Integrated MSc Chemistry

CURRICULUM AND SYLLABUS

(Effective from 2018 Admission Onwards)

Vision of the Institute

To be a global leader in the delivery of engineering education, transforming individuals to become creative, innovative, and socially responsible contributors in their professions.

Mission of the Institute:

1. To provide best-in-class infrastructure and resources to achieve excellence in technical education,
2. To promote knowledge development in thematic research areas that have a positive impact on society, both nationally and globally,
3. To design and maintain the highest quality education through active engagement with all stakeholders –students, faculty, industry, alumni and reputed academic institutions,
4. To contribute to the quality enhancement of the local and global education ecosystem,
5. To promote a culture of collaboration that allows creativity, innovation, and entrepreneurship to flourish, and
6. To practice and promote high standards of professional ethics, transparency, and accountability

PROGRAM OUTCOMES (PO)

Students of all Integrated/PG degree Programmes at the time of graduation will be able to

PO1. **Science knowledge**: Knowledge of basic science fundamentals

PO2. **Problem analysis**: Develop analytical skills to identify, formulate, analyze complex mechanisms using first principles basic sciences.

PO3. **Development of solutions**: Design solutions for complex chemical process problems and evolve procedures that meet the specified needs with appropriate consideration for the public health and safety and environmental considerations.

PO4. **Critical review of solutions:** Use of research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. **Modern analytical tool usage**: Select, and apply appropriate techniques, resources, and modern analytical tools

PO6. **The scientist and society**: Apply reasoning through the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional chemical practice.

PO7. **Environment and sustainability**: Understand the impact of the chemical processes in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the chemistry practice.

PO9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication**: Communicate effectively on complex scientific activities with the science community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance**: Demonstrate knowledge and understanding of the scientific and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

PO12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO1: Graduate can demonstrate the understanding the basic principles of synthetic and analytical applications of chemistry along with proficiency in communication and professional excellence in project management and execution.

PSO2: Graduate will be competent for higher education in world class universities, research in industrial organizations and also to seek a career in teaching.

PSO3: Graduate can be employable in research and development, analytical and quality control services including ICT enabled sectors and also motivated for entrepreneurship.

PSO4: Graduate will manifest commitment to society, environmental awareness, moral and ethical values in scientific scenario.

Integrated MSc Chemistry

CURRICULUM

(Effective from 2018 Admission Onwards)

SEMESTER I

Course Code	Course Title	L T P	Cr	ES
18ENG101	Communicative English	2 0 2	3	
	Language Paper I	1 0 2	2	
18CHY101	General Chemistry I	3 1 0	4	
18CSA100	Problem Solving and Computer Programming	3 0 0	3	
18MAT105	Introduction to Calculus and Matrix Theory	3 1 0	4	
18PHY103	Mechanics	3 1 0	4	
18CSA180	Problem Solving and Computer Programming Lab.	0 0 2	1	
18PHY181	Physics Lab. I	0 0 2	1	
18CUL101	Cultural Education I	2 0 0	2	
	TOTAL		**24**	

SEMESTER II

Course Code	Course Title	L T P	Cr	ES
18ENG121	Professional Communication	1 0 2	2	
	Language Paper II	1 0 2	2	
18CHY111	General Chemistry II	3 1 0	4	
18CSA116	Advanced Computer Programming	3 0 0	3	
18MAT114	Ordinary Differential Equations and Vector Calculus	3 1 0	4	
18PHY114	Electricity and Magnetism	3 1 0	4	
18CHY184	Inorganic Quantitative Lab. – Volumetric Analysis	0 0 2	1	
18CSA181	Advanced Computer Programming Lab.	0 0 2	1	
18PHY182	Physics Lab. II	0 0 2	1	
18CUL111	Cultural Education II	2 0 0	2	
	TOTAL		**24**	

SEMESTER III

Course Code	Course Title	L T P	Cr	ES
18CHY202	Physical Chemistry I	3 1 0	4	
18CHY203	Inorganic Chemistry I	3 1 0	4	
18ENV300	Environmental Science and Sustainability	3 0 0	3	
18MAT207	Introduction to Probability and Statistics	3 1 0	4	
18PHY305	Basic Electronics	3 1 0	4	
18CHY281	Inorganic Qualitative Lab	0 0 3	1	
18SSK201	Life Skills I	1 0 2	2	
18AVP201	