maynard Keynes and Milton Friedman: Keynes vs Classicals, Consumption function, Effective Demand; The Multiplier, The Demand for Money, Milton Friedman chief contributions

SSEI-DSE-02 Regional Development and Regional Economics with Special Emphasis on Uttarakhand

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UNIT-I Regional Planning and Development: Meaning and importance of regional planning, Small state and regional planning

Uttarakhand Economy and Regional Planning: .Resources in Uttarakhand- Water and land resources, Energy, Hydro-potential in Uttarakhand, Natural and Geographical features which affect regional economy and planning of Uttarakhand, Planning Process and Problems in Uttarakhand: An evaluation, Other relevant issues such as Migration and Environment in Uttarakhand,

UNIT-II Demographic Features of Uttarakhand State: Population size and growth, Sex ratio, Population density, Urbanization, Literacy, Mortality and life Expectancy, Fertility, Age structure,
Religious Composition, Current debate on Demographic Dividend in India and population structure in Uttarakhand,

Poverty, Inequality and Employment in Uttarakhand: Trends and Structure of GDP of Uttarakhand, Budgetary allocation to different sectors and thrust areas of the budget, Changing structure of income in Uttarakhand, Trends and patterns of poverty in Uttarakhand, Rural poverty, Urban poverty, Policy implications, Worker population ratio, Growth and Structure of Employment

UNIT-III Agricultural Growth, Productivity Trends and Crop Patterns: Agriculture sector in Uttarakhand, Share and growth rate of agriculture sector in Uttarakhand, Trends in the Area, Production and Yield of the major crops, Land use and Cropping pattern in Uttarakhand, Factors affecting agricultural performance in Uttarakhand, Irrigation, Role of Women in Uttarakhand economy

Agriculture and Agriculture based Economic Activities : Commercial crops, Dairy Farming, Agro based Cottage Industry and Small Scale industry, Food processing and Agro Industries in Uttarakhand.

UNIT-IV Industrial Sector in Uttarakhand: The industrial scene at the time of creation of the state, Extent and pattern of industrialization in Uttarakhand, Productivity trends in the manufacturing sector, Recent policy initiatives, Micro and small enterprises (MSEs), Public Sector Enterprises (PSUs), Challenges and Outlook

Tourism in Uttarakhand -Role of Tourism in Uttarakhand economy, Tourism policies in Uttarakhand, Tourism based Small Scale industry in Uttarakhand, Employment potential of Tourism in Uttarakhand,

SSEI DSE-03 Banking and Monetary Economics

UNIT-I Introduction: Evolution & Functions of Money, Circular Flow of money, Role of Money in Capitalistic, Socialistic & Mixed Economy**, Classical Theory of Money:** Say's Law and Walras' Law; Classical dichotomy and the neutrality of money

UNIT-II Demand for Money: Theories of Demand for Money – Fisher and Cambridge versions, Approaches of Keynesian, Friedman, Patinkin, Baumol, Tobin.,Pigou Effect and Real Balance Effect.

UNIT-III Components of Money Supply: Supply of Money, Determinants of money supply, High – powered money, Money multiplier**, Role, constituents and functions of money and capital markets:** RBI – recent monetary and credit policies, Commercial banks and Co–Operative Banks, Specialized financial and investment institutions, Non–Bank Financial Institutions and Regional Rural Banks.

UNIT-IV Monetary Policy: Goals, targets, indicators and the transmission mechanism; instruments of monetary policy, **Monetary Management in An Open Economy:** International capital markets, portfolio diversification; the International Monetary System; Monetary Policy in India' s Open Economy; Financial Sector Reforms in India. The Narasimham Committee Report.

Fourth Semester
(Choose one elective course)

SSEI DSE-04 Gender Economics

UNIT-I Economics and Gender Bias: Feminist criticism of development indices (Gary Becker); Theories of Gender inequality: Biological and Structural; Theories of Gender inequality: Feminist; Feminist reading of Economic Laws: Marginal Productivity Theory and Laws of Maximization.

UNIT-II Women: Demographic Aspect: Demography of female population: Age structure, Mortality rates and Sex ratio; Causes of declining sex ratios and fertility rates in LDCs with special reference to India; Theories and measurement of fertility and its control; Gender and population control policy with special reference to India.

UNIT-III Women and Labour Markets: Factors affecting female entry in labour market**;** Female work participation in agriculture and non-agricultural activities (with reference to India)**;** Wage differentials in female activities**;** Determinants of wage differentials: gender, education, skill, productivity, efficiency.

UNIT-IV Gender Planning, Development Policies and Governance: Mainstreaming gender into development policies; Gender Planning techniques and gender sensitive governance; Paradigm shifts from women's well-being to women's empowerment; Democratic decentralization and women's empowerment in India.

SSEI DSE-06 Economics of Education and Health

Unit 1: Role of health and education in human development: health and education outcomes and their relationship with macroeconomic performance

Unit 2: Theoretical Foundations of Health Economics: Demand for health, uncertainty and health insurance market, alternative insurance mechanisms, market failure and rationale for public intervention; ,equity and inequality; Evaluation of Health Programs (Costing cost effectiveness and cost- benefit analysis, burden of disease).

Unit 3: Health Sector in India: Health outcomes, health systems, health financing, public policy for health sector; rationale for government intervention in the health sector

Unit 4: Education: Investment in Human Capital; Rate of return to education: private and social; quality of education, signalling or human capital, theories of discrimination, gender and caste discrimination in India;

Unit 5: Education Sector in India: An Overview; Educational Development; Public expenditure on education; Access and inequality in quality of education

Fifth Semester
(Choose one elective course)

SSEI-DSE-07 Agricultural Economics

Unit-I Economics and Economic Growth: Characteristics of Agriculture, Definition of Agriculture , Agricultural Economics as a Social Science, Structure of Agriculture Sectors , Inputs Used and Products of Agriculture

Unit-II Principles of Economics: Production Principles , Production Costs, Supply and Revenue , Principles of Profit Maximization and Loss Minimization, Principles of Consumption and Demand, Price Elasticity Concepts , Principles of Market Price Determination, Competitive vs. Non- Competitive Market Models , Global Issues

Unit-III Population Growth, World Food Production Trends , Trade in Agricultural Products , The Role of Agriculture in Economic Growth , Marketing Food and Agricultural Products , Functional and Institutional Approaches to Marketing , Costs of Marketing Food and Agricultural Products , Operation of the Futures Markets , Agricultural Problems and Policy Analysis , Goals and Policies and Programs , Price and Income , Resource Use (May Include: Natural Resources, Land Economics, Locally Grown Foods, etc.)

Unit-IV Agricultural Sector based measuring the National Economy: The Circular Flow of Income , Measuring Inflation, Unemployment , Nominal vs. Real Income, Macroeconomic Policies, Fiscal Policies , Monetary Policies , International Trade , Absolute vs. Comparative Advantage, Exchange Rates , . Balance of Trade, Balance of Payments, Trade Policies (All Agriculture Related)

SSEI-DSE-09 Financial Economics

Unit 1: Investment Theory and Portfolio Analysis

a. Deterministic cash –flow streams: Basic theory of interest; discounting and present value; internal rate of return; evaluation criteria; fixed income securities; bond prices and yields; interest rate sensitivity and duration; immunisation; the term structure of interest rates; yield curves; spot rates and forward rates. b. Single- period random cash flows: Random asset returns; portfolios of assets; portfolio mean and variance; feasible combinations of mean and variance; mean --- variance portfolio analysis; the Markowitz model and the two-fund theorem; risk free assets and the one- fund theorem.

c. CAPM: The capital market line; the capital asset pricing model; the beta of an asset and of a portfolio; security market line; use of the CAPM model in investment analysis and as a pricing formula.

Unit 2: Options and Derivatives: Introduction to derivatives and options; forward and futures contracts ; options ; other derivatives ; forward and future prices; stock index futures ; interest rate futures ; the use of futures for hedging ; duration based hedging strategies ; option markets; call and put options; factors affecting option prices; put- call parity; option trading strategies ; spreads ; straddles strips and straps ; strangles ; the principle of arbitrage ; discrete processes and the binomial tree model; risk – neutral valuation.

Unit 3: Corporate Finance: Patterns of corporate financing ; common stock ; debt ; preferences ; convertibles , Capital structure and the cost of capital ; corporate debt and dividend policy ; the ModiglianiMiller theorem.

Sixth Semester

(Choose one elective course)

SSEI-DSE-10 Network Economics

Unit-1:

1. Introduction: Overview of Network Economics, its History, and its Importance in Economics Today, Mathematical Background: Basics of Nonlinear Programming Theory Basics of Network Theory, The Variational Inequality Problem: Basic Qualitative Theory Relationship to Optimization Problems and Other Classical, Mathematical Programming Problems, Sensitivity Analysis

Unit-2:

Algorithms for the Solution of Variational Inequality Problems: The General Iterative Scheme - Projection and Relaxation Methods, The Modified Projection Method Decomposition Methods - Serial and Parallel,. Basic Models of Traffic Assignment and Solution Procedures: Introduction and History, The Standard Model, The Extended Model Multimodal Models, The Elastic Demand Model

Unit-3:

Environmental Networks: Overview of Environmental Issues and Policies,Spatial Oligopoly with Permits, Qualitative Properties, Knowledge Networks: Conceptualization and History, Basic Models Migration Networks: The Costless Model, Model with Migration Costs, Model with Class Transformations, Financial Networks: Portfolio Optimization as a Network Flow

Problem, Multi-Sector, Multi-Instrument Financial Equilibrium, Policy Interventions **Unit-**

4

Multi-criteria Network Equilibrium Modeling for the Information Age: Multi-criteria DecisionMaking on Networks, Equilibrium Concepts, application to Teleshopping and Telecommuting Decision-Making, Space-Time Networks: Extension of Multi-criteria Decision-Making to Decision-Making Over Space and Over Time, Application to Telecommuting versus Commuting Decision-Making

Supply Chain Networks with Electronic Commerce, Introduction to Supply Chains and Network Agents, Electronic Commerce: B2B and B2C,Network Equilibrium, Applications and Extensions

SSEI-DSE-11 Basics of Economic Psychology

Unit I: Introduction to Economic Psychology
Meaning of Economic behavior, and Economic psychology, history, fields of study, methods of study, and future of the science, Intersection of Economics and Psychology, introduction to Behavioural Economics and Neuroeconomics

Unit II: Psychology of money:
Why we need money and Experiments with money, Psychoanalysis and the symbolism of money, psychological understanding of poverty, Causes of poverty, Attitudes toward the poor, Behavior of the poor, psychological meaning of employment and unemployment. Unemployment and health

Unit III: Necessities, luxuries and wealth
Distinction between necessities and luxuries, Psychoanalysis and wealth, wealth and happiness Psychological and economic motivation of entrepreneurs

Unit IV: Psychology and motivation
Meaning of Entrepreneur, Psychological and economic motivation of entrepreneurs. Charity or taxation? Reducing tax evasion, Psychological Games

SSEI-DSE-12 Labour Economics

Unit-I Introduction: Meaning- Concept, Significance and Pecularities of Labour. Nature, Scope and Importance of Labour Economics. Actors of Labour, Economics, Characteristics of Indian Labour Market.

Unit-II Labour Supply: Measuring the labour force: employment and unemployment rate, labour force participation rate, workers preferences, differences in preferences across workers, effect of non-labour income on working hours, effect of wage rate change on working hours, income, reservation wage, labour supply curve, labour supply elasticity.

Unit-III Labour Demand: Employment decision in short run and long run labour demand curve for a firm and industry, firm output decision,, impact of wage change on output and employment, Labour demand elasticity, employment effects of minimum wages, minimum wage as antipoverty program.

Unit-IV Labour Market Equilibrium: Meaning, concept, competitive equilibrium across labour markets, impact of immigration on labour market in short run and long run economic benefits of immigration, immigration surplus.

Seventh Semester
(Choose any two elective courses)

SSEI DSE-13 Public Policy- Theory and Practices

Course Outcome:

Unit-I Public Policy and Institutionalism: Introduction to Public Policy; Public Policy as Multidisciplinary Governance Tool; Social Engineering and Social Construction in the political and institutional environment; Sector Application of Public Policy; Policy impacts; collective action, Public opinion, Market and Rational Problem solving; Democratic Society and Public Policy; Developing critical thinking.

Unit-II Models of Public Policy: Creation and Implementation: Political institutions and processes involved in creation and implementation of Public Policy; Models of Public Policy; Politics of program and Policy Evaluation. Tools of Policy Analysis; understanding long term policy trends and reconsiderations and validation; Social Policy Making- Case Study Approach(Medical insurance policy, Security and Financial market policy, Foreign policy, Demographic policy and Poverty

Unit-III Comparative Public Policy: Introduction to comparative Public Policy: Case Studies from UK, China and India in Health, Education and relevant sector; Public Policy and Gender, Inequality, Race; Understanding International Indexes-PQLI, HDI.

Unit-IV India, Indian Economy and Public Policy: Indian Public Policy and poicy making institution; History of Indian Public Policy; The Institutions; Public Policy making in the primary sectors- Agriculture and Industry; Indian Economy and Indian Institutions; Change and Development of Indian Public Policy during planning period.

SSEI DSE-14 Demography

To be updated

SSEI DSE-15 Game Theory

Unit-I Introduction: What is Game Theory? The Theory of Rational Choice, Coming Attractions: Interacting Decision-Makers; Nash Equilibrium**:** Theory, Strategic Games, Example: The Prisoner's Dilemma, Examples.

Unit-II: Games with Perfect Information: Nash Equilibrium, Studying Nash Equilibrium Experimentally, Examples of Nash Equilibrium, Experimental Evidence on the Prisoner's Dilemma,, Focal Points, Best Response Functions, Dominated Actions, Equilibrium in a Single Population: Symmetric Games and Symmetric Equilibria.

Unit-III Mixed Strategy Equilibrium: Introduction, Some Evidence on Expected Payoff Functions, Strategic Games in which players may randomize, Mixed Strategy Nash Equilibrium, Dominated Actions, Pure Equilibria When Randomization is Allowed, Illustration: Expert Diagnosis, Equilibrium in a Single Population, Illustration: Reporting a Crime.

Unit-IV Extensive Games with Perfect Information: Theory, Extensive Games with Perfect Information, Strategies and Outcomes, Nash Equilibrium, Subgame Perfect Equilibrium, Finding Subgame Perfect Equilibria of Finite Horizon Games: Backward Induction, **Games with Imperfect Information:** Motivational Examples, General Definitions, Two Examples Concerning Information, Illustration: Cournot's Duopoly Game with Imperfect Information.

SSEI DSE-16 Sustainable Development

To be updated

Eighth Semester

(Choose any two elective courses)

SSEI DSE-17 Regional Economy of Himalayan States

Unit 1: Mountain Economies and their Development

Introduction- Regional economic development; Concepts and theories; Characteristics of mountain economies; Structural transformation and comparison with the Indian economy; Regional inequalities in select indicators of development; Multidimension poverty in Himalayan states; Development strategies for Himalayan region

Unit 2: Livelihoods, Employment and Migration

Livelihoods: Meaning, quality and diversification—land and other assets, education; Characteristics of labour force and workforce; Structural changes in employment and recent trends; Unemployment and underemployment; Characteristics of migration and migrant workers; Impact of outmigration on income and household economy; Covid-19 and reverse migration; Climate change and impact on livelihoods

Unit 3: Sectoral Aspects of Himalayan Economy

Agriculture: features and challenges; Industry: growth, composition and challenges Services sector; Trends, growth and challenges; Rural economy, Diversification of rural employment; Tourism and its impact on income; Micro, small and medium enterprises; Infrastructure and regional economic development

Unit 4: Sustainable Development

Context and the concept; Difference between economic growth, development and sustainable development; Form MDGs to SDGs; Sustainable Development Goals—targets, achievements and regional disparities; Public policy for promoting SDGs

SSEI DSE-18 Economics of Inclusion

To be updated

Course Learning Outcome

Unit-I Economics Theories of Discrimination: Basic concepts in economics (micro), Basic concepts in labour economics., Neo classical theories of discrimination, Basic theories of political economy, Theories of work & wage.

Unit-II Finding evidences of discrimination Quantifying discrimination (Case Studies)

Unit-III Links b/w discrimination, poverty and public policy, Anti poverty programmes of the government and pre-discrimination, legislation of government.

Unit-IV Equal Opportunity& its Economic Implications, Affirmative Action & Reverse Discrimination.

SSEI DSE-19 Behavioural Economics

Unit I: Introduction

Behavioural economics and consumer behavior, new findings from evolutionary neuroscience, intuition, broadening psychology's reach, integrating emotions into economic theory, economic decision making- a behavioural perspective

Unit II: Behavioural Microeconomics

Heuristic and biases, Risk and Uncertainty, Inter-temporal decision making, bounded rationality, prospect theory, Behavioural game theory, Nudges, Policy, and Happiness

Unit III: Behavioural Macroeconomics

Neo-Keynesian Rational Expectation model, serial correlation in behavioural macroeconomic model- the sources of autocorrelation and the long lag in behavioural macroeconomic model Animal Spirits and economic decisions, Introduction to behavioral finance

Unit IV: Economic Expectations, Emotions and Well being

Economic expectation, buying intention, consumer confidence, relation between attitude and behaviour, Emotions and utility functions, emotion and consumer choice- subjective wellbeing and income- poverty, unemployment and consumer satisfaction.

SSEI DSE-20 Informal Sector and Economic Development To be updated

SSEI 411: Advanced Econometrics

Unit-I Review of Elementary Econometrics: Two variable and multiple variable linear regression model, Generalized least square, Problems of heteroscedasticity, autocorrelation and multicollinearity, Estimation of non-linear equations

Unit-II Regression with Qualitative Variables and Other Techniques: Dummy variable, Regression with dummy dependent variables, LPM, Logit, Probit and Tobit models

Unit-III Dynamic Econometric Model: Autoregressive and distributed lag models, Koyck's approach, partial adjustment and adaptive expectations model, instrumental variables, Error correlation mechanism

Unit-IV Applications of Single Equation Models: Application of single equation technique in demand analysis, Estimation of demand functions under different conditions, Estimation of consumption function, Cross section and time series, Estimation of Production functions: Cobb Douglas & C.E.S.

SSEI-413: Research Methodology

Unit-I Research: Meaning, Objectives, Importance; Research Methods and Methodology Research Problem, Research Process; Research Design: Meaning, Importance and Types; Steps in Research Design; Features of a Good Research Design

Unit-II Sampling: Meaning, Methods, Merits & limitations; Census and Sample method, Characteristics of a good sample; Sample size, its determination, and Sampling and Non Sampling errors; Steps involved in Developing Sampling design.

Unit-III Measurement and Scaling: Measurement in Research, Measurement scales, Source of error in measurement scales; Hypothesis: Meaning Procedure of Hypothesis testing; Tests of significance for small & large samples t, f, z test; Chi square: Meaning, Steps involved and its uses; Analysis of variance: meaning & Techniques of Analysis of variances

Unit-IV Report Writing: Significance, types, steps involved, Outline of a research report; Mechanics of a Report writing and precautions to be taken in Report writing; Different Referencing Style

Detailed Syllabus of Generic Elective Course (Other Department/Faculty)

SSEI GE-01 Foundations of Economics-I

UNIT-I Introduction

Problem of scarcity and choice: scarcity, choice and opportunity cost; production possibility frontier; economic systems.

Demand and Supply: law of Demand, Determinants of demand, shifts of demand versus movements along a demand curve, market demand, law of Supply, determinants of Supply, Shifts of Supply Vs Movements along a Supply curve, Market equilibrium.

Elasticity: price elasticity of demand, calculating elasticity, determinants of price elasticity, other elasticities.

UNIT-II Theory of Consumer Behavior

Concept of Utility, Diminishing Marginal Utility, Equi-marginal utility; Indifference curves, Budget constraint,Consumer's Equilibrium condition under Cardinal and Ordinal Approach.

UNIT-III Theory of Producer Behavior

Production function, law of Variable Proportions, Isoquant and Isocost lines, Producer's Equilibrium condition; Cost Analysis- costs in the short run, costs in the long run, Revenue Analysis- Concepts and Relationships.

UNIT-IV Market Mechanism

Perfect Competition, Monopoly and Monopolistic Competition- definitions, features and Price and Output determination under different market conditions.

SSEI GE-02 Foundations of Economics-II

UNIT-I Introduction

What is Macroeconomics? Macroeconomic issues in an economy, National Income- Circular flow of Income and Concepts of GDP and GNP

UNIT-II National Income Accounting

Measurement of National income and related aggregates- Income; Value Added Method and Expenditure Method, Nominal and Real income, Aggregate Demand and Aggregate Supply

UNIT-III Determination of GDP

Consumption function- concepts of MPC, APC, Saving function- concepts of MPS, APS, and Investment Functions and Investment Multiplier, Determination of Equilibrium Income and Output- The Concept of Full Employment and unemployment

National Income Determination in an Open Economy with Government

Fiscal Policy: impact of changes in Government Expenditure and Taxes; Net exports function; Net exports and equilibrium national income.

UNIT-IV Money in a Modern Economy

Concept of Money in a modern economy; Demand for money; Quantity theory of money; liquidity preference and rate of interest; Money supply and Monetary policy. Inflation- Demand pull and Cost push inflation, Measures to control inflation.

Doon University, Dehra Dun

M.A./M.Sc. Geography

COURSES OF STUDY

UNDER CHOICE BASED CREDIT SYSTEM

(CBCS)

Doon University, Dehra Dun

M.A./M.Sc . Geography

COURSES OF STUDY

UNDER CHOICE BASED CREDIT SYSTEM

(CBCS)

Duration : 2 years Level
: P.G.

Type : Degree
Eligibility : Graduation and Equivalent

M.A./M.Sc . Geography is P.G. Geography course . Minimum time to complete the course is two years

Paper 1
Advanced Geomorphology
Code:SLE 101

Unit	contents
Unit I	**Concepts , Methods and Techniques** Nature , Scope and significance of geomorphology . Methods and approaches to the study of landforms , Fundamental geomorphological concepts as given by W. Thornbury , Systems approach in geomorphology, Trends in Geomorphology study.
Unit II	**Tectonics and Slope Sculpture** Isostasy , Plate tectonics and mega - land forms , Mountain building . Structural land forms , Inversion of relief , Mass - movement - classification , factors governing and resultant landforms . Material of the Earth crust-Rocks
Unit III	**Landform Theories and Models** Theories of landscape development by G Gilbert . W.M. Davis , W.Penck , J.T. Hack , and L.C. King . Polycyclic landscape , Morphogenetic landscape evolution regions . Techniques of geomorphological mapping . Rates and pattern of landscape evolution
Unit IV	**Geomorphologic Processes** Glaciation , Glacial and glacio - fluvial landforms . Peri - glacial processes and landforms ; Fluvial processes and landforms : River basins as geomorphic unit , Drainage patterns and systems . Morphometry of drainage basins , Development of Valley Profile . Graded curve - profile equilibrium , channel forms and pattern , denudation theories of slope development slope measurement.
Unit V	**Applied Geomorphology** Geomorphic Hazards . Geomorphology in Civil Engineering : Application of geomorphology in planning and resource Management . Anthropogenic and Technocratic processes in geomorphology . Landforms of Garhwal Region.

First semester

Paper 2
Geographic Thought
Code:SLE 102

Unit	contents
Unit I	**Geography - Its Nature and concepts** Geography as a scientific discipline , methods and approaches Geography as the study of areal differentiation Man - environment relationship , and spatial organization . The measure of significance in geography , Time and genesis in Geography : Development of Dualism in Geography- Physical Dualisms . vs. Human Geography , Systematic vs. Regional Geography ; other dualisms
Unit II	**Development of Geographical Thoughts** Evolution of geographic knowledge since the classical times - contributions made by Greeks , Romans Egyptians Indians & Chinese . Geography geography during the Dark Age : Contributions of Arab Scholars ; Renaissance in Geography
Unit III	**The Formation of Modem Geography** The beginning : Thought of Varenius and Kant ; General Course of geographic thought in the Second half of the 19th Century and in the first half of the 20th century : Contributions made by German French . British . American and Russians - Analysing the works and ideas of the main exponents : Humboldt , Ritter , Richthofen , Ratzel & Hettner , Blache & Brunhes Mackinder & Herbertson ; Semple . Huntigton & Karl Saur Lomonosov & Gerasimov ,
Unit IV	**Development since Early Fifties** Quantitative Revolution ; Quantification and statistical analysis in geography - Its role and main reactions to it : Development of Models and Paradigms in geography - uses , objectives and types of models , Systems theory in geography ; Locational spatial analysis and Spatial Organizations
Unit V	**Recent Conceptual Development** Philosophical issues in scientific methods : Positivism and Logical Positivism in Geography : Perception , and Behavioural geography , and Humanistic geography ; and geography of place , Gender , Inequality and Development, Recent development and changes in indian geography and its future. Modern techniques and concepts in geography; remote sensing, systems approach and geographic information system.

Paper 3
Regional Geography of India
Code:SLE 103

Unit	contents
Unit I	**Physical Aspects** Geological history , physiographic divisions , drainage system , climate including origin and mechanism of the Indian monsoon , New Theory of Monsoon , Nino impact on the climate .. Climatic division , Distribution and types of soils and natural vegetation.
Unit II	**Demographical Aspects : Rural and Urban** Population distribution , density and growth , population problems and policies . Sex and literacy differentials , Genesis - of - ethnic / racial - diversities tribal areas and their problems ; trends of urbanization , population policy . Cultural linguistic zones . Target human - groups and their problems- Tribals and scheduled castes , People of Hill and migration .
Unit III	**Economic Aspects ; Agricultural Power / and Minerals** Agricultural regionalization - A - climatic regions , Crop intensity . Cropping pattern and crop combination . Agricultural productivity and efficiency in India , Green revolution and other agro proactive revolutions Agricultural land use policy in India sources and extent - of irrigation in different parts of India . Power generation and utilization : Major - river valley projects Mineral zones of India .
Unit IV	**Industrial Regions** Industrial development . Types of industry study of mineral - based , agro based and forest - based industries , household industry , engineering and other demand - based industries , new industrial policy , Industrial regionalization . Study of the transport network development : roadways , railways , airways and waterways , policies and problems ; International Trade - trends and direction
Unit V	**Geographical Regions of India** Regional planning, Planning regions of India: Multilevel planning. Different types of regions, Geographical regions of India: Detailed regional study of Chhota Nagpur , Bastar region . Malabar Coast. Meghalaya region, Kashmir region, thar region.

First semester

Paper: 4a

Climatology and climate change

Code:SLE 104a

Unit	contents
Unit I	**Fundamentals of Climatology** Meaning , Nature and Scope ; relationships with meteorology and with other sciences ; Elements of climate . Structure of atmosphere and its characteristics ; Solar radiation and terrestrial heat balance ; humidity and precipitation .
Unit II	**Atmospheric Processes** Atmospheric pressure , Air masses , fronts and associated atmospheric disturbances (cyclogenesis and cyclolysis) ; concepts and methods of determining evaporation ; evapotranspiration and moisture indices ; physiological climatology , Micro - climatology .
Unit III	**Climate Types** Climatic Classification : Thronthwaite's , Koeppen and Geiger's ; Regional Climatology : Tropical climates , mid latitude climates , polar and highland climates , monsoon , Mediterranean and desert climate.
Unit IV	**Climate Change : Responses & Adaptation** Climatic Changes : Theories and Evidences of Paleo - Climates , global warming ; ozone depletion ; Variation in Precipitation Pattern ; Impacts of Climate Change and Adaptation Strategies .
Unit V	**Applied Climatology** Applied climatology with special reference to sources and analysis of Indian climate ; Detailed study of Indian monsoon . Cloud burst .

First semester
Paper: 4b
Agricultural Geography
Code:SLE 104b

Unit	contents
Unit I	**Meaning and Concept** Nature , scope and significance of agricultural geography : approaches to the study of agricultural geography . Modern concepts of agriculture ; physical and cultural factors of dispersal ; Types of Farming & agriculture.
Unit II	**Agricultural Land Use** Determinants of agricultural land use ; Physical , economic . socio - cultural , institutional and technological factors of agricultural dynamics . Land use types , land - holding , land - tenure system etc .: Von Thunen's theory of agricultural location and its recent modifications ; land use survey in the world with special reference to Britain & India .
Unit III	**Distribution of Soil and Means of Irrigation** Soil properties and land capability classification ; measurements of agricultural efficiency and productivity ; efficiency & cropping intensity ; Potential land and landuse planning : Agricultural infrastructures , modem farm technology and inputs ; Irrigation system . Green and other revolutions .
Unit IV	**Types and Methods** Agricultural typology ; Crop association and crop combination regions - based on minimum deviation method . Weaver's method . Doi's method . least square method & maximum positive deviation method ; Cropping pattern Crop concentration and diversity ; Crop mixing and rotation .
Unit V	**Agricultural Regions** Whittlesey's agricultural classification types & War pattern with special reference to U.S.A ... Parameters and characteristics of agricultural regions of Agricultural scenario of India ; Post - revolution Indian agriculture ; Uttarakhand and management planning .

First semester

Paper: 4c

Rural Development and Planning

Code:SLE 104c

Unit	contents
Unit I	**Meaning and Concept** Definition , nature , scope and significance of settlement geography : Approaches to Rural Development , Evolution of Settlement studies in geography . Concept and Contents ; Human Settlement as a systems . Rural urban dichotomy
Unit II	**Evolution and Pattern of Settlements** Origin , evolution of Indian villages & their relationships in different regions . Spatial components of rural settlements - size , spacing , shape , site arrangement pattern and their relationship - Indian context ; distribution of rural settlements in different geographical environs : Types and patterns of rural settlements their characteristics , special reference to the Himalaya .
Unit III	**Morphology of Settlement** Settling processes - sites and evolution of rural settlements ; spatio - temporal dimensions Morphology of rural settlements with special reference to India . Functions and functional taxonomy of rural settlements : Rural settlements and spatial organization ; Rural service centres and growth foci - nature
Unit IV	**Rural Development Programmes in India :** The Gandhian model of Rural development Community Development Programmes and Panchayati Raj . Integrated Rural Development Programmes , special groups , P. M. Awash Yojana and area specific programmes , Slums and their problems , Mountain and tribal development programmes in India .
Unit V	**Policy and Planning** Rural Settlement Planning in India , Policies & Programmes related to Rural Development in India . Methods of micro level planning . Block and District level planning .

First semester

Paper 5

Practical (cartography)

Code:SLE 105

Unit	contents
Unit I	**Map Projections** Construction , Characteristics and Uses of Map projections ; Polyconic , International , Gall's Equatorial cases of Gnomonic and Stereographic projections , Interrupted Sinusoidal and Interrupted Mollweides Projections , UTM Projection and Marcater's Projection .
Unit II	**Interpretation of Topographical Maps** Significance of map . Index system , Grid reference , Map reading Component of topographical map- scale , direction , symbols , coordinates , direction , distance e Identification of land forms . Interpretation of land use , drainage and settlements pattern Study of any two topographical sheets , one hill and one plain .
Unit III	**Relief Features and Slope Analysis** Depiction of relief : Contours and contouring from spot heights ; Altimetric frequency curve , block diagrams (one point perspective) Slope and gradient , relief profiles , methods of slope analysis (e.g , Wentworth's , Rare & Henery method & Smith's methods) construction of longitudinal and transverse profiles
Unit IV	**Interpretation of Geological Maps** Geological Maps and their Interpretation ; Folded and faulted structures , effect of relief on the sequence and pattern of rock outcrops .
Unit V	**Drainage Morphometric Analysis** Drainage Analysis : Ordering . Density , Frequency , Longitudinal Profiles , Graded profile . Hypsometric Curve .

SEMESTER - 1

DISSERTATION (MINOR)

Code : SLE 106

Problem oriented work based Dissertation

The students will be required to select the topic and area with the help of their respective supervisors allotted to them by the Department . Dissertation must be submitted to the Department one week before the commencement of the Theory Examinations . The size of the dissertation should normally range between 30 and 40 pages . The Dissertation will be evaluated by a panel of examiners appointed by the Convener of BOS , Geography . The evaluation and viva - voce examination will be conducted by both the external and internal examiners .

SEMESTER - I

SEMINAR / PRESENTATION

The students will be required to select any one of the topics allotted to them by the Department . The Topic will be related to the disciplines already studied by students in the same semester as core or elective courses . The assessment of the presentation of the students / examinees will be done by external and internal examiners appointed by the Convener / Head of the Department / University .

Second semester

Paper 1

Geography of Natural Resources

Code:SLE 201

Unit	contents
Unit I	**Basic Framework** Meaning , Scope and Approaches to Resource Geography , Main Concepts of Economic Geography, Concept of Resources related to man nature and culture , Dynamic concept of resources , Classification of resources
Unit II	**Distribution Patterns of Natural Resources** Land , Soil , water , minerals , agriculture , energy resources and their world distribution . Biotic resources and Biotic succession ; Biomes of the world , Functioning of ecosystem . Use and misuse of resources . Problems of energy crises
Unit III	**Economic Regionalization** Agricultural Regions of the World (Derwent Whittlesey) . Theory of Agricultural Location (Von Thunen) , Theory of Industrial Location (Weber) , Major Industries : Iron & Steel , Textiles , Petro- Chemical & Sagar . Industrial Regions of the World . Resource regions . Industrial regions of the world (Great Lake Region Industrial Belis - of Japan - Ruhr basin and Ukrain)
Unit IV	**World Transport Network** Major Trans - Continental Railways , Sea & Air Routes , International Trade Patterns & Trend , Major Trade . Blocks : NAFTA , EEC , ASEAN , Effect of Globalization on Developing Countries.
Unit V	**Management of Natural Resources :** Utilization of natural resources , Concept and Approaches of natural resource management , People's participation and shared decision making in natural resource management . Role of R S and GIS techniques for the assessment of natural resources.

Second semester

Paper 2

Fundamentals of Remote Sensing and GIS

Code:SLE 202

Unit	contents
Unit I	**Meaning & Concept of Remote Sensing (RS)** Process and stages of Remote sensing . Electromagnetic Radiation (EMR) Interaction of EMR with the Earth surface & atmosphere . Types of Platforms Basic principles of Thermal & Microwave Remote Sensing , infrared (TR) Region of EMR , Characteristics of IR Images and their use , Radar Image Characteristics , Advantages of Radar Imagery .
Unit II	**Aerial Photo – Interpretation** Aerial photographic Systems & Methods : Classifications ; Factors of Photo image & quality ; scale & Resolution ; Maps & air photos . Photogrammetry - Geometry of aerial photographs . Stereoscopic vision , Till Relief & Image Displacement : Fundamentals of Air photo - interpretation Factors & Elements of Image Interpretation .
Unit III	**Digital Image Processing** Types of Image , Digital form of data , Digital Processing Techniques , Digital image classification . Computer fundamentals of Remote sensing Remote Sensing Programme in India .
Unit IV	**Geographic Information System (GIS)** Meaning , scope & concepts , History & development , Elements of GIS : GIS Software . Types of data , data models and structure , Representation of spatial and non - spatial Information , Data Input Methods Data Base , Remote Sensing & Data integration
Unit V	**Recent Trends of GIS** Internet GIS , Virtual 3 - D GIS , Digital Elevation Model (DEM) , GPS System & application, computer(assisted) cartography, application of GIS in Geomorphology, land-use planning and urban settlement analysis.

Second semester
Paper 3
Geography of the Himalayan Mountain
Code:SLE 203

Unit	contents
Unit I	**Origin of the Himalaya** Geo - physical identity of the Himalaya , Location , Extent Himalyan orogeny and Neo-techtonic, Structural division of the Himalaya.
Unit II	**Physical Aspects :** Physical divisions , Relief , Drainage , Glaciers , Lakes , Landforms the Himalaya . Climate , Vegetation , Bio - diversity , Natural Hazards , Environmental degradation in the Himalaya.
Unit III	**Regional Classification** Regional divisions of the Himalaya , Regionalization III macro . meso and micro regions . Parameters and Characteristics . Salient Characteristics of each region.
Unit IV	**Cultural Aspects** Population density , growth , and distribution , Settlement IV Urbanization . Tribal and Pastoral communities , Agriculture , Animal husbandry . Horticulture , Transport and Tourism , Power Projects , Implications of out - migration on the regional economy and problems of waste land expansion.
Unit V	**Development and Planning** Geographical account of Kashmir, laddak, Lahul and Spiti Doon valley Kathmandu Valley – Dhiyang valley and Tista valley Mountain development Planning and Policy , Future prospects of development in the Himalaya .

Second semester

Paper 4

Practical (Computer, Remote Sensing and GPS)

Code:SLE 204

Unit	contents
Unit I	Basics of computer , Coordinate system , UTM projection , World global system (WGS) . Import and export of file , Geo - referencing (map to image and image to map) Re sampling.
Unit II	Digitization (point , line and polygon) . Sub setting with AOY layer . Mosa Radiometric and Geometric errors and correction Image classification.
Unit III	Spatial data and Non spatial data integration . Editing of data . Building topology , Image interpretation , Interpretation keys , Raster and Vector.
Unit IV	Aerial Photo Interpretation : Stereo test card vision testing . Stereo visic basics of aerial photographs . Fiducial marks , tilt , mosaic . Types of air photographs , Identification of features and mapping.
Unit V	Basic Concepts of GPS - Components and Basic Facts ; Components of GPS , Practical mapping of GPS of marks Practical.

Second semester
Paper 5a
Oceanography
Code:SLE 205a

Unit	contents
Unit I	**Basic of Oceanography** Meaning objectives , scope and significance of oceanography, Plate tectonics , Ocean floor spreading
Unit II	**Marine Topography** Submarine relief , Ocean bottom relief , Configuration of Pecific Indian and Atlantic ocean floor.
Unit III	**Ocean Salinity and Temperature** : Physical and chemical properties of sea wat Marine Sediments , Coral reef.
Unit IV	**Movement of the ocean water :** Ocean motions horizontal and vertical , Waves Tide currents , Costal beach and shoreline process
Unit V	**Marine Problems and Policy** Tsunamis , Elnino , Ocean resources . Sea level change and Global warming , Ocean routs , Ocean transgression . Marine policy and laws.

Second semester

Paper 5b

Tourism Geography with Spatial References to Himalaya

Code:SLE 205b

Unit	contents
Unit I	**Introduction and the Concept** Definition , Scope , Nature , Significance and Development of Tourism Geography . Concept and approaches of Tourism Geography , Geography of tourism as applied Geography Development of Tourism in the world .
Unit II	**Tourism Types** Types of tourism : Cultural , Coastal , Adventure tourism , National and International tourism , Eco - tourism . Globalization and tourism , Political fallouts . Tourism in India .
Unit III	**Components of Tourism** The Basic geographical Components of Tourism , Elements of Tourism , Inventory of Tourism resources , Tourism infrastructure . Organization Tourism
Unit IV	**Tourist industry** Nature Scope and characteristics . Trends and magnitude of modern Tourism Tourism and national economy growth impact and implications : Socio - cultural significance of Tourism and related issues
Unit V	**Planning for Tourism development** Development of Tourism in the Himalayas with special reference of Uttarakhand , Its existing potentials and promotion of Tourism - pilgrimage . Combine Tourism as a process of development and change in Hill region ; problems & planning measures . futuristic Tourism in the Himalayas.

Second semester
Paper 5c
Population Geography
Code:SLE 205c

Unit	contents
Unit I	**Meaning and Concepts** Meaning , Nature , Scope and Significance of Population Geography , Concepts approaches and Methods of population study , Sources of population data Development of population geography, population geography and demography.
Unit II	**Demographical Traits** Population Distribution , Growth , Density , Factors in population growth , App - S Structure , Fertility . Literacy and mortality analysis . Occupational and C structure . Population Cycle . Broad World patterns .
Unit III	**Population Dynamics** Population Movements , Definition and types of migration , Rural - Urban migration Push and pull factors . Urbanization . Theories and laws of migration Causes consequences of migration with special reference to Uttarakhand
Unit IV	**Theories and Model** Theories of population growth . Demographic Transition Model . Population Typology . Population Pressure . Inequality of resource availability , Over - Under and Optimum population , Population - Resource Regionalization .
Unit V	**Population Policies and Programmes** Human Development Index . Population Policies of developed (Canada . Japan) and developing (China , Brazil) countries , Population Projection , National population Policies in India . Human Resource Development planning.

SEMESTER -II

Paper Sixth

DISSERTATION (MINOR)

Code : SLE 206

Problem Oriented Work Based Dissertation

The students will be required to select the topic and area with the help of their Respective supervisors allotted to them by the Department . Dissertation must be submitted in the Department one week before the commencement of the Theory Examinations . The Size of the dissertation should normally range between 30 and 40 pages . The Dissertation will be evaluated by a panel of examiners appointed by the Convener of BOS , Geography . The evaluation and viva - voce examination will be conducted by both the external and Internal examiners .

SEMESTER - 11

SEMINAR / PRESENTATION

The students will be required to select any one of the topics allotted them by the Department . The Topic will be related to the disciplines already studied by students in the same semester as core or elective courses . The assessment of the presentation of the students / examinees will be done by external and internal examiners appointed by the Convener / Head of the Department University .

Third semester
Paper 1
Environmental Geography
Code:SLE 301

Unit	contents
Unit I	**Nature and Concept of Environment** Nature , scope and significance of environmental study : Approaches to environmental studies ; Concept of ecosystems , Concepts and principles of geography . ecology , Components and functions of ecosystems , Ecological perspective in Geography.
Unit II	**Biosphere and Ecosystem** Biosphere as an Major ecosystems of the earth , Biomes and their type Productivity and equilibrium in the ecosystems (stability , unity , and diversity) ,, Ford chain and Food webs , Energy flow in ecosystems , biogeochemical cycle , hydrological cycles, carbon cycle.
Unit III	**Ecology of Population** Growth curve , Law of population growth , biotic - potentials , Human Ecology - Population growth , Nasality and mortality in human population , Problems - of population growth ; Food production and world hunger , Green Revolution .
Unit IV	**Environmental Crises** Global climatic change . Shrinking of glaciers , Acidic rains , El - Nino - effect ; Desertification , Endangered genetic resources , Natural Hazards -earthquakes , cyclones landslips , draught , floods ; Cultural Hazards - man induced ecological changes i.e. Forest fires , pollution . Environmental Impact Assessment (EIA) .
Unit V	**Environmental Management and Planning** Concepts and principles of Environmental Management , Sustainable development , Integrated Watershed Management , Recycling of resources , waste disposal , reforestation , control of forest fire . , World Environmental Movements (Stockholm Conference , Earth summit , etc.) . Environmental programmes in India .

Paper 2

Research Methodology

Code:SLE 302

Unit	contents
Unit I	**Basic of Research :** Meaning , objectives , concept and significance of research in Geography . Scientific method , Method and Technique . Approaches (qualitative a quantitative) and methods of Geographical research.
Unit II	**Types of research** basic or pure research , applied research , explanatory and descriptive research , quantitative and qualitative research , action and diagnostic research , historical and experimental research **Process of Research** Steps in research process , formulation of research problem , revie of literature . Geographical research problem : meaning , identification , selection a techniques defining research problem .
Unit III	**Hypothesis :** Definition , characteristics , significance , formulation and testing of hypothesis . Geographical research problems , selection and techniques of the problem. **Methods of Data Collection** Types of data , Methods of data collection ; primary and secondary data , schedule and questionnaire , observation and interview , audio - visual method and Tabulation of data.
Unit IV	**Sampling Design** Meaning , methods and steps and design of spatial sampling Probability sampling and non - probability sampling . **Research Design : Meaning , concept and types research design** Process of research formulation of synopsis , Preparation of maps and diagrams. .
Unit V	**Basic Concept of SPSS (Statistical Package for Social Science) :** Meaning a operations and data analysis , Application of remote sensing and GIS. **Report Writing** Meaning , types of report , steps . Bibliography : meaning and types Framing of pilot research project and preparation of research paper .

Third semester
Paper 3
Cultural Geography
Code:SLE 303

Unit	contents
Unit I	**Meaning and Concept of Cultural Geography** Nature concept and components of culture Geography , Development of Cultural Geography . Major concepts of Cultural Geography , Cultural Landscape , Cultural processes , cultural diffusion , cultural hearths ; Cultural Ecology .
Unit II	**Evolution and Development** Evolution of Culture and Humanization of the Earth : Brief cultural history of man . Migration processes and cultural development - prehistoric , primitive agrarian , Industrial revolution and cultural development ; Role of technological changes in cultural development .
Unit III	**Human races** Origin , dispersal and related theories ; Types and distribution ; Major ethnic . Racial groups . Religion and culture , Major Religions and Cultural groups . World distribution of languages ; Major linguistic cultural groups
Unit IV	**Development and Cultural Transformation** Man and the Biophysical environment ; Environmental perception , Resource and Culture , Agricultural innovations and dispersals . Industrial and Technological revolution ; Transport and Trade . Processes and elements of cultural transformation .. .
Unit V	**Cultural Regionalization** Problems and Criteria of Regional classification of cultures ; Major contributors to the study of cultural regionalization . Cultural regions of the world . Cultural realms- Monsoon Asian , Meso - African . Western European , Anglo - American .

Paper 4

Practical

Field Surveying

Code:SLE 304

Unit	contents
Unit I	**Plane Table Survey** Intersection and Resection methods . Three point problem , Determination of height using Indian clinometers.
Unit II	**Prismatic compass survey :** Open and Close Traverse methods and error removed by Bowditch method .
Unit III	**Levelling and Triangulation :** Dumpy level Survey , contouring and profiling . EDM survey and Theodolight survey and total station / EDM
Unit IV	**GPS Survey :** Ground and Computer base mapping . Total Station and EDM survey
Unit V	**Survey Camp-** Field survey using by all instruments and camp report Writing .

Third semester Paper

5a

Glacial Geomorphology Code:SLE 305a

Unit	contents
Unit I	**Definition, Concept and Scope** Definition, scope, Concepts and significance of Glacial Geomorphology, Approaches and relationship with climatology. Ice Age, Causes of ice ages. Pleistocene Glaciations.
Unit II	**Types of Glaciers** Types , movement , morphology , advancement and retreat of glaciers . Important glaciers of the world . Concept of glacial cycle.
Unit III	**Glacial Processes** Erosional process ; glacial erosion , development of erosional landforms . Depositional process and landforms . Types and forms of moraines , glacio fluvial and glácio- lacustrine landforms .
Unit IV	**Periglacial Processes and Landforms** Periglacial process : frozen ground phenomenon -identifical , depth Variations , classification and distribution Periglacial landforms . adaptation of human beings to periglacial environment .
Unit V	**Techniques of glacial studies** Techniques of glacial studies- Remote sensing and GIS . Advanced Survey technique and use of GPS . Inventory of Himalayan Glaciers . Case study of Gangotri Glacier . Glaciers are as recreational recourse .

Third semester Paper
5b
Natural Hazards and Disaster Management
Code:SLE 305b

Unit	contents
Unit I	**Meaning and Concept** Meaning , concept and scope of natural hazard and Disaster . Types of hazards , Elements of hazard , Disaster and hazard . Major requirements for coping with disaster.
Unit II	**Long term Measures :** Prevention , Mitigation , Preparedness , Disaster and development , Disaster legislature , Counter disaster resources , Disaster management plans , Utilization of resources .
Unit III	**Response to Disaster Impact** Response ; Search , Rescue and Evacuation , Logistic ; Incident command System . Disaster management cycle ..
Unit IV	**Major Post impact Factors** Recovery , Post disaster review and damage assessment , Relief , Rehabilitation and Restructuring
Unit V	**Regional Pattern of Disaster Management :** International disaster assistance , Leadership in disaster , Organization , Disaster scenario of Uttarakhand , Disaster management system in Uttarakhand . National disaster management policy in India .

Third semester Paper

5c

Regional Planning and Development

Code:SLE 305c

Unit	contents
Unit I	**Meaning and Concept** Meaning , concept , scope and approaches of Regional planning ; types a hierarchical levels of regional planning local , regional and national ; Geography its role in regional planning & development.
Unit II	**Theories and Models** Theoretical and operational frame work of regional planning ; Classical economic growth theories- a review , stages of growth theory , central place theory and growth pole model and spatial diffusion theory , Comparative advantages theory , cumulative causation model , core - periphery model ,
Unit III	**Methods and techniques** Methods and techniques of regional analysis and planning ; planning process and delineation of planning regions - different approaches ; Short term and Long term planning , Multi level regional planning and Decentralized Planning .
Unit IV	**Regional Development** Regional developmental strategies , Identification of planning region , Planning for backward area , Hill area and Tribal area . Case studies of planning programmes - achievements , problems and prospects , form -Japan , China and U.K.
Unit V	**Regional Planning in India** Spatial inequalities and regional imbalances in India ; Regional planning in India trends and characteristics ; Planning for problem regions ; parameters and - identification of planning regions in India ; Dilema of development in mountain regions with special reference to Uttarakhand .

Third semester Paper
5d

SEMESTER - III

Paper - Sixth

DISSERTATION (MINOR)

Code :SLE 306

Problem Oriented Work Based Dissertation

The students will be required to select the topic and area with the help of their respective supervisors allotted to them by the Department . Dissertation before the commencement of the Theory Examinations . The size of the dissertation should normally range between 30 and 40 pages . The Dissertation will be evaluated by a panel of examiners appointed by the Convener of BOS , Geography . The evaluation and viva - voce examination will be conducted by both the external and internal examiners

SEMESTER - III

The students will be required to select any one of the topics allotted them by the Department . The Topic will be related to the disciplines already studied by students in the same semester as core or elective courses . The assessment of the presentation of the students / examinces will be done by external and internal examiners appointed by the Convener Head of the Department University .

must be submitted to the Department one week

Fourth semester

Paper 1

Regional Geography of Uttarakhand

Code:SLE 401

Unit	contents
Unit I	**Physical Setting** physical setting- geo - structural divisions , Physiographic regions . Drainage system , Climate , Natural vegetation.
Unit II	**Processes and Landforms** Glaciers , Fluvial , mass - wasting , Slope , and Relief , Landforms , Lakes , Natural Hazards and disaster . Natural regions of Uttarakhand . Hydro power Projects .
Unit III	**Cultural Aspects** Distribution , growth density of population . sex ratio , occupational structure and literacy . Rural hill migration . Tribes . Rural Settlement types , Pattern of Urbanization and Transport net work . Cultural regions of Uttarakhand .
Unit IV	**Land Resources** Distribution of land use , types , Agricultural land use , Horticulture , Animal Husbandry , Natural recourse , Tourism , and Industrial development.
Unit V	**Environmental Constraints** Spatial inequalities and regional imbalances in India ; Regional planning in India trends and characteristics ; Planning for problem regions parameters and identification of planning regions in Dilema of development in mountain regions with special reference to Uttarakhand .

Fourth semester

Paper 2

Urban Geography Code:SLE 402

Unit	contents
Unit I	**Meaning and Concept** Meaning , scope and objectives of Urban Geography ; Approaches to the study of Urban Geography ; Theoretical and operational concepts of towns ; Towns in historical and spatial perspectives.
Unit II	**Urban Morphology** Urban setting - site , situation , growth and stages ; Urban morphology - Land use models and city growth - Concentric zone , sector and multiple nuclei models ; Centripetal and centrifugal forces of urban growth ; Urban land use .
Unit III	**Urban Functions** Demographic structure and characteristics of urban population ; Concept of urban functions ; Functional typology of urban centres - some qualitative and quantitative techniques of functional classification : Structure and characteristics of Central Business District (C.B.D.) . Slums - nature , types and dimensions - Indian context .
Unit IV	**Delimitation** City - region interaction , Urban Fringe Characteristics , Umland Parameters and delineation , Central Place Theory Centrality and functional hierarchy ; Rank- Size - Rule and city size & spacing . Regional pattern of urbanization - World & India
Unit V	**Planning and Policy** Models , layout and growth of planned cities ; some planned cities of India ; Urban development Planning in India - policies , programmes and implication . Hill towns of Uttarakhand .

Fourth semester
Paper 3
Geo- hydrology
Code:SLE 403

Unit	contents
Unit I	**Meaning and Concept** Definition , Concepts and scope of geo- hydrology , hydrology in relation to water resources development , Components of hydrological cycle , Hydrological cycle .
Unit II	**Water and its Disposition** Hydrological properties of rocks , Precipitation , Runoff process , Computation of runoff , Water Discharge and measurement , Hydrograph analysis .
Unit III	**Underground Hydrosphere** Structure of the underground hydrosphere , Vadose and phreatic Zones , Recharge and discharge of ground water , Types of aquifer . Underground water classification .
Unit IV	**Ground Water Movements :** Infiltration ; capacity , rate , and methods of computation . Evaporation of runoff , Hydraulic conductivity , Darcy's law , Permeability , Transmissibility . .
Unit V	**Conservation and Planning** Water balance , Utilization of water resources , Conservation of water ; present future perspective , planning and programs . Concept of artificial recharge and water harvesting , Surface water Resources of India .

Fourth semester
Paper 4
Quantitative Technques
Code:SLE 404

Unit	contents
Unit I	Types of spatial data- Point , Line and Area , Levels of their measurement Nominal , Ordinal , Interval and Ratio . Diagrammatic representation of data- Circle , Spheres , Block pile ,
Unit II	Techniques of mapping- Dot . Choropleth and Isopleth . Elements of map Generalization , Symbolization and Classification .
Unit III	interpretation of Indian weather maps- July and January . Representation of Ergo graph , Climato graph and Hyther graph .
Unit IV	Statistical Techniques- Correlation , Regression Analysis , Deviation a Dispersions .. .
Unit V	Field Study work (GPS Survey mapping)

Fourth semester

Paper 5a
Mountain Geomorphology
Code:SLE 405a

Unit	contents
Unit I	**Basic Concept of Mountain Geomorphology** Nature , concept , location , extent and classification of mountains . Mountain Systems of the World .
Unit II	**Orogeny of the Mountains** Origen , plate tectonics and mountain building process . Geosynclines , relief , lithology and structures . Origin of the Himalaya.
Unit III	**Geomorphologic Processes** Glacial , fluvial , mass wasting , natural hazards , earthquakes , anthropogenic influences , climatic change etc.
Unit IV	**Landforms and geo - hydrology** Mountain hydrological system , landform mapping techniques , underground water , Watershed management ,. .
Unit V	**Importance of the Mountains** Aesthetic concept of mountains , sustainable mountain development , geopolitics of mountain regions , Problems of mountains . Future prospects of development in the mountains ,

Fourth semester

Paper 5b

Advanced GIS and GPS Applications

Code:SLE 405b

Unit	contents
Unit I	**Geographical Information System** Geography as a spatial science ; Basic concepts of GIS ; Components & Elements of GIS . Geo - referencing , Scale , Map Resolution : Types of Information in Digital Map ; Attribute Information ; Display Information ; Layering ..
Unit II	**Geographical Data Base and Data Models** Geographic Data Types : Spatial and Non - spatial data ; Principal Functions of GIS ; Data Capture ; Data Base and Spatial Data . Geo - Relational Data Model ; Topological Data Structure ; Attribute Data Management ; Relational Database - Concepts & Model .
Unit III	Geospatial Data Analysis , Digital elevation model (DEM) , Web GIS . Internet GIS , Computer Cartography , Recent trends of GIS .
Unit IV	**GPS Applications** Basic Concepts : GPS Components and Basic Facts ; Components of a GPS ; GPS Positioning Types ; Accuracy of GPS ; Reference station ; Application of GPS in resource mapping . Map Updating , Cadastral Mapping , Micro Level Surveying etc.
Unit V	**Applications of GIS** Application of GIS in Geographical studies with special reference Natural Resource Management , Urban Management , Environmental Management , Agricultural Planning . Emergency Response System and Decision Support System .,

Fourth semester
Paper 5c
Political Geography
Code:SLE 405b

Unit	contents
Unit I	**Meaning , Concept and Scope** Definition , Concept , Nature , Scope and Approaches of Political Geography ; historical development ; Political Geography Vs Geo - politics ;
Unit II	**Concept of Boundaries** Frontiers and boundaries and their laws ; international boundaries functions and classification ; Buffer zones ; problems of land locked states ; territorial waters . Concept of state and nation ; Spatial factors of state - Location , size and shape ; Core area , capital city .
Unit III	**Geo - Politics of the world**, World geo - politics and geo - political regions of the world ; Colonization , Decolonization , Federalism , Strategic basics and Military alliance . Geopolitics of Indian ocean . Determinants of Sea power in Geo - strategic ideas of Haushofer , Mahan , Mackinder and Spykman .
Unit IV	**Geopolitical study of India and Neighbours** Geopolitics of India , Pakistan , and China . Geopolitics of SE Asia . Water dispute and Terrorism . State Politics of India . Non aligned movement . Buffer State and core area .
Unit V	**Electoral Geography of India** Concept , nature and scope of Electoral Geography . National and regional political parties and voting behaviours in India . Changing political nature of India . Legislative structure of Uttarakhand . Role and future of regional parties in Uttarakhand . Problem of re delineation of constitutions in Uttarakhand and its effects .

CURRICULUM OF MASTERS' ACADEMIC PROGRAMMES

School of Environment & Natural Resources (SENR)

Doon University

Kedarpur, P.O- Ajabpur, Dehradun – 248001

Course Code: ETC - 500
Course Title: Fundamental of Environmental Science and Technology

Number of Credits: 2 **L-T-P 2**-0-0

Unit I: Ecosystems; biotic and abiotic components, production and consumption, trophic levels, productivity and energy flow, food webs, cycling of elements. Description and study of typical natural and artificial ecosystems.

Unit II: Biochemistry, photosynthesis and respiration, important biological compounds, enzymes. An introductory study of environmental resources and their use. Relations and cycles within ecosystems. The causes, monitoring and correction of pollution of environmental systems.

Unit III: Microbiological concepts: cells, Structure and function of cell constituents, classification and characteristics of living organisms, characterization techniques, reproduction, metabolism, microbial growth kinetics. Association of microorganisms with man, animals and plants microorganisms in nature. Extremophilic microorganisms

Unit IV: Microbial Growth and Control: Methods of determining growth, factors affecting growth, types of growth, continuous, discontinuous, synchronous and non-synchronous. Control of microorganisms-physical control by filtration, irradiation, temperature (high & low), chemical control by antimicrobial agents and chemotherapeutic agents, microbial indicators of water pollution, MPN method for coliform count in drinking water.

Unit V: Applications to environmental engineering: assimilation of wastes, engineered systems, concepts and principles of carbon oxidation, nitrification, denitrification, methanogenesis, etc.

Course Code: ETC -

510

Course Title: Principles and Design of Wastewater Treatment and Disposal Systems

Number of Credits: 3 **L-T-P 3**-0-0

Unit-I: Characteristics of water: Physical, chemical and biological standards. Wastewater treatment concepts; pretreatment, primary treatment, secondary treatment, tertiary treatment. Adsorption, Ion-exchange, Membrane processes. O and M of water treatment plants, Industrial water treatment. Water quality standards.

Unit-II: Theory and design of physicochemical unit operations, screening, grit, removal equalization, sedimentation. Filtration: Slow and rapid gravity filter, multi-media filters and pressure filters. Design of slow sand filter and rapid sand filter. Disinfection: theory and application of chlorine. Miscellaneous methods of water treatment- removal of iron and manganese, hardness, fluorides, colour, taste and odour, dissolved metals and gases.

Unit-III: Aerobic unit operations for organic carbon removal such as activated sludge, trickling filter, oxidation ditch, oxidations ponds, aerated lagoons, root zone treatment, vermifilter etc. Anaerobic operations for organic carbon removal such as UASB, filters, fluidized/expanded bed systems etc. Biological unit operations for nitrogen and phosphorus removal.

Unit-IV: Tricking filters classification, Design parameters, NRC formula, Recirculation in tricking filter merits and demerits, Operation problem encountered in tricking filters and Corresponding remedial measures. Design problems, Theory and Design of Rotatory biological contactors**.**

Unit-V: Theory and design of Sludge treatment, sludge thickening, sludge drying, sludge thickening, Sludge conditioning, incineration, aerobic and anaerobic digestion of sludges. Theory and design of wastewater disposal and systems; disposal to inland water bodies, sea/ocean disposal; land/underground disposal.

530

Course Title: Solid and Hazardous Waste Management

Number of Credits: 3 **L-T-P 3**-0-0

Unit I: Introduction: Solid waste- Sources and types of solid wastes factors affecting the generation rates. Municipal solid waste (MSW)**:** physical and chemical composition, factors affecting MSW quality and quantity, hierarchy of waste management, RCRA, integrated solid waste management. Overview of solid waste generation and management practices in India. Hazardous wastes, types, sources, composition and classification. Legal framework for handling and storage of municipal, medical and hazards wastes in India.

Unit II: Waste Storage, Collection and transportation, Storage- movable bins, fixed bins. MSW Collection system, Container system, stationary container system, Transfer and transport, processing, waste transportation system, waste, separators, size reduction equipments, screening equipment, Material recovery facility. Hazardous wastes storage- onsite and offsite storage, hazardous waste transportation, international trade/export/ import of hazards waste, Basel Convention, Electronic waste – storage and treatment options. Waste disposal system and health and pollution issues.

Unit III: Waste recycling and waste -to–energy concept: role of formal and informal sector, resource derived fuels (RDF)- concept, processing, application and limitations, waste-to-energy, concept, waste calorific value assessment, sources, Thermal conversion technologies: incineration, gasification, pyrolysis, biogas, fuel from wastes and char; limitation and health issues. Composting and vermicomposting: types, process description, design and operational consideration of aerobic and anaerobic composting, process description.

Unit IV: Hazardous waste treatment methods: criteria for treatment selection, land disposal, combustion, solidification. Sanitary Landfill Technology: Land-filling, site selection criteria, landfill layout, landfill sections, occurrence of gases and, leachate in landfills: composition and characteristics, operation control, waste decomposition phases in sanitary landfill, gas control and utilization, flaring system. Bioreactor landfill- types and operation management, Post closure operations in landfill.

Unit V: Incinerator technology: concept, engineering and applications, types of incinerators, mass incinerator system for MSW, thermal processing system, different units of a typical incinerator, unit operations, fuel gas controlling, air pollution control in incineration, residual management, legal, political and social issues with incineration technology, medical waste treatment, residues management in hazardous waste treatment, Technical issues and solutions in mass incinerators, ecosystem health and occupational issues in incinerator.

Course Code: ETC -

550

Course Title: Basic Instrumentation in Environmental Science & Technology

Number of Credits: 2 **L-T-P 1**-0-1

Unit – I Basic Principles of Instrumentation, solvent extraction and its application, ion exchange and electrophoresis, Paper and Gas Chromatography, Instrumentation and applications of HPLC and TLC.

Unit – II Information on Analytical Methods, Limitations of analytical methods, Accuracy and precision, Classification and minimization of errors. Basic Principals of Spectroscopy, Basic principles, Instrumentation and Applications of UV and VIS spectrophotometers, IR and EMR-Spectrophotometry- interaction of radiation with different types of molecular energy, NMR.

Unit – III Introduction, principle, instrumentation and environmental applications of flame photometer – AAS. Atomization flame atomization graphite furnace atomizers, application of AAS. Atomic Emission Spectroscopy – Instrumentation – quantitative analysis – direct reading spectrometers. Plasma excitation – flame excitation – laser excitation – chemical interferences – concentration range – Mass spectrophotometer.

Unit – IV Introduction, Principle, Instrumentation and Application of Nephelometry, Turbidimetry, Conductometry, Potentiometer, Ion Selective Electrodes.

Unit – V Collection and Presentation of Data, Rules for construction of diagram and graphs – types of diagrams and graphs – measure of centre value, tendency and measure of dispersion – correlation and regression analysis– test of hypothesis, test of significance – t, χ^2 and ANOVA.

Course Code: ETC - 590

Course Title: Remote Sensing & GIS Application in Environmental Management

Number of Credits: 3 **L-T-P 2**-0-1

Unit I: Cartography and Photogrammetry – Introduction, map reading, scale, types and sources, map coordinate system and projections (Cylindrical, Conic, Azimuth), map preparation, visualization and guidelines of mapping. Photogrammetry, Geometry of aerial photographs, Concept of Parallax, Terrain Analysis, DEM interpolation techniques, Cartography, Map projections.

Unit-II: Basics of Remote Sensing – Physics of Remote Sensing, Electromagnetic Radiation, Spectral signature for various land cover feature, Visual image Interpretation, RS Data Acquisition Mechanism, Platforms, Sensors, Data Types and Errors, Basics of Thermal, Microwave and LiDAR Remote Sensing.

Unit-III: Digital Image Processing – Concepts of Digital Image Processing, Data and Image storage formats: Image Preprocessing, Radiometric correction, Image Enhancement, Contrast Enhancement, Spatial and frequency domain filtering, Image Classification, and Image Fusion)

Unit-IV: Geographical Information System & GPS – Fundamentals of GIS, Data Input and Output: Spatial and Non spatial Data, Spatial and Network Analysis, Vector & raster based analysis, Global Positioning System, Fundamentals of Mobile Mapping.

Unit-V: Application of Remote Sensing and GIS – Relevance in planning, Land use/Land cover, forestry, agriculture, water resources, urban sprawl, environmental studies, disaster management.

Course Code: ETC -

Number of Credits

591

Course Title: Statistical Applications

: 3 **L-T-P 2**-0-1

Unit I: Introduction: Mathematical models – deterministic and stochastic, generation of environmental data, stochastic processes in environment, the nature of random variables, populations and samples; parameters and statistics.

Unit II: Measurement theory, levels of measurement, statistical descriptors of environmental data- numerical and graphical, Chebyshe's theorem, measurement uncertainty – accuracy, precision and bias.Probability theory: probability concepts; probability distribution functions and their application –discrete and continuous distributions.

Unit III: Data sampling: Methods for selecting sampling locations and times, types of sampling designs- probability and non- probability sampling, sampling theory, sampling distribution, parameter estimation, point and interval estimates; confidence interval estimation of means, differences of means, proportions, difference of proportions, variances ratio of variances sample size determination for different sampling designs

Unit IV: Tests of hypothesis: Hypothesis testing- parametric and non- parametric tests: Concerning means, differences of means, proportions, differences of proportions, variances, ratio of variances.

Unit IV: Correlation analysis: graphical analysis, bivariate correlation, covariance,correlation coefficient, distribution of correlation coefficient and its statisticalsignificance. Simple regression analysis: assumptions and definitions, principleof least squares, regression parameters their distribution and statisticalsignificance, applications in process description and prediction.

540

Course Title: Air Pollution and its Control

: 3 **L-T-P 2**-0-

Unit I: Air pollution: composition and structure of atmosphere, global implications of air pollution. Classification of air pollutants: particulates, hydrocarbon, carbon monoxide, oxides of sulphur, oxides of nitrogen and photochemical oxidants. Indoor air pollution, Effects of air pollutants on humans, animals, property and plants. Mobile air pollution sources, Indoor air quality; Air quality and emission standards (Indian and International)

Unit II: Air pollution chemistry, meteorological aspects of air pollution dispersion; temperature lapse rate and stability, wind velocity and turbulence, plume behaviour, dispersion of air pollutants, the Gaussian Plume Model, stack height and dispersion. Combustion fundamentals (Stoichiometry, thermodynamics, kinetics,); combustion of solid and liquid; Aerosols - Stokes' Law, Brownian Motion of Aerosol Particles, General Dynamic Equation for Aerosols;

Unit III: Air pollution legislation; Ambient air sampling, collection of gaseous air pollutants, collection of particulate air pollutants, stack sampling. Design of gravitational settling chamber, cyclone separator, fabric filter, electrostatic precipitator. Engineering control concepts; process change, fuel change; pollutant removal and disposal of pollutants

Unit IV: Introduction to air pollution control, control devices for particulate contaminants: gravitational settling chambers, cyclone separators, wet collectors, wet and dry scrubbing, fabric filters (Bag-house filter), electrostatic precipitators (ESP), condensation, flare processes, thermal and catalytic oxidation, other emerging air pollution control devices etc.), removal of dry particulate matter, liquid droplets and mist removal, gaseous pollutants and odour removal.

Unit V: Control of gaseous contaminants: Absorption, Adsorption, Condensation and Combustion Control of sulphur oxides, nitrogen oxides, carbon monoxide, and hydrocarbons. Automotive emission control, catalytic convertor, Euro-I, Euro-II and Euro-III specifications, Indian specifications.

Course Code: ETC -

Number of Credits 0

570

Course Title: Environmental Impact Assessment and Management

: 3 **L-T-P 2**-1-

Unit I: Environmental Management System: The evolution of environmental management standard, British Standard 7750, Technical Committee 207, ISO 9000 and ISO 14000 series, origin, objective, scope and applicability of ISO 14000, components parts of ISO 14000 and their relationship, legal considerations and requirements of ISO 14000. ISO 14040: Guidelines standards for a company's management system; general principle of conducting life cycle assessment (LCA), definition, stages and scope of LCA and LCA inventory. ISO guide 64: its purpose. ISO 14000 checklist.

Unit II: EIA: Planning and management of environmental impact studies. Impact indentation methodologies: base line studies, screening, scooping, checklist, networks, overlays. Prediction and assessment of impacts on the socio-economic environment. Environmental cost benefit analysis. Decision methods for evaluation of alternatives, Case studies. Environmental impact assessment at project level, regional level, sectoral level, and policy level. Guidelines of preparation of project report and its evaluation, methods of clearance from the concern authorities at various labels

Unit III: Sustainable development, Environmental policy in planned, mixed and market economies, global environmentalism, Preventive environmentalism and environmental management. Pollution prevention and control laws and acts: Constitution of India & environment, Constitution protection to Environment laws, Administrative & legislative arrangement for Environmental production, Indian Standards, Pollution control acts in India, critical appraisal, fiscal incentives for environmental protection.

Unit IV: Environmental Audit: Introduction, Environmental information Purpose & advantage of studies, General approach of environmental Auditing Environmental Audit, Audit programs in India, Auditing program in major polluting Industries, Reports of the Environmental audit studies. Ethics in society, Environmental consequences, Responsibility for environmental degradation, Ethical theories and codes of Ethics, Changing attitudes.

Unit V: Flow sheet analysis; Energy and resource (material and water) audits for efficient usage and conservation; Waste audits, emission inventories and waste management hierarchy for process industries; Thermodynamic constraints to waste minimization; Holistic and critical technology assessment; Environmental performance indicators; Concept of industrial ecology and symbiosis of eco-parks.

597

Course Title: Environmental System Analysis & Modelling

: 3 **L-T-P 2**-1-

Unit I: System and System Analysis, Static and Dynamic System, models and modeling, Types of Models, Stochastic and Deterministic Models, Dynamic Simulation Modeling, Necessity of models in management of Environmental System, Steps followed in Modeling, Model Conceptualization, Model Development, Solution Methodologies- Numerical, analytical and Monte Carlo methods of simulation, Numerical solutions to ordinary & partial differential equations

Unit II: Atmospheric structure, composition and thermodynamics, the continuity and thermodynamic energy equations, the momentum equation in Cartesian and spherical coordinates, Vertical-coordinate conversions, Hydrostatic and nonhydrostatic models, sigma-pressure coordinate, sigma-altitude coordinate, Finite-differencing the equations of atmospheric dynamics, Boundary-layer and surface processes

Unit III: Air Pollution Dispersion Modeling:Meteorological factors affecting air quality, Lapse rates, Dry adiabatic, Moist Adiabatic and ambient Lapse rates , Stable, Unstable and Neutral Atmospheric Condition, Maximum Mixing height, Temperature Inversions, Effect of Lapse Rate on Plume behavior- Conning, Looping, Lofting, fanning, fumigation, Point Source Gaussian Plume Model- Effective Stack Height, Pasquil-Gifforth Stability criteria, Horizontal and Vertical Dispersion, Wind Speed Correction, Numerical Examples and Some case studies on Air Pollution Dispersion Modeling

Unit IV: Surface Water Quality Modeling: Control mass and volume, Material balance equation, Dissolved Oxygen Depletion, Biochemical Oxygen Demand Measurement, Modeling BOD as a First-order Reaction, Ultimate Biochemical Oxygen Demand, Biological Oxygen Demand: Temperature Dependence, Nitrogenous Oxygen Demand, Theoretical Oxygen Demand, Chemical Oxygen Demand, Dissolved Oxygen Sag Curve, Steps in Developing the DO Sag Curve, Numerical Examples and some case studies on surface water quality modeling.

Unit V:

Application of Statistical modeling in environmental system, time series modeling and forecasting, Time Series Regression and ExploratoryData Analysis, Autocorrelation and Partial Autocorrelation, ARIMA Models, Multiplicative Seasonal ARIMA Models, Spectral Analysis and Filtering, The Spectral Density, Periodogram and Discrete Fourier Transform, Linear Filters, Signal Extraction and Optimum Filtering,

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Number of Credits

Course Code: ETE 575
Course Title: Industrial Safety & Health Management

: 3 **L-T-P 2**-0-1

Unit I: Introduction: Occupational Health Hazards, Promoting Safety, Safety and Health training, Stress and Safety, Ergonomics - Introduction, Definition, Objectives, Advantages, Importance of Industrial safety, role of safety department, Safety committee and Function. Design and location, distance between hazardous units, colour coding, Lighting, ventilation, Flow charts, pilot plant applications and machine guarding and its types, Housekeeping. Accidents related with maintenance of machines, maintenance of machines- advantages. Works permit systems - Significance of documentation.

Unit II: General causes and classification of fire, Detection of fire, extinguishing methods, firefighting installations with and without water, Machine guards and its types, automation. High pressure hazards, safety, emptying, inspecting, repairing, hydraulic and nondestructive testing, hazards and control in mines. Definition: Incident, accident, injury, dangerous occurrences, unsafe acts, unsafe conditions, hazards, error, oversight, mistakes, etc. Accident Prevention: Theories / Models of accident occurrences, Principles of accident prevention, Accident and Financial implications, Hazard identification and analysis, fault tree analysis, Event tree analysis, failure modes and effects analysis, Hazop studies, Job safety analysis - examples, Plant safety inspection - objectives and types check procedure inspection report.

Unit III: Types and effects of radiation on human body, Measurement and detection of radiation intensity, disposal of radioactive waste, control of radiation, Industrial noise: sources, measurement, effects on health and its control. Air pollutants: Effect of different gases and particulate matter, acid fumes, smoke, fog on human health. Vibration - effects, measurement and control measures, Industrial Hygiene. Safe limits of amperages, voltages, distance from lines, etc., Overload and Short circuit protection, Earthing standards and earth fault protection, Electrical equipment in hazardous atmosphere, Criteria in their selection, installation, maintenance and use. Introduction of Construction industry, Scaffolding and Working platform. Welding and Cutting, Excavation Work, Concreting and Cementing work, Transportation of men and material, Handling and Storage of compressed gas.

Unit IV: First aid: Body structure and Functions, Position of causality, the unconscious casualty, fracture and dislocation, Injuries in muscles and joints, Bleeding, Burns, Scalds and accidents caused by electricity, Respiratory problems, Rescue and Transport of Casualty, Cardiac massage, poisoning, wounds, Personal Protective Equipments: Need, selection, supply, use, care and maintenance, Personal protective devices for head, ear, face, eye, foot, knee and body protection, Respiratory personal protective devices.

Unit V: Legislative measures in industrial safety: Factories Act. (1948). Workman's Compensation Act, 1943, Employees State Insurance Act, 1948, Mines Act, Air (Prevention and control) Pollution Act, 1981, Water (Prevention and Control) Pollution Act, 1974, Boiler Vessels Act, Child labour and Women Employee Act, The factories rules, history, Provisions under the factories Act and rules made there under with amendments, Functions of safety management. ILO Convention and recommendations in the furtherance of safety, health and welfare. Bureau of Indian standards on safety and health 14489 - 1998 and 15001 – 2000, OSHA, Process Safety Management (PSM) as per OSHA, PSM principles, OHSAS – 18001, EPA Standards, Performance measurements to determine effectiveness of PSM.

Course Code: ETE 557

Course Title: Environmental Quality and Pollution Monitoring Techniques

: 3 **L-T-P 2**-0-1

Unit 1 Transport of Pollutants in the Environment and Approaches to their Analysis

Sources, Dispersal, Re-concentration and Degradation, Transport and Re-concentration of Neutral Organic Compounds, Bioconcentration, accumulation in Sediments, Biomagnification, Degradation, Transport and Re-concentration of Metal Ions, Solubilization, Deposition in Sediments, Uptake by Organisms, Safe Level, Sampling and Sample Variability, Representative Samples, Sample Storage, Critical Paths and Critical Groups, General Approach to Analysis, The Choice of Laboratory or Field Analysis, Quality Assurance, Finding a Suitable Method , Laboratory Standards.

Unit 2- Water Analysis – Major Constituents

Sampling, Measurement of Water Quality, Suspended Solids, Dissolved Oxygen and Oxygen Demand, Total Organic Carbon, pH, Acidity and Alkalinity, Water Hardness, Electrical Conductivity, Techniques for the Analysis of Common Ions, Ultraviolet and Visible Spectrometry, Emission Spectrometry (Flame Photometry), Ion Chromatography, Examples of the Use of Other Techniques.

Unit 3- Water Analysis – Trace Pollutants

Organic Trace Pollutants, Guidelines for Storage of Samples and their Subsequent Analysis, Extraction Techniques for Chromatographic Analysis, Gas Chromatography, Liquid Chromatography, Immunoassay, Spectrometric Methods, Metal Ions, Storage of Samples for Metal Ion Analysis, Pretreatment, Atomic Spectrometry, Visible Spectrometry, Anodic Stripping Voltammetry, Liquid Chromatography, Metal Speciation: A Comparison of Techniques

Unit 4- Analysis of Land, Solids and Waste

Common Problem Areas in the Analysis of Solids, Sampling, Pretreatment, Extraction of the Analyte, Sample Clean-up, Analytical Determination, Quality Assurance and Quality Control, Specific Considerations for the Analysis of Biological Samples, Sampling and Storage of Plant Material, Pretreatment, Extraction Techniques for Organic Contaminants, ashing and Dissolution

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Number of Credits

Techniques for Trace Metals, Analysis of Animal Tissues, Specific Considerations for the Analysis of Soils, Sampling and Storage, Pretreatment, Extraction of Organic Contaminants, Extraction of Available Ions, Dissolution Techniques for the Determination of Total Metal Concentrations in Soil, Determination of pH. Specific Considerations for the Analysis of Contaminated Land, Waste and its Disposal by Landfill, Sediments and Sewage Sludge.

Unit 5- Atmospheric Analysis

Gases: Determination of Time-Weighted Average Concentrations, Absorption Trains, Solid Adsorbents, Diffusion (or Palmes) Tubes, Determination of Instantaneous Concentrations, DirectReading Instruments, Gas Detector Tubes, gas Chromatography and Mass Spectrometry, Monitoring Networks and Real-Time Monitoring, Remote Sensing and other Advanced Techniques.

Particulates: Sampling Methods, high-Volume Samplers, Personal Samplers, Cascade Impactors, Further Considerations for Organic Compounds, Sampling Particulates in Flowing Gas Streams, PM10 Sampling, Sampling of Acid Deposition, Analytical Methods Involving Sample Dissolution, Metals, Organic compounds, Direct Analysis of Solids, X-Ray Fluorescence, X-Ray Emission, Neutron Activation Analysis, Infrared Spectrometry, Methods for Asbestos Analysis.

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Number of Credits 1

Course Code: ETC 596

Course Title: Lab 5 - Computer Application in Environmental Engineering

Number of Credits: 2 **L-T-P 0**-0-2

Types of Models, Stochastic and Deterministic Models, Dynamic Simulation Modeling, Necessity of models in management of Environmental System, Steps followed in Modeling, Model Conceptualization, Model Development,

Introduction to programming, –Design Principles-control flow-execution steps-desirable & undesirable characteristics, Conditional statements, Functions — calling Functions – Passing arguments- Arrays – Defining and processing an array – Array Functions-Passing arrays to Functions – Multidimensional Arrays – Strings-arrays of Strings- String Manipulation functions, General Characteristics of Object Oriented programming,

Solution Methodologies- Numerical methods : Solution of Algebraic and transcendental equation, The Bisection Method, iteration method, Newton-Raphson method, Interpolation, Finite differences, Forward differences, backward differences, Numerical differentiation and integration, Simpson's 1/3-rule, Simpson's 3/8 rule, Romberg integration, Matrices and linear system of equations, Rank, inverse of a Matrix, Gauss elimination method, LU decomposition Eigenvalue problem, SVD, Numerical solution of ordinary differential equations, Runge-Kutta Method

525

Course Title: Environmental Biotechnology

Unit I: Concept of environmental biotechnology and environmental engineering, scope and importance, genetic engineering structure of DNA, RNA, Replication of DNA, genetic code, Genomic and cDNA libraries-PCR (polymerase chain reaction) and gene closing- use of genetically altered microorganisms for field biodegradation of hazardous materials. Molecular biology tools for Environmental management, rDNA technology in waste treatment, Genetic Sensors, Metagenomics, Bioprospecting, Nanoscience in Environmental management, Biosensors development to monitor pollution.

Unit II: Bioremediation, Types of bioremediations, Bio augmentation for bioremediation, Bioreactors, Bioremediation of herbicides, pesticides, hydrocarbons, oil spills. Bioaugmentation, Biosorption, Boleaching, bioremediation: Bioreactors for Bioremediation, Metabolic pathways for Biodegradation for specific organic pollutants. Microbiology of degradation of xenobiotic in environment– ecological considerations, decay behavior and degradative plasmids, hydrocarbons, substituted hydro carbons, oil pollution, surfactants, pesticides. Biological detoxification of cyanide, oxalate, urea, petrochemical industry effluents, toxic organics, phenols.

Unit III: Microbiology of wastewater treatment: Aerobic processes - Activated sludge, oxidation ditches, trickling filters, towers, rotating discs, rotating drums, oxidation ponds. Anaerobic processes: Anaerobic digestion, anaerobic filters, up-flow anaerobic sludge blanket reactor. Treatment schemes for waste waters of dairy, distillery, tannery, sugar and antibiotic industry. Activated Sludge Process (ASP) – Trickling Filters – oxidation ponds. Bioreactors – RBC, Biological filters-fluidized bed reactors, inverse fluidized bed biofilm reactor, membrane bioreactor Neutralization, equalization and pretreatment. ETP Sludge management

Unit IV: Novel methods of pollution control: Vermitechnology, vermistabilization, Methane production, Root zone treatment, Membrane technology, Biodegradable plastics. Air pollution and its control through biotechnology, Biotechnology in reduction of CO_2 emission, Bioscrubbers, Biobeds, Biotrickling filters and their applications. Bioremediation of Petroleum Sludge using Bacterial Consortium and Biosurfactant- Biofilms in Porous Media. Environmental Nanotechnology Research - Nanotechnology for Bioremediation of Heavy metals and organic pollutants.

Unit V: Environmental Biotechnology in Bio-energy production- Chemistry and Biochemistry of Biomass, energy crops, chemical and enzymatic parameters, degradation of cellulose. Biodiesel: source of raw material and processing of biodiesel, production of bio-ethanol, process and

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Number of Credits 1

production, quality. Bio-hydrogen production, production of hydrogen from waste water. Genetic engineering to enhance hydrogen production rates. Algal Technology in renewable energy production.

577

Course Title: Environmental Audit & Certification

Unit I: Environmental management System: environmental policy, implementation and requirements of Environmental Management System (EMS) standards, inter-relationships and differences between the ISO 14000 series, EMAS, the ISO 9000 series and Total Quality Management.

Unit II: Environmental audit: principles of auditing, types of environmental audit, compliance audits, environmental risk assessments, pre-acquisition/ divestment audits, EMS audits, environmental statement audits, internal audit, single issue audits (e.g. waste or energy). Planning and preparation, audit team, examination of documented systems and internal control, site setting, site inspections and interviews, audit reporting and follow-up.

Unit III: Environmental legislations: roles and responsibilities of all national environmental regulatory agencies; local government and regional planning authorities; waste, environmental health and water regulatory authorities, other agencies responsible for enforcement of environmental law. Knowledge of major national environmental legislation (planning law, air, water, land, waste, hazardous substances, Eco – labeling, IPCC), National Environmental Protection Acts, Environmental Policy Plans.

Unit IV: Environmental Aspects/Impacts and Performance: environmental aspects/ impacts of an operation, identification of fugitive emissions and waste streams, interpretation of process flow diagrams. Assessment of environmental effects of products using LCA, environmental performance of industry, amelioration techniques to mitigate environmental effects.

Unit V: Certification system: international standard for environmental management systems ("EMS"). ISO 14001 2004, international and national EMS certification system, environmental audit system in India. Environmental management and certification Institutes.

535

Course Title: Industrial Solid Waste Management

Unit 1: Hazardous waste: Sources and characteristics, handling, collection, storage and transport. Storage facility development: on-site and off-site waste storage, storage design criteria, marking and labeling. Sampling and analysis of hazardous wastes – analytical approach for hazardous waste characterization – proximate analysis – survey analysis – directed analysis – analytical methods.

Unit II: Landfill technology: key principle of a landfill site, co-disposal landfill, purposedesigned landfill, planning, siting, and permitting of landfills, Planning, Siting, Landfill processes, lechate collection and treatment, Risks of landfill and their control, liner system, liner selection procedure, waste compatibility, co-disposal criteria, multi-disposal system, stabilized waste landfilling, Landfill operations, Landfill equipment, Filling sequences, Daily cover, Monitoring, Post-closure care and use of old landfills, Landfill mining

Unit III: Waste-to-Energy: Heat value of refuse, Ultimate analysis, Compositional analysis, Proximate analysis, Calorimetry, Materials and thermal balances, Combustion air, Waste-toenergy combustors, Modular starved air combustors, Pyrolysis, Mass burn versus RDF, Waste Incinerator- principle, types, operation and technical controls, Rotary Kilns, Fluidized-bed Incinerators, Reciprocating Grate Incinerators, undesirable effects of combustion, Waste heat, Ash management, Air pollutants and control, Dioxin problem.

Unit IV: Material separation and recycling: General expressions for materials separation, separation techniques, Binary separators, Polynary separators, Reciprocating and disc screens, Float/sink separators, Theory of operation, Air classifiers, Other float/sink devices, Magnets and electromechanical separators, Magnets, Eddy current separators, Electrostatic separation processes, Other devices for materials separation, Materials separation systems, Performance of materials recovery facilities. Material recycling in industries: case studies, environmental management, and resource recovery, waste audit and benefits. Case studies of material recovery from mining waste solids, Metal Processing industry, food and beverage industry, paper and pulp industry.

Unit V: Industrial waste immobilization, stabilization, solidification, additives, key issues in waste stabilizations, waste assessment, performance tests, case studies, transitional techniques in waste treatment and management, criteria for selection of technology, Thermal desorption technique,

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Number of Credits 1

Industrial sludge treatment. Legal frameworks for hazardous waste handling and storage waste trading, international laws, Basel Convention, Procedure for hazardous waste storage and transport clearance.

594

Course Title: Environmental System Analysis

Unit 1: Introduction to natural and man-made systems, Systems modeling as applied to environmental systems. Nature of environmental systems, the model building process, addressing to specific environmental problems. Application of optimization methods such as search techniques, linear programming, dynamic programming and integer programming to analyze various environmental management alternatives, Integrated management strategies addressing multi-objective planning and optimization over time. Strategies for analyzing and using environmental systems models, Laboratory - Simulation of Environmental Processes, Application of Environmental Databases and Environmental Software Packages, including systems optimization.

Unit II: System and System Analysis, Static and Dynamic System, models and modeling, Types of Models, Stochastic and Deterministic Models, Dynamic Simulation Modeling, Necessity of models in management of Environmental System, Steps followed in Modeling, Model Conceptualization, Model Development, Solution Methodologies- Numerical, analytical and Monte Carlo methods of simulation, Computer Coding, Data Acquisition and Processing, Model Calibration, Model Validation and Verification, Sensitivity Analysis

Unit III: Air Pollution Dispersion Modeling: Meteorological factors affecting air quality, Lapse rates, Dry adiabatic, Moist Adiabatic and ambient Lapse rates, Stable, Unstable and Neutral Atmospheric Condition, Maximum Mixing height, Temperature Inversions, Effect of Lapse Rate on Plume behavior- Conning, Looping, Lofting, fanning, fumigation, Point Source Gaussian Plume Model-Effective Stack Height, Pasquil-Gifforth Stability criteria, Horizontal and Vertical Dispersion, Wind Speed Correction, Numerical Examples and Some case studies on Air Pollution Dispersion Modeling

Unit IV: Application of Operation Research in Environmental Engineering: Introduction, The Linear Programming Model, Examples of Linear Programming Problems, Developing Linear Programming Models, Graphical Solution to LP Problems, The Simplex Method, Simplex Tableau for Maximization Problem, Marginal Values of Additional Resources, Sensitivity Analysis,

Complications in Applying the Simplex Method, Application in resource allocation and, Water Quality and West water Treatment, Application of Transportation Problems and Dynamic Programming in Water Supply Engineering.

Unit V: Case studies of dynamical systems/Case study on environmental modeling using empirical data.

Course Code: ETE 514
Course Title: Membrane Processes for Water and Waste Treatments

: 3 **L-T-P 2**-0-

Unit I: Introduction to membrane separation processes, Membrane filtration, dead and filtration, Cake filtration, Equation of Ruth, Kozney-Carman law, Cross flow filtration, general principles. Membrane Manufacturing, Biological Membranes, Membrane Polymer Manufacturing: Chemistry, Industrial Processes and Membrane Performance Implications.

Unit II: Membrane characterization, Membrane module types, Transport Mechanisms and Membrane Fouling, Membrane principles and transport mechanisms, Membrane fouling, Pressure Driven Membrane Processes.

Unit III: Membrane Process: Functioning in closed loop, open loop and with re-circulation, Module arrangement; series or parallel and optimization. Economic study, Applications: drinking water, municipal wastewater, Case studies. Coupling Renewable Energy & Membrane Technology, Applications and Processes, Other membrane applications, Current research in membrane science & technology

Unit IV: Electrodialysis: Electrodialysis Development, Principles, Electrochemistry, Industrial Applications and Membrane Performance Implications. Reverse osmosis, Nanofiltration, Membranes and modules, MF/UF experimental set up, Laws of MF/UF, Limiting Phenomena: Concentration polarization and membrane fouling, Mass transport, and Energy balance.

Unit V: Microfiltration- principles and applications, Ultrafiltration- principles and applications, Membrane Bioreactors, Membrane bioreactor (MBR) principles and applications, Industry performance of drinking water ultrafiltration and wastewater MBR Technology.

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Number of Credits 1

Course Code: ETE 515
Course Title: Industrial Wastewater Treatment

: 3 **L-T-P 2**-0-

Unit I: Introduction: Industrial scenario in India, Industrial activity and Environment - Uses of Water by industry, Sources and types of industrial wastewater, Nature and Origin of Pollutants, Industrial wastewater and environmental impacts, Regulatory requirements for treatment of industrial wastewater – Industrial waste survey, Industrial wastewater monitoring and sampling generation rates, characterization and variables, Toxicity of industrial effluents and Bioassay tests – Major issues on water quality management.

Unit II: Prevention and Control of Industrial Pollution, Benefits and Barriers, Waste management Hierarchy, Source reduction techniques, Pollution Prevention of Assessment, Material balance, Evaluation of Pollution prevention options, Cost benefit analysis, payback period - Waste Minimization Circles.

Unit III: Treatment Technology: Equalisation, Neutralisation, Oil separation, Flotation, Precipitation, Heavy metal Removal, Aerobic and anaerobic biological treatment, Sequencing batch reactors, High Rate reactors, Chemical oxidation, Ozonation, carbon adsorption, Photocatalysis, Wet Air Oxidation, Evaporation, Ion Exchange, Membrane Technologies, Nutrient removal, Treatability studies.

Unit IV: Wastewater Reuse Residual Management: Individual and Common Effluent Treatment Plants, Joint treatment of industrial and domestic wastewater - Zero effluent discharge systems, Quality requirements for Wastewater reuse, Industrial reuse, Present status and issues, Disposal on water and land, Residuals of industrial wastewater treatment – Quantification and characteristics of Sludge, Thickening, digestion, conditioning, dewatering and disposal of sludge, Management of RO rejects.

Unit V: Industrial manufacturing process description, wastewater characteristics, source reduction options and waste treatment flow sheet for Textiles, Tanneries, Pulp and paper, metal finishing, Oil Refining, Pharmaceuticals, Sugar and Distilleries.

Course Code: ETE 542
Course Title: Air Pollution Modeling

: 3 **L-T-P 2**-0-

Unit I: Introduction to Air Quality Modelling. Approaches to model formulation. Model classification, criteria for model selection.

Unit II: Air pollution meteorology - meteorological parameters, stability classification; plume rise; plume behaviour, dispersion parameters.

Unit III: Basic diffusion equation, deterministic, numerical and statistical modeling approach. Introduction to boundary layer, turbulence - physical modeling approach. Stochastic modeling approach to air pollution dispersion.

Unit IV: Theory of Gaussian plume model and its application. Introduction to Indoor air quality models. ISCST3, CALINE4, ROADAIR.

Unit V: Case studies of air pollution modeling systems and their application in pollution load and dispersal predictions.

Course Code: ETE -

P 2-0-1

555

Course Title: Environmental Instrumentations

Number of Credits: 3 **L-T-**

Unit I: Spectroanalytical Methods: Electromagnetic radiation, properties, emission and absorption of radiation. Fluorescence and Phosphorescence. Atomic absorption and emission spectrometry- principle and instrumentation. ICP source. Fluorimetry, nephelometry and turbidimety, principle and instrumentation. Ultraviolet-visible spectrophotometry principle and instrumentation. Beer's law.

Unit II: Spectroanalytical Methods: Electromagnetic radiation, properties, emission and absorption of radiation. Fluorescence and Phosphorescence. Atomic absorption and emission spectrometry- principle and instrumentation. ICP source. Fluorimetry, nephelometry and turbidimety, principle and instrumentation. Ultraviolet-visible spectrophotometry principle and instrumentation. Beer's law.

Unit III: Spectroanalytical Method: Chromatographic Methods, Classification, general theory-column efficiency and resolution, band broadening. Evaluation methods, quantitative determination. Principle and instrumentation of gas chromatography and HPLC. Ion exchange chromatography and size exclusion chromatography. Mass spectrometry

Unit IV: Electro analytical Methods: Potentiomety- electrochemical cell, reference electrodes, Glass electrode. Measurement of pH. Potentiometric titrations. Ion – selective electrodes. Conductomety, electrolytic conductivity, specific, equivalent and molar conductance. Conductance cells, conductivity meters. Conductometric titrations. Coulometry and polarography.

Unit V: Radio analytical and Other methods: Particles emitted in radioactive decay. Measurement of radioactivity, Ionization chamber, proportional counter, scintillation counter and Geiger counter. Isotopic dilution analysis and activation analysis. NDIR for CO analysis, chemiluminescent analyzer for NOx, fluorescent analyzer for SO_2 , flow injection analysis and CHNS analyzer. Gel documanetaion, PCR technology.

Course Code: ETE -

Number of Credits **P 2**-0-1

596

Course Title: Geoinformatics for Resource Management

: 3 **L-T-**

Unit I: Components of Remote Sensing - Energy, Sensor, Interacting Body - Active and Passive Remote Sensing – Platforms – Aerial and Space Platforms - Balloons, Helicopters, Aircraft and Satellites- Synoptivity and Repetivity - Electro Magnetic Radiation (EMR) – EMR Spectrum – Visible, Infra-Red (IR), Near IR, Middle IR, Thermal IR and Microwave – Black Body Radiation – Planck's Law - Stefan-Boltzman law. Advances in Remote Sensing: Advance Classification, Hyperspectral Remote Sensing, Microwave Remote Sensing, Thermal Remote Sensing, LiDAR: introduction and applications.

Unit II: Atmosphere characteristics - Scattering of EMR - Raleigh, Mie, Non –Selective and Raman Scattering – EMR Interaction with water vapour and ozone – Atmosphere Windows – Significance of Atmospheric Windows - EMR interaction with earth surface Materials – Radiance, Irradiance , Incident , Reflected , Absorbed and Transmitted Energy – Reflectance – Specular and Diffuse Reflection Surfaces – Spectral Signature – Spectral Signature curves – EMR interaction with water, soil, and Earth surface.

Unit III: GIS - Components of GIS – Hardware, Software and Organization Context – Data– Spatial and Non Spatial – Maps – Types of Maps – Projection – Types of Projection – Data Input – Digitizer, Scanner - Editing - Raster and Vector data structures - Comparison of Raster and Vector Date structure – Analysis using raster and Vector Data - Retrieval, Reclassification, Overlaying, Buffering – Data Output – Printers and Plotters. Advances in GIS and Current Trends: Current Trends and advancement in GIS, Participatory GIS and Mobile GIS, WebGIS, Open source GIS softwares, Distributed GIS systems.

Unit IV: Satellites – Classification – Based on Orbits – Sun Synchronous and Geo Synchronous – Based on Purpose – Earth Resources Satellites, Communication Satellites, Weather Satellites, Spy Satellites, Satellite Sensors, Resolution – Spectral , Spatial Radiometric and Temporal Resolution – Description of Multi Spectral Scanning – Along and Across Track scanners – Description of Sensors in Landsat, SPOT, IRS series – Current Satellites – Radar – Speckle – Back Scattering – Side Looking Airborne Radar - Synthetic Aperture Radar – Radiometer – Geometrical characteristics.

Unit V: Digital Satellite Image - Image enhancement - Filtering - Classification – Integration of GIS and Remote Sensing – Application Remote Sensing and GIS in Environmental Engineering –management and monitoring of land, air, water pollution, conservation of resources and coastal zone management. Case-studies on National Initiatives-NNRMS, Forest Cover/Type Mapping, Bio Mass Estimation, Habitat Analysis, Bio-Diversity Characterization, Environmental

Monitoring, Hazard Monitoring, Urban Sprawl, Solid Waste Management, Watershed and Sea Surface Temperature.

Course Code: ETE -

Number of Credits: 3 **L-T-P 2**-0-1

528

Course Title: Ecological Engineering

Unit I: Ecological Engineering: Aim, scope and applications of Ecology and Ecological Engineering. Principles of ecological engineering, nature of an ecosystem, communities in ecosystem, Energy flow and material cycling in ecosystems – Productivity in ecosystems. Rationale of ecological engineering and eco-technology, classification of eco-technology

Unit II: Principles, characteristics and components of Systems and Modeling – Structural and functional interactions in environmental systems, environmental systems as energy systems. Mechanisms of steady – State maintenance in open and closed systems - Modelling and ecotechnology: Elements of Modelling: Modelling procedure, Classification of ecological models, Applications of models in eco-technology, Ecological economics, and Human modifications of environmental systems.

Unit III: Ecological Engineering Processes: Self-organizing processes, multiple seeded microcosms – Interface coupling in ecological systems. Concepts of energy – Determination of sustainable loading of ecosystems, Adapting ecological engineering systems to potentially catastrophic events – Agro ecosystems – Determination of sustainable loading of ecosystems

Unit IV: Eco-sanitation: concept and applications. Principles and operation of soil infiltration systems, Wetlands and ponds Source separation systems – Aquaculture systems, vermifiltration system, duckweed pond system development, detritus based, treatment for solid wastes, vermitechnology in waste stabilizations and energy recovery, applications of ecological engineering for marine systems.

Unit V: Case studies of integrated ecological engineering systems and their commercial prospects.

518

Course Title: Bioremediation Technology

Unit I: Bioremediation - Processes and principles of bioremediation technology: biodegradation, Acclimation, detoxification activation, bio-availability. Types of bioremediation: *Ex situ* and *in-situ*, Bioaugmentation and biostimulation, solid phase and slurry phase bioremediation. Factor affecting bioremediation process: impact of chemical structure, recalcitrance, predicting products of biodegradation, cometabolism and biotransformation.

Unit II: Microbial Degradation of Biopolymers: Cellulose, xylan, starch and other glucans, pectin, lignin and chitin, lipids and fats and bioplastics. Biodegradation of Hydrocarbons: Methane, ethane, propane, butane and other long chain alkanes, alkenes, alkynes, Aerobic and anaerobic biodegradation of aromatic compounds, Microbial degradation of halogenated and sulfonated compounds, Biodegradation of pesticides, PCB, PAH and other industrial chemicals.

Unit III: Bio stimulation of naturally occurring microbial activities: - environmental modification – use of cosubstrates, oxygen supplementation, (Composting and aerobic bioreactors, in situ aeration)– Nutrients and fertilizers, Criteria to be met for considering bioremediation- factors affecting bioremediation, treatability studies for bioremediation- purpose, experimental design and example protocol. Advantages and disadvantages of specific bioremediation technologies- land farming, prepared beds, biopiles, composting, bioventing, biosparging, pump and treat method, constructed wet lands, use of bioreactors for bioremediation. Phytoremediation.

Unit IV: Hazardous wastes, biotechnology for hazardous waste management, cyanide detoxification, detoxification of oxalate, urea. Biotechnological application for pollution reduction in Paper and pulp industry, tannery industry, oil refining industry, textile mill industry, Air pollution control through bioremediation: Deodorization process bioscrubbers, biobed, biotrickling filters.

Unit V: Reforestation through micropropagation casurina for tropical reforestation on adverse sites, development of stress tolerant plants; use of mycorrhizae in reforestation, reforestation of contaminated soils. Vermitechnology in waste bioremediation and contamination removal. Constructed wetland and energy-biomass system for waste remediation and energy harvesting. Case studies of bioremediation of polluted sites.

520

Course Code: ETE -

Number of Credits: 3 **L-T-P 2**-0-1

Course Title: Applied Environmental Chemistry

Unit I: Oxidation - reduction reactions and equations; gas laws, equilibrium and Lechatelier's principle, activity and coefficients, variations in equilibrium relationships, shifting chemical equilibrium, amphoteric hydroxides, buffers and buffer index; solubility of salts, complex formation. Chemical reactions: chemical equilibrium and chemical thermodynamics, acid-base equilibria, solubility equilibria, oxidation-reduction equilibria. Process kinetics, reaction rates and catalysis, surface and colloidal chemistry, adsorption.

Unit II: Concept and scope of environmental chemistry, components of environment. Atmospheres: Chemical composition of atmosphere- particles, ions and radicals, formation of particulate matter, photochemical and chemical reactions in the atmosphere, chemistry of greenhouse gases and ozone layer depletion, gaseous transformations in the atmosphere and removal mechanisms; photochemical smog; nuclear winter. Global environmental problems: chemistry of CFC, ozone depletion, greenhouse effect, acid rain, La Nino etc.

Unit III: Lithosphere: Chemical composition of lithosphere, water and air in soil, inorganic and organic components in soil; acid, base and ion- exchange reaction in the soil, soil acidity, salinity and sod city, effects of ecological factors on the toxicity of soil, Bio- geochemical cycles. Chemistry of pollution due to detergents, pesticides, polymers, trace-organics, metals, petroleum and radioactive compounds.

Unit IV: Chemistry of water and waste water: Hydrological cycle, structure of water molecule, basic concept of colloidal and quantitative chemistry. Applications of principles of chemistry for solving environmental engineering problems.

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Course Code: ETE 560
Course Title: Sustainable Urban Habitats and Green City

Number of Credits: 3 **L-T-P 2**-0-1

Unit I: Introduction: Urban ecology, sustainability and role of cities: Theories of urban ecology and linkages with sustainable development, Concepts of Eco-cities, smart cities, compact cities etc. Management of Urban Environment: air quality, noise, drainage system, urban water management, urban waste management, challenges and opportunities of urban, rural and periurban growth.

Unit II: Urban Ecosystem: Urban institutes, networks and stakeholders– roles and responsibilities. Urban climate and resource quality, urban habitats – natural and man-made, urban wildlife, urban forest system and management, urban flood issues and managements, integrated urban environmental planning and framework, Urban gardens and landscapes – concept and applications. Urban transport, eco-system health, urban planning and sustainability.

Unit III: Climate Change, Energy and Building: Environment and energy in a global context, world resources, economics and law, sustainability in architecture, issues related to and responses to climate change, renewable energy. Climate, comfort and building performance climate, topography, condensation, thermal comfort, climate influences on design, solar electric systems, heat transfer, thermal performance, thermal mass, building regulations, Renewable energy systems design - Photovoltaics, solar hot water, small scale biomass and wind power systems design. Adaptation and mitigation measures to make cities resilient, social sustainability.

Unit IV: Concept of green building – concept and environmental issues, energy and resource supply. Principles of ventilation, cooling techniques, energy building services: an environmental perspective, dampness and condensation, breathing walls; solar resource, solar water heating, water and waste, waste solutions. Environmentally responsive materials, contained composite structures, Timber use, Rammed Earth, Timber construction.

Unit V: Environmental Impact of Buildings: environmental ethics. Assessments methods, embodied energy and life cycle analysis; energy distribution, energy and nuclear power, the intelligent building, low or zero carbon housing. Environmental sustainability assessment, management and post occupancy evaluation. Energy performance ratings. Computer simulation of buildings, data for simulation, modelling strategies, lighting, computational fluid dynamics and practical examples.

Course Code: ETC 580

Course Title: Industrial Training/attachment (8 week) & Report Presentation

Number of Credits: 4 **L-T-P 0-4-**1

The aim of this course is to enable the student with practical aspects of the environmental issues and their management in industrial sector. The students have to arrange and undergo an industrial training for minimum eight weeks in an industry giving emphasis to energy conservation/management/renewable energy/energy audit/wastewater treatment, solid waste management, pollution abetment technologies and equipments during the semester break between semester 2 and semester 3 and complete within 60 calendar days. The students are requested to submit a report of the training undergone and present the contents of the report before the evaluation committee. Evaluation committee will award the marks of end semester based on training quality, contents of the report and presentation.

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Number of Credits **L-T-P 0**

Course Code: ETE 582

Course Title: Project Proposal Writing and seminar

: 2 **-0**-2

This course aims to improve the professional competency and research aptitude of the student by providing an opportunity to explore the research areas, problem identification and formulating it a dissertation project work. The students learn the Writing Process, Prewriting procedures, Writing the first draft, Revision, text and time management, text organizations, expert opinion, brainstorming session, final draft check lists, Citation methods, Reference checking. The students also learn about research ethics, manuscript preparation for publication, components of thesis, and plagiarism. Students have to submit a literature review on the relevant topic of their dissertation work, which will be evaluated by the supervisor of the student.

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Number of Credits **L-T-P 0**

Course Code: ETC 593 Course
Title: Project - I

: 8 -1-3

This course aims to improve the professional competency and research aptitude of the student by providing an opportunity to explore the research ideas. This will consist of a mini research project to be completed during 3rd Semester. The project work aims to develop the work practice in students to apply theoretical and practical tools/ techniques to solve real life problems related to industry and environment. The project work can be a design project/ experimental project and / or computer simulation project on any of the topics in the area of GIS, Environmental Modelling, and Energy/Renewable energy technology, Material Development and Testing, Liquid and Solid Waste Management and Treatment. The project work is allotted individually on different topics. The students shall be encouraged to do their project work in the parent institute itself. If found essential, they may be permitted to continue their project outside the parent institute, subject to the

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Number of Credits **L-T-P 0**

approval of the Departmental Committee. The evaluation of the project will be done by Schools committee consist of Supervisor (Chairman) and two members – (one external, and one from the same School of other School of the parent Institute).

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Number of Credits **L-T-P 0**

Course Code: ETC 594 Course
Title: Project - II

: 14 -1-20

The Project – II further aims to improve the professional competency and research aptitude by providing an opportunity to explore the research ideas through research and development. The student is required to undertake the master research project– II during the fourth semester. The problem of third semester (Project – I) can be continued in the 4th semester to explore the idea in detail. The Project – II will consist of original and new research contribution by the student, complied in a Thesis Form for final evaluation. The project work can be a design project/ experimental project and / or computer simulation project on any of the topics in the area of: RS & GIS, Environmental Modelling, Energy/Renewable Energy Technology, Material Development and Testing, Liquid and Solid Waste Management and Treatment or any other Applied Research Topic which covers the mandate of this M. Tech. Programme. The project work is allotted

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Number of Credits **L-T-P 0**

individually on different topics. Department will constitute an Evaluation Committee to review the project work. The Evaluation committee consists of at least three faculty members of which internal guide (Chairperson) and another expert in the specified area of the project shall be two essential members (one from same School and other from other Institutions/Organizations).

School of Social Sciences (SoSS)

Two-Year Master's Programme in Social Work (MSW)

Course Curriculum Design

Department of Social Work

Mode of evaluation: Written		
Unit	**Topics**	**No. of L/T/P**
I Introduction to Social Work Concepts	• Social work: concept, nature, definition, objectives and code of ethics • Philosophy of social work: values, principles & • relationship of social work with sociology, psychology, social anthropology, economics and political science • Concept of social work: social welfare, social services, social reforms and social development	

II Historical development of social work in India and Abroad.	• Historical development of social work in UK, USA • social work traditions in India: reform movements of 19^{th} -20^{th} century • Gandhian philosophy and concept of social work and its relevance	12L+3T
III Perspectives of social work in India	• Advent of missionaries • Feminist perspective, subaltern perspective (Dalit & Adivasi) • Tribal & Peasants women movements and Marxian perspective	11L+4T

IV Social work practice areas	• Community development • Industry • medical and psychiatric • family and child welfare • Social defense • school of social work • social work with elderly, marginalized section, child labor, women empowerment, HIV-AIDS, differently abled persons, transgender	11L+4T

Course Title: **Man & Society (MSW-502)**

Mode of evaluation: Written		
Unit	**Topics**	**No. of L/T/ P**
I Basic sociological concepts	• Society, community, association, Institution & social structure. • Social Processes: Cooperation, Competition, Conflict, Accommodation, Assimilation.	
II Social Institutions and Social Groups	Marriage, Family, caste, Kinship, religion. Social groups: concept & types.	
III Socialisation and Social Change	Socialization: concept theories and agencies. Social Change meaning and types.	
IV Social Control/stratification	Social control: concepts, forms and agencies. Social stratification: Caste and Class.	

Course Title: **Dynamics of Personality and Human Behavior (MSW-503)**

Unit	Topics	No. of L/T/P
I **Introduction to psychology and its relevance in social work practice**	• Socio-cultural environment and behavior: Introduction to psychology and its relevance in social work practice. • Human behavior and development: concept, determinants, principles, concept of growth and development.	
II **Theories of Human developmen t or major theories of personality:**	• Psychoanalytic theories of personality: Sigmund Freud-psycho-analytic, Erikson: psycho Social and Adler. • Behavioural Theories: Miller and Bandura • Humanistic theories: Rogers and Maslow	
III **Life span perspectives of human development**	Concept, developmental tasks and hazards during prenatal period, infancy, childhood, puberty, adolescence and adulthood. Social, emotional and cognitive development during different development stages. Meaning of normal and abnormal behavior, types, causes and manifestations of abnormal behavior.	
IV **Personality and basic sociopsychological processes**	Social Psychology concepts and scope, Attitude, Motivation, perception, belief & prejudice, Sterio-Types. Personality Concept, types and traits, assessment of personality, personality disorder: concept & causes, Psychosis, neurosis.	

Course Title: **Social Disorganization & Contemporary Social Problems (MSW-504)**

Credits: 4		
Mode of evaluation: Written		
Unit	**Topic**	**No. of L/T/P**
I Social Disorganization	Social Disorganization: Concept, Causes, Approaches Types.	
II Concept of Social Problems.	• Contemporary Indian Social Problems; • Alcoholism and Drug Addiction, Dowry, Prostitution, Casteism, Communalism, Corruption, Poverty and Unemployment.	
III Juvenile delinquency	• Juvenile delinquency and Crime; • Concept, Theories, Prevention and Control. Changing factors of Crime,	
and changing factors of crime	White-Collar Crime and Organized Crime.	
IV Violence Forms	Violence; Forms, Theories and Control Strategies. Social defense; Concept and Scope.	

Concurrent field work (MSW-505)

Concurrent field work (40 Days) based on first semester theory papers.

SEMESTER II

Course Title: **Social Case Work and Group work (MSW-521)**

Credits: 4	
Mode of evaluation: Written	

Unit	Topics	No. of L/T/P
I Social Case work- Introduction	• Social Case work: concept, objectives & components & Principles. • Process, Techniques & Skills of Social Case Work • Approaches of Social Case work practices	
II Case work interview	Case work interview: Steps & Consideration, Home Visits: Importance & Meaning Recording: Meaning: Concept & Types Relationship: Concept & Types	
III Groups in Social group work	Groups in Social group work: Treatment & Task groups History& Perspectives of Social Group Work Social Group work: Meaning, objectives & skills Principles of Social Group work Models of Social Group work	
IV Group Dynamics	Group Dynamics: Concept, Dimensions & its importance in group work practices Leadership: Concept, Qualities & Types, Theories of Leadership Programmes Development & Planning: Meaning, Concept & Process Group cohesiveness: Meaning & Determinants Group Effectiveness: Meaning & Determinants Recording in Social Group work.	

Course Title: **Community Organization and Social Action (MSW-522)**

Credits: 4		
Mode of evaluation: Written		
Unit	**Topics**	**No. of L/T/P**
I Introduction to Community	Community: Concept, Nature, Characteristics & Types Functions of the Community Importance of Community life in modern life Community Power Structure Social Action Movements: Concept & Types.	
II Community Organization	Community Organization: Concepts. Relevance & characteristics Relevance of Community Organization with others methods of Social work Community Organization process Principles of Community Organization, Recording in Community Organization	
III Models Of community organisation	Locality Development/Neighborhood Model Social Planning Social Action Community organization and Community Development	
IV Social Action	Social Action: Definitions and Concepts Principles of Social Action Methods of Social Action/Strategies Social Action, Social Legislations & Social Work	

Course Title: **Social Welfare Services & Social Welfare Administration (MSW-523)**

Credits: 4		
Mode of evaluation: Written		
Unit	**Topics**	**No. of L/T/P**
I Concept of Social Welfare	• Concept of Social Welfare and Welfare State • Growth and development of Social Welfare Services in India • Social Welfare Services under Five Year Plans • Social Welfare Agencies: Government and NonGovernment Organization.	

II Central Social Welfare Board	• Central Social Welfare Board: Structure and Functioning • Administration of Social Welfare Services in India • Social Legislation in a Welfare State with reference to India.	
III Social Welfare Administration	• Social Welfare Administration: concept, nature, objective, characteristics and principles. • Social Welfare Administration: Policy Planning and Development. • Problems of Social Welfare Administration in India.	
	Functions of Social Welfare Administration.	
IV Social Welfare and Development Programme	Social Welfare and Development Programme: Child Development, Youth Development, Women Empowerment, Welfare of the Aged, Handicapped, Welfare of Backward Classes with special reference to Scheduled Caste/ Scheduled Tribes, Labour Welfare.	

Course Title: **Social Research, Statistics and Computer Application (MSW-524)**

Credits: 4	

Unit	Topics	No. of L/T/P
I Introduction to social work research	Meaning & Characteristics of Scientific method. Research: Goal, Steps, types & ethics. Social Work Research-Use of Research in Social Work, Processes of Social work research. Social Surveys Experimental Study Design and its types, Logic of experimentation, causation and control Exploratory Research Design Descriptive Research Design Action Research & Participatory Research	

II Sampling/ Data Collection tools	Problem formulation and variables, level of measurement, use of scales. Sampling: Meaning, Assumptions, types-probability & non-probability sampling. Methods, Tools & techniques of Data Collection; Primary and Secondary Data, Direct observation method, Interview-Personal and group interview-Interview schedule and questionnaire. Data Processing and Tabulation. Analysis and Report Writing	
III Aesthetics and Techniques of photography	Social Statistics: Meaning, Concept and uses Measurement of central tendency: Mean, Median & Mode. Measurement of Dispersion, Co-efficient of co-relations, chi-square test, T-test, ANOVA and ANCOVA	
IV Fundamentals of Computer	History, Language and components Applications of Computer operating System and Internet MS-Office, Word, EXCEL SPSS. Proposed	

MSW-III semester

Course Title: **Social Policy, Planning and Development (MSW-601)**

Credits: 4		
Unit	**Topics**	**No. of L/T/P**
I Introduction to Social Policy	• Concept, Aims, objectives and fields. Inter relation between policy planning and development. • Social Policy and Indian Constitution & Directive principles of state policy • Approaches and Models of Social Policy. • The Process of Social Policy Formulation.	
II Understanding Social Planning	• Social Planning; Concept, Objectives, Scope, Models, Interrelationship between Social and Economic Planning Social Planning in India: Five Years Plans. • Social Planning and Social Change. • Factors to Development of Planning in India.	

III Social Development	Development; Positive and Negative Dimensions. Social Development; Concept, Models and Theories. Historical and Social Context of Development in India. Sustainable Development; Concept, Strategies, Critical issues. Salient Features of Social Development, Thoughts of Gandhi, Vinoba and Jai Prakash Narayan. Gandhi and Professional Social Work. Approaches to Social Development; Similarities and Differences.	
IV Social Legislation and Legal System	Social Legislation: Concept, Sources and Types. Social Legislations: Challenges in Formulation and Implementation Social Legislation: Practice Area of Social Work Social Legislations Related to Vulnerable Groups	

Course Title: **Communication and Social Work (MSW-602)**

Unit	Topics	No. of L/T/P
I Concepts of communication	• Communication: Concept and Definition, Components, Significance, Steps, Channels, Methods, Barriers. • Principles and Skills.	
II Models and Theories of Communication	• Models and Theories of Communication. • Forms of Communication: Formal and Informal, Intrapersonal and Inter-personal. • Verbal/oral and Non-Verbal/Written.	
III Directions in Communication	• Directions in Communication: Vertical, Horizontal and Diagonal. • Media: Representation/Documentation of Reality with special Reference to weaker sections Assessment and Impact. • Methods and Techniques of Designing and Conducting Campaign.	
IV Media Scene in India	• Media Scene in India: Print and Audio-Visual, Effective writing for Media; Press and framing of events, documenting reality, Press-Conference, Press notes. • Public Relation and crisis Management; Role of Media in perception of crisis; Communication Management in Public relation campaign and crisis-prevention; use of puppets, songs, folk lore, street theatre, posters, logos, exhibitions etc.	

Course Title: **Human Rights and social work practice (MSW-603)**

Credits: 4		
Unit	**Topics**	**No. of L/T/P**
I Human Rights and Duties	Human Rights and Duties: Concepts, History, Evolution and classification, Theories Relating to Human Rights: Natural Rights, Legal Rights, Positivist, Liberal, Marxian and Gandhian Thoughts	
II International Mechanism & Human Rights	• International Mechanism & Human Rights: International HRMovements: • Conventions for the Recognition of Human Rights, Norms & standards, UN Charter on Human Rights, Universal Declaration of Human Rights 1948, International Covenants on Economic, Social & Cultural Rights, International Covenants on civil & political rights	
III Protection and Promotions of Human Rights at International level:	• UN Gen Assembly, • Economic & Social Council, • Human Rights Council, Committees under International Covenants & Conventions, • Convention on the Rights of Child, • Convention on Elimination Discrimination against women (CEDAW), • Racial Discrimination: Conventions on all forms of discrimination, 1965 and related instruments, National Human Right Commission	
IV Human Rights & Social Work	• Human Rights & Social Work: Human Rights & Code of Ethics of Social Work: Philosophical foundations, Human Rights education for individuals, groups and communities, • Developing Human Rights in Society- Right to Development, Right to Food, Right to Education, Right to Water & Sanitation and Right to Housing, Methods and Techniques for Promoting Human Rights: Advocacy, PIL, RTI ,Legal aid programmes in India.	

Course Title: **Social Ecology Environment and Management (MSW-604)**

Credits: 4		
Units	**Topic**	**No. of L/T/P**
I Concept of Social Ecology	• Social Ecology: Meaning, Elements; Nexus between Ecology and Environment; Ecology and Development. • Problems of Ecological Imbalances: Deforestation, Detribalization, Migration and Depopulation, loss of Flora and Fauna, Pollution and Health Hazards.	
II Environment	• Environment, Natural Resources and life Style; Environment Management – Maintaining, Improving and Enhancing; Current Issues of Environment Displacement. • International Treaties and Agreements Relating to Environment Conservation.	
III Law Relating to Environment Protection	• Forest Conservation Act. • Environment Protection Act. • Water (Prevention and Control of Pollution) Act. • Air (Prevention and Control of Pollution) Act.	
IV Role of Govt. and Non Govt. Organisations	• Role of Non-Government Organisations in Environment Protection. • Environment Movements in India.	

Course Title: **Development of Youth and Welfare of Aged (MSW-605)**

Credits: 4		
Unit	**Topics**	**No. of L/T//P**
I Concept of Youth	• Concept and Characteristics of Youth. • Emerging Patterns of Youth Culture in Contemporary Indian Society. • Inter-generation Conflicts. • Needs and Problems of Youth in Rural and Urban Settings Educated Unemployed Youth in India. • Youth Unrest and Crime.	
II Development of Youth in India	National Policy of Youth. National Commission on Youth. Nehru Yuva Kendra, Balika Mandal, NCC, Employment and Guidance Services, Youth Counselling.	
III Concept of Ageing	• Definition of old age (developmental, biological, social, psychological and cultural perspective) Status and Role of Ag in India. • Psychological and sociological theories of ageing • Demographic Characteristics of the Aged Population : Longevity, Physical and Mental Health. • Issues of Neglect, Abuse, Violence and Abandonment and Rights of older persons against that.	
IV Policies and schemes for aged	• National Policy and Legislative Provisions for the Aged. • Schemes for the Welfare of the Aged : Institutional Care, Day Care and Medi-care Unit. • Preparation for Old Age, Retirement Planning Raising Family and Community Awareness about the Problems of Ageing an the Aged. • Participation of Senior Citizens in Socio-economics Development.	d

Course Title: **HIV –AIDS and social work practice (MSW-606)**

Credits: 4	

Units	Topic	No. of L/T/P
I HIV – AIDS: An Introduction	• The pandemic of HIV/AIDS: extent of the problem, routes of transmission, nature and progression of the disease • Changing demographics of age, class, gender and ethnicity of HIV/AIDS pandemic • HIV/AIDS as a development issue: MDG plan of action for control of HIV/AIDS • Stigma, prejudice and discrimination faced by PLHA and their family members	8L+ 6P
II Intervention	Behaviour change communication for safer sex practices among special populations Prevention strategies and programmes for the general population, in occupational and rape-related exposure and parent to child transmission Targeted Interventions among high-risk groups like people in same sex relationships, injecting drug users, hemophiliacs, sex workers, truck drivers, transgendered people etc.	
IIII Community based intervention	Current and experimental treatments/protocols (ART/HAART) and adjunctive therapies, control and treatment of opportunistic infections, issues impacting treatment options Community based HIV/AIDS Care and Support for PLHA Greater Involvement of people with AIDS (GIPA) and PLHA Networks: NGO response and network of positive people. GIPA Models Components of comprehensive care: psychosocial support, nutritional and healthcare support, palliative care, care and support of orphans	
IV Human rights and HIV	Politics of AIDS: historical account of government, agency and community responses Human rights and legal issues in HIV/AIDS NACO and State AIDS Control Societies, NGO Interventions: Case studies National AIDS prevention and control policy	

Course Title: **Culture & Society in Uttarakhand (MSW-607)**

Program/Class: Degree	Year: Second	Semester: III
Credits: 4		

Units	Topic	No. of L/T/P
I History of Uttarakhand	• Socio-political History of Uttarakhand Himalayas • Communities and Ethnicities in Uttarakhand • Gender Roles and their Narratives: Socio-economic Division of Labour	
II Culture and Ecology	• Geography: Spatial Orientation in a Mountainous Region • Agro-Pastoral Livelihood Practices and Culture • Traditional Forest Management • Ecological Festivals	
III Classical and Indegenous system	• Little and Great Tradition: Classic and Indigenous System of Faith • The Four Plus Dhams and Their Religio-Cultural Impact • Presiding Deities and Followers: Dieties of Nature, Plan Indian Deities, Apotheosized Dieties, Migrant Dieties. • Performing Arts, Fairs and Festivals • Kumaoni Holi, Ramilia, Hill Jatra	
IV Rituals and yatras	Processional Rituals, Samskaaras and Local Practice Nanda Devi Raj Jat, Four Mahasus Processions of Goddesses Procession of Yakhas Garvadhan, Punsavan, Karnbhedan, Naamkaran, Yagypaveet, Marriage, Funerary Rites, Post-Funerary Rites	

Block Placement (45 Days)/ Internship (MSW-608)

Semester: IVth Semester

Credits: 4		
Units	**Topic**	**No. of L/T/P**
I Concept of HRM and HRD	• Concept of HRM and HRD, its objectives, Scope and Principles. • Principles of organization: Hierarchy, unity of command, authority, co-operation, span of control, supervision, delegation, centralization, de-centralisation..	

II Relationship between HRM and HRD	• Inter-relationship between HRM and HRD. • Policies for Employee upliftment. • Maintaining Discipline, Disciplinary Procedure, Positive aspect of Discipline; Domestic Enquiry, Discharge and Dismissal, Resignation, Retirement.	
III Theories of HRM	• Theories of Organization: Theory of scientific Management, the bureaucratic theory, the classical theory, the human relations theory. • Man Power Planning, Selection, Induction, Training, Promotion and Transfer. • Job Analysis, Job Evolution, Performance Appraisal, Career	
	Planning and Development, Discipline, Wages and Salary Administration.	
IV Training and Development	Training & Development; Establishment of Training needs Strategies, Training Inputs, Evolution of Training Needs, Training Methodology. Collective Bargaining and Worker"s Participation in Management, Industrial Relationship and Model Grievance Redressal Procedure, Causes of Indiscipline & Procedures of Disciplinary Action.	

Course Title: **Counseling and Social Work Practice (MSW-622)**

Credits: 4		
Units	**Topic**	**No. of L/T/P**
I Counseling: Introduction	• Counselling: Meaning, Definition, Needs, Goals, Principles & Methods. • Steps, Approaches and Models: Western and Indigenous. • Counseling Process, Stages of Counselling and Counseling Situations..	
II Basics of Counseling	• Individual Counseling: Client as a person, Voluntary and Non-Voluntary, Expectations, Behavior. • Marriage, Family and Group Counselling.	
III Techniques of Counseling	• Techniques of Counselling: Initiating Contact, Intake, Report, Establishing Structure, Interaction, Attending Behavior, Observation, Responding, Rating and its Interpretation. • Counselling in Social Service Organisation: Government and Non-Government.	
IV Counseling and social work	• Counselling in Social Work Practice; Social Worker as a Counselor. • Problems of Counsellors. • Recent trends in Counselling. • Training for Counselling.	

Specialization Course

Course Title: **Rural Community Management (MSW-623)**

Credits: 4		
Unit	**Topics**	**No. of L/T/P**
I Rural Community: An Introduction	• Characteristics Features of Indian Rural Community. • Rural Institution : Family, Marriage and Caste, Caste Panchayat. • Panchayati Raj Institution: Village Panchayat, Kshetra Panchayat & Zila Panchayat.	

II Rural Marketing/ NGO Management	• Managerial Economic and Rural Marketing. • NGO, Project Management and Local Governance. • Rural Enterpreneurship Development, Rural Financing, Cooperative Management, Strategic Growth Perspective. • Natural Resource Management, Enveronment & Right to Information Act.	
III Role of various agencies	• People"s Participation in Rural Development. • Role of District Rural Development Agency (D.R.D.A.). • Role of District Planning & Development Committee (D.P.D.C.). • Role of Co-Operative, Commercial Bank. • National Bank for Agriculture and Rural Development (N.A.B.A.R.D.). • Role and Function of Block Development Officer.	
IV Programmes of rural development	• Rural Development Programases. • Land Ownership and Land reforms in India. • Rural Planning and Reconstruction.	

Course Title: **Industrial Relation & Personal Management (MSW-624)**

Credits: 4		
Unit	**Topics**	**No. of L/T//P**
I Industrial Relations: concept and objectives	Concept, Objectives, Scope, Important Determinant and Reflectors, Various Approaches to Industrial Relations. Industrial Relations Policy in India.	
II Industrial Disputes	Industrial Disputes: Concept, Causes and Magnitude. Industrial Disputes Act, 1947.	

III Collective Bargaining and schemes of worker's participation	Collective Bargaining: Concept, Objectives, Principles, Forms & Methods. Participative Management: Concept, Objectives & Scope. Approaches to Participation. Current Scheme of Worker"s Participation in Management in India and Quality Circle.	
IV Welfare and Administration	The Problems and Practice of Welfare and its Administration in Industrial Setting, Scope, Practices, Gaps and Suggestions. Social Security Meaning, Different Methods and Philosophies of Social Security. Compensation and Salary Administration. Labour Legislation in India – The Factories Act, 1948. The Minimum wages Act, 1948. The Payment of Wages Act, 1936. The Contract Labour (Regulation And Abolition) Act, 1970. The Workman"s Compensation Act, 1923. The Meternity Benefit Act, 1961. The Industrial Employment (Standing Orders) Act, 1946.	

Course Title: **Medical & Psychiatric Social Work (MSW-625)**

Credits: 4		
Unit	**Topics**	**No. of L/T/P**
I Medical Social Work	• History of Medical and Psychiatric Social Work. • Medical Social Work: Concept, Scope, Principles, Approaches & Skills. • Socio-Psycho-Somatic Study of Illness & Diagnosis. • Role of Medical Social Worker in Various Medical Settings.	
II Psychiatric Social Work	• Psychiatric Social Work: Concept of Mental Health and Mental Illness. • Stress and Stress Related Diseases. • Psycho-Somatic Diseases. • Mental Health Act, 1987. • Role of Psychiatric Social Worker in the Mental Hospital.	

III Hospital Organisation	Hospital Organisation – Hospital Staff and Position of Medical Social Worker in the Hospital. Hospital Management. Counselling and Psychotherapy. Family Therapy and Group Therapy.	
IV Infections and Communicable Diseases	Typhoid, Leprosy, Tetanus, Diptheria, Cholera, Maleria, Small Pox, AIDS, STD, Tuberculosis, Cancer. Cardiac Illness. Common Diseases and their Treatment.	

Course Title: **Correctional Social Work (MSW-626)**

Credits: 4		
Unit	**Topics**	**No. of L/T/P**
I Correctional Social Work	• Correctional Social Work: Concept, Scope and Techniques. • Application of Social Work Methods in the Institutional and Non-Institutional Correctional Setting. • Dilemmas of Custody – Corrections Mix.	
II Community based Corrections	• Corrections: A Component of the Criminal Justice System. • Community based Corrections: Probation, Parole and AfterCase. • Group Counselling and Group therapy in Correctional Institutions.	

III Problems of Trained Social Workers in Correctional Settings	• Problems of Trained Social Workers in Correctional Settings. Future of Correctional Social Work: Trends and Perspective. • Social Case Work in Correctional Settings, Case Conferences, Role of Other experts in the Correctional Work. • Follow up and rehabilitation of Criminals. • Social Work with Women Criminal and Social Work with Habitual Offenders. • Social Work with Suicides.	
IV Legal forms Work of Corrections in Institutional Settings	• Legal forms Work of Corrections in Institutional Settings: Prison Act, 1894; and Prisoners Act, 1900. Juvenile Justice (Care and Protection) Act, 2002. • Legal Fram Work of Community – Based Corrections, Probation of Offenders, Act, 1958. Rules for Parole and Pre-Mature Release of Prisones.	
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Elective Course

Course Title: **Social Work and Disaster Management (MSW-627)**

Credits: 4		
Unit	**Topics**	**No. of Lectures**
I Disaster: Meaning and classification	• Disaster – Meaning, Classification and an Overview. • Environmental Issues and Disaster.	
II Predisaster preparedness and precautions	• Pre-disaster preparedness and precautions, Flood, Cyclone, Earthquake, Tsunami, Sun-Stroke, Drought, Epidemics, Pandemics and Endemics. • Role of NGO in Management of preparedness.	
III Post – Disaster Management Agencies	Post – Disaster Management Agencies: Evacuation, Corpse Disposal, Rehabilitation, Sanitation, Fooding, Medical Care, HAM Radio. Relief and Rehabilitation. Search, Rescue, Evacuation, Refugee Camp Management. First Aid, Cleaning Operation, Counseling for Trauma, Public Health and disease Management. Role of NGO in Post Disaster Management. Co-ordination with Government Agencies.	
IV Issues in Disaster Management	Issues in Disaster Management. Education for disaster management, Risk Reduction, Social Vulnerability, Financial Management of Disaster, Communication and disaster. Disasters and impact on Poverty. Corporate Social responsibility and disaster. Community and disaster management. Essentials of urban risk reduction, Government planning for disaster management. Application of technology in disaster management.	
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Course Title: **Migration Studies (MSW-628)**

Credits: 4		
Unit	**Topics**	**No. of L/T/P**
I Migration: concept and causes	Migration : Definition, Types and causes Theories of Migration	
II Internal Migration	Internal Migration in India- Trend and Pattern Indian External Migration: Trend and Pattern	
III Migration and Development	Migration: Development and Poverty Migration and Employement Migration and It‟s impact on resources	
IV Policies of Uttarakhand Goverment	Migration in Uttarakhand: Trend, Patterns and Consequences Policies and strategies of Uttarakhand Government towards mitigate Migration	

Course Title: **Gender and Development (MSW-629)**

Credits: 4		
Units	**Topic**	**No. of L/T/P**
I Gender as a social construct	• Gender as a social construct, Gender identity, equity, discrimination • Patriarchy - Social structure and social institutions, Feminism: Major feminist thoughts • Women in India: The Changing Status of Women in India: Colonial and Post Colonial. • Status Indicators: Demographic, Social, Economic and Political.	
II Perspective on Gender Studies	Perspective on Gender Studies: Gender Studies in India, Liberal, Radical, Socialist and Post Modernist.	
III Women and Development	Women and Development: Impact of Development Polices on Women‟s Empowerment. \ Constitutional Provisions and State Initiatives to Uplift the Status of women, Violence against Women.	
IV Women's Movement	Women‟s Movement: Organizations, Movement and Autonomy. An Overview of Women‟s Movement in India. From Chipko to Sati:- The Contemporary Indian Women‟s Movement. Challenges Before Women‟s Movement. Status of Women in Uttarakhand: Opportunities and Challenges	

Course Title: **Family and Child Welfare (MSW-630)**

Credits: 4		
Units	**Topics**	**No. of L/T/P**
I Family as a social institution	• Concept, Types and Functions of family. • Family dynamics – power, myths, role and patriarchy in family • Concept, Types and Social Importance of Marriage • Review of changing situations in marriages and marital relationship	

II The Family in the context of Social Change:	• Concept and characteristics of social change. • Impact of migration, industrialization, urbanization, liberalization, privatization and globalization on family – changing functions, values, relationship, communication.	
III Quality of Life and Family:	• concept and Indicators of quality of life • Family and Millennium Goals	
IV Work with families:	• interventions, techniques and skills • Family as a centered in social work – problem solving approach. • Life enrichment programmes – developmental approach. • Programmes for family empowerment and protection of human rights • Efforts of government in strengthening families – Policy, Legislation and programmes. (Brief review)	
	ICDS, Micro-credit, component plan, Schemes for families, Public Distribution System, Health – Family Welfare Programme, Health Insurance.	

School Of Management

Doon University

SYLLABUS

MBA 2022-23 2023-24

MBA-I SEMESTER

Course Code: MBA701 **Course Title**: **Management Theory and Practice**

Course Type: Compulsory

Credit:4 **(L-3 T-1 P-0)=45 lectures**

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

Conceptual framework of Management: Managerial roles & skills - Evolution of Management thought - Trends and Challenges of Management in Global Scenario.

Nature and purpose of planning - Planning process - Types of plans – Objectives - Managing by objective (MBO) Strategies - Types of strategies - Policies - Decision Making - Types of decision - Decision Making Process - Rational Decision Making. Conditions of Certainty, Risk and Uncertainty; Bounded rationality.

UNIT-2

Organising: Concept, nature and principles. Organization Structure and Design- Departmentalization- Functional Organizations, Product Organizations, Matrix Organizations, Boundaryless Organization. Authority and responsibility, Division of Labour, Span of Control, Line versus Staff Positions, Decentralization and delegation.

UNIT-3

Directing: Concept, Leadership-concept, theories and styles, Communication Process, Channels and barriers, - Organization Culture - Elements and types of culture - Managing cultural diversity. Motivation: Concept and implication of Motivational theories on work behaviour.

UNIT-4

Controlling -Elements of managerial control, management control techniques, Types of control - Budgetary and non- budgetary control techniques - Managing Productivity - Cost Control - Purchase Control – Maintenance Control - Quality Control. Recent Trends in Management: - Social Responsibility of Management – environment friendly management, Management of Change, Management of Crisis, Diversity Management, Total Quality Management, Stress Management and International Management.

Course Code: MBA702 **Course Title: Accounting for Managerial Decisions**

Course Type: Compulsory

Credit:4 **(L-3 T-1 P-0)=45 lectures**

Evaluation: 20(sessional) + 30 (midterm) + 50 (endterm)

UNIT-1

Overview: Accounting concepts, conventions and principles; Accounting Equation, Accounting for management, Comparison of management accounting and financial accounting.
Mechanics of Accounting: Double entry system of accounting, journalizing of transactions; preparation of final accounts, Profit & Loss Account, Balance Sheet, Policies related with Depreciation

UNIT-2

Analysis of financial statement: Ratio Analysis- solvency ratios, profitability ratios, activity ratios, liquidity ratios, market capitalization ratios, preparation of Cash Flow Statement and its analysis.

UNIT-3

Common Size Statement; Comparative Balance Sheet and Trend Analysis of manufacturing, service & banking organizations.

UNIT-4

Concept of Cost, Cost-Volume-Profit Analysis, P/V Ratio Analysis and their implications, Breakeven Point and their analysis for various types of decision-making.
Transfer Pricing, Responsibility Accounting, Activity Based Costing, Life Cycle Costing: concept, strategies and applications of each.

Course Code: MBA703 **Course Title**: M**anagerial Economics**

Course Type: Compulsory

Credit:4 **(L-3 T-1 P-0)=45 lectures**

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

Introduction to Economics; Nature and Scope of Managerial Economics, Significance in decision-making and fundamental concepts. Economic theories and business practices.

Demand Analysis; Law of Demand, Exceptions to the law of Demand, Determinants of Demand. Elasticity of Demand- Price, Income, Cross and Advertising Elasticity; Uses of Elasticity of Demand for managerial decision making, measurement of Elasticity of Demand. Demand forecasting meaning, significance and methods. Supply Analysis; Law of Supply, Supply Elasticity; Analysis and its uses for managerial decision making.

UNIT-2

Production concepts & analysis; Production function, single variable-law of variable proportion, two variableLaw of returns to scale. Cost concept and analysis, short-run and long-run cost curves and its managerial use.
marginal utility, equi-marginal utility, indifference curve, substitution effect, price effect, income effect.

UNIT-3

Market Equilibrium and Average Revenue Concept. Market Structure: Perfect Competition, features, determination of price under perfect competition. Monopoly: Feature, pricing under monopoly, Price Discrimination. Monopolistic: Features, pricing under monopolistic competition, product differentiation. Oligopoly: Features, kinked demand curve, price leadership. Pricing Strategies; Price determination, full cost pricing, product line pricing, price skimming, penetration pricing.

UNIT-4

National Income; Concepts and various methods of its measurement, Keynesian theory of income and employment. Business Cycles, Inflation and stagflation-causes and effects.

Course Code: MBA704 **Course Title**: **Business, Society and Law**

Course Type: Compulsory

Credit:4 **(L-3 T-1 P-0)=45 lectures**

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

Components of business environment, Process of businessenvironment
Analysis Economic environment, Different economic systems (Capitalism, socialism and mixed economy), Economic policies (Monetary & Fiscal), Global trends in business and management, Foreign capital and collaboration,
Economic trends in Indian industries

UNIT-2

Relationship between business and political environment, Constitutional provisions affecting business;Competition law, Industrial policy after 1991, Consumer Protection Act 1986, Environment Protection Act 1986,Dimensions of these laws and their impact
on business.

UNIT-3

Composition of Indian money and capital markets, Role of commercial banks, Financial institutions and non-banking financial institutions.
RBI and capital market reforms, Foreign direct investment (FDI)**,**WTO, Its roles and functions, MNCs, International institutions: World Bank and IMF, Trading Blocs

UNIT-4

Economic development and ecology, Green marketing,Environmental technologies, Ecological implications of technology, Sustainable development.

Course Code: MBA705 **Course Title : Managerial Communication**

Course Type: Compulsory

Credit:4 **(L-3 T-1 P-0)=45 lectures**

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

Managerial Communication - Meaning and Significance, principles of effective communication. Road blocks to managerial communication; Removing roadblocks; Gateways to communication, strategies for improving organizational communication.
Cross-cultural Communication – Significance, elements, cultural context and barriers to Cross Cultural Communication

UNIT-2

Business Correspondance-Summarizing, leave application, permission letter, business letters - sales, request, order, inquiry, acknowledgement, complaint and collection letters, memorandum writing, office order, circular, notice writing, agenda and minutes of meeting, modern forms of communication: e-mails, video conference and conference calls

UNIT-3

Models for Understanding Interpersonal Relationships- Models- Exchange Theory; Johari Window; Transactional Analysis

UNIT-4

Report writing - proposal writing, types of reports, academic and technical reports, digital communication - content writing (blogs and websites), proof reading, media writing – press note. Job Application and Resume Writing, Mock Interviews

Course Code: MBA706 **Course Title: Business Statistics and Research Methodology**

Course Type: Compulsory

Credit:4 **(L-3 T-1 P-0)=45 lectures**

UNIT-1

Statistics: Statistics for managers, Categorical and Numerical data, Statistical thinking and analysis, Association between variables, Probability-Concept of probability, Definition of probability, Rules of probability, Independent Events, Dependent Events, The Bayes' Theorem Probability Distributions, Binomial and Poisson Model, Normal Probability model, Departures from Normality.

UNIT-2

Measure of Central Tendency-Objectives of averaging. Requisites of measure of central tendency. Mathematical averages – arithmetic mean (simple and weighted), geometric mean, harmonic mean. Averages of positionmedian and mode. Partition values- quartiles, deciles and percentiles. Relationship between mean, median and mode. Comparison between measures of central tendency.

UNIT-3

Measure of Dispersion-Significance of measuring dispersion (variation). Classification of measure of dispersion, Correlation and regression: Nature and significance of correlation, types of correlation, methods of studying correlation, graphic method, non-graphic method, Karl Pearson's rank and concurrent deviation methods, Regression: Nature and uses of regression analysis, curve fitting

UNIT-4

Introduction to research methodology, research methods, meaning and objective of research, Research process, research objective and plan, Nature of research designs, types of research designs, Basic concepts of measurement and scaling, types of data, datacollection methods, Report Writing.

MBA SEMESTER-II

Course Code: MBA809 **Course Title: Financial Management**

Course Type: Compulsory

Credit:4 **(L-3 T-1 P-0)=45 lectures**

UNIT-1

Nature of Corporate Finance: Scope and objectives of finance function, Shareholders' wealth maximization, Agency problem, Financial Instruments – Issuance, Regulation and Markets. Time Value of money.

UNIT-2

Investment Decisions: Analysis of Capital budgeting decisions, discounted and non-discounted techniques in capital budgeting, Risk analysis in capital budgeting. Types of Projects – selection criteria, capital rationing.

UNIT-3

Financing and Dividend Decisions: Cost of various Capital Components-Equity shares, Preference shares, Bonds and debentures, Optimum capital structure, financial and operating leverages, Capital Structure theories. Dividend

Policy and Its determinants, Irrelevance of dividend: MM Hypothesis, Relevance of dividend: Walter's model and Gordon's model.

UNIT-4

Working Capital Management: Principles of working capital management, Accounts Receivable management, Inventory management and Cash management, factors influencing working capital requirement, Computation of working capital, Sources of Working Capital.

Course code: MBA 810 Course Title: Marketing Management
Course Type: Compulsory

Credit:4 (L-3 T-1 P-0)=45 lectures

Evaluation: 20(sessional) + 30 (midterm) + 50(end term)

UNIT-1

Introduction to Marketing:

Core Concepts - Need, Want, Desire and Demand, Exchange, Customer Value, Difference between sales and marketing, 4Ps Framework. Marketing Philosophies– Product, Production, Sales, Marketing, Societal, Relational. Marketing Myopia. Marketing Environment – Micro and Macro Environment,. Holistic Marketing, Role of Technology in Marketing

UNIT-2

Understanding Consumers:

Consumer Buying Behavior, Organizational Buying Behaviour, Consumer Decision Making. Identifying Customers - Segmentation, Targeting & Positioning **Product Decisions:**

Product, Product Mix Strategies - Product Mix, New Product Development, Product Life Cycle, Branding, Packaging and Labelling, Consumer Adoption Process

UNIT-3

Pricing Decisions:

Significance of Pricing Decision, Factors influencing Price Determination, Pricing Methods and Techniques, Developing Pricing Strategies **Channel Decisions:**

Classification of distribution channels, Designing Distribution Channels - VMS, HMS, MMS; Market logistics decisions. Channel management - Selection, Training, Motivation and Evaluation of channel members. Managing Channel Conflicts, Retailing and Wholesaling

UNIT-4

Communication Decisions:

Role of Promotion in Marketing, Promotion mix – advertising, personal selling, sales promotion, publicity and public relations. Social media marketing, Media selection, Advertising effectiveness, Integrated Marketing Communication

Course Code: MBA811 Course Title: Human Resource Management

Course Type: Compulsory
Credit:4 (L-3 T-1 P-0)=45 lectures

UNIT-1

Contemporary Human Resource Management, Evolution of Human Resource Function, HRM, Competitive Environment and Strategy -Harvard model, Guest model, Ulrich's HR model, AMO framework. Nature of Diverse Workforce, Trends in Workforce Diversity,
Impact of Diversity on Organizations, Managing Diversity, Managing Knowledge Workforce.

UNIT-2

Human Resource Planning Methods and Forecasting, HR Accounting, Job Analysis, Recruiting and Selecting Employees, Recruiting Methods, Selection Techniques.
Training and Development, Employee Orientation- Analysing, designing, implementation and evaluation of training program,Management Development.

UNIT-3

Compensation and Benefits, Determinants of Compensation Strategy, Incentives and Performance-based Rewards, Benefits Program, Contemporary issues in Compensation and Benefits. Performance Appraisal, Process and Methods, Performance
Management and Feedback, Career Management, Career Development Issues and Challenges.

UNIT-4

Industrial Relations, Overview of Indian Industrial Relations, Role of Labour Unions, Trends in Unionization, Collective Bargaining and Negotiating Labour Agreements.
Ethics and Human Resource Management, Rightsizing the Organizations, Managing Terminations and retention, Voluntary Turnover, Managing Human Resource during Mergers and Acquisition, Employee Safety and Health, Global Issues in International Human Resource Management

Course Code: MBA812 Course Title: Operations Management

Course Type: Compulsory

Credit:4 (L-3 T-1 P-0)=45 lectures

UNIT-1

Introduction to Operations Management; Historical Evolution; Strategic role of Operations; Systems view of Operations Management; Functions of Operations manager; Designing Products; Services and Processes; Flexible Manufacturing System. Facility Location and Layout Planning; Job Design; Work Study and Work Measurement; Method Study.

UNIT-2

Production Planning & Control, Master Scheduling; Aggregate Planning; Rough Cut Capacity Planning; Gantt Charts & Sequencing. Just in Time (JIT); Lean Production System; Total Productive Maintenance (TPM). Financial Analysis of Operating Plans; Ergonomics; Environmental Consideration – Green manufacturing; Ethical issues in OM.

UNIT-3

Fundamentals of Inventory Management; Material Requirement Planning (MRP); Manufacturing Resource Planning (MRP II); Enterprise Resource Planning; Project Management – PERT/CPM.

UNIT-4

TQM; Contributions of Quality Gurus - Demings, Juran, Philip Crossby & Ishikawa; Techniques of Quality Control; ISO 9000 & ISO 14000; Statistical Process Control; Quality Circles; Kaizen; Six Sigma Approach, Service Quality Management

Course Code: MBA813 **Course Title: Global Business Management**

Course Type: Compulsory

Credit:4 **(L-3 T-1 P-0)=45 lectures**

UNIT-1

Introduction to Global Business

Globalization – Meaning, Implications, Globalization as a driver of International Business, International Business contrasted with domestic Business, Drivers of International Business, The Multinational Corporation – evolution, features and dynamics – from the Conglomerate to the Born Global Enterprise.

UNIT-2

Theories of International Business (Traditional theories for developed country incumbents vs Modern theories for Emerging Markets – Stage Model, Accelerated Internationalisation Models, LLL Theory, Leapfrogging and Spring-boarding theories, Modes of Entry into International Business – Trade, Contractual Entry and Investment related modes.

UNIT-3

Global Trading Environment

Theories of International Trade, Political Economy of International Trade – Tariff and Non-tariff Barriers, Global Regulation of International Trade – WTO, UNCTAD; Regional Economic Integration – theory, stages, working

UNIT-4

Global Investment Environment

Theories of Foreign Direct Investment, Traditional and Modern theories of FDI, Modes of FDI - Greenfield, Mergers and Acquisitions and Brownfield Investment, Motives of FDI, FDI contrasted with FPI

Course Code: MBA814 **Course Title: Organizational Behaviour**

Course Type: Compulsory

Credit:4 **(L-3 T-1 P-0)=45 lectures**

UNIT-1

Organizational Behaviour: Understanding OB, Interdisciplinary nature of OB, Management and OB, Robbin's Model of OB
Trends and Changes in OB - Globalization and Culture, Shifting demographics of the workplace, Nature of Job, Technology

UNIT-2

Perception, Job related Attitude and Behaviour, Cognitive Dissonance theory, Attitude Change, Learning theories, Applications of Learning in Organizations, OB Modification at levels, Individual differences, Values and Personality, Work related aspects of Personality

UNIT-3

Motivation- Need based theories, Process-based theories, Application of Motivation, Designing Motivating Workplace, Motivation and Performance, Emotions at work.
Group Dynamics, Management of Teams, Decision making in Organizations, Helping, Cooperation, and Conflict in organizations, Influence, Power and Politics

UNIT-4

Leader and Approaches to Leadership, Contemporary issues in Leadership
Organizational Change- Process and Resistance
Organizational Culture- Layers and Characteristics, Hofstede's cultural dimensions Stress-Nature and Causes, and major effects, Stress Management and wellbeing.

MBA SEMESTER-III

Course Code: MBA 917 **Course Title: Strategic Management**

Course Type: Compulsory

Credit:4 **(L-3 T-1 P-0)=45 lectures**

UNIT-1

IntroductiontoStrategicmanagementandconcepts,BusinessStrategy,Strategyprocess,ValueandCompetitiveAdvantage,Internal Context - The strategic design of organizational structures,OrganizationstructureandCompetitiveadvantage,AligningStrategyandOrganization,BuildingandCreatingCompetitiveadvantage,ExplorationandExploitation.
ExternalContext–

IndustryAnalysis,EffectofIndustryCharacteristicsonFirmPerformance,FrameworkforIndustryanalysis,Competi tionandNicheMarket,CompetitioninConcentrated Markets,Incumbency advantage,Business Models,ValueChain,HorizontalandVerticalOrganization,Culture,ManagingStrategic Change.

UNIT-2

Strategy Formulation- Examining Business Strategy,Mission &Objectives, Business Strategy – Porters' Competition Strategies,Cooperative Strategies,StrategicAlliances,Corporate Strategy,DirectionalStrategy,PortfolioStrategy,CorporateParenting,Functional Strategy, Location of Functions, Strategies to Avoid,Strategic Choice-ConstructingScenarios.

UNIT-3

StrategyImplementation-GlobalStrategy,InternationalEntry,International Coordination, Stages of International Development,InternationalEmployment,Measurementof PerformanceOrganizing and Structure- Stages of Corporate Development,Organizational Life-Cycle, Flexible types of Organization structure,MatrixStructure,NetworkStructure,ReengineeringandStrategyImplementation,Staffing,Leading,ActionPlanning

UNIT-4

Evaluation and Control- Measuring Performance, Measures, Typesof Controls, Activity-based Costing, Enterprise Risk Management,Primary Measures of Corporate Performance,Balance ScorecardApproach,Benchmarking,StrategicInformationsystem,ProblemsinMeasuringPerformanceGrowthth roughNewVenturing,Expansion,Diversification,Restructuring, Divestment, Acquisitions and Alliances, TechnologyAdoption.GlobalizationandStrategy,Globalintegrationversusnationaldifferentiation,Currenttrendsinstrategicmanagement

Course Code: MBA918 **Course Title**: **Managing Innovation and Entrepreneurship**

Course Type: Compulsory

Credit:4 **(L-3 T-1 P-0)=45 lectures**

UNIT-1

DefineEntrepreneurship,Entrepreneurshipdomain,ManagersEntrepreneurs and Entrepreneurial Managers, Entrepreneurship andsmallbusiness, CharacteristicsofEntrepreneurs,EntrepreneurialOrientation,Entrepreneurial Motivation, Models of Entrepreneurial Motivation,FactorsinfluencingEntrepreneurialBehaviour, EntrepreneurialProcessModel,3MAnalysisforopportunityscreening,NewVenturecreationprocess,ProcessofEnterpriseformation

UNIT-2

Importance of creativity management, Creative thinking process, keystagesofthecreativeprocess,corecomponentsofindividualcreativity, Design thinking, Use of design thinking for innovation,linkbetweencreativityandinnovation, DefiningInnovation,typesofinnovation,innovationlifecycles,sources of innovation,Strategiestoencourageinnovation, AdoptionandDiffusionofInnovation, Innovation Paradigms, Theories of Diffusion.

UNIT-3

Approach to innovation and entrepreneurship to small, medium, andlarge corporations, innovation and entrepreneurship in the context ofsmall and medium enterprises (SMEs) and large corporations, openinnovation,processofinnovation,radicalinnovationsandincrementalinnovations Impactofchangingenvironmentoninnovationandentrepreneurship,roleofstrategicmanagementinthedevelopmentofaninnovativeandentrepreneurialorganization,linkbetweeninnovationandentrepreneurship with strategy, internal organizational characteristicsforinnovationandentrepreneurship, DisruptiveInnovation,PathwaysforDisruptiveInnovation,ScreeningOpportunitiesandAssessingMarkets,CausesofInnovationFailure,CustomerDevelopmentProcess,CustomerValueProposition,MarketResearch

UNIT-4

Innovationandentrepreneurshipindomesticandinternationalbusiness,PlanningBusinessModelsandStrategy,DevelopingEntrepreneurialstrategy,Strategydevelopmentframework,RiskManagementinInnovation,Planningandentrepreneurialriskperception
Innovationsthroughindividualsandteamstomeetcustomerdemands,entrepreneurial behaviorsforindividualsand teamstoidentify and exploit opportunities, integration of entrepreneurshipandmarketingformarket orientedandcustomerfocusedinnovations

Course Code: MFM919 **Course Title: Corporate Tax Planning**

Course Type: Elective-Finance

Credit: 2 **(L-2 T-0 P-0)=30 lectures**

UNIT-1

Nature and Scope of Tax Planning: Nature, Objectives of Tax Management, Tax Planning, Tax Avoidance &Tax Evasion, Assessment Year, Previous Year, Assessee – types, Residential status, Non-resident Indians.

Tax on Individual Income – Computation of tax under the heads of Salaries, Income from House Property, Profits & Gains of Business, Capital Gains& Income from Other Sources. Tax deductible at source, Equity and firm valuation.

UNIT-2

Corporate Income Tax: Tax concessions and incentives for corporate decisions. Tax planning for depreciation; Treatment of losses &unabsorbed items; Carry forward and set off losses

UNIT-3

Overview of Goods and Service Tax, Implementation of GST, Liability of Tax Payer, Levy of Exemption from Tax & Registration

UNIT-4

Levy of GST, Remission of Tax, Registration Procedure.

Course Code: MFM920 Course Title: Financial Markets and Services

Course Type: Elective-Finance

Credit:2 (L-2 T-0 P-0)=30 lectures

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

FinancialSystem-Introduction,Featuresof IndianFinancialSystem,Developments Components,CapitalMarket,MoneyMarket,TypesandFeaturesofInstruments,FEMA.

Banking Services-Types of Banking Institutions, Regulatory Framework and Calculation of EMI, Provision for NPA, Credit Principles, KYC, Basel Norms and Recent Developments in Banking System

UNIT-2

Non-Banking Financial Companies-Role of NBFCs in Economic Development, Objectives, Functioning, Regulations and Recent Developments.

UNIT-3

Life Insurance and General Insurance: Features, Policies, Role and Development of Insurance Sector, Insurance Sector in India, Mutual Funds.

UNIT-4

Financial Markets-Concepts, Nature,Features,Functions,StructureTypes,Role of Financial Markets in Economic Development, New Issue Markets, Underwriting, Arrangements and Recent Developments,SEBI Guidelines,SecondaryMarkets- Nature Features, Functions, Role of Stock Markets, Stock Exchanges, Recent Developments and SEBI Guidelines.

Course Code: MFM921 Course Title: Working Capital Management

Course Type: Elective-Finance

Credit:2 (L-2 T-0 P-0)=30 lectures

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

Introduction, meaning, concepts, classification and importanceof working capital, Objectives of WCM. Over-capitalisation, undercapitalisation, zero working capital, Short-term vs longtermfinancing-Ariskreturntrade-

off.Liquidityvsprofitabilitytrade-off.Working capital approaches. Factors determining working capital requirements, Assessment and forecasting of working capital requirements, Operatingcycle.

Management of Inventory. Relevance and scope, Deciding theoptimum level of inventory in a firm, Purpose and benefits of holding inventory. Risk and cost of holding inventory, Inventory management - tools, techniques, Inventory management models. Determining stock levels and safety stocks, Inventory strategies & techniques

UNIT-2

Management of Accounts Receivables, Motives of extending credit, Determining maximum length of credit period, Credit terms, opportunity costs, receivables at cost or saleprice, Goals and functions of ARs management, changes in credit policy

UNIT-3

Cash management-meaning and concept statements analysis. Cash vs profit.Cash flow presentation as per IFRS, Management of liquidity-Shiftability theory, Liquidity newly defined, liquidity crises 7 firm level action, Measurement of liquidity, Window dressing, Certainty model by Baumol,Uncertainty model by Miller & Orr, Cash flow forecasting, Cash collection system

UNIT-4

Management of Accounts Payables, Trade credits-terms of purchase, stretching accounts payables, Cost of Stretching, The model of cost of stretching APs, Overtrading and the need of a good information system, Financing Working Capital Gap, Sources of working capital finance, Bank finance, Tandon and Chore committees on Bank finance, Other sources of working capital finance and deciding a suitable mix.

Course Code: MMK922 Course Title: Consumer Behaviour

Course Type: Elective-Marketing

Credit:2 (L-2 T-0 P-0)=30 lectures

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

IntroductiontoConsumerBehavior:

Definition, Nature and Scope of Consumer Behavior, Customer Satisfaction, Customer Loyalty,CustomerRetention,ConsumerResearch.ConsumerDecisionMaking– Factorsinfluencingconsumption decisions, Process and Models of Consumer Decision Making.

UNIT-2

Micro Influences on Consumption:

Needs, Motives & Consumption-Needs and goals,Theoriesof Motivation.Personality-Nature and TheoriesofPersonality,Behavioraltraitsofconsumers,Self-conceptandconsumption,BrandPersonality,RoleofEmotions.ConsumerPerception–

ProcessofPerception,PerceivedQuality,PerceivedRisk.Consumer Learning – Elements of learning, Theories of Learning, Consumer Involvement Consumer Attitude–Attitude formation, Models of consumer attitude formation

UNIT-3

MacroInfluencesonConsumption:
Social Influences on Consumer Behavior – Consumer socialization, Family and life cycle. Reference group, Consumption related Reference Groups, Factors Affecting Reference Group Influence.Word of mouth, Opinion leadership, Social classes

UNIT-4

Cultural Influences on Consumer Behavior - Culture and Subcultures, Indian Core Values, Measuring Cultural Values, Influence of Culture on Consumer Behavior.

Course Code: MMK923 **Course Title: Marketing Research**

Course Type: Elective-Marketing

Credit:2 **(L-2 T-0 P-0)=30 lectures**

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

Introduction: Importance, Scope and Limitations, Types of Research, Planning and Designing Research, Methods of DataCollection,DataPreparation-Validation,Editing,Coding,Tabulation and Cross Tabulation of Data, Data Analysis andInterpretation,HypothesisTesting,UnivariateandVicariateDataAnalysis.Multivariate Data Analysis.

UNIT-2

Sampling and Questionnaire Design and Construction:Introduction to Sampling, Sampling Process, Sampling Techniques–Probabilistic and non-probabilistic, Sampling Designs, Sample Size, Application of Sampling, Steps involved in Questionnaire Construction, Questionnaire Designs, Attitude Measurement, Types of Scales for Attitude Measurement

UNIT-3

Application of Marketing Research: Product Research, Utility of Market Research to Brand Positioning and Market Segmentation Analysis, Distribution Research, Advertising and sales Promotion Research, Sales Control Research and Strategic Planning.

UNIT-4

Presentation and Follow Up:Role of the Report, Type of Reports, Contents of the reports, Personal Presentation of the Report, Follow up.

Organization of Marketing Research Department: Marketing Research Agencies, Types and Functions of Marketing Research Agencies and Ethical Issues of Marketing Research

Course Code: MMK924 **Course Title: Advertising & Brand Management**

Course Type: Elective-Marketing

Credit:2 **(L-2 T-0 P-0)=30 lectures**

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

Advertising: Concept,types and objectives of advertising, social, ethical and economic aspects of advertising DAGMAR Approach, Hierarchy-of-Effects Model.
Advertising budgets: Factors influencing budgeting decisions,methods of budgeting Advertising Agencies: types, services of AdAgenciesCreativity:Importanceofcreativity,creativityprocessCreativityImplementationandEvaluation:Advertising appeals,Execution styles Creative Strategy Development:Ad campaigns,Creative brief,major selling ideas Creative tactics:In print and electronic media

UNIT-2

Marketanalysis:Analysis of market,Company's marketing strategy,Creative strategy Establishing Media objectives Developing and Implementing Media strategies:The Media Mix,Target Market Coverage, Geographic Coverage, Scheduling, creative aspects, Reach and Frequency, flexibility, budget considerations Evaluation of Media:Merits and demerits of Broadcast,Print and SupportMedia

UNIT-3

Definition and benefits of branding, Inputs for branding, Model(DavidAker's)to develop brand strategy, Brand management process.

BrandPositioning:Definition and importance of positioning.Positioning Strategy:Targetmarket, Defining competition, Establishing Points of difference and Points of parity, Updating positioning over time. Brand Equity: Meaning ,Relevance of brand equity to business,
Brand elements to build brand equity.Designing marketing programme (Product,Price,Distribution channel and IMC strategy to build brand equity

UNIT-4

Brand Portfolio: Meaning and Objectives of portfolio, Developing portfolio, Challenges in brand portfolio management.
Brand Architecture:Models of brand architecture, Developing brand architecture, Indicators of brand architecture issues. Product and Brand Extensions:Advantages of Extensions, Disadvantages of BrandExtensions,Brand Extension Guidelines Leveraging Secondary Brand Associations: Company, Country of origin, Channels of Distribution, Co-Branding, Licensing, CelebrityEndorsement, Events.

Course Code: MHR925 Course Title: Learning and Development

Course Type: Elective-Human Resources

Credit: 2 (L-2 T-0 P-0)=30 lectures

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

Introduction: Concept and key components of Learning and Development – Overview of Training and Development systems –The forces influencing working and learning – Linking Training &Development to company's strategy–Requisites of effective training. Strategic Training: Evolution of Training – Learning as a strategic focus–Strategic Training & Development process–Organizational characteristics that influence training. Training Needs Assessment (TNA): Purpose of TNA – Training need assessment at different levels– Approaches to TNA–Training need assessment methods.

UNIT-2

Learning and Transfer of Training: Concept of Learning – Learning Theories – Learning Process – Instructional emphasis for learning. Program Design: Considerations in designing effective training programs –Curriculum course, and lessons design– program design implications for transfer of training – using knowledge management for learning and transfer of training

UNIT-3

Training and Development Methods: Traditional Training methods –Technology based training methods. The Trainer: Roles and competencies of Trainer. Evaluation of Training: Rationale for Evaluation–Training outcomes–Types of Evaluation Techniques & KirkPatrick model of evaluation – CIRO model – ROI of training Instruments–Costing Training Programmes–Measuring ROI of training programmes

UNIT-4

The Future of Training & Development: Training for Sustainability –Increased use of new technology for training delivery–Capturing and sharing intellectual capital and social learning – Just-in-time learning and performance support–Increased Emphasis on Performance Analysis:Big Data and learning for business enhancement–Stake holder focused learning–Training partnership and outsourcing.

Course Code: MHR926 Course Title: Strategic Human Resource Management

Course Type: Elective-Human Resources

Credit: 2 (L-2 T-0 P-0)=30 lectures

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

Strategic Human Resource Management–Concept and Aims of Strategic Human Resource Management – Models of Strategic HRM –Strategic HRM: Best Fit and Best Practice – Strategic HRM and the ResourceBased view of the firm– Strategic role of HR function.

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:Functional Strategic Human Resource Strategies-Employee resourcing strategy, Strategies for Managing Performance, Strategic Human Resource Development, Reward and Compensation Strategy, Employee.

UNIT-2

Strategic HRM and Strategic Change- Strategic HR issues and role of HR in the context of Change, Culture Management, Total Quality Management, Knowledge Management, Merger and Acquisition

UNIT-3

Evaluating and Measuring the Impact of Strategic HRM–Overview and Approaches–Quantitative and Qualitative Criteria–Balanced Score card and HR Scorecard Perspective Benchmarking etc–Evaluating strategic Contributions of Traditional HR Areas- Strategic contribution of HRM to organizational success– High Performance Work Practices(HPWP)

UNIT-4

Human Resource Strategy and the Dynamics of industry-based Competition–Strategic HRM for specific business situations- Talent Management, Knowledge Management with special reference to HRM practice in Knowledge Based Industry—Strategic HR issues vis-à-vis Emerging Organizational Forms

Course Code: MHR927 Course Title: Leadership Skills and Practices

Course Type: Elective-Human Resources

Credit: 2 (L-2 T-0 P-0)=30 lectures

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

Introduction to leadership, the crucial role of leadership, different Roles of a leader,, Leadership theory paradigms, levels of analysis of leadership, Leadership traits, Big-5 model and leadership, derailed leaders, effective leaders, Achievement Motivation theory, Leader Motive Profile, Pygmalion effect, Ethical leadership

UNIT-2

Leadership Behavior& styles-Michigan & Iowa, Leadership Grid, Contingency theory-Fiedler model, Hersey Blanchard SLT, Leadership Continuum theory, Normative theory, Leadership substitute theory.

UNIT-3

Team Leadership-Vertical Dyad Linkage theory, LMX theory, Followership, Delegation, Self Managed Teams, Ginnet's Team effectiveness Model, Fundamentals of Networking, Negotiation, Coaching as a Leader, Leader conflict Management Charismatic and transformational leadership, stewardship, servant leadership, Resonant Leadership-work of Goleman, boyatzis, etc

UNIT-4

Crisis leadership, Leading Change, Selected Profiles of Top leaders from Industry and Polity

Course Code: MOS928 Course Title: Supply Chain Technology and Systems

Course Type: Elective-Operations and Supply Chain Management

Credit: 2 (L-2 T-0 P-0)=30 lectures

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

LogisticsTechnologyOverview&Strategy;ProjectManagement,NetworkModeling& Optimization

ERP&E-Commerce Systems, Warehouse Technology, Automation,Transportation Technology, Supply chain performance measurement, Supplier Relationship Management Product Development and Commercialization, Returns Management

UNIT-2

Manufacturing Systems & Technology, Manufacturing Flow Management, CRM Systems & Data, Customer Service Management Demand Management, Developing and implementing Technological partnerships in Logistics and Supply Chain Technology and Systems

UNIT-3

Developing and Implementing Partnerships in the Supply Chain, Supply Chain Performance Measurement, Electronically Linking the Supply Chain

UNIT-4

The Future of Logistics Technology: Supply Chain Mapping, Software Selection/Implementation and Technology Trends, Technology in logistics Technology, Implementing supply chain management, Supply Chain Information Systems, Supply Chain Management – Future Directions

Course Code: MOS929 Course Title: Fundamentals of Supply Chain Management And Logistics Management

Course Type: Elective-Operations and Supply Chain Management

Credit: 2 (L-2 T-0 P-0)=30 lectures

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

Role of Logistics and Supply Chain Management in the Economy and Organisation:Logistics and supply chain concepts and models; Global logistics environment; Hong Kong logistics environment; Role of logistics in the economy; Supply chain relationships. Third-party and fourth-party logistics providers; Outsourcing.

UNIT-2

Transportation and Inventory Management: Importance of transport in the economy; Factors affecting transport costs and pricing; Integrated transport modes(air/sea/road/rail/pipeline); Containerization; Modal choice Procurement Management: Role and function of procurement; Procurement strategies; E-procurement. Elements of customer demand and services; Factors affecting level of customer service; Order fulfillment process.

UNIT-3

Material Handling and Storage: Objectives and principles of material handling; Types of material handling equipment; Role of packing. . Reasons for holding inventory; Inventory costs; Inventory strategies; Role and functions of warehousing; Types of warehouses: factors affecting type, size and number of warehouses.

UNIT-4

Information Technologies in Global Logistics and Supply Chain Management: Importance of information in supply chains; Role of information technologies in supply chains; E-logistics; RFID and Bar code technologies.

Course Code: MOS930 Course Title: Service Operations Management

Course Type: Elective-Operations and Supply Chain Management

Credit: 2 (L-2 T-0 P-0)=30 lectures

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

Understanding The Nature Of Services and Service Operations:-Introduction and imperatives of services, Nature and characteristics of services, Classification of services and analyzing service operations, Forecasting Demand In Services

Aligning Service Strategy And Service Competitiveness: Introduction to Service Strategy, Competitive Service Strategies, Strategic Service Vision, New service design and development, Service system design and delivery process, Smoothing Customer Demand In Services

UNIT-2

Technology & automation in services, Service encounter, Human resource planning & employee selection, managing people in Services organization, Work measurement in Services, Service Capacity Management

UNIT-3

Service Quality: Defining Service Quality, - Quality Service by Design, Service process control, Total quality management tools, Quality philosophy and performance excellence,-Service recovery and Service guarantee,-Resource and Workforce Scheduling in Services

UNIT-4

Service facility design: Process analysis of facility layouts, Facility location decision factors, - Quantitative models for facility location: Service facility on a line or on a plane, -Quantitative models for facility location: Based on different objective functions of optimization criteria, Quantitative models for multiple service facilities

MBA-IV SEMESTER

Course Code: MBA-1033 **Course Title: Business Analytics**

Course Type: Compulsory

Credit: 4 **(L-3 T-1 P-0)=45 lectures**

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

Exploring Data Analysis: Introduction, Data Types; Data Visualization ,Process of Business Analytics; Tools for Analytical Process; Role of Analytics Team; Types of Analytics; Descriptive Analytics; Predictive Analytics; Prescriptive Analytics; Applications and Usage of Descriptive and Predictive Analytics in Business Operations

UNIT-2

News vendor Problem; Forecasting using Historical Demand Data;Predictive Analytics,Risk and Decision making in uncertainty: using optimization models, Simulation Models; Prescriptive Analytics, High Uncertainty: using Decision Trees

UNIT-3

Introduction to People Analytics, and Performance Evaluation; basic principles of people analytics; Analytics for Staffing cycle; tools and techniques of organizational network analysis; Talent Analytics: Data usage and analytics for talent assessment and maximizing the employability

UNIT-4

Supply Chain Overview; Models; Domains in a Supply Chain; Sell Analytics;Logistics Analytics; Make Analytics; Source Analytics; Cash Cycle to Measure Supply Chain Efficiency

Course Code:MFM-1031 **Course Title: International Financial Management**

Course Type: Elective-Finance

Credit: 2 **(L-2 T-0 P-0)=30 lectures**

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

International Finance: Finance function in a global context, global financial markets, International Monetary System- Introduction to IDR-Sovereign Risk. International Financial Environment – IMF -SDR–EMU–CAD (BOP)

UNIT-2

Foreign Exchange Market: Structure, mechanism of currency trading, exchange rate quotations, forward contracts, interest arbitrage, exchange rate regimes and the foreign exchange market in India (Numerical Problems)

UNIT-3

Management of Currency Exposure: Measurement of exposure and risk, managing transaction exposure, operating exposure, short-term financial management in multinational corporation (Numerical Problems). Currency Derivatives –Netting–forfeiting.

UNIT-4

International Financing Decision: Evaluating borrowing options, funding avenues in global corporate markets, international equity financing, introduction to ADRs, GDRs, Private Equity, understanding International transferring. International Capital Structure, International Portfolio

International Project appraisal: Problems and issues in foreign investment analysis, methods of Capital Budgeting, NPV and APV methods (Numerical Problems).

Course Code:MFM-1032 Course Title: Security Analysis and Portfolio Management

Course Type: Elective-Finance

Credit: 2 (L-2 T-0 P-0)=30 lectures

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

Concept and Objectives of Investment, Types of Securities and Avenues for Investment, Investment Management Process, Risk and Its Measurement, Relationship between Risk and Return, Valuation of Securities, Equity Shares, Preference Shares and Bonds, Term Structure of Interest rates, Mutual Funds, Hedge Funds. Value at Risk (VaR).

UNIT-2

Efficient Market Hypothesis, Testing for Market Efficiency, Economic & Industry Analysis, Company Analysis, Fundamental and Technical Analysis, Volatility and Its Measurement. Portfolio Theory– Diversification and Optimal Portfolios, International Portfolios

UNIT-3

Capital Asset Pricing Models, Factors Models, Arbitrage Pricing Theory. Measuring Portfolio Performance. Bond Portfolio Management and Interest Immunization, Foundations of Behavioural Finance, Prospect Theory, Market Anomalies, High Frequency Trading, Algorithmic Trading.

UNIT-4

Derivatives: Instruments, markets and regulation, Management of Portfolio of derivative securities, Hedging using options and futures contracts. Pricing models – Binomial model, Black-Scholes model; Option Trading Strategies, Application of swaps. Financial Modelling on R Studio.

Course Code: M1033 **Course Title: Financial Derivatives Course**
Type: Elective-Finance

Credit: 2 **(L-2 T-0 P-0)=30 lectures**

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

Introduction of Financial Derivatives -types of derivatives-Trading mechanism and contracts of the main Financial Derivatives instruments: Clearing and settlement of trades, margin trading.
Forwards and Futures trading and differences between them: Trading in Forwards, Futures: theory, pricing and hedging strategies for foreign exchange, short and long-term interest rate and Index Futures.

UNIT-2

Options Market: Trading and hedging using Options; equity Options; Options vs. Futures. Option pricing using Black-Scholes Model and Binomial Analysis; Options on Stock Indices and currency; Option Greeks; Exotic Options (Numerical Problems)

UNIT-3

Options trading Strategies - Spreads (Bull Spreads, Bear Spreads and Butterfly Spreads) - Combinations (Straddles, Strangles, Strips and Straps)

UNIT-4

Swaps Markets: Structure, currency, interest-rate, equity and commodity Swaps- pricing of swaps - pricing simulations. (N.P. –Numerical Problems)

Course Code: MMK-1036 **Course Title: Services Marketing**

Course Type: Elective-Marketing

Credit: 2 **(L-2 T-0 P-0)=30 lectures**

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

Understanding Services: Introduction - meaning of service concepts, nature and scope of services, marketing of services versus physical goods, growth of services sector in India, Classification of services. Customer involvement in service process and managing service encounters.

UNIT-2

Services Marketing: The distinguishing key characteristics of services, Consumer behavior in services. Services marketing mix - Product, Pricing, Place, Promotion, People, Physical Evidence and Process.-Service triangle-Segmenting, Targeting and positioning for services marketing

UNIT-3

Role of Quality in Service – Service Quality management, Dimensions of service quality, – gap model - SERVQUAL –demand management services strategies–service blue printing - Service failures and Recovery strategies, etc.

UNIT-4

Overview of Strategies for Services marketing-strategies to deal with intangibility, inventory inconsistency and inseparability of Services.

Contemporary issues in service marketing-Current trends in services marketing.

E-commerce and e-marketing–e-CRM-Innovations in services marketing- self-service technologies-Marketing of varied services.

Course Code: MMK1037 **Course Title: International & Rural Marketing**

Course Type: Elective-Marketing

Credit: 2 **(L-2 T-0 P-0)=30 lectures**

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

Introduction to globalization and marketing across borders; global trade and marketing; Drivers of globalization; Multinational corporations; Analysis of International Marketing Environment and Identifying Foreign Markets-Political Considerations and Governmental Influences; Cultural and Social Dynamics; Economic Development and Geographical Conditions Competitive Conditions; Legal and Financial Influences, Trade theories. International Marketing Research, Cross Cultural Behavior, Emic and Etic Approach, Hofstede's Cultural Classification, Trompenaar's Cultural Classification, International Trade Patterns

UNIT-2

Identification of International Markets, Segmentation of International Markets, Methods of International Markets Evaluation. Entry Mode Decisions, Various Modes of Entry in International Markets: Exports (Direct and Indirect, Piggybacking, International Licensing, Franchising and Leasing, International Strategic Alliances and Management Contracts, Overseas Turnkey Projects, International JV's, Wholly Owned Foreign Subsidiaries. Factors affecting selection of Entry Modes.

UNIT-3

Introduction-Definition, Scope of Rural Marketing, Concepts, Components of Rural Markets, Rural versus Urban Markets, Rural Market in India–size and scope, Factors contributing to Growth of Rural Markets.

UNIT-4

Rural Consumer behavior- Characteristics of rural consumers, Occupation and Income, Economic circumstances, Lifestyle, Consumer buying behaviour models, Factors affecting Rural Consumer Behaviour, Consumer Buying Process. Rural Marketing Environment- Rural Environment, Occupation Pattern, Expenditure Pattern, Rural Demand and Consumption Pattern, Rural Markets- Segmentation, Targeting and Positioning strategies, Four A's of Rural Marketing Mix

Course Code: MMK1038 Course Title: Sales, Distribution, &Retail Management

Course Type: Elective-Marketing

Credit: 2 (L-2 T-0 P-0)=30 lectures

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

Role and Importance of Sales Management, Types of Personal Selling, The Sales Management Process, Emerging Trends in Sales Management, Selling and Buying Styles, Selling Skills, Stages in the Selling Process, The Process & Methods of Prospecting, Pre-Approach & Approach Process, Methods of Sales Presentation, Handling Customer Objections, Closing the Sale and Follow Up. Organizing, Staffing and Training sales force: Sales organization structures recruiting and selecting sales people, planning, executing and evaluating sales training programs. Directing Sales Force Operations: motivating sales personnel, compensating sales people, sales meetings and contests, sales quotas and sales territories

UNIT-2

Evaluating and Controlling the Sales Effort: The sales budget, analysis of sales volume and profitability and evaluating salesperson's performance.
Distribution Management:-Role of Distribution Channel, Distribution Channel Strategy, Channel Design Process, Classification Schemes of Channel Flows, Channel Establishment Plan, Company Channel Design. Channel Information System-Role and Benefits, Components of Channel Information System, Designing a Channel Information System, Channel Conflict, Conflict Resolution Mechanism, Strategies of Channel Influence

UNIT-3

Introduction to Retailing – Concept, Nature and Scope, Functions, Economic Significance of Retailing, Retail Mix, The Retailing environment in India, Types of Retailers–Retail Formats, Theories
Of Retail Development,The Retail Life Cycle. The Retail Strategy: Retail Market Strategy, Financial Strategy, Human Resource Management, inventory management, Information Systems and Supply Chain Management. Retail Location-Levels of Location Decision, Trading-Area analysis, Factors Affecting the Attractiveness of a Site.

UNIT-4

Merchandise Management: Managing Merchandise Assortments, Merchandise Planning Systems, Buying Merchandise, Concept of the Private Label, National brands or Private labels, Retail Pricing. Store Layout - Objective of Store Layout, Types of Store Layout, Space Management, Fixtures, Flooring & Ceiling, Lighting, Color, Signage, Music, Scent. Category Management – Concept, Role of the Category Captain, Category Management Business Process, Assortment Planning Process

Course Code: MHR-1041 **Course Title: Performance Management**

Course Type: Elective-Human Resources

Credit: 2 **(L-2 T-0 P-0)=30 lectures**

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

PM-Concept, values, factors affecting performance, objectives, principles and characteristics of PM , PM cycle, performance measures, psychological contract, comparison of MBO, Performance appraisal and PM

Performance and development planning, Managing under performance–approach, mechanism, capability procedure, Feedback-nature, use, effective feedback-guidelines

UNIT-2

360 degree feedback-effectiveness, pros and cons, coaching-process, approach, techniques, skills, self awareness

UNIT-3

PMS in select organizations, rating less appraisals, PMS –from systems to spiritual approach, Astra Zeneca, BHEL, NTPC, DHL –PMS

UNIT-4

Impact of PMS on firm performance, Competency mapping, An introduction to talent management, developing a high performance culture.

Course Code: MHR-1042 **Course Title: Cross-Cultural Management**

Course Type: Elective- Human Resources

Credit: 2 **(L-2 T-0 P-0)=30 lectures**

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

Meaning, Importance, features of culture, Dimensions-Different culture dimension model-Hofstede Model, Kluckhohn and Strodbeck value orientation model, Globe Model, Edward Hall model, Trompenaars model , role of culture in international Business Diversity at work, Reasons for cultural and behavioural differences Diversity and inclusion: Culture and diversity, Ensuring cultural diversity and its importance, Barriers to cultural diversity.

UNIT-2

Cross cultural communication-Meaning, Factors affecting cross cultural communication, making cross cultural communication effective Cross culture management:-Challenging role of Managers in cross culture management

Mapping cross-cultural differences, Cross cultural influence and Technology, Culture and styles of Management, Conflicts and cultural differences, Managing Cross Cultural Teams, Culture and Leadership.

UNIT-3

IHRM-Meaning, Model of IHRM, Dimension of IHRM, features of IHRM–international recruitment and selection, Domestic HRM vs.IHRM

Key HR Challenges facing organizations working internationally. Expatriates (International Adjustment), Expatriation & Repatriation Management.

UNIT-4

Challenges faced by global manager, Women as International manager, Role of ethics in cross cultural management

Culture in India, Japan, China and US, International Assignment and Expatriate management

Course Code: MHR1043 **Course Title: Industrial and Labour Legislation**

Course Type: Elective-Human Resources

Credit: 2 **(L-2 T-0 P-0)=30 lectures**

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

The Factories Act, 1948: Approval, Licensing and Registration-Inspecting Staff –Health–Welfare Working Hours–Annual Leave with wages–Periodical Returns-Registers and Records

The Minimum Wages Act, 1948: Fixing of Minimum Rates of Wages–Minimum Rates of Wages–Procedure for Fixing and Revising Minimum Wages –Advisory Boards and Committees – Wages in Kind –Wages for worker who works for less than normal working day–Wages for two or more classes of work–Minimum time rate wages for piece rate work–Maintenance of Registers and Records.

UNIT-2

Employees State Insurance Act,1948 – Objectives, definitions –personal injury, wages, partial and permanent disablement, Administration – Corporation, Standing committee and Medical benefit council, finance and audit, contributions, benefits and penalties.

Employees Provident Fund and Miscellaneous provisions Act,1952–Objectives, Definitions, Central board, State board, Executive committee, Board of trustees, Contribution to the scheme, employees provident fund scheme, Employee pension scheme, appeals to the EPF appellate tribunals, recovery officer, penalties.

MaternityBenefitAct,1961–Objectives and benefits, provisions related to employment of or work by women during certain periods, right to payment of maternity benefits, notice of claim of maternity benefit and payments, leave, dismissal in absence during pregnancy, forfeiture of maternity benefits. Purpose and special features of the Code on Social Security, 2020.

UNIT-3

Workmen Compensation Act, 1923 – Objectives and application, Definitions – dependent, employer, partial and total disablement, workman injury,accident provisions regarding Employer's liability, amount of compensation and its computation, compensation distribution, notice and claims, procedures before authorities–Commissioners.

Payment of Wages Act,1936 – Objective, scope and application, definitions, provisions relating to responsibility for fixation of pay, fixation of wage periods ,deductions from wages, remedies available to worker, power of authorities, penalty for offences.

UNIT-4

Payment of Bonus Act, 1965: Objective, scope and application, definitions, provisions relating to computation of bonus, eligibility and disqualifications for bonus, minimum and maximum amount of bonus, set-on and set-off of allocable surplus as bonus, bonus linked with productivity or production.

Equal Remuneration Act, 1976: Application, provisions related to payment of remuneration at equal rates to men and women, register to be maintained, role of inspectors, Central Advisory Committee – composition, term of office, cessation of membership, Penalties PurposeandspecialfeaturesofTheCodeonWages,2019.

Course Code: MOS-1046 Course Title: Applied Operations Research and Supply Chain Analytics

Course Type: Elective-Operations and Supply Chain Management

Credit: 2 (L-2 T-0 P-0)=30 lectures

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

Definition & scope of Operational Research, Formulation of simple Linear Programming Problems, Simplex method and basics of Duality. Characteristics of Inventory System, Simple Economic Lot Size Inventory models, Reorder Level, Simple single period Stochastic Inventory Model.

Definition of Queues and their characteristics, Queueing Models with Markovian Input and Markovian Service, M/M/1&M/M/C Queueing Models. Definitions of Reliability, Availability, Reliability of multi components systems, failure time distributions: exponential and Weibull.

UNIT-2

Context of today's supply chains (SC) analytics, Understanding and defining the supply chain analytics (SCA), Revisions of Basic Lessons of Supply Chain Management, Why is Analytics Important in a supply chain?, Relating Operations Management with Supply chain concepts with SC Analytics, The importance of supply chain analytics in the flows involving material, money, information and ownership

UNIT-3

Supply chain analytics: Key issues in supply chain analytics, What involves in supply chain analytics, Concept of Descriptive Analytics in a Supply Chain Discussion on a Few Supply Chains Analytics applications in India (students participation is expected), Decision Domains in supply chain analytics

UNIT-4

Business Analytics (BA) in Supply Chain Management: Introduction to Modeling, Approaches for Optimization and Simulation, Modeling software, Supply Chain (SC) Decisions that requires mathematical or interpretative modeling, Understanding of Data and its role in Analytics Analytics of a Transportation problem in a SupplyChain, Managerial implication of results of analytics, Modeling Coordination Decisions, Performance Management in Supply Chain Management, IT Management in Supply chain management

Course Code: MOS1047 **Course Title: World Class Manufacturing**

Course Type: Elective-Operations and Supply Chain Management

Credit: 2 **(L-2 T-0 P-0)=30 lectures**

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

World Class Manufacturing Environment, Imperatives for success, System approach and change in mind set, Strategic decisions in Manufacturing Management, Choice of technology, Capacity and layouts, Automation in Materials handling system.

Multilocational Business, Managerial attitude towards globalisation of business, Entering the international area, Managerial challenges for the future.

UNIT-2

Principles advocated in Just-in-Time System, JIT Manufacturing System, JIT Pull System, Use of Kanban System, JIT Purchase, Source development, Supply chain Management, Total quality Management Philosophy, TQM Principles, TQM Tools, Quality through design, Quality Management System and ISO 9000, QS9000etc.

UNIT-3

Total productive Maintenance, Concept of reliability, reliability improvement, Concept of maintainability and Maintainability improvement, Software in use, Problems in implementation, Indian experience, optimised production technology

UNIT-4

Automation in Design and Manufacturing, Role of IT in World class Manufacturing, Concept of Flexible Manufacturing System, Group technology, Cellular Manufacturing Systems, Environment Pollution, Factors causing Pollution, Effect on human health, Control of environment Pollution.

Course Code: MOS1048 Course Title: Strategic Operations and Supply Chain Management

Course Type: Elective-Operations and Supply Chain Management

Credit: 2 (L-2 T-0 P-0)=30 lectures

Evaluation: 20(sessional) + 30 (midterm) + 50 (end term)

UNIT-1

Operations and Supply Chain Planning: Demand Forecasting, Capacity Planning, Capacity Requirement, Facility Location, Facility Layout, Resource Aggregate Planning, Material Requirements Planning, Manufacturing Resource Planning, Enterprise Resource Planning, Economic Batch Quantity

Designing of Operational System and Control: Production Design, Process Design & Selection, Process Planning, Product Life Cycle, Process Selection

UNIT-2

Production Planning and Control: Production Planning and Control Introduction, Time Study, Work Study, Method Study &Job Evaluation, Measurement Techniques of Productivity Index, TQM Basic Tools and Certification, ISO Standard Basics

UNIT-3

Break Down Maintenance, Preventive Maintenance, Routine Maintenance, Replacement of Machine, Spare Parts Management

UNIT-4

Strategic Analysis and Strategic Planning for Manufacturing and Service Setups, Strategy Formulation Function-wise (Production Strategy, Marketing Strategy, Manpower Strategy etc.), Structuring of Organization for Implementation of Strategy, Strategic Business Unit, Business Process Re-engineering

Proposed Syllabus and Scheme of Examination

for

Four Year Undergraduate (Biological Sciences)

Exit options

One Year Undergraduate Certificate in Biological Sciences

Two Year Undergraduate Diploma in Biological Sciences

Three Year B.Sc. (Hons) in Biological Sciences

Four Year B.Sc. (Hons. with Research) in Biological Sciences

SCHOOL OF BIOLOGICAL SCIENCES,
DOON UNIVERSITY, DEHRADUN-248001, UTTARAKHAND

DISCIPLINE SPECIFIC COURSES

Course Code	**:**	**BSC101**
Course Title	**:**	**Chemistry – I (Basic concepts of Organic Chemistry)**
Total Credits	**:**	**4 (Theory 3; Practical 1)**
L-T-P	**:**	**3-0-1**
Total Hours	**:**	**Theory 45; Practical 30**
Semester	**:**	**I**

Course Content (Chemistry – I)

Unit I: Aqueous Solutions and Concentrations

Water, pH and buffers, concept of pKa (titration curves of amino acids), Henderson-Hasselbach equation, buffering zone, buffer index, concept of pI and zwitter ion.

Concentrations (percentage composition, molarity, molality, normality, mole fraction and parts per million).

Unit II: Concept of Acids and Bases.

Arrhenius concept, Bronsted Lowry concept, Lewis's concept, the levelling effect, effect of pH on the structure of biomolecules.

Unit III: Chemical Bonding and Molecular Forces

Introduction to ionic interactions and covalent bond, inter-molecular and intra-molecular forces, types of intermolecular forces and their characteristics: ion-dipole, dipole-dipole, dipole-induced dipole, and dispersion (London) forces, hydrogen bond (intra-molecular and inter-molecular), effect of inter/intra-molecular forces on structure of different biomolecules.

Unit IV Stereochemistry

Stereochemistry and its importance. Geometrical isomerism, cis-trans and E/Z nomenclature Optical isomerism – optical activity, plane polarized light, enantiomerism, chirality, specific molar rotation, Stereoisomerism with two chiral centers: Diastereomers, mesoisomers, Resolution of racemic modification. Projection diagrams of stereoisomers: Fischer, Newman, and Sawhorse projections. Relative Configuration: D/L designation. Absolute Configuration: R/S designation of chiral centres, Conformational isomerism – ethane, butane and cyclohexane, diagrams, and relative stability of conformers.

List of Experiments (Chemistry – I)

Practical

1. Preparation of solutions based on molarity, normality, percentage, dilutions etc.
2. Preparation of buffers.
3. Estimation of Mohr's salt/ oxalic acid by titrating with $KMNO_4$.
4. Estimation of Cu (II) ions iodometrically using $Na_2S_2O_3$.
5. To find pKa value of given acetic acid

Course Code	**:**	**BSC102**
Course Title	**:**	**Light and Life**
Total Credits	**:**	**4 (Theory 3; Practical 1)**
L-T-P	**:**	**3-0-1**
Total Hours	**:**	**Theory 45; Practical 30**
Semester	**:**	**I**

Course Content (Light and Life)

Unit I

Nature of light, spectrum of light which is useful/ harmful (ionizing radiation) for various biological processes in life of plants and animals. Unit of light energy (Photon, quantum), the different Photo Biological reactions. Measurement of light (Lux, Foot Candle). Comparative account of chemistry and functional roles of pigments associated with harvesting light energy: pigments/receptors of light, chlorophylls, caroteniods, phycobilinoproteins, bacteriochlorophylls, phytochromes rhodopsin etc. Photoreception in animals, evolution of eye and visual processing in vertebrate retina.

Unit II

Photosynthesis: History, Photosynthetic equation, Light and dark reactions, mechanism of photolysis of water and oxygen evolution, Q cycle, O_2 evolving complex; C_3, C_4, CAM plants, spectrum of photoautotrophs, photoautotroph vs photoheterotrophs; Photoautotroph vs. chemoautotroph, structure of chloroplast and quantasome, Anoxygenic and oxygenic photosynthesis, reaction centers. Bacterial Photosynthesis

Unit III

Bioluminescence: definition, discovery, diversity of organisms (plants and animals), photoreceptors - distribution, mechanism; General account of effect of light on morphology and physiology (stomatal opening and closing, transpiration, respiration, growth and differentiation) Phytochrome mediated photomorphogenesis phenomena - seed germination etc. Photoperiodism: LDP, SDP, DNP plants, vernalization, vernalin, etiolation and de- etiolation. Changes during fruit ripening process as affected by light.

Unit IV

Behavioural aspects of ecology and physiology: circadian rhythms, jetlag, rhythm of heart beat, melanocytes and skin colour, chromatophores and colour changes in animals. Light as an inducer for biosynthesis of enzymes, hormones and other biomolecules.

List of Experiments (Light and Life)

Practical

1. Demonstration of
   - (a) etiolation and de etiolation;
   - (b) Light and CO_2 are essential for photosynthesis (Moll's half leaf experiment) and measure oxygen evolution during photosynthesis
   - (c) Oxygen liberation during photosynthesis using *Hydrilla*, Measurement of light using Luxmeter, light penetration in water using Secchi dis*c*
   - (d) *Berles*e funnel experiment to demonstrate the effect of light on soil fauna

(e) Animal migration in aquatic ecosystems during day and night (pictures only) (f) To study the estrous cycle of rat

2. Chemical separation of chloroplast pigments/Chromatographic separation of chloroplast pigments.
3. Demonstration of Hill's reaction and study of the effect of light intensity (any two light conditions).
4. Study of the effect of red and blue light on seed germination and development of pigments during fruit ripening.
5. Photographs/slides/specimens of photoautotrophic and photosynthetic bacteria, chloroplast, quantasome, bioluminescent organisms (plants and animals)
6. To test / survey for colour blindness using Ishihara charts

Course Code	**:**	**BSC103**
Course Title	**:**	**Biodiversity**
Total Credits	**:**	**4 (Theory 3; Practical 1)**
L-T-P	**:**	**3-0-1**
Total Hours	**:**	**Theory 45; Practical 30**
Semester	**:**	**I**

Course Content (Biodiversity)

Unit I Defining Biodiversity

Components of Biodiversity. Biodiversity crisis and biodiversity loss. Importance of biodiversity in daily life. Biodiversity and climate change.

Unit II Ecosystem and Biodiversity

Types of Ecosystems: India as mega biodiversity Nation. Hot spots and biodiversity in India. Biodiversity and Ecosystem functioning. Plant and Animal systematic. Species concept in biodiversity studies.

Unit III Modern Tools and Techniques in Biodiversity Assessment

Endemism, endemic plants and animals**;** Assessment of mapping of biodiversity**;** GIS/Remote sensing**;** Biotechnology and Conservation, IUCN**;** Germplasm banks, National Parks, Botanical Gardens**;** Wildlife Sanctuaries, Bioresources, Biodiversity for ecological restoration

Unit IV Bio-prospecting

Representative type (one each) studies from Cryptogams, Phanerogams, Non-chordates and Chordates**;** Sacred flora and fauna. Bio-prospecting - Microorganisms as a source of novel enzymes, antibiotics, antiviral agents; Immunosuppressive agents and other therapeutic agents. Botanicals for Biocontrol, Health and biodiversity.

List of Experiments (Biodiversity)

Practical

1. Measuring biodiversity of ecological communities
2. Study of a simple ecosystem (suggested habitats: pond, river, estuarine, grassland, forest and desert) and description of the biotic and abiotic components of the ecosystem.
3. Study of five endangered plant species of India
4. Enlist the biodiversity of Localized area
5. Study of five endangered animal species of India

Course Code	**:**	**BSC151**
Course Title	**:**	**Chemistry – II (Physical Chemistry for Bioscience)**
Total Credits	**:**	**4 (Theory 3; Practical 1)**
L-T-P	**:**	**3-0-1**
Total Hours	**:**	**Theory 45; Practical 30**
Semester	**:**	**II**

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Course Content (Chemistry - II)

Unit I: Chemical Energetics

Review of the Laws of Thermodynamics.
Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formation, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data.
Variation of enthalpy of a reaction with temperature – Kirchhoff's equation.
Statement of Third Law of thermodynamics and calculation of absolute entropies of substances.

Unit II: Chemical Equilibrium

Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between ΔG and ΔG^{o}, Le Chatelier's principle. Relationships between Kp, Kc and Kx for reactions involving ideal gases.

Unit III: Chemical Kinetics

The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction. Derivation of integrated rate equations for zero and first order reactions. Half–life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation.

Unit 6: Photochemistry

Laws of photochemistry. Fluorescence and phosphorescence. Quantum efficiency and reasons for high and low quantum yields. Primary and secondary processes in photochemical reactions. Photochemical and thermal reactions.

List of Experiments (Chemistry - II)

Practical

1. Determination of heat capacity of a calorimeter for different volumes.
2. Determination of the enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
3. Determination of integral enthalpy of solution of salts (endothermic and exothermic).
4. Initial rate method: Iodide-persulphate reaction
5. Integrated rate method: (Acid hydrolysis of methyl acetate with hydrochloric acid; Saponification of ethyl acetate)
6. Study the kinetics of interaction of crystal violet with sodium hydroxide colourimetrically.

Course Code	**:**	**BSC152**
Course Title	**:**	**Biophysics**
Total Credits	**:**	**4 (Theory 3; Practical 1)**
L-T-P	**:**	**3-0-1**
Total Hours	**:**	**Theory 45; Practical 30**
Semester	**:**	**II**

Course Content (Biophysics)

Unit I Mechanics

Newton's Laws of motion. Dynamics of a system of particles, Conservation of momentum and energy, work energy theorem. Conservation of angular momentum, torque, Motion of a particle in central force field. Special Theory of Relativity: Constancy of speed of light, postulate of Special theory of relativity, length contraction, time dilation, relativistic velocity addition, Mass-energy momentum relations.

Unit II Waves and Oscillations

Fundamentals of waves and oscillation, Doppler effect, effects of vibrations in humans, physics of hearing, heartbeat. Modern optics: Two slit Interference, Diffraction, Resolving power, Resolution of the eye, Laser characteristics, Principle, Population inversion, Application of laser in medical science, Polarization of EM wave, Malus Law, Polarizing materials, Polarizer, Analyzer.

Unit III Biological membranes

Colloidal solution, Micelles, reverse micelles, bilayers, liposomes, phase transitions of lipids, active, passive and facilitated transport of solutes and ions, Fick's Laws, Nernst Planck Equations,

Diffusion, Osmosis, Donnan effect, permeability coefficient. Ionophores, transport equation, membrane potential, water potential.

Unit IV Spectroscopic techniques

Basic principles of electromagnetic radiation, energy, wavelength, wave numbers and frequency. Review of electronic structure of molecules (Molecular Orbital theory), absorption and emission spectra. Beer-Lambert law, light absorption and its transmittance. UV and visible spectrophotometry-principles, instrumentation and applications. fluorescence spectroscopy, static & dynamic quenching, energy transfer, fluorescent probes in the study of protein, nucleic acids, Infra-red spectroscopy, light scattering in biology, circular dichroism, optical rotatory dispersion, magnetic resonance spectroscopy.

List of Experiments (Biophysics)

Practical

1. Determination of acceleration due to gravity using Kater's Pendulum
2. Determination of the acceleration due to gravity using bar pendulum
3. Determination of the frequency of an electrically maintained tuning fork by Melde's Experiment
4. Determination of the coefficient of Viscosity of water by capillary flow method (Poiseuille's method)
5. Verification of Beer Law
6. Determination of Molar Extinction coefficient
7. Determination of CMC for a detergent
8. Effect of different solvents on UV absorption spectra of proteins.

Course Code	**:**	**BSC153**
Course Title	**:**	**Ecology**
Total Credits	**:**	**4 (Theory 3; Tutorial 1)**
L-T-P	**:**	**3-1-0**
Total Hours	**:**	**Theory 45; Tutorial 15**
Semester	**:**	**II**

Course Content (Ecology)

Unit I: Introduction to Ecology

Relevance of studying ecology, History of ecology, Autecology and synecology, levels of organization, Laws of limiting factors, detailed study of temperature and light as physical factors.

Unit II: Population

Unitary and Modular populations, Unique and group attributes of population: Density, natality, mortality, life tables, fecundity tables, survivorship curves, age ratio, sex ratio, dispersal and dispersion; Exponential and logistic growth, equation and patterns, r and K strategies, Population regulation - density-dependent and independent factors; Population interactions, Gause's Principle with laboratory and field examples, Lotka-Volterra equation for competition and Predation, functional and numerical responses

Unit III: Community

Community characteristics: Dominance, diversity, species richness, abundance, stratification; Ecotone and edge effect; Ecosystem development (succession) with example; Theories pertaining to climax community

Unit 4: Ecosystem

Types of ecosystems with one example in detail, Food chain, Detritus, and grazing food chains, Linear and Y-shaped food chains, Food web, Energy flow through the ecosystem, Ecological pyramids,

and Ecological efficiencies. Nutrient and biogeochemical cycle with one example of Nitrogen cycle

Practical

1. Study through specimens/photographs/slides of Parasitic angiosperms, Saprophytic angiosperms, VAM fungi, Root nodules, Corolloid roots, Mycorrhizal roots, Velamen roots, Lichen as pollution indicators.
2. Principle and function of Sechi disc, Atmometer, Anemometer, Hygrometer, Hair hygrometer, Luxmeter, Rain guage, Soil thermometer, Min-Max thermometer
3. To determine a minimal quadrat area for sampling in the given simulation sheet
4. To determine density/frequency/abundance of the vegetation by quadrat method in the field or on given simulation sheet
5. To determine soil texture, soil density, bulk density, particle density and pore space.
6. To determine water holding capacity and percolation rate of soil.
7. To determine pH, Cl, SO_4, NO_3, base deficiency, organic matter, cation exchange capacity in the soil.
8. Plotting of survivorship curves from hypothetical life table data.

Course Code	**:**	**BSG101**
Course Title	**:**	**Biostatistics**
Total Credits	**:**	**4 (Theory 3; Practical 1)**
L-T-P	**:**	**3-0-1**
Total Hours	**:**	**Theory 45; Practical 30**
Semester	**:**	**I**

Course Content (Biostatistics)

UNIT I

Types of Data, Collection of data; Primary & Secondary data, Classification and Graphical representation of Statistical data. Measures of central tendency and Dispersion. Measures of Skewness and Kurtosis.

UNIT II

Probability classical & axiomatic definition of probability, Theorems on total and compound probability), Elementary ideas of Binomial, Poisson, and Normal distributions.

UNIT III

Methods of sampling, confidence level, critical region, testing of hypothesis and standard error, large sample test and small sample test. Problems on test of significance, t-test, chi-square test for goodness of fit and analysis of variance (ANOVA)

UNIT IV

Correlation and Regression. Emphasis on examples from Biological Sciences.

Practical

1. Based on graphical Representation
2. Based on measures of Central Tendency & Dispersion
3. Based on Distributions Binomial Poisson Normal
4. Based on t, f, z and Chi-square

Course Code	**:**	**BSS101**
Course Title	**:**	**Wildlife Conservation & Management - I**
Total Credits	**:**	**2 (Theory 2)**

L-T-P	**:**	**2-0-0**
Total Hours	**:**	**Theory 45**
Semester	**:**	**I**

Course content (Wildlife Conservation & Management – I)

UNIT - I: Scope and Importance of Wildlife of India

Definition of Wildlife: Causes of wildlife depletion; Economic importance of wildlife; need for wildlife conservation; rare, endangered, threatened and endemic species of fishes, amphibians, reptiles, birds and mammals in India- India as a mega wildlife diversity country.

Unit II: Habitat analysis

Evaluation and management of wildlife - Physical parameters and Biological Parameters. Standard evaluation procedures: Faecal analysis of ungulates and carnivores: Faecal samples, slide preparation, Hair identification, Pug marks and census method, Geographical Information System (GIS), Global Positioning System (GPS), and Remote Sensing (RS).

Unit III: Human-wildlife conflict

Poaching, illegal trading, conflict management and shifting from extraction to preservation. effect of extinction of a species on ecosystem; Forest landscape restoration.

UNIT - IV: Conservation of Wildlife

In-situ and ex-situ conservation: Wildlife Sanctuaries, National Parks, Tiger Reserves and Biosphere reserves: Definition, formation, management, and administration; Wildlife Projects: Tiger, Elephant, and Lion; Zoos and Zoological Parks: Definition- Aims of Zoos- Formation and Management of Zoos and Zoological Parks - Central Zoo Authority of India; Captive breeding: Aims, Principles, methods; Role of Government and Non-Governmental organizations in conservation.

Course Code	**:**	**BSG102**
Course Title	**:**	**Natural Resource Management**
Total Credits	**:**	**4 (Theory 4)**
L-T-P	**:**	**4-0-0**
Total Hours	**:**	**Theory 45**
Semester	**:**	**I**

Course Code	**:**	**BSG102**
Course Title	**:**	**Natural Resource Management**
Theory/Practical	**:**	**Theory**
Credits	**:**	**4**
Semester	**:**	**I**

Unit I: Natural resources and Sustainable utilization

Definition and types of natural resources; Concept and approaches (economic, ecological and sociocultural) of Sustainable utilization

Unit II: Land and Water

Land utilization (agricultural, pastoral, horticultural, silvicultural); Soil degradation and management. Fresh water (rivers, lakes, groundwater, aquifers, watershed); Marine; Estuarine; Wetlands; Threats and management strategies

Unit III: Forests

Definition, Cover and its significance (with special reference to India); Major and minor Forest products; Depletion; Management.

Unit IV: Energy

Renewable and non-renewable sources of energy, and their management

Unit V: Contemporary practices in resource management

EIA, GIS, Participatory Resource Appraisal, Ecological Footprint with emphasis on carbon footprint, Resource Accounting; Waste management.

Course Code	**:**	**BSS102**
Course Title	**:**	**Wildlife Conservation & Management - I**
Total Credits	**:**	**2 (Theory 2)**
L-T-P	**:**	**2-0-0**
Total Hours	**:**	**Theory 45**
Semester	**:**	**I**

Course content (Wildlife Conservation & Management – II)

UNIT - I: Wildlife in Uttarakhand

National Parks (Corbett National Park; Nanda Devi National Park; Valley of Flowers National Park; Rajaji National Park; Gangotri National Park; Govind National Park), *Sanctuaries* (Govind wildlife sanctuary; Kedarnath wildlife sanctuary; Askot wildlife sanctuary; Sonanadi wildlife sanctuary; Binsar wildlife sanctuary; Mussoorie wildlife sanctuary; Nandhaur Wildlife Sanctuary), *Conservation reserves* in Uttarakhand; Microbial Diversity in Uttarakhand.

UNIT - II: Wildlife Census Techniques

Planning census – Total counts - Sample counts – Basic concepts and applications - Direct count (block count, transect methods, Point counts, visual encounter survey, waterhole survey); Indirect count (Call count, track and signs, pellet count, pugmark, camera trap)-Identifying animals based on indirect signs; Capture-recapture techniques.

UNIT - III: Management of excess population & translocation

Bio- telemetry; Common diseases of wild animal; Quarantine; Population Viability and Habitat Analysis (PVHA), captive breeding and propagation, rescue, rehabilitation and reintroduction, gene banks, ex-situ and in-situ conservation.

Unit IV: Sustainable wildlife management

Eco tourism / wild life tourism in forests; various Environmental movements in India: Bishnoi movement, Chipko movement, Narmada bachao andolan, Silent valley movement, Baliyapal movement.

Bachelor of Design

(W.E.F. Academic Session 2022-23)

CURRICULUM (NEP)

Credit Requirements: 176

8 Semesters

School of Design

Doon University, Dehradun

School of Design

Bachelor of Design (4 Years)

COURSE ABSTRACTS

FIRST SEMESTER

Programme/ Class:	Bachelor of Design (4 years)	**Year:**	First	**Semester:**	First
Subject: Design					
Course Code:	DNC101	**Course Title:**	Design Sketching		
Credits:	4	Core			
Max. Marks:	100	Min. Passing Marks: 30			
Total No. of Lectures-Tutorials-Practical (in hours per week):		**L-P-T:**	1-0-3		

Unit	Topics	No. of Lectures
I	Design Sketching Type of pencils and its use, line weight and variation, construction lines, hand movement exercise, grading exercise. Freehand straight lines, smooth curves, ellipses, ellipses in minor axis.	5
II	Freehand straight lines, smooth curves, ellipses, ellipses in minor axis,	5
III	Perspective sketching- Ground line, station point etc, Above eye level and below eye level, One point perspective and two point perspective Indoor and outdoor perspective drawing, Texture and Pattern, Figure in motion, detailed objects ,observing and drawing details of natural and manmade objects, Thumbnail sketches and quick studies.	15
IV	Drawing of objects outdoors. Exercises for improving observation and visual memory. Detailed drawing/Object drawing	15
V	Human Anatomy- Muscle structure, 7.5 head figure, hand, feet, ear, nose	20

Programme/ Class:	Bachelor of Design (4 years)	**Year:**	First	**Semester:**	First
Subject: Design					
Course Code:	DNC102	**Course Title:**	Analytical Drawing		
Total No. of Lectures-Tutorials-Practical (in hours per week):		**L-P-T:**	1-0-3		

Unit	Topics	No. of Lectures

I	Use of tools Straight Edge Ruler and set Square , T Squares, Compasses, pencils etc . Construction will include lines, angles, polygons, derivations, curvilinear shapes.includes use of to aid geometric drawing	15
II	Drawing various kinds of straight lines, including those that connect random points. Further assignments involve the analysis of forms and objects into basic construction principles in one's mind and then using that to create an accurate representation on paper.	15
III	Depictions of 2D and 3D forms using freehand construction techniques while encouraging them to look at forms in a critical, deconstructive manner.	15
IV	Use of isometric grids and architectonic explorations will help students strengthen their analytical drawing skills further. Introduced to the concept of the Fibonacci series, the golden ratio, divine proportions etc Exploring straight lines with variations in weight. Connecting points in space. Making cubes, ellipses, cylinders & spheres freehand, using analytical methods. Making revolved forms based on a defined side profile (bottles, vessels). Representing thickness and flanges; Adding details like handles, spouts. Isometric grids and architectonic forms. Proportional transformation of form based on grids. Analyzing complex forms into basic geometry and then 'constructing' them freehand . Additive and subtractive forms in drawing analytically.	15

Programme/ Class:	Bachelor of Design (4 years)	**Year:**	First	**Semester:**	First
Subject: Design					
Course Code:	DNC103	**Course Title:**	Colour & Composition		
Credits:	4		Core		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):			**L-P-T:**	1-0-3	

Unit	Topics	No. of Lectures
I	Basic dot, transforming to a line, shapes and other two dimensional manifestations like patterns and texture. The emphasis will be on two dimensional (2D) exploration. Form exploration will include geometric and organic forms though the two will be differentiated and taught to explore and express abstract concepts with the use of basic forms.	15
II	Creating patterns & textures using basic forms will also be explored. It will be important to build sensitivity to use of elements in terms of shape, number, size, proportion etc. White space as a design tool will be explored and employed to achieve visual equilibrium. Movement in 2D form is also to be studied through a single representation and through multiple panels.	20

III	Color theory (value, shade, hue etc), creation of color variation (additive, subtractive etc), various color wheels and their derivatives (complimentary, triads etc) color scales, color interaction etc.	20
IV	Gestalt theory and its principles-Principle of proximity. Principle of closure, Principle of similarity, Principle of continuity.Principles of perception,Principle of organization, Principle of symmetry, its use in visual communication.	20
V	Composition Principles- Balance, contrast, Emphasis, movement, pattern, rhythm, unity/variety. Rule of third, golden section, golden triangle, golden spiral.	15

Programme/ Class:	Bachelor of Design (4 years)	**Year:**	First	**Semester:**	First
Subject: Design					
Course Code:	DNG104	**Course Title:**	Materials & Workshop Skills		
Credits:	4		Core		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):		**L-P-T:**	1-0-3		

Unit	Topics	No. of Lectures
I	Use of hand tools. Material study like wood,plaster of paris, metal sheet,	15
	Cement, Polystyrene, Acrylic sheet etc.	
II	Exploring the use of materials as per their innate properties and functions derived from them. Materials explored will include Plaster of Paris, Wood, Metal sheet, Polystyrene, Acrylic etc .	15
III	Theoretical aspects of these materials and explore practical aspects like physical properties, weathering, manipulation etc.	15
IV	Explore new form and functions using materials in combination and alone.	15

Programme/ Class:	Bachelor of Design (4 years)	**Year:**	First	**Semester:**	First
Subject: Design					
Course Code:	DNS105	**Course Title:**	Creative Thinking		
Course Outcomes:					
The student at the completion of the course will be able to: • Understand the role of creativity and innovation in your own work and in other disciplines. • Understand the importance of diverse ideas, and to convey that understanding to others.					
Credits:	2		Core		
Max. Marks:	100		Min. Passing Marks: 30		

Total No. of Lectures-Tutorials-Practical (in hours per week):		L-P-T:	1-0-1

Unit	Topics	No. of Lectures
I	Introduction to design thinking. The five stages of design thinking Stage 1: Empathize—Research Your Users' Needs. Stage 2: Define—State Your Users' Needs and Problems. Stage 3: Ideate—Challenge Assumptions and Create Ideas. Stage 4: Prototype—Start to Create Solutions. Stage 5: Test—Try Your Solutions Out.	10
II	How to improve creative thinking. Random Input; Problem Reversal; Ask Questions; Applied Imagination - Question Summary; Lateral Thinking; Six Thinking Hats; The Discontinuity Principle; Checklists; Brainstorming; Forced Relationships/Analogy; Attribute Listing; Morphological Analysis; Imitation; Mindmapping; Storyboarding;Synectics; Metaphorical thinking; Lotus Blossom Technique.	15
III	Aids and barriers to creativity.	5

SECOND SEMESTER

Programme/ Class:	Bachelor of Design (4 years)	Year:	First	Semester:	Second
Subject: Design					
Course Code:	DNC151	Course Title:	Design Sketching II		
Credits:	4	Core			
Max. Marks:	100	Min. Passing Marks: 30			
Total No. of Lectures-Tutorials-Practical (in hours per week):		L-P-T:	1-0-3		

Unit	Topics	No. of Lectures
I	Freehand straight lines, smooth curves, ellipses, ellipses in minor axis. Pen sketching(Ball, gel, Ink).	
II	Perspective Terminology like Ground line, station point etc, Perspective drawing above eye level and below eye level exercises, one and two point perspective- indoor and outdoor perspective	
III	Still life drawing, Details objects in ball pen	
IV	Human Anatomy- Head(Male and Female), 7 and 1/2 head body(male and Female), Ear, Eyes, lips, Nose,Hand, feet, Figure in Motion.	

Programme/ Class:	Bachelor of Design (4 years)	**Year:**	First	**Semester:**	Second
Subject: Design					
Course Code:	DNG154	**Course Title:**	Introduction to Photography & Computer Graphics		
Credits:	4		Core		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):			**L-P-T:**	1-0-3	

Unit	Topics	No. of Lectures
I	Understand Image: Types of shots: distance, angle and movement; digital image basics: image format, resolution, aspect ratio, Pixels, DPI and PPI; composition and aesthetics: rules and guidelines; visual element and principles; timing and decisive moment; photo critique; prominent photographers.	15
II	Introduction to digital photography & technicalities: Introduction to digital photography, digital cameras How camera works; Exposure: shutter speed, aperture, ISO; arriving at proper exposure, depth of field, white balance, understanding histograms Photography techniques: soft focus, long exposure, short exposure, multiple exposures, time-lapse photography; Understanding lenses: wide angle lenses, telephoto lenses, and macro lenses, image sensor: types of image sensors, size and aspect ratios, image formats, image.	15
III	Graphical software such as photoshop, indesign, illustrator. vector and raster graphics. Software interface like menu bar, options bar, tool panel, document window. Graphic Design Concepts & Practices:- 1-Elements of design, 2- Typography, 3- Color, 4- Layout, 5- Information Hierarchy, 6- Industry standard design- Adobe InDesign, Photoshop, and Illustrator	15
IV	Assignments related to Adobe Photoshop, Adobe Indesign, Adobe Illustrator. Adobe Photoshop- Retouch photos, create graphics etc. Adjust color, contrast etc. Prepare images for use on the web or in print. Adobe Illustrator- Create graphics: logos, icons, patterns, packaging etc. Draw vector graphics for web and print. Adobe Indesign-Create layouts with text, color, and graphics. Create multi-page documents such as brochures, books, magazines etc. Prepare files for final output, such as a print or PDF.	15

Programme/ Class:	Bachelor of Design (4 years)	**Year:**	First	**Semester:**	Second
Subject: Design					
Course Code:	DNC153	**Course Title:**	Geometry & Form in Space		
Credits:	4		Core		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):			**L-P-T:**	1-0-3	

Unit	Topics	No. of Lectures
I	Introduced to the concept of geometric and organic volumes, how to generate them and further, how to evolve them into new and original 3D forms.	15
II	Solids will be broken into surfaces, edges and apexes to understand inter relations. Properties of basic solids like cube, cone, pyramid, cylinder and prism	15
III	Platonic and Archimedean solids.	15
IV	The concept of 'duals' and truncations will be introduced and analyzed with 3D paper models.	15
V	Categorizing all known and related terms into a structural tree of geometry. Drawing precise straight lines with varying weight. Parallel lines using set-squares. Parallel curved lines, tangential curves,developing patterns using compass. Bi-section of a line with compass, Bisection of angles with compass, Proportionate division of lines with parallel lines. Perpendicular to a straight line, Parallel lines at specified distances, tangent to a circle. Progressive Circles touching each other within angles. Triangle, Square Pentagon, Hexagon and Octagon withset square and Tsquare with protractor for exterior angle division.	30

Programme/ Class:	Bachelor of Design (4 years)	Year:	First	Semester:	Second
Subject: Design					
Course Code:	DNC152	Course Title:	Design Concerns		
Credits:	4		Core		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):		L-P-T:	1-0-3		

Unit	Topics	No. of Lectures
I	A broad overview of design & creative approaches to problem solving	15
II	Study of the rationale behind design which introduces a systematic design process, an overview of the practice of design, the societal impact of design, critical issues and the relationship of design to its socio-cultural environment.	15
III	The aim will be to try and break the hold of conventional educational models and structures and encourage a more left-brain oriented approach to problem solving.	15
IV	Practice empathy in applying a human-centered approach to design techniques, such as user research, user experience, prototyping, and journey mapping	15
V	Project on solving a basic design problem from students' immediate environment, using all steps of the design process	30

Programme/ Class:	Bachelor of Design (4 years)	Year:	First	Semester:	Second
Subject: Design					
Course Code:	DNS155	Course Title:	History of Design		
Credits:	2		Core		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):		L-P-T:	1-0-1		

Unit	Topics	No. of Lectures
I	Western Context: The chronology of design movements, from Arts & Crafts movement to postmodern design. Focus on the origins of formal design education in BauHaus. Study of design history through artifact analysis and analysis of services, interactions, policies, institutions and legal and technical systems as well as physical objects and spaces.	15
II	Exploring the design tradition in India and its uniqueness. Advent of design and design education in India. Links with handicrafts and artisans. Celebrated Indian designers.	15

THIRD SEMESTER

Programme/ Class:	Bachelor of Design (4 years)	**Year:**	Second	**Semester:**	Third
Subject: Design					
Course Code:	DNC201	**Course Title:**	Introduction to Typography		
Credits:	4		Core		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):		**L-P-T:**	1-0-3		

Unit	Topics	No. of Lectures
I	Typeface choice :- Kerning, Paragraph indication, Type size, Weight, Type on image/screen, X-height H. Capitalization, Display initials, Line length, Stance, Word emphasis M. Leading, Alignment, Text wraps, Mixing typeface, Hierarchy, Reverse text, Letter/word space, Type distortion.	15
II	Study of Typography, History, Classification, Anatomy and usage of various letterforms. Theoretical and applicable principles of communicating with letterforms. Multilingual Typography. Expressiv Typography. Compositions with type.Exploration of three dimensior features of letter forms. Typography in different contexts like Books Mailers, New media, Posters, Signages, Motion graphics etc. Study c grids and layouts.	15
III	Serifs and Sans-Serifs Types of Serifs . Type designers & Lettering artists.	15
IV	Grids in page layout and composition, Grids for lettering, One letter composition.	15

Programme/ Class:	Bachelor of Design (4 years)	**Year:**	Second	**Semester:**	Third
Subject: Design					
Course Code:	DNG206	**Course Title:**	Advanced Photography		
Credits:	4		Core		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):			**L-P-T:**	1-0-3	

Unit	Topics	No. of Lectures
I	Landscape & Architectural Photography: Picture framing, camera angles, Tripods and their importance, types of lenses and suitability for subjects, Vantage points	15
II	The importance of foreground interest and how background imagery influences photos, recommended gear and Camera techniques, Lighting and lighting equipment for indoors and outdoors.	15
III	Macro photography: Concept of bokeh and how it may be captured; Effects of light in macro photography, Magnification & reproduction ratios, True Macro Vs Close-Up, Macro Photography with regular lenses, Depth of field and shutter speed experiments, Directional light and how to manipulate it, Avoiding lens flares.	15
IV	Portrait Photography: In a studio and non-studio setting, considerations, tricks and light study, capturing identity and personality in portraits, creating empathy, working with subjects and creating comfort.	10
V	Post Processing: Digital corrections in photography, Digital Dark Room Workflow.	5

Programme/ Class:	Bachelor of Design (4 years)	Year:	Second	Semester:	Third
Subject: Design					
Course Code:	DNS207	Course Title:	Film Appreciation		
Credits:	2		Core		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):		L-P-T	1-0-1		

Unit	Topics	No. of Lectures
I	Movies and Their Roles in our Lives. Elements of a Film - Story, Narrative Structures, & Audience Semiotics and Cinematic Terms. Film Screening and Discussion on that film.	10
II	Introduction to different Genres of Films (Animation, Adventure, Horror, Suspense, Drama, Romance etc). Familiarizing with World films and filmic movements (French films, Japanese films, Hollywood films, Indian films, Italian films, Iranian films etc., Italian Neorealism, French New wave, Western, German Expressionism etc).	10
III	Literary Elements in Film. Themes and Symbolism. Mise enScène - Settings, Props and Costumes Acting, Cinematography, Lighting. Editing, VFX, Sound.	5
IV	Criticism: Weighing the Balance. Film Screenings and Discussions.	5

Programme/ Class:	Bachelor of Design (4 years)	Year:	Second	Semester:	Third
Subject: Design					
Course Code:	DNE202	Course Title:	Illustration		
Course Outcomes:					
The student at the completion of the course will be able to: • Understand the basic approach to drawing and composition as a means of story-telling or information giving. • Effectively communicate an idea, explain a concept or tell a story through pictures .					
Credits:	4		Elective		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):		L-P-T:	1-0-3		

Unit	Topics	No. of Lectures
I	Introduction to traditional Illustration, Introduction to various techniques of illustration.	15

II	Mediums Exploration like Watercolor. Charcoal, pen, Ink, oil pastels, dry Pastels, poster colors etc . Different techniques- wet on wet, underpainting, Gradients and Color Blending, Layering Watercolors, Dry Brush, Lifting Color, Watercolor Blooms etc.	15
III	Live sketching - Environmental Studies, Plants, Our Surroundings , animals, vehicles etc	15
IV	Book illustration, editorial, sequential art, concept art, character development.	15

Programme/ Class:	Bachelor of Design (4 years)	**Year:**	Second	**Semester:**	Third
Subject: Design					
Course Code:	DNE204	**Course Title:**	Publication Design & Printing		
Credits:	4		Elective		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):		**L-P-T:**	1-0-3		

Unit	Topics	No. of Lectures
I	Publishing History, the act or process of producing (a printed work) and ɔublic, printed work (as a book or magazine) made for sale or distribution.	15
II	Combining Type and Images, Grids, Guides, and Aligning Objects	15
III	Define advanced publishing concepts; design and produce a project; create and maintain visual continuity in a document; and demonstrate advanced levels of skill in layout, design, and production using industry standards.	15
IV	Users: Identify the user groups that your product will target. User Survey: You are free to use internet resources for user survey and field work but it is essential to speak to at least a few real users for the purpose of this project.	15
V	All aspects of its design, including the layout, format, selection of fonts, colors etc. should be incorporated into the final prototype	60

Programme/ Class:	Bachelor of Design (4 years)	Year:	Second	Semester:	Third
Subject: Design					
Course Code:	DNE203	Course Title:	Form Derivation I		
Credits:	4		Elective		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):		L-P-T:	1-0-3		

Unit	Topics	No. of Lectures
I	How form can be morphed and manipulated using various criteria and methodological tools like radii manipulation, formal transition, edge treatment etc	15
II	Explore how new forms can be generated, existing forms can be modified, and explore the transition phases between two distinct forms. Attributes and metaphors that can be given to forms, both in 2D and 3D.	15
III	Sketching to express ideas is essential for this module. And the sketches will be translated to models for some of the assignments.	15
IV	Material Exploration and model making will include Thermocol, MDF, polystyrene and metal wire. The use of color will be explored in the 2D models for this course.	75

Programme/ Class:	Bachelor of Design (4 years)	Year:	Second	Semester:	Third
Subject: Design					
Course Code:	DNE205	Course Title:	Simple Product Design		
Credits:	4		Elective		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):		L-P-T:	1-0-3		

Unit	Topics	No. of Lectures
I	Users: Identify the user groups that your product will target. Study of ergonomics and human factors. User Survey: You are free to use internet resources for user survey and field work but it is essential to speak to at least a few real users for the purpose of this project.	15
II	Market Survey: What products are available in the niche that you have selected in India and abroad?	15
III	Materials: You are free to use/specify any material for your design, keeping the user in mind Processes: You are free to choose the hand-made or machine-made process, keeping the manufacturing numbers in mind.	15
IV	Model: A finished model is essential for this project. It may be a working prototype if time and workshop permit otherwise a 1:1 block model is to be made.	60

V	User Testing: It is important to try out your concept model with actual target users and document the process through relevant photographs.	15

FOURTH SEMESTER

Programme/ Class:	Bachelor of Design (4 years)	**Year:**	Second	**Semester:**	Fourth
Subject: Design					
Course Code:	DNC251	**Course Title:**	Digital 3D Modeling		
Credits:	4		Core		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):			**L-P-T:**	1-0-3	

Unit	Topics	No. of Lectures
I	Introduction to software,Modeling with Polygons, using the graphite, working with XRefs, Building simple scenes, Building complex scenes with XRefs, using assets tracking, deforming surfaces & using the mesh modifiers, modeling with patches & NURBS	15
II	3D modeling Product modeling, Object Modeling, Interior etc.	15
III	Lighting & Camera -Configuring & Aiming Cameras, camera motion blur, camera depth of field, camera tracking, using basic lights & lighting Techniques, working with advanced lighting, Light Tracing, Radiosity, video post, mental ray lighting etc.	30
IV	Animation - Creating Keyframes, Auto Keyframes, Move & Scale Keyframe on the timeline, Animating with constraints & simple controllers, animation Modifiers & complex controllers, function curves in the track view, motion mixer	30
V	Rendering with V-Ray V-ray light setup, V-ray rendering settings, HDRI Illumination, Fine-tuning shadows, Final render setting etc.	30

Programme/ Class:	Bachelor of Design (4 years)	**Year:**	Second	**Semester:**	Fourth
Subject: Design					
Course Code:	DNC252/DNG255	**Course Title:**	Interaction Design A/B		
Credits:	4		Core		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):		**L-P-T:**	1-0-3		

Unit	Topics	No. of Lectures
I	Design Fundamentals This course provides an introduction to visual communication principles and design processes. User Centered Design Students will explore topics and processes of interaction design through the lens of human physiology and behavior. Projects will be developed to allow students to strengthen collaborative and design skills while integrating people's needs into the design process.Interactions, Media, Senses 1.Designing interactions for the physical, cognitive and social environments of the user. 2. Medias and co-evolution of technology Understanding design in the context of digital, time based products with data storage, connectivity, sensors, actuators and multi-modal displays. 3. Study of how people perceive, understand, use and experience interactive objects and spaces.	30
II	Design methodology for complex products, services and events: Design of integrated systems, products for future use, products to be used in groups, devices used in public places, design of multi-modal interfaces, expressive interfaces, products that enrich user experience	30
III	The course takes an interdisciplinary approach drawing upon product design, visual communication, information architecture, cognitive psychology and computer science. The focus is on working collaboratively in groups to solve design problems.	30
IV	Interaction Medias 1. Introduction to time media, video, audio, games 2. Storytelling in an interactive medium 3. Design of multi-modal, sound and conversational interfaces 4. Building interactive installations and exhibition spaces	30

Programme/ Class:	Bachelor of Design (4 years)	**Year:**	Second	**Semester:**	Fourth
Subject: Design					

Course Code:	DNS256	**Course Title:**	Design Exposure Visit
Course Outcomes:			
Credits:	2	Core	
Max. Marks:	100	Min. Passing Marks: 30	
Total No. of Lectures-Tutorials-Practical (in hours per week):		**L-P-T:**	0-0-2

Unit	Topics	No. of Lectures
I	The Design Exposure Visit module is meant to expose students to field experiences of multiple kinds. There should be visits to manufacturing facilities to help students understand what mass production entails. If possible, visits to smaller manufacturing set ups should also be included to help students mentally compare the two. There should be visits to Design Studios to help students understand how design consulting works. A visit to another design institution will help build curiosity and healthy	30
	competition. There should be some field assignments given that help the students dig deeper and take initiative in fact finding and field exploration. Design is a fledgling field yet so a deeper exploration of resources is important, as is awareness of other parallel fields that design works in tandem with, like engineering, printing, production, supply chains etc. The tour can take place in a nearby city or a further away city but it should involve outstation travel to fully immerse students in the experience, without the usual distractions.	

Programme/ Class:	Bachelor of Design (4 years)	Year:	Second	Semester:	Fourth
Subject: Design					
Course Code:	DNE253	Course Title:	Moving Graphics & Storyboarding		
Credits:	4		Elective		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):		L-P-T:	1-0-3		

Unit	Topics	No. of Lectures
I	Introduction to storyboarding as an essential tool for planning motion graphics and animation forms a part of the course. Students need to be introduced to basic components of storyboards, Rule of Thirds, Foreground, Middle Ground and Background, Developing Drawing Skills, Shot Angles etc need to be explored.	30
II	Introduction of Adobe Aftereffect, Interface like tools, file, etc	30
III	Fundamental Principles of motion graphics	30

Programme/ Class:	Bachelor of Design (4 years)	Year:	Second	Semester:	Fourth
Subject: Design					
Course Code:	DNE254	Course Title:	Form Derivation II		
Credits:	4		Elective		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):		L-P-T:	1-0-3		

Unit	Topics	No. of Lectures
I	Form as sculpture, to incorporate intangible attributes; Form as emotion	15
II	Understanding of house styles and key form characteristics; Form as branding	15
III	Form families and house styles	30
IV	Use of advance modeling materials and skills to generate high fidelity form models	30

FIFTH SEMESTER

Programme/ Class:	Bachelor of Design (4 Years)	**Year:**	Third	**Semester:**	Fifth
Subject: Design					
Course Code:	DNC301	**Course Title:**	Digital Illustration		
Credits:	4		Core		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):		**L-P-T:**	1-0-3		

Unit	Topics	No. of Lectures
I	Introduction to Illustration tools, their interface, Creating a document, adjusting format, area. Understanding the basics concepts of digital illustration vis a vis manual illustration.	
II	Digital Geometry, introduction to and usage of tools to create and transform shapes. Creating Vectors : linear and curved, editing vectors, pattern creation,	
III	Using colours and text to optimize illustrations. Creating colour palettes, working with CMYK and RGB modes	
IV	Types of illustration styles, Flat illustrations, illustrations with gradients, adding volume, tracing elements, working with layers.	

Credits:	4		Core		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):		**L-P-T:**	1-0-3		

Unit	Topics	No. of Lectures
I	Introduction to space, functions of space, defining the style of space, knowing and understanding the space and rising. Analyzing the physical and visual space and its previous conditions and influences. Understanding budgeting.	2
II	What is a functional space? Understanding layouts, making space flexible, space distribution, understanding users and objects in space. Creating moodboards, ideas and elevations. Understanding use of materials, finishes and specifications	4
III	Concept of materiality and colours, Direct and indirect light and energy saving, sustainability of space, understanding the ergonomic aspects and designing of healthy spaces for wellness and comfort.	4
IV	Planning and equipping the space, visibility and communication, temporary and permanent spaces within the space, economic valuation of space	3
V	Object selection, furniture selection and styling, Designing graphics for architectural spaces; signs, information, messages in relation with space	2

Programme/ Class:	Bachelor of Design (4 Years)	Year:	Third	Semester:	Fifth
Subject: Design					
Course Code:	DNP306	Course Title:	Self Study		
Credits:	6		Core		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):		L-P-T:	1-0-5		

Unit	Topics	No. of Lectures
I	This project is a documentation of a design, craft, culture etc. related topic. This will help you to look at any design research topic in a holistic context and understand how it is an important mirror of society and culture. The study should include cultural, social, economic and material aspects of the selected topic. The course is also about structuring research and putting it across in a coherent manner. The final output should be in the form of a tangible report, booklet, brochure etc.	

Programme/ Class:	Bachelor of Design (4 Years)	Year:	Third	Semester:	Fifth
Subject: Design					
Course Code:	DNE303	Course Title:	Design for Immersive Media		
Credits:	4		Elective		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):		L-P-T:	1-0-3		

Unit	Topics	No. of Lectures
I	History & Development of Immersive Media. Multimedia narratives. Social Media and online reading revival, On demand TV and binge watching revolution. Audio immersions, revival of radios and podcast. Content marketing and immersive transmedia storytelling.	5
II	Understanding AR / VR /MR , stereoscopic displays, motion tracking hardware, input devices and computing platforms, VR applications, VR hardware, Case study Oculus Rift and google cardboard. Web VR. Case studies.	5
III	Scope of usage of immersive media in industries like automotive, healthcare, tourism and real estate.	5
IV	Design Project for immersive media	75

Programme/ Class:	Bachelor of Design (4 Years)	Year:	Third	Semester:	Fifth
Subject: Design					
Course Code:	DNE304	Course Title:	Advanced Prototyping		
Credits:	4		Elective		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):		L-P-T:	1-0-3		

Unit	Topics	No. of Lectures
I	Prototyping Basics; Understanding different kinds of models and their applications	3
II	Principles and choices for model making, workflow, space, tools. Understanding materials for prototyping such as paper, foam, polystyrene, thermoplastics, polyurethane, clay, wood	5
III	Modeling Concepts, Types Of Prototypes, Prototyping Cycles, Soft Prototypes, 3d Quick Models, Paper And Quick Mock Up Models, Principle Models	5
IV	Understanding realistic finishes in prototyping through the use of putty and fillers, coatings, plating, paints etc.	2

SIXTH SEMESTER

Programme/ Class:	Bachelor of Design (4 Years)	Year:	Third	Semester:	Sixth
Subject: Design					
Course Code:	DNC351	Course Title:	Packaging Design		
Credits:	4		Core		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):		L-P-T:	1-0-3		

Unit	Topics	No. of Lectures
I	What is packaging, packaging types, packaging dynamics, Brand manifestation & product differentiation,	2
II	Concept Creation, Structural Generation And VIsual Component Of Packaging, Packaging Study And Analysis, Structural Design, cartons, bottles, tubes, can, tubs & jars, blister packs, gift packs, innovative forms.	6
III	Typography & graphic selection, surface graphics, information layout and hierarchy, language, photography, illustrations and colours, finishes and effects	6

IV	Packaging sustainability, environmental considerations	1

Programme/ Class:	Bachelor of Design (4 Years)	**Year:**	Third	**Semester:**	Sixth
Subject: Design					
Course Code:	DNP356	**Course Title:**	Portfolio Building		
Credits:	6		Core		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):			**L-P-T:**	1-0-5	

Unit	Topics	No. of Lectures
I	Compilation of all work done so far that demonstrates student's skills and abilities comprehensively in an appropriate digital format, web based or otherwise. Course should include effective documentation of design projects, studio photography of final prototypes, effective copy, building a consistent visual and narrative style etc.	

Programme/ Class:	Bachelor of Design (4 Years)	**Year:**	Third	**Semester:**	Sixth
Subject: Design					
Course Code:	DNC352/DNG355	**Course Title:**	Identity Design A/B		
Credits:	4		Core		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):			**L-P-T:**	1-0-3	

Unit	Topics	No. of Lectures
I	What is Branding and why is it important?	2
II	Costing of Branding, Planning & Timescales	3
III	Immersion & Discovery, Brand Purpose, Understanding your audience, Brand Brief	4
IV	Design road map, Logo's role in identity, finding your type, brand colors, custom iconography	4
V	Business Stationery, Packaging Design & Print	2

Programme/ Class:	Bachelor of Design (4 Years)	Year:	Third	Semester:	Sixth
Subject: Design					
Course Code:	DNE353	Course Title:	Introduction to Film & Script Writing		
Credits:	4		Elective		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):		L-P-T:	1-0-3		

Unit	Topics	No. of Lectures
I	Basic Storytelling, What makes a good story well told, division into three acts, The world of the story, Objective & subjective drama	3
II	Screenwriting tools, Protagonist and objective, conflict, obstacles, premise and opening, theme, unity, exposition, characterization, development of story, preparation and aftermath, plausibility, dialogue, visuals	3
III	Dramatic scenes, Rewriting, Dramatic Irony, Elements of the future and advertising, Stage Vs. Screen	3
IV	Planning the project, Previsualization & storyboarding, choosing videotape format, Choosing equipment & camera, Lighting and art direction, Production sound	3
V	Editing hardware, Sound editing and colour corrections, Titling and simple compositions, Rotoscoping and compositing	3

Programme/ Class:	Bachelor of Design (4 Years)	Year:	Third	Semester:	Sixth
Subject: Design					
Course Code:	DNE354	Course Title:	Complex Product Design		
Credits:	4		Elective		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):		L-P-T:	1-0-3		

Unit	Topics	No. of Lectures
I	Introduction to Product Design and Development, Product Design Steps and Product Analysis, Profit Consideration, Value Engineering (History, Concept and Definitions), Value Engineering vs. Cost Cutting.	2
II	Creative Thinking, Problem Identification and VEJP, Types of Product Functions, Functional Analysis, Functional Analysis System Technique.	2
III	Function-Cost Relationship – I, Function-Cost Relationship - II, VE Applications in Product Design, VE Tools and Techniques – I, VE Tools and Techniques – II, Behavioral Roadblocks	3
IV	Industrial Design and Product Design, Types of products ID as per ICSID and WIPO, Product Conceptualisation, Physical simulation of a small	4

	system	
V	Gumstix, Beagle, Raqsberrypi, Arduino, Kit application. Adaption for I/O, Application of CAD tools (dessault, Siemens. Autodesk, McNeil), specifics of Design for production scale-up, Connectors and wiring, Integration and Validation	4

SEVENTH SEMESTER

Programme/ Class:	Bachelor of Design (4 Years)	**Year:**	Fourth	**Semester:**	Seventh
Subject: Design					
Course Code:	DNP406	**Course Title:**	Internship		
Credits:	6		Core		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):			**L-P-T:**	0-0-6	
Unit	**Topics**				**No. of Lectures**
I	During the internship students should learn the real world skills to be able to develop an individual career plan, create a resume and successfully interview for a job, demonstrate employability skills; including safely and competently working in a design department or design firm. Students will be required to maintain a work log and write a final report.				

Programme/ Class:	Bachelor of Design (4 Years)	**Year:**	Fourth	**Semester:**	Seventh
Subject: Design					
Course Code:	DNC402/DNG405	**Course Title:**	Social Design & Research A/B		
Course Outcomes					
The student at the completion of the course will be able to: 1. Understand the importance of participation of each stakeholder in design. 2. Create a project based on in-depth analysis via participation of local populace in a rural community.					
Credits:	4		Core		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):			**L-P-T:**	1-0-3	
Unit	**Topics**				**No. of Lectures**

I	Participatory Rural Appraisal and Community Based Participatory Research, Introductions.	4
II	Tools for Participation, Transects, participatory mapping, mobility maps, resource maps, cultural maps, health maps, literacy maps, seasonal calendars, timelines	6
III	Creation and execution of participatory toolkits and other research tools; Data collection and analysis in participatory design	5
IV	Delivery of Design Project	

Programme/ Class:	Bachelor of Design (4 Years)	**Year:**	Fourth	**Semester:**	Seventh
Subject: Design					
Course Code:	DNC401	**Course Title:**	Design Management & Entrepreneurship		
Credits:	4		Core		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):		**L-P-T:**	1-0-3		

Unit	Topics	No. of Lectures
I	Introduction To Design Management. Design Thinking. What Is Design Thinking? How Design Thinking Is About More Than Style	5
II	Customer Profiling &; Value Mapping; Identifying Challenges &; Gathering Data; Making Sense Of Your Data.	8
III	Designing & Design Control – Prototyping; Understanding Customers & Making Choices; Finding The Right Business Model, Testing & Creating Alignment; Measuring & Monitoring; Reinventing.	8
IV	Customer Co Creation & Learning Launch; Leading Growth & Innovation In Your Organization	7
V	Intellectual Property, Definition; Copyright, Patent & Trademarks; Other Iprs (Geographical Indications, Plant Varieties, Designs, Trade Secrets, Traditional Knowledge & Traditional Cultural Expression)	2

Programme/ Class:	Bachelor of Design (4 Years)	Year:	Fourth	Semester:	Seventh
Subject: Design					
Course Code:	DNE403	Course Title:	Copy-Writing		
Credits:	4		Elective		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):			L-P-T:	1-0-3	

Unit	Topics	No. of Lectures
I	Elements Of Copywriting; Aim, Features, Strategy, Benefits, Audience, Reaction	6
II	Creating Marketing Communications Messages; Basics Of Strategy Development, Creative Thinking And Marketing Communications Tools	8
III	Understanding the process; understanding what works; Creation Of Advertising Messages For Both Print And Electronic Media	8
IV	Utilizing your copywriting skills, Creating your own copy	8

Programme/ Class:	Bachelor of Design (4 Years)	Year:	Fourth	Semester:	Seventh
Subject: Design					
Course Code:	DUNE404	Course Title:	Electricals & Electronics		
Credits:	4		Elective		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):			L-P-T:	1-0-3	

Unit	Topics	No. of Lectures
I	Basic definitions of Charge, Voltage, Current, Power, Energy	4
II	Resistor(R), Ohm's Law, Ideal Sources, Internal Resistance Of Voltage And Current Sources, Energy transfer, resistor Dissipation	10
III	Circuit Laws, Series And Parallel Connections, Analysis Of Circuits, Utility and Power,	10
IV	Capacitors, Magnetic Fields, and Transformers, Capacitance in space, Magnetic field, Magnetic circuit, Transfer Action	6
V	Delivery of a design project using learnings from the course	

EIGHTH SEMESTER

Programme/ Class:	Bachelor of Design (4 Years)	**Year:**	Fourth	**Semester:**	Eighth
Subject: Design					
Course Code:	DNP452	**Course Title:**	Design Dissertation		
Credits:	18		Core		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):			**L-P-T:**	2-0-16	

Unit	Topics	No. of Lectures
I	The Design Thesis Project is meant to be a final execution of the Design Process under the guidance of academic & professional mentors. It is a demonstration of both, the understanding of inputs received during 7 semesters of education and also, the preparedness to independently execute design projects. **Procedure** ➔ Submission of Thesis Project Proposal to SOD Design Mentor ➔ Approval of Thesis Project Proposal by SOD ➔ Commencement of Thesis Project (Approximately 4 months) ➔ 1st Compulsory Guide Visit (Within 4-6 weeks of Project Start) ➔ Submission of 3 copies of Project Documentation to SOD ➔ Intimation of Colloquium Date by SOD ➔ Colloquium Jury	330

Programme/ Class:	Bachelor of Design (4 Years)	**Year:**	Fourth	**Semester:**	Eighth
Subject: Design					
Course Code:	DNC451	**Course Title:**	Colloquium		
Course Outcomes					
The student at the completion of the course will be able to: • Present their Project in a professional manner as is expected in the industry • Should be able to communicate the salient points of their design process					
Credits:	4		Core		
Max. Marks:	100		Min. Passing Marks: 30		
Total No. of Lectures-Tutorials-Practical (in hours per week):			**L-P-T:**	1-0-3	

Unit	Topics	No. of Lectures
I	A formal presentation of the Thesis Project in the form of an exhibit: may be in the form of a series of panels, supported by a slide presentation and verbal presentation. Should be able to pick the salient points of the design process that are crucial in communicating the project to a panel, and represent them in the most effective way. Students will also answer questions in a Viva Voce.	60

School of Media & Communication Studies (SoMCS) Doon University, Dehradun

Four-Year Bachelor Programme in Media and Communication Studies
(Course Curriculum Design as per NEP 2020)

Semester –I

Course Title: MSC101: Introduction to Communication (DSC)

Unit	Topics	No. of L/T/P
I	**Meaning and concept of Communication** • The concept and definition of communication. • Communication process and elements • Verbal and non- verbal communication • Types - Intra personal, Inter personal, Group, Public, Mass communication. • Effective Communication • Barriers in Communication	11 L + 4 T
II	**Mass Communication& Mass Media** • Mass Communication: Meaning & definitions, Characteristics & features	
	• The Function and Context of Mass Communication • Scope and the concept of Mass & Mass Culture of Mass Communication • Mass Media- Definition and meaning • Tools of Mass Media-Books, Newspaper, Radio, Television, New media: Books, Newspapers, Magazines, Radio, TV, Films, Video • Modern Mass Media Channels, Internet, social networking media, Blog, Podcasts, Vlog	12L+3T

III	**Mass Communication Theories** • Introduction: Meaning of and need for "theory", • **Direct effect paradigm**- Hypodermic or bullet Theory • **Limited Effect Paradigm**- Individual differences, Personal influence theory • **Sociological Theories**-Cultivation theory, Agenda setting theory, The uses and gratification theory, Dependency theory • **Normative theories**- Authoritarian, Libertarian or free press theory, social responsibility theory, Communist theory, Development communication theory, Democratic- Participation theory	11L+4T
IV	**Communication Models** • Model: Definition and concept • Understanding some basic principles/models of communication-SMR, SMCR, Newcomb, Lasswell, Osgood, Shannon and Weaver, Wilbur Schramm and George Gerbner, Dance model	11L+4T

Course Title: MSC102: Development of Media in India (DSC)

Unit	Topics	No. of L/T/P
I	**Media and India •** Defining media. • Folk Media & Mainstream Media- Differences and attributes • Unique features of each media- Newspapers, Radio, Cinema, Television, New Media • Role of Media in development of India	8L+2T
II	**Print Media in India** • Historical development of Media-Printing Press and its development. • Major Newspaper during Pre-Independence era. The Vernacular Press • Role of Press in freedom struggle. Censorship and press during freedom movement. • Press council of India. • News agencies-PTI, UNI, NANAP. • Press Commissions.	8L+3T
III	**Indian Cinema** • Historical development of media- Indian cinema- its beginnings and development. • Pre- independence days of Indian Cinema. • The talkies, studio system. 'New Wave'. • Regional Cinema. Documentary films. • Censorship and cinema. • NFDC	8L+3T
IV	**Electronic Media- Radio & Television in India** Radio • Historical development of media- Radio in India- its beginnings and development. • Popular radio formats and programs.	14L+3T

	• Community Radio. • The picture today. Television • Historical development of media- TV in India- its beginnings and development. • Genres of Television broadcasting • Various committees for TV ownership and regulation- Chanda Committee, Verghese Committee. • AIR and Doordarshan. Prasar Bharti Act. • Broadcast Bill. DTH and CAS. • NBA and code of ethics. • Present day Television	
V	**Digital Media in India** • The digital media in India. Internet – the new media- Beginning and development • The boom of Information technology in India. • Digital Media Ethics Code • Information superhighway & ICT • Convergence. • The digital divide.	7L+3T

Course Title: MSC103: Introduction to Indian Polity and Society (DSC)

Unit	Topics	No. of L/T/P
I	**Indian Society: An Overview** 1. Indian Society through history 2. Unity in diversity and national integration 3. Tradition and modernity 4. Rural and urban India 5. Social Change: Modernisation, Westernisation, Sanskritisation	8L+2T
II	**Indian Social Structure** 1. Social stratification: caste and class, backward classes 2. Indian villages, agrarian class structure, village autonomy, jajmani system 3. Family, marriage and kinship 4. Scheduled Tribes, Minorities and other social groups	7L+4T
III	**Constitutional Framework** 1. Constitution: Preamble and basic features 2. Fundamental Rights and Directive Principles 3. Organs of government: The Legislature, Executive and Judiciary	7L+4T
IV	**Government System and Federal Structure** 1. Parliamentary system 2. Central government, state governments 3. Inter-state relations 4. Panchayati Raj, urban local bodies 5. Constitutional and Non-Constitutional bodies	8L+5T

Course Title: To be given by University: AEC **Credits: 2** **To be offered by University**

Course Title: MSS101: Writing for Media (SEC)

Unit	Topics	No. of L/T/P
I	**Introduction to Media Writing** 1. Media- meaning, concept & expanse 2. Media Writing- Types	2L
II	**Writing for Print Media** 1. Writing News Report 5 Ws and 1H (Hard News) 2. Writing Soft News a. Feature Writing b. Travelogues 3. Press Releases 4. Opinion Pieces	5L+6P
III	**Writing for Radio and TV Media** 1. Writing Radio Jingles 2. Writing Radio News Script 3. Writing for Radio Ads 4. Writing TV news script	5L+5P
IV	**Writing for Films and Digital Media** 1. Spec Script 2. Screenplays, Script writing 3. Blogging 4. Podcasting and other digital media writing	3L+4P

VAC-1 2 Credit COMM-VAC 11 To be offered by the University

Course Title: MSG101: Introduction to Communication (GE)

(For other Schools/ Departments)

Credit: 4 (3+1+0)

Syllabus (As Per DSC Course MSC101)

Course Title: MSG102: Creative Writing (GE)

Unit	Topics	No. of L/T/P
I	**General Principles of Writing** 1. Creative Writing: An Introduction 2. How to achieve lucidity and directness 3. Authenticity and Credibility 4. Authorial Voice 5. Genesis of themes- preparation of writing 6. Building a Climax	13L+2P
II	**Writing Short Story** 1. Writing for Children- Simplicity, Fantasy, Transmission of values, etc. 2. Detective stories- Suspense, Choice of characters etc. 3. Experimental Stories- Anti-climax, Anti-hero, Anti- plot, open ended narrative	12L+3P
III	**Writing Features & Reviews** 1. Book reviews 2. Travel writing 3. Interviews 4. Writing about/on women	10L+5P
IV	**Writing for Media** 1. Writing for Radio 2. Writing for TV 3. Writing for Digital Media	10L+5P

Semester –II

Course Title: MSC151: People and Culture of India (DSC)

Credits: 4 (L-T-P: 3+1+0)

Unit	Topics	No. of L/T/P
I	**Exploring the term 'Culture':** 1. Meaning and ambit of 'culture' 2. Culture, social practices and everyday life 3. Indian culture in historical and civilizational perspective 4. Understanding culture in modern India	8L+2T
II	**Racial Diversity in India:** 1. Ethnic diversity and ethnic identities in India 2. Ethnicity as culture 3. Ethnic conflicts and resolutions	7L+4T
III	**Social Perspective:** *1.* Understanding '*varna'* and *'jati'* *2.* Class and class consciousness	
	3. Caste and Class 4. Tribal culture and issues concerning tribes in modern India	7L+4T
IV	**Culture and Religious and Linguistic Identities:** 1. Formation of religious groups in India: A historical perspective 2. Understanding communalism and communal conflicts in Indian social fabric 3. Linguistic identities 4. Languages and state re-organisation	8L+5T

Course Title: MSC152: Photography (DSC)

Credit:4(L-T-P: 2+0+2)

Unit	Topics	No. of L/T/P
I	**Photography: History and basic concepts** History of Photography, Photography as a medium of communication. Eminent Indian photographers and their work Different types of Cameras. Principle of Image formation, Pin hole concept Different parts of a DSLR camera	6 L
II	**Tools and Gadgets/Equipment** Recording medium, Different types of file formats for the digital images, memory card. Sutter speed, Aperture, ISO, White Balance, Focusing, Exposure, Sensor size, Depth of field etc., Lenses- Normal, Wide and Tele lenses, Fish eye lenses, Prime and Zoom lenses, Macro Lenses etc. Tripod, Mono pod, hand held mountings Safe handling and Care of equipment's Lens hood, Flash unit, filters, close up attachment	10 L+ 10P
III	**Aesthetics and Techniques of photography** Rules of Frame Composition Different camera shots and Camera angles Rule of Third, Head Room, Looking Room, Balance Use of lines and dots in a frame Shape, pattern, Texture and colors 2D Vs 3D Composition Lighting- Need and importance, Hard light & Soft light, Warm light & Cool Light, Color temperature, Studio Lighting & its functions, Outdoor lighting, Reflectors etc. Front Light, Back Light, Side light, Catch light, Property Light, Rim Effect High Key & Low key Three-point lighting- Key, Fill & back light Make-up Basics of Photo Editing	10 L +10 P
IV	**Types of Photography** Portrait, Candid Photography, Macro, Wild life, Nature and landscapes, Disaster, Social photography, Night photography. Photography for News, Photo Feature	4 L+ 10 P

Unit	Topics	No. of L/T/P
I	**Introduction to Computers:** Definition, characteristics & uses, Evolution of computers, System unit (memory, ALU & control unit), Input /Output devices, Storage devices Memory- primary & secondary. Introduction to Software, its type (system, application & utility). Introduction to Data Processing.	4L+2P

II	**Operating Systems:** Introduction to Windows, features of Windows, the document window, the dialog window, the icons. Windows explorer; Control panel, Setting wallpaper, screen saver, background. Creating a folder, Compressing/Zipping files (WinZip), Virus & Antivirus. Word processors: Introduction to word processing, Features of Word processors, working with formatted documents, Shortcut keys. Introduction and working with iMac and its shortcut keys	4L+4P
III	**Internet Communication:** Protocols, Types of Internet Connections, ISPs, Domain Name System, Intranets, Email Concepts (receiving, sending, addressing, downloading, formatting, sending attachment), Configuring e-mail software. Introduction to Computer Security, Introduction to Basics of Internet, Security Threat and Security Attack, Malicious Software, Hacking. Users Identifications and Authentication.	6L+2P
IV	**New Technologies and social media:** Role of Smart phones in growth of Social Media, The Internet, OTT, Citizen Journalism, social sites, blogs, Effect of social media on masses, Problems related to New Media: Plagiarism and Cyber bullying.	6L+2P
V	**MS Office:** *Word:* Typing and Formatting of text, Inserting and formatting table, picture, shapes etc., page layout, hyperlink, word Art etc. *Spreadsheets (Excel):* Functions and its parts. Introduction to charts: types of charts, creation of chart from adjacent data/nonadjacent data, printing a chart, printing worksheet etc. *Presentation Software(PPT):* Uses, Presentation tips, components of slide templates and wizards, using template, choosing an auto layout, using outlines, adding subheadings, editing text, formatting text, using master slide; adding slides, changing colour scheme, changing background and shading. *Publisher:* by use of different templates creating Visiting cards, calendars, pamphlets, Brochures, Websites etc.	6L+10P
VI	**Exposure to softwares being used in Media:** Demonstration of Photoshop, CorelDraw /In design, QuarkXPress, Adobe Premier Pro and Audacity etc.	4L+10P

Unit	**Topics**	**No. of L/T/P**
I	Need and importance of Photo Editing Basic editing in MS word and Power Point	5 P
II	Photo Editing in professional software (Photoshop or any other similar application software) Different file formats, Automate Selection Tool, Sharpen and blur tool, Dodge and burn tool, Shape tool, Eye dropper Tool, Spot healing, Red eye, Patch, Eraser, Cropping, transform tools etc.	10 P

III	Adjustments-Levels, Brightness, Contrast, Vibrancy, Hue and saturations etc. Different Filters-Liquefy, Artistic, Blur, Sharpen, Sketch, Texture etc. Multi-layer editing	8 P
IV	Creative use of Typing Tool, Collage Making, Basic graphics etc.	7 P

Course Title: MSS152: Theatre Communication (SEC)

Credit:2 (L-T-P: 2+0+0)

Unit	Topics	No. of L/T/P
I	**Drama and its theories: Indian and Western** 1. Concept of drama- Indian and Western 2. Elements and structure of drama according to Indian and Western Dramaturgy 3. A brief study of different classifications of Western dramas – Tragedy, comedy, tragic comedy, melodrama and farce. 4. A brief introduction to various 'isms' in relation to drama including realism, naturalism, symbolism, expressionism, absurd and epic 5. Playwrights and their contribution: Sanskrit – Kalidasa, Bhasa, Sudraka, Bhavabhuti, Visakhadutta, Bhattanarayana; Ancient Greek and Roman – Aeschylus, Sophocles, Euripides, Aristophanes, Seneca Western – Shakespeare, Moliere, Ibsen, Brecht, Pirandello, Miller, Chekov, Beckett, Ionesco	10L
II	**Modern Indian Theatre:** 1.Origin and development of modern Indian theatre with reference to region, state and personalities 2. brief study of new trends in theatre since Independence movement both at national and regional level, such as, IPTA movement, Navanatya movement, Root Theatre movement, Third Theatre, Alternate theatre, Street theatre, Theatre of the Oppressed, Applied theatre, Forum Theatre, Site Specific theatre 3. An overview of major playwrights, directors and other contributing personalities of various regions, whose plays are widely performed at the national level. 4.Popular Play Houses, Theatre Companies, Institutions and Groups in India and their contribution	8L
III	**NatyaSastra and Rasasutra:** 1. Brief discussion on Natyasastra 2. Brief discussion on Rasasutra	6L
IV	**Acting and Direction:** 1. Brief discussion on different schools of acting- Western and Eastern 2. Brief discussion on different directorial innovations and methods	6L

Units	Topic	No. of L/T/P
I	Introduction: Radio Jockey or Radio Speaker Basics, tips and techniques, Building a foundation Functioning of a Radio Jockey or Radio Speaker, Types and formats of stories	5L+5P

II	Voice Grooming: Understanding your voice, tips and techniques for voice grooming; RJ styling; RJ code for men and women, what to speak and present; Know your voice; Know your listener; Presentation Techniques; Role of Announcer/Radio Jockey/News Reader	5L+5P
III	Writing Script for Radio: Radio Formats; News Presentation; Know your equipment; Sound Recording, Editing and streaming; technical process of Radio Broadcasting; Ace your interview/screen test, how to better your RJ's skills; The who's who of Radio Jockey or Radio Speaker share their secret mantras	5L+5P

Semester - III

Course Title: MSC201: Media Organizations: Structure and Functions (DSC)

Unit	Topics	No. of L/T//P
I	**Media Organization and Management** • Principles of Management • Types of Organization and their functions • Ownership patterns • Advantages and Disadvantages of Various forms of Ownership	10L+2T
II	**Newspapers finance and control** • Budgeting and Financial management • Newspaper registration – RNI – • Recruitment policy – training – • Wage policy - Wage boards – Readerships surveys • ABC-Advertising policy	11L+2T
III	**Organizational Structure of Media houses** • Organizational Structure of Print Media Organizations • Organizational structure of Radio station • Organizational Structure of Television News Channels • Organizational Structure of News Agencies	12L+6T
IV	**Press Commissions and Organizations in India** • First and Second Press Commission recommendations • Press Council of India • Government Information Systems: Concept and Philosophy • Prasar Bharti, AIR, Doordarshan, Cable TV, DTH, CAS-TV • PIB, DAVP, DFP, Song and Drama Division, Films Division, etc.	12 L+5T

Course Title: MSC202: Reporting, Writing and Editing for Print Media (DSC)

Credit:4 (L-T-P: 2+0+2)

Units	Topic	No. of L/T/P
I	**News Perspectives:** Definition, Principles of news: News values, Lead - five w's and 1 h, Types of lead, Structure of news – Inverted pyramid style, Writing news in an inverted pyramid, News writing styles, types of news; Soft news, hard news; Importance of Headline; Intros and their importance, Lead copy	8L+ 6P
II	**General Assignment Reporting:** Beat reporting- Types of beat reporting: political reporting, education reporting; environment reporting, cultural reporting, sports reporting, parliament reporting, court reporting, crime reporting, and war reporting. Reporting for the magazines; Use of computers by reporters; Online reporting, Blog and Web writing, Citizen Journalism, Photo Journalism. Kinds of reporting: investigative reporting, interpretative reporting, indepth reporting. Interviewing: principles and techniques; types: news interview; profile, writing questionnaire for interviews, techniques of writing questions on the spot, open ended, profile interviews	10L + 18P
IIII	**News Sources:** Sources of news; news gathering techniques; types of sources: news agency, press release, and press conference and other types – primary, secondary sources; Oral press briefing, special press briefing;Press Release, Press Note.	6L + 3P
IV	**Essentials of Good Writing and Purpose of Media Writing:** Writing to Inform, Writing to Describe, Writing to Persuade, Writing to Educate; The ABCD of Media Writing: i. Accuracy ii. Brevity iii. Clarity iv. Discernment; Principles of Media Writing, Robert Gunning's Principle of writing.	6L + 3P

Course Title: MSC203: Film Appreciation (DSC)

Units	Topic	No. of L/T/P
I	**Development and Origin of Cinema**: Contribution of Lumiere Brothers, Melies, Griffith, Charles Chaplin and Cecil B. Demille	6L + 2T
II	**Film Aesthetics-Regional and National:** Cinema in India, Bollywood, Film Movements; Origin of Indian Cinema, Evolution of Indian Cinema, Referring to Pioneers like Phalke, Ardershir Irani, Sohrab Modi, Guru Dutt, Raj Kapoor, Bimal Roy and Satyajit Ray. Coming up of talkies, the era of superstars, multi- starrers, angry young man; Rise of Multiplexes.	8L + 4T
III	**Modern Cinema:** Meaning, Importance and its relevance New Wave Cinema: Concept, Origin and Growth; Art and Parallel Cinema Emergence of New Cinema till now	9L + 2T
IV	**Film Censorship:** Central Board of Film Certification, Directorate of Film Festivals Role of Censor Board in terms of Film Appreciation; Major film festivals and awards: Indian and Global Writing Film reviews Film Certification categories	7L + 3T
V	**Film as a medium:** Characteristics of Good Cinema, importance and its status in present scenario. Film Appreciation, Principles of Film Appreciation. Film Appreciation vs Film Criticism, Film	8L + 2T
	Review, Film Journalism; Institutes like FTII, SRFTII.	
VI	**How to read a film:** Understanding Camera movements, shots and angles, lighting techniques etc. Different aspects of film making: Literary, Dramatic and Cinematic; Basic Camera shots and Movements Film editing Principles: Mise-en-scene and montage	7L + 2T

Course Title: MSS201: Print Designing Tools (SEC)

Credit:2 (L-T-P: 1+0+1)

Units	Topic	No. of L/T/P
I	Introduction to the Design software as Quark Xpress; creation of advertisements, importation and movement of copy and images, use of text wrap, rules, various palettes, master pages, templates etc.	5L + 5P
II	Corporate Identity: Usage of Types & Fonts, Color schemes, Punch line, Orientation. Corporate Stationary: Logo, Letterhead design, Business Card, Envelop, Catalogues, Brochures, Digital Posters, Calendar Design.	5L + 5P
III	Difference between Newspaper & Magazine layouts creating layouts for Fashion feature or Business articles or News pages	5L + 5P

Course Title: MSS202: Introduction to Website Designing (SEC)

Credit:2 (L-T-P: 0+0+2)

Units	Topic	No. of L/T/P
I	**Creating the website:** • Thinking • Template • Title • Theme • Cover Photo • Preview and Publishing etc.	8P
II	**Editing and updating the website:** • Inserting Content, Image, Video, Hyperlink, Tables, Charts etc. • Formatting and Layout • Adding pages etc,	8P
III	**Creation of websites:** • Developing website for educational Institutions • Developing website for Sorts • Developing website for Media • Developing website for Cultural and Tourism purposes etc.	14P

Course Title: MSS203: Communication and Workplace Competencies (AEC)

Unit	Topics	No. of L/T/P
I	**Introduction to Basic Concepts of Communication** 1. Explaining and understanding communication 2. Verbal and Non-verbal 3. Listening 4. Speaking Exercise 5. Writing a speech/statement on a given topic and rehearsing it using proper verbal and non-verbal approaches 6. Presentation	5L+3T
II	**Basic Language Skills** 1. Articles, tenses 2. Subject-verb disagreement 3. Double-past mistakes and confusing words	5L+2T
III	**Written Communication and Presentation Skills** 1. Concepts 2. Preparing presentations with PPT 3. A/V Video Recording and playback for feedback 4. Role play 5. Concept writing, email writing, formal letters (etiquettes and styles – formal and informal)	5L+3T
IV	**Group Discussion** 1. How to speak in a group 2. Participating 3. Listening 4. Taking initiative 5. How/when to enter/intervene in a GD 6. Research on given topic for GD	7T

Semester - IV

Course Title: MSC251: Reporting and Writing for Electronic Media (DSC)

Credit: 4 (L-T-P: 2+0+2)

Unit	Topics	No. of L/T//P
I	**Basics of Electronic Media** • Definitions- Elements and related Concepts • Print versus Electronic Media • Sources of News • Reporter at Work • Challenges and Demands of the Profession	6L + 1 P
II	**Television newsroom** • TV news: Principles, Elements and Concepts • Structure of a television news channel and a news room • Role and responsibilities of news team members • Types of news bulletin and their structure	4L + 2P
III	**TV News Production** • Various Formats of News and News Programmes-News package, Visual on anchor, anchor read, anchor graphics, anchor byte etc. • Stand Up, Piece to camera (PTC), Phono and Vox-pop in television news. • Studio/ Panel discussions • Interviewing Techniques • Beat Reporting, Live reporting • Covering Disasters and Tragedies • Presentation Skills, Phono/Phoner • Sting Operation, Media Trials • Storytelling • Fake news, Post Truth	4L+ 10P
IV	**Television News Script** • News Writing • Formats of TV News Script • Importance of Slug, Anchor, Voice- Over, Byte • Reporter's Copy & Producers Copy • News Editing, Character Generation	4L + 4P
V	**Basics of Radio Broadcasting**: • Radio news: Principles and concept • Structure of Radio News Room • Roles and responsibility of Radio broadcasters • Radio Broadcasting AIR	4L + 2P

VI	**Radio News Production** • Field reporting, reporting specialized areas • Investigative reporting • Radio News Formats- Radio Bulletin • Studio Discussion/ Panel Discussion • Phone-in Program • Voice Modulation	4L+6P
VII	**Radio Script** • Grammar of sound • Features of Radio Script • News writing –structuring radio-copy; editing agency copy, reporter's copy- compiling radio news programs • Structuring a radio report – news capsuling • Presentation skills	4L+5P

Course Title: MSC252: Television Production (DSC)

Credit: 4 (L-T-P: 2+0+2)

Unit	Topics	No. of L/T/P
I	**Understanding Different TV Program Formats:** Educational Programs, Farmer's Programs, Children`s Programs, TV Commercials, Sponsored Programs etc, Fiction Vs Reality Programs: Fiction- Soap Operas, Sit-Com, Tele films, Mythological and Historical serials etc. Reality Programs- Talent hunt shows (as dance & Music shows), Quiz shows, Adventure shows, Live Programs, Documentaries etc. News & Current Affair Programs: News Bulletins, Interviews, Discussions, Vox-pops etc.	5L + 5P
II	**Different stages of a Television program**- Preproduction, Production and post production Proposal, idea, Communication objectives, target audience, Script, Story board, Reece, Budget, Crew members etc.	4 L+6P

III	**Video Camera:** Types & Characteristics, Basic parts and its functions- Shutter speed, Aperture, ISO, Focusing, Depth of field, White Balance etc. Different type of Lenses-Normal, Wide angle and Tele lenses, Prime and Zoom Lenses etc. Different camera mounts- Hand held, Tripod, Pedestals, Trolley, Dolly, Jib, Crane, Gimbals, Sliders, Drone etc. Basic Camera Shots, angles & movements Picture/ Frame Composition- Headroom, looking room, Rule of Third, Eye line etc. Lighting- Need and importance, Hard light, soft light, Color temperature, Studio Lighting & its functions, Outdoor lighting, Reflectors etc. Studio sets & props; Make-up Sound: Basic Characteristics, Microphones, Sound Recording	4L+18P
IV	**Post Production** Logging, Editing Decision List, Basics of Editing Single track Vs multi track editing, Offline Vs Online editing Compositing, Chroma key, Color correction etc.	1L+10P
V	**Single & Multicamera Production:** Single Camera Vs Multi camera shooting TV Studio set-up, Production Control Room, Floor manager, Different	1L+ 6 P
	command and cues Outdoor Broadcast	

Unit	Topics	No. of L/T/P
I	**International Communication and Communication Patterns in Historical Perspective** 1. International Communication: Definition, history, evolution and role of propaganda 2. Evolution of international news agencies: Structure and functions 3. MacBride Commission's Report, UNESCO Response, World Culture Report, Role of NAM and IPDC	8L+3T
II	**Debate over International Information Flow and Global Power Dynamics** 1. Media flow imbalance: Global media flows, contra flows, types of flows and statistics 2. Digital divide and digital opportunities: Digital natives, digital immigrants and digital subalterns. 3. ICTs and NICTs and their impact on global communication (Current statistics and reports)	10L+4T
III	**Globalisation and International Communication** 1. Information flow and media and cultural imperialism 2. Globalisation, media ownership and monopolies 3. Soft power, nation state and globalization 4. Information Society, WSIS etc.	12L+4T
IV	**Understanding Intercultural Communication** 1. Intercultural Communication: Theory, concepts, patterns 2. Cultural values and identities 3. Understanding Intercultural Communication differences, challenges and opportunities 4. Ethnocentrism, bias, stereotyping, culture shock, assimilation, cultural relativism 5. Cultural context in verbal and nonverbal communication	15L+4T

Course Title: To be given by University: AEC **Credit: 2** **To be offered by University**

Course Title: MSS251: Video Editing Tool (SEC)

Credit: 2 (L-T-P: 0+0+2)

Unit	Topics	No. of L/T/P
I	**Basics of Video Editing:** Need and importance of Video Editing Basic understanding about Non-Linear Editing Different Formats and Aspect ratio/Pixel Ratio	5P
II	**Working over a video editing software-I:** Adobe Premier/ FCP or any other Professional Video editing software Basic Tools Setting up a project Importing Media Organizing Media	8P
III	**Working over a video editing software-II:** Mastering the essentials of Video editing Using Transitions (Cut, Fade in- Fade out, Dissolve, wipe etc) Working with Clips and Markers Adding Video effects Mastering Advanced Editing Techniques Putting Clips in Motion	8P
IV	**Working over a video editing software-III:** Editing and Mixing Audio Improving Audio Applying Color Correction and Grading Exploring Compositing Techniques Creating New Graphics Exporting Project	9P

Course Title: MSS252: Basic Skills for TV Anchoring (SEC)

Credit: 2 (L-T-P: 1+0+1)

Units	Topic	No. of L/T/P
I	**Introduction:** Anchoring Basics, tips and techniques; Building a foundation: Functioning of a TV news channel, Types and formats of news stories; Basics of fluency, Voice: pitch/tone/intonation/inflection; Voice Over: Rhythm of speech, Breathing, Resonance, VO for TV commercials/Corporate videos/ radio commercials/ TV Documentaries	5L+5P
II	**Screen Appearance:** Showing how to hold an audience's attention, Teaching awareness of voice and its function, Demonstrating how to control body language, Breathing and articulation; Duties and responsibilities while news reading, Understanding the news scripts and news agenda; On-air Essentials, Studio reading & Recording the voice; A look at personality, style and general show presentation; Examples of anchors work and detailed analysis of their styles; Making & adding effective promo and jingles while anchoring; Talk Show Host and moderating an event; Legal pitfalls (what not to say); What to expect in a studio: Tips and techniques, microphones, EP, studio lights; Voice Grooming; Understanding your voice, tips and techniques for voice grooming	5L+5P
III	**Anchor styling:** TV dress code for men and women, what to wear, make up; Getting ready for the interview; Ace your interview/screen test, how to better your anchoring skills; Anchor Tips: The who's who of TV anchoring share their secret mantras. Reporting techniques-Reporting a news & Interviewing, recording the byte & transcription & scripting; Different Reporting styles-Political, Entertainment, Crime, Sports & Business etc.	5L+5P

Course Title: MSS253: Introduction to Blogging (SEC)

Credit: 2 (L-T-P (1+0+1)

Units	Topic	No. of L/T/P
I	**Blogging: A Brief Information** 1. Blog: Meaning and Concept 2. Brief History of Blogging 3. Discussion on Actualities 4. A brief history (1993 -till date) 5. Modern Blogging	8L
II	**Beginning with Blogging:** 1. Writing Skills (Practice) 2. Introduction to various blogging sites 3. Working on the blogging sites (Practice)	3L+5P
III	**Setting up the Website:** 1. Building a blogging site 2. Exploring the dashboard 3. Customizing your page	4L+5P
IV	**Blog SEO:** 1. Brief Introduction to SEO 2. Understanding search engines 3. Optimizing your page titles and meta descriptions 4. Theme and template setting	5P

Course Title: MSG252: International Communication (GE)

(for other Schools/ Departments) **Credit:**

4 (L-T-P:3+1+0)

Syllabus (As Per DSC Course MSC253)

Semester -V

Course Title: MSC301: Communication for Development (DSC)

Unit	Topics	No. of L/T//P
I	**Understanding Development** • Development- Concept &Definitions • Indicators of Development – a critique • Current debates in relation to Development	10L+2T
II	**Understanding Development Communication** • Concepts and Definition of Development Communication • Significance of Development Communication • Different approaches to development communication	11L+2T
III	**Media & Development** • Mass Media as tool for development • Problems with the use of media for development • Creativity in media presentation of development issues • Role & performance record of each medium in development communication -Print, Radio & TV	12L+6T
IV	**Communication & Development: The Indian Experience** • Rural Development and Agricultural Extension • Health & Family Welfare • Literacy & Education, Safe drinking water, Slum Development etc. • Issues and concerns and future of development communication	12 L+5T

Course Title: MSC302: Science Communication (DSC)

Credit: 4 (L-T-P: 3+1+0)

Units	Topic	No. of L/T/P
I	Introduction to Science Communication: Science Journalism; Science & Technology and India; Science Museums and Science Centres	5L+1T
II	Environmental Communication: The study of Environmental Communication; Concepts of "Nature" and "Environment"; Deep Ecology and Critical Theory; Anthropocentrism vs. Eco centrism	8L+1T
III	Communication and Disaster Management: Disaster and Disaster Preparedness; Response: Rescue, relief and rehabilitation; Technology and Disaster communication: Emergency Response community radio, internet, email, mobile, social media, blogging; Risk Communication	10L+3T
IV	Natural Disaster and role of Media: The Nepal Earthquake of April 2015 The Kashmir Floods Oct 201 The Orissa Cyclone 2014 Uttarakhand Disaster 2013 and role of media in disaster mitigation with reference to Uttarakhand	8L+3T
V	Science Writing: Science News Content, report and articles writing; Science Fiction; Experiments and Experiences of great Scientists; Health Communication	7L+3T
VI	Public Understanding of Science: Science & Society Communicating Science via Fictional Media; Language and Vocabulary of Science; Agricultural Extension	7L+4T

Course Title: MSC303: Advertising and PR (DSC)

Credit: 4 (L-T-P: 3+0+1)

Unit	Topics	No. of L/T/P
I	**Introduction to Public Relations & Advertising:** 1. PR- Definition and Concept 2. Advertising- - Definition and Concept 3. Difference between PR and Advertising 4. PR Vs Advertising Vs Propaganda 5. PR Vs Advertising Vs Publicity 6. PR Vs Advertising Vs Public affairs 7. PR Vs Advertising Vs Lobbying	6L
II	**Advertising & Public Relations: History & Theories** 1. Evolution of Public Relations 2. Ivy Lee, Edward Bernays, George Creel 3. James Grunig's Models 4. Evolution of Advertising a. Advertising in pre-print era b. The Industrial Revolution c. World Wars d. Great Depression 5. History of Indian Advertising 6. Advertising theories-DAGMAR, AIDA, Hierarchy of Needs, Hierarchy of Effects, Marketing Mix	8L
III	**Fundamentals of Public Relations & Advertising:** PR CONCEPTS 1. Basic Principles- Audience Analysis, Public Interest, Change Agent, Social Responsibility etc. 2. Publics in PR-who is the public? 3. Public Opinion and Opinion Leaders ADVERTISING CONCEPTS 1. Brand- definition, evolution, life-cycle, positioning 2. Brand Equity, Brand Image and Brand Loyalty 3. Classification of Advertising on the basis of: a. Purpose b. Media c. Geography. d. Audience 4. Types of Advertising 5. Functions of Advertising 6. Advertising Appeals- Meaning & Concept 7. Discussion on various advertising appeals	10L+5P
IV	**Advertising & PR- Process and Tools:** 1. RPCE model 2. PR Tools-Press Conference/Meets Press Releases/Communiqué /Briefs/ Rejoinders/White Papers Blogs, newsletters etc. 3. PR writing- Position papers, White papers etc.	10L+6P

V	**PR Agency & PR Research:** 1. PR Agency- Structure & Functions 2. PR Research- Strategic & Evaluative	5L+2P
VI	**Ethics: PR and Advertising:** 1. PR ethics- Free Flow of Information, Disclosure of Information, Defamation, Privacy, etc. 2. Corporate Social Responsibility (CSR) 3. Codes of ethics 4. A discussion on PRSI, PRSA 5. Spin	6L+2P

Course Title: MSE/MSG301: Corporate & Strategic Communication (DSE/GE)

Credit: 4 (L-T-P: 3+0+1)

Unit	Topics	No. of L/T/P
I	**Introduction to Strategic Communication:** 1. Strategic Communication - Concept, Definition and Dimension. 2. Corporate Communication- Meaning & Concept 3. Integrated Marketing Communication (IMC) 4. Strategic Management Vs Operational Management	9L
II	**Strategic Communication: Public Relations:** 1. Propaganda, Public affairs, Lobbying 2. Issues Management 3. Corporate Identity 4. Crisis Communication 5. Stakeholder Management	10L+5P
III	**Strategic Communication: Advertising** 1. Brand Personality and Identity 2. Limits to Branding 3. Framing the message 4. The Elaboration Likelihood Model	8L+4P
IV	**Strategic Communication: Development and related concepts** 1. Nation Branding 2. Behaviour Change Communication 3. Preparing IEC Material 4. Seeking Beneficiary Participation	10L+6P
V	**Strategic and Corporate Communication Research & Ethics** 1. Strategic Communication Researches 2. Evaluative Researches 3. Ethics in designing communication	8L

Course Title: MSE/MSG302: Environmental Communication (DSE/GE)

Credit: 4 (L-T-P: 3 +1+0)

Units	Topic	No. of L/T/P
I	**Environmental Communication:** Rhetorically Shaping the Environment; Communication and Crisis	10L+3T
II	**Environmental Journalism:** Concepts of "Nature" and "Environment"; Deep Ecology and Critical Theory; Public Participation in Environmental Decisions	12L+3T
III	**Environmental Conflict as Moral Conflict:** Anthropocentrism Vs. Eco centrism; Media Representations	5L+1T
IV	**Communication, Risk, and Society:** Environmental movements; Campaigns; Environmental Advocacy: Advocacy and Engagement inaction	18L+8T

Course Title: MSE/MSG303: Reporting and Writing for Digital Media (DSE/GE)

Credit:4 (L-T-P: 2+0+2)

Unit	Topics	No. of L/T/P
I	**Understanding online communication**: Meaning and definition Online Communication. Characteristic and importance of Internet. New media differences with print, radio and TV media. Satellite Radio, online (Web), Podcasting, Mobile Content, Advertising, Integrating Social Media& UGC Content; Online broadcast technologies: webcasting, Social TV, Video conferencing, Skype etc. Mobile as a new tool of communication, Mobile for news and advertising, Role of Smart phones in growth of Social Media. Exploring mobile for various applications. Mobile an effective tool for promotional media. Mobile as a business tool for media organizations. Mobile for social communication. Mobile safety and precautions.	10L+ 6P
II	**New trends in Journalism:** Citizen Journalism, Community Journalism; Convergence Journalism. Social Media; Types of Social Media; Need and Impact of Social Media, Remediation and New Media technologies; Online Communities; Web 2.0; Mobile Journalism; Hyperlocal Journalism; Click bait; Digital Activism.	8 L+4P
III	**Online Journalism:** Introduction, Objectives, New Horizons, History, E-paper and Online paper, Online editions of newspapers. Process of newsgathering, news making and news dissemination for Online news portal. Headlines for web paper, Reporting, Editing,	6 L+10P

IV	**Writing for New Media:** Internet language, elements of writing for web. Structure and characteristics of Internet news stories, Writing articles, features, stories, poems for websites and portals. Uploading photographs and videos. Handling a developing story. Writing non-news content for the web. Effective blog writing. Writing for social networking. Writing and posting blogs. Mobile- SMS language, Writing news content, Writing non-news content, Developing contents for mobile. Hash Tag,Meta tags, Search engine optimization to popularize content. Digital Marketing and Analytics.	6L+10P

Course Title: MSE/MSG304: Photo Journalism (DSE/GE)

Credit:4 (L-T-P: 2+0+2)

Unit	Topics	No. of L/T/P
I	**Photo journalism** • Photo Journalism: Meaning & Definition, Growth & Development • Importance of photograph in newspaper • Ethics of Photo Journalism • Photojournalism in India	6L+ 3 P
II	**Roles and Challenges of Photo journalism** • Difference between photography and Photo-journalism • Photojournalist at field- Roles, responsibility and Challenges • News Value in Photo-Journalism, Sources in News Photography • Elements- Caption, photo story, Stand alone, Photo feature, Visual story	8 L+8 P
III	**Types of Photojournalism** • Event Photojournalism- City coverage, Spot news coverage • Specialized field of Photojournalism- Sports, Fashion & Glamour, War, Wildlife and Travel photo-journalism • Photo journalism for- Newspaper, Magazine, Website and Blog	8L+9L
IV	**Basics of Camera** • Photography: Elements & principles • Camera and types • Focal length, aperture, shutter speed, depth of field, Focusing exposure	

	• Composition: Basic elements of composition, rule of thirds **Photo Editing** • Basic principles of Photo- Editing • Role of a photo editor • Photo Composition- Color, contrast, Visual apprehension • Techniques of Photo Editing • Photo Editing Software	8L+10 P

Semester-VI

Course Title: MSC351: Communication Research (DSC)

Credit: 4 (L-T-P: 3+1+0)

Unit	Topics	No. of L/T/P
I	**Introduction to Communication Research:** 1. Concept & definition of research in general & Communication Research in particular 2. Difference between Media Research & Communication Research 3. Development of Media Research 4. Four Phases of Mass Media Research 5. Objectives of Research	8L
II	**Research Concepts:** 1. Types of Research- Descriptive, exploratory, Applied, Fundamental, Qualitative, Quantitative etc. 2.Variables- Types of Variables and their concepts 3. Sampling -Meaning, Concept & Need 4. Probability & Non-Probability 5. Types of Probability Sampling & Non-Probability Sampling 6. Hypothesis: Meaning, definitions.	12L + 4 T
III	**Research Methods:** 1. Survey Method 2. Observation Method 3. Content Analysis 4. Case Study 5. Experimental Research 6. Moving Image Analysis 7. Policy Research	12L+4T
IV	**Introduction to Statistical Methods:** 1. Measures of Central Tendency 2. Measures of Dispersion	3L+2T

V	**Research Writing** 1. Report writing & Interpretation 2. Layout of Research Report 3. Significance of Report Writing 4. Writing Abstracts & Synopsis 5. Research Paper Writing 6. Bibliography (Introduction to APA) 7. Ethics in Research and Publication	10L+5T

Course Title: MSC352: Radio Production (DSC)

Credit: 4 (L-T-P: 1+0+3)

Unit	Topics	No. of L/T/P
I	**Introduction to Radio Programs:** Quality of Radio as a medium. General Principles of Writing for Radio. , Radio programs formats: overview of and introduction to all program	6L
	formats in fiction, non-fiction/ news based/entertainment RJing, talks, talk shows, phone-in programmes. Radio magazine, Interview, Talk Show, Discussion, Feature, Documentary etc.	
II	**Radio Production Tools and Technology:** Analog Vs digital sound, Digitalization of sound and Different Sound formats. Nature of sound – Sound wave, Stereo Vs Mono sound, Pitch, Volume, Baas, Treble, Echo, Reverb, Noises and ambience, etc. Microphones – Different types –Dynamic, Ribbon, Condenser, Different types according to pick up pattern –Unidirectional, bidirectional, Omni directional, cardioids etc. , Special types- wireless, lapel, reflected type, shotgun etc.	2L+5P
III	**Process of Radio Program Production:** Pre-production – Idea and concept, target audience, Research, developing Script, marking the script, rehearsal etc. Production-Indoor Vs outdoor recording, Different cables and Connectors, different types of recorders, Audio Console, Precautions during recording. Studio console: recording and mixing; Personnel in Production process – Role and Responsibilities. Post production- Editing terminologies- fade in, fade out, Cross fade, bed, SFX etc., Exposure of sound editing software. Single track editing, multi-track editing.	4 L+10P

IV	**Production of different Genres of Radio programs:** Production of at least four among different genres of radio programs - Announcements and compeering, Radio News, Radio talks, Radio Interviews, News Paper reviews, Film Reviews, Radio Discussions, Radio Features, Vox pop, Phone-ins, Radio Commercials, Radio Jingles, Music Programming, Radio Magazines, Radio Commentary, Radio Drama, Radio Documentary etc.	20P
V	**Radio Program- Presentation aesthetics:** Voice Quality: Pitch, Modulation, Pace, Energy, Timbre,Tone etc. Announcing and Presentation for different program formats, Mic consciousness Pronunciation and delivery of words Voice personality etc.	3L+4P

Course Title: MSC353: Media Laws and Ethics (DSC)

Credit: 4 (L-T-P: 3+1+0)

Unit	Topics	No. of L/T/P
I	**Ethical Framework and Media practices** • Freedom of expression (Article 19(1)(a) and Article 19(1)2) • Freedom of expression and defamation- Libel and slander • Issues of privacy and Surveillance in Society • Right to Information • Idea of Fair Trial/Trial by Media • Intellectual Property Rights • Media ethics and cultural dependence	9L+2T
II	**Media Technology and Ethical Parameters** • Live reporting and ethics • Legality and Ethicality of Sting Operations, Phone Tapping etc • Ethical issues in Social media (IT Act 2000, Sec 66 A and the verdict of The Supreme Court) • Discussion of Important cases-eg- Operation Westend • Some Related laws- Relevant sections of Broadcast Bill, NBA guidelines	10L + 4 T
III	**Representation and ethics** • Advertisement and Women • Pornography • Related Laws and case studies- Indecent representation of Women (Prohibition) Act, 1986 and rules 1987, Protection of Women against Sexual Harassment Bill, 2007, Sec 67 of IT Act	8L+4T
	2000, Digital Media ethics code 2021 and 292 IPC etc.	

IV	**Media and Regulation** • Regulatory bodies, Codes and Ethical Guidelines • Self-Regulation • Media Content- Debates on morality and Accountability: Taste, Culture and Taboo Censorship and media debates	8L+4T
V	**Media and Social Responsibility** • Economic Pressures • Media reportage of marginalized sections- children, dalits, tribals, Gender • Media coverage of violence and related laws - inflammatory writing (IPC 353), Sedition, incitement to violence, hate speech. • Relevant Case Studies – Muzaffarnagar Riots, Attack on civil liberties of individuals and on social activists	10L+1T

Course Title: MSE/MSG351: Mobile Journalism (DSE/GE)

Credit: 4 (L-T-P: 2+0+2)

Unit	Topics	No of L/T/P
I	**Introduction to Mobile Journalism** • Journalism- Concept, Principles and Demands • Newsgathering- Sources, News Values and Elements • Roles and Responsibility of journalist • Beat Reporting & News Writing • Citizen Journalism • Mobile Journalism (MoJo)- Concept and Process • Importance of Mobile Journalism • Introduction to Smartphone • Story telling through Mobile or Smartphone • Limitations of Mobile phone	8L+4P
II	**Mobile Photography and videography** • Mobile Photography Using smart phones for taking effective pictures • Shooting video with Smart phones • Conducting Interviews • Event coverage using Mobile Phones • Streaming Live Videos with Mobile Phones	8L+12P

III	**Editing on Mobile** • Editing photos and videos taken on smart phones • Use of Mobile video editing apps • Editing software for Mobile • Editing and uploading mobile photo and video on Web Media	6L+10P
IV	**MoJo and Social Media** • Understanding Social media • Impact of MoJo on Social media • Impact of MoJo on Mainstream Media • Concept of Fake News, Paid news and Post-Truth • Ethics and Best practices in Mobile Journalism	8L+4P

Course Title: MSE/MSG352: Event Management (DSE/GE)

Credit:4 (L-T-P: 3 +1+0)

Unit	Topics	No of L/T/P
I	**Introduction to Event Management:** 1. Introduction to Event Management 2. Historical Perspective 3. Size & type of event 4. Event Team 5. Code of ethic	10L
II	**Principles of Event Management:** 1. Principles of Event Management, 2. Concept & designing. 3. Analysis of concept 4. Logistics of concept.	8L+6T
III	**Event Planning & Team Management:** 1. Aim of event 2. Develop a mission 3. Establish Objectives 4. Preparing event proposal 5. Use of planning tool	10L
IV	**Event Marketing, Advertising & PR:** 1. Nature and Process of Marketing 2. Marketing mix, Sponsorship 3. Image, Branding 4. Advertising 5. Publicity and Public Relations	7L+4T

V	**Event Safety and Security:** 1. Security, 2.Occupational safety, 3. Crowed management 4. Major risks and emergency planning 5. Incident reporting, emergency procedures 6. Event Laws and Licenses	10L+5T

Course Title: MSE/MSG353: Visual Communication (DSE/GE)

Credit: 4 (L-T-P: 2+0+2)

Unit	Topics	No of L/T/P
I	**Meaning and importance of Visual communication:** Meaning of Visuals, Visual Literacy, Visual thinking, Visual learning, Uses of Visuals, Functions of Visuals Factors affect Perceptions of persons to watch visuals- Past experience and learning, attitude and interests, needs and feelings, current situations etc. History of Visuals- Paintings (from caves to present era). Architectures (Historical buildings), Photography (From Plate to digital), Movies (from silent to digital, Advertisements etc.	10L+ 3 P
II	**Visual Communication- Elements and its significance:** Homogeneous and heterogeneous field, Figure –Ground Boundary, Notan, Visual search. Illusion, Morphics Gestalt Grouping- Law of Proximity, Law of Similarity, Law of Continuity and law of Closure, Space/Depth Cues- Relative size, Linear Perspective, Texture Gradient, Color, Shadow, Interposition	10 L+ 7 P
	Elements of Visual- Dot, Line, Shape, Pattern, Texture etc.	
III	**Visual designing:** Composition, Rule of third, Balance, Movement, Rhythm, Visual search etc. Designing for Visual communication- Poster, cartoons, Book jacket, Interior designing, greeting cards, Pottery designing, t-shirt etc.	6L+10 P
IV	**Applied form of Visual Communication:** Gestures and sign languages, signs and symbols, calligraphy, poster, electronic moving display messages, exhibitions, dramas, dance and cultural programmes, leaflets, newspapers, magazines and journals, comics books, window display - point of sale, films, television graphics, web displays etc.	4L+ 10P

Course Title: MSE/MSG354: New Media (DSE/GE)

Credit: 4 (L-T-P: 3+1+0)

Unit	Topics	No. of L/T/P
I	**New Media: Introduction & History** 1. New Media: Concept & definition 2. Cyberspace: Meaning & Concept 3. ARPA 4. Reasons behind the birth of international network 5. CERN	6L
II	**Key Concepts in Digital Communication I:** 1. Browser 2. Search Engines 3.Websites 4. URL 5. Cookies	5L+2T
III	**Key Concepts in Digital Communication II:** 1. Virtual reality and Virtual Community 2. Chat rooms, MUDs and Bots 3. Interactivity 4. Hypertext(uality) 5. Multimedia(lity)	10L
IV	**Network Society & Related Concepts:** 1. Network Society: Definition & Concept 2. The Information Age: Manuel Castells 3. Informational Economy 4. Global Economy 5. The Network Enterprise	8L+2T
V	**Online Journalism and E-Commerce:** 1. Web Journalism-Skills & Challenges 2. Weblog 3. E Commerce- Trends & Challenges	8 L+3T
VI	**Other Issues:** 1. Democratization of the Internet 2. Net Neutrality 3. Instant Gratification 4.Metaverse 5. Future	8 L + 8 T

Course Title: MSE/MSG355: Digital Media Production (DSE/GE)

Credit: 4 (L-T-P: 1+0+3)

Unit	Topics	No of L/T/P
I	**Digital Media Communication:** Characteristic and importance of Internet. New media differences with print, radio and TV media. Satellite Radio, online (Web), Podcasting, Mobile Content, Advertising, Integrating social media& UGC Content; Online broadcast technologies: webcasting, Social TV, Video conferencing, Skype etc. Mobile as a new tool of communication, Mobile for news and advertising, Role of Smart phones in growth of social media. Exploring mobile for various applications. Mobile an effective tool for promotional media. Mobile as a business tool for media organizations. Mobile for social communication. Mobile safety and precautions.	8 L+2P
II	**Different Program Formats:** Short Videos, Web series, Short News Bulletins, Live streaming, Vox -pop, Educational Lectures, Educational/Instructional films, Video Album/songs, Advertisements etc.	3L + 8P
III	**Digital Media Production:** Different stages of a New Media program production - Preproduction, Production and post production Proposal, idea, Communication objectives, target audience, Script, Reece, Budget, Crew members etc. Video Camera: Types & Characteristics, Basic parts and its functions- Shutter speed, Aperture, ISO, Focusing, Depth of field, White Balance etc. Different type of Lenses-Normal, Wide angle and Tele lenses, Prime and Zoom Lenses etc. Basic Camera Shots, angles & movements Picture/ Frame Composition- Headroom, looking room, Rule of Third, Eye line etc. DSLR Vs Mobile Camera Shooting Lighting- Need and importance, Hard light, soft light, Color temperature, Outdoor lighting, Reflectors etc., Make-up Sound: Basic Characteristics, Microphones, Sound Recording Editing	4L+ 20 P
IV	**Application and Uses:** Opening and managing a YouTube Channel, Producing low cost Video contents as short film, Cover song, news bulletin etc. and live streaming of any event.	15P

Course Title: MSI/MSP351: Internship /Project

Credit: 2 (L-T-P: 0+2+0)

Semester - VII

Course Title: MSC401: Advanced Research Methodology (DSC)

Credit: 4 (L-T-P: 3+1+0)

Unit	Topics	No. of L/T/P
I	**Introduction to Research:** 1. Concept & definition of Research 2. Objectives of Research 3. Descriptive Vs Exploratory Research 4. Significance of Research	2L+1T
II	**Types of Research:** 1. Grounded Theory in brief 2. Triangulations / Mixed Methods in brief 3. Experimental Researches- Experimental and Control Groups 4. Cross –sectional researches 5. Longitudinal Research 6. Naturalistic Enquiry (Ethnographical Research) etc.	8L+3T
III	**Research Concepts I:** 1. Variables- Types of Variables and their concepts 2. Reliability & Validity in Research 3. Concepts & Constructs 4. Inductive and Deductive Approaches to Research 5. Measurement and research NOIR. 6. Measurement Scales	8L+3T
IV	**Research Concepts II:** 1. Generating Research Questions & Hypotheses 2. Sampling -Meaning, Concept & Need 3. Probability & Non-Probability Sampling 4. Types of Probability Sampling & Non-Probability Sampling 5. Hypothesis: Meaning, definitions.	6L+2T

V	**Research Methods:** 1. Survey Method 2. Observation Method 3. Interview Method 4. Content Analysis 5. Case Study 6. Experimental Research 7. Data Preparation	8L+2T
VI	**Research Writing:** 1. Report writing & Interpretation 2. Types of Report 3. Layout of Research Report 4. Significance of Report Writing 5. Writing Abstracts & Synopsis 6. Research Paper Writing 7. APA style of in-text citation and referencing	8L+3T
VII:	**Research& Publication Ethics:** 1. Ethics in Publication 2. Ethics in Research 3. Impact factor, H-index, i10 index etc.	5L+1T

Course Title: MSE/MSG401: Media Studies: Key Debates (DSE/GE)

Credit: 4 (L-T-P: 3+1+0)

Unit	Topics	No. of L/T/P
I	**Ideology& Culture** 1. Ruling class and the ruling ideas- Marx & Engels 2. Base and Superstructure debate in Marxist Cultural Theory 3. Hegemony -- Gramsci 4. The Culture Industry- Horkheimer & Adorno 5. The Public Sphere - Habermas 6. Ideological & Repressive State Apparatuses – Althusser	12L+4T
II	**Political Economy of Communication** 1. Understanding the Political Economy of Communication -Graham Murdoch, Janet Wasko& Vincent Mosco 2. Manufacturing Consent – Noam Chomsky 3.The Media Economics- Albarran& Picard	10L+4T

III	**Postmodernism, New Media& Globalization** 1. Simulation & Simulacra - Baudrillard 2. Postmodernism: The cultural logic of late capitalism – Fredric Jameson 3. Postmodern Virtualities – Poster 4. Globalization, Glocalization &Interlocalization	11L+3T
IV	**Politics and Communication** 1.Political communication: three key players – Politicians, Media and the Public 2. Political communication – Lippman &Klapper. 3. Spin-Doctoring: Political Public Relations. 4. Mediatisation of politics in Indian context. 5. Rhetoric in political communication.	12L+4T

Course Title: MSE/MSG402: Media Technologies and Public Policy (DSE/GE)

Credit: 4(L-T-P: 3+1+0)

Unit	Topics	No. of L/T/P
I	**Understanding Media Technology** 1. History and Social Construction of Media Technology 2. Technological Determinism and Beyond 3.Media Technology as Global Industry 4. Media Technology and Social Change	10L+3T
II	**New Media and the Idea of 'Convergence'** 1. Understanding Evolution of New Media in Historical Context 2. Technological Convergence and Convergence Culture 3. Convergence of Users and Producers 4. The Internet and Future of Interactive Media	10L+4T
III	**The Concept of Media Policy** 1. Overview of the Field of Media Policy 2. Evolution of Media Policies and Related 3. Legal Framework in Political Context 3. The Concept of Interpretive Policy 4. Global Order and Global Media policy	12L+4T

IV	**Media Policy in India** 1. Historical Overview of Indian Media Policy Current Media Policy 2. Impact of Globalization on Indian Media Policy 3. Critical Evaluation of Important Indian Media Policy Regime such as 1995 Supreme Court Judgment on Airwaves, Information Technology Act, 2000 and Information Technology (Amendment) Act, 2008, Communication Convergence Bill, 2001, Broadcasting Bill, 1997 and Cable Television Network Regulation (Amendment) Act, 2011 and latest laws and policies especially with regards to Third-party apps and social media	13L+4T

Course Title: MSE/MSG403: Applied Statistics and Tools for Communication Research (DSE/GE)

Credit: 4 (L-T-P: 2+0+2)

Units	Topic	No. of L/T/P
I	Introduction: An Overview of Statistics: Meaning, Definition and Characteristics; Nature, Importance and Limitations of Statistics; types of Variables (Continuous and Discrete) and Levels of Measurement (NOIR); Importance of Statistics in Media Research (With reference to Content analysis, Code Book Preparation and Coding)	5L+1P
II	Descriptive Statistics: Importance and Limitations; Measures of Central Tendency: Arithmetic Mean, Median, Mode; Measures of Variability I: Range and Mean Deviation; Measures of Variability II: Quartile Deviation and Standard Deviation	5L+1P
III	Correlation Analysis: Meaning, Concept and Characteristics of Correlation; Types of Correlation: Basic type (Positive, Negative and Zero), Linearity Based- Linear, Non-linear and Curvilinear; Partial Correlation: Pearson's Product Moment Correlation and Spearman's Rank Order Correlation; Determination of Correlation by Graphical Methods and Coefficient of Correlation; Concept of Multi-co linearity and Multiple Correlation.	5L+5P
IV	Test of Significance: Concept and Application of Hypothesis testing and Test of Significance; Types of Errors, Level of Significance, Critical region, One-tailed and Two-tailed Tests, Size and Power of Test, Degree of Freedom; t-test: Independent Sample t-test, Paired t- test; Chi-square Test: Meaning and Application	4L+6P
V	Analysis of Variance (ANOVA) and Time Series: Chi-square test with SPSS; One-way ANOVA: Meaning, Interpretation, Application and Calculation with SPSS; Cluster Analysis; Post-hoc Measurement; Structural Equation Modelling	4L+5P

VI	Factor Analysis Methods: Factor Analysis: Meaning, Interpretation, Application; Principle Component Method; Logistics Regression	3L+6P
VII	Regression: Meaning, Application and Interpretation of Regression and its terms- R, R2, Alpha-coefficient, Beta-coefficient, tvalue in Regression Analysis; Meaning, Application and Interpretation of Regressionanditsterms-R,R2,Alpha-coefficient,Beta-coefficient, tvalue in Regression Analysis; Concept and Application of Multiple Correlation and Regression, Relationship between Correlation coefficient and Regression coefficient; Uses of Regression Analysis in Research Paper	4L+6P

Course Title: MSE/MSG404: Media and Gender (DSE/GE)

Credit:4 (L-T-P: 3+1+0)

Units	Topic	No. of L/T/P
I	**Introduction to Gender & Media:** 1. Gender-concept and definition. 2. Media- concept and definition. 3. Approaches to Gender & Media: Industry, Audience, Text	5L+2T
II	**Key Concepts and Approaches:** 1. Gender as a social construct 2. Stereotypes, (In) visibility and Gaze 3. Feminism and Ideology 4. Post Feminism	8L+2T
III	**Media Texts and Representations:** 1. Intersectionality 2. Bodies & Objectification 3. Masculinity 4. Sexuality 5. Sports and Games	8L+3T
IV	**Media Production:** 1. Gender and Political economy 2. Gender Inequalities in Cultural Industries 3. Feminized Labour 4. Consumer Culture and selling feminism - Children's Media and Merchandising constructing Gender 5. Commodity Feminism	10L+3T
V	**Media Audiences:** 1. Reception 2. Fandom 3. Ressistance	6L+3T

VI	**Digital Culture and Gender:** 1. Gender and self-presentation 2. Cyber misogyny and Trolling 3. Gender and online activism 4. The branded self	8L+2T

Course Title: MSP401:

Academic Project (Communication Production-Radio/TV/Print)

Credit: 6 (L-T-P: 2+1+3)

Semester - VIII

Course Title: MSC451: Principles and Theories of Mass Communication (DSC)

Credit: 4 (L-T-P: 3+1+0)

Unit	Topics	No. of L/T/P
I	**Nature and Scope of Communication** • Definition, Concept, and Process of Communication • Communication as Action- Verbal and Non-Verbal • Types and Modes of Communication • Stages of Communication • Effective Communication and Barriers to Communication • Global Communication and Information and Communication Technology	10L+2T
II	**Mass Communication: An Overview** • A brief History of Mass Communication • Folk and Traditional Media • The Rise of Mass Media- Print, Radio, Television and New/ Digital Media • Functions of Mass Media • Global Mass Communication • Mass Communication in India	10L+3T

III	**Theories and Models of Communication: Critical understanding** • Defining Theory and Evolution of Mass Media Theory • Theories of Communication: Hypodermic, Individual Differences, Cognitive Dissonance, Personal Influence Theory etc. • Sociological Theories of Communication: Cultivation, Social Learning, Agenda Setting • Play, Uses and Gratification, Dependency Theory etc. • Normative Theories: Authoritarian, Libertarian, Social Responsibility, Soviet- Communist Media • Development Communication, Democratization Theory etc. • Basic Models of Communication: Linear, Transmission, Transactional and Interactional models • Lasswell, Shannon and Weaver, Osgood and Schramm Models, Newcomb's model • George Gerbener's Model and Westley and Mc Lean Model of Mass Communication • New Media Theories	15L+6T
IV	**Ideas & Ideologies in Media Theories** • Basic structure of Dominant paradigm • Functionalism, Structuralism • Critical theories, Hermeneutics/Cultural theories • Marxist theory, Neo Marxism & Frankfurt School • Basic Idea of Marshall McLuhan, Michel Foucault, Sigmund Freud etc.	10L+4T

Course Title: MSE/MSG451: Mass Media and Society (DSE/GE)

Credit: 4 (L-T-P: 3+1+0)

Mode of evaluation: Written		
Total No. of Lectures-Tutorials-Practical in a week: L-T-P: 3+1+0		
Unit	**Topics**	**No. of L/T/P**
I	**Understanding Society and Social Processes and Mass Media** 1. Understanding society and Indian social system 2. Social structure and social processes 3. Concept, forms and functions of Mass Media	10L+3T
II	**Media and Social World** 1. Sociology of media 2. Mass media and socialization 3. Media, industry and social world 4. Mass media and social relations 5. Gender and communication 6. Mass media and public opinion	15L+4T

III	**Understanding Media as Industry** 1. Mass media and globalization 2. Media ownership patterns and corporatization of media 3. Mass media and profit	10L+4T
	4. Advertising and its impact	
IV	**Media and Politics** 1. Media influence and political world 2. Media and ideology 3. Mass media and international relations	10L+4T

Course Title: MSE/MSG452: Social and Political Thought (DSE/GE)

Credit: 4(L-T-P: 3+1+0)

Unit	Topics	No. of L/T/P
I	**Indian Social and Political Thought - I** 1. Indian Renaissance: Raja Ram Mohan Roy, Vivekanand 2. Liberal and hardline thinkers: Political Liberalism of G K Gokhale, Militant Nationalism of B G Tilak	10L+3T
II	**Indian Social and Political Thought - II** 1. Gandhi: Critique of western civilization, Nationalism, Satyagrah, Non-violence, Hind Swaraj, Ideal State 2. Nehruvian Thought 3. Socialist Thoughts: Radical Humanism of M N Roy, Socialism of R M Lohia, Total Revolution of J P Narayan 4. B R Ambedkar's thoughts on Social Justice and Social Democracy	15L+4T
III	**Western Social and Political Thought** 1. Greek Political Thinkers: Plato and Aristotle 2. Theories of Government: Machiavelli 3. Social Contract Theories: Hobbes, Locke 4. Social and Political Thoughts of George Hegal, Karl Marx	12L+4T
IV	**Comparative Analysis** Western and Indian Social Political Thought: A Comparative Analysis	8L+4T

Course Title: MSE/MSG453: Mainstream Cinema and Society (DSE/GE)

Credit: 4 (L-T-P: 3+1+0)

Unit	Topics	No. of L/T/P
I	**Introduction to Cinema:** 1. Cinema- concept and definition. 2. History of cinema- 3. Actualities and Cinema of attractions. 4. French beginnings- George Meleis' and beginning of editing 5. Films of the period and Language of cinema, Arrival of sound	8L
II	**World Film movements:** 1. Rise of American Films 2. German expressionism 3. Soviet Montage 4. French Avant Garde 5. Italian Neo-realism	10L+8T
III	**Theories in Cinema Studies:** 1. Feminist film theory 2. Narrative construction of Reality 3. Auteur Theory	10L
IV	**Indian Cinema:** 1. Beginnings – pioneers of Indian Cinema 2. Talkies 3. The studio system and its decline 4. New Wave- Parallel and Middle Cinema 5. Second New Wave	10L+5T
V	**Cinema & Society:** 1. Censorship 2. Cinema for Change 3. Representations 4. Portrayals in Mainstream Cinema	7L+2T

Course Title: MSE/MSG454: Data Journalism (DSE/GE)

Credit: 4 (L-T-P: 3+1+0)

Unit	Topics	No. of L/T/P
I	**Understanding Data** What is data, Types of data, Understanding the difference between data and big data, Different kinds of data that journalists deal with on an everyday basis, Understanding why is data necessary for journalists, Need for data driven journalism	6L+2T
II	**Basic understanding about the datasets released by the Government** What kind of datasets does the government collect and why is it necessary for the government to collect these datasets, What are the different kinds of data released by government – a basic overview, What are the different offices which release government data, Importance of Census, Importance of Development Data: Learning to use Open Government Data platform data.gov.in, Accessing data through Right to Information Act, 2005	10L+2T
III	**Dealing with Economic and Financial Data** Why is data pertaining to the economy important? Understanding different kinds of economic datasets released by the Government of India, RBI, NITI Aayog and other bodies - GDP, CPI inflation, WPI inflation, Fiscal Data, Current Account Deficit, Foreign Direct Investment, Trade data including trade deficit and export-import data, Balance of Payments data, Manufacturing PMI, Services PMI, Index of Industrial Production, and foreign exchange data, data on revenue collection, expenditure data and labour and workforce data, Understanding the Union Budget as a dataset, Understanding how and why does data from the Indian Meteorological Department matter, Understanding corporate data stored and managed by Registrar of Companies, Learning how to analyse quarterly and annual results of listed companies, Learning how to use websites of BSE Sensex and NSE Nifty for data mining on companies, Data released by oil marketing companies, Data released by Society of Indian Automobile Manufacturers (SIAM), Data released by telecommunication companies/ TRAI	12L+5T
IV	**Dealing with Social Indicators** Understanding different social datasets released by the government and other agencies, Annual Health Survey, Rural Health Statistics, Sex Ratio, Child Sex Ratio, Decadal Growth Rate, Literacy Rate, Dropout Rate, Employment/Unemployment Data, Under 5 Mortality Rate, Infant Mortality Rate, Maternal Mortality Rate, Human Development Index, Data related to the Integrated Child Development Scheme (ICDS), Electricity data, Sanitation data, Housing data, Road and Highways data, Environment data	10L+4T

V	**Data Analysis and Story writing** Learning how to analyse data, Learning how to use data analysis to write a story, Learning techniques of data visualisations through various freeto-use softwares.	7L+2T

दून विश्वविद्यालय
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Sample Syllabus Structure of Employability/ Entrepreneurship/ Skill Development

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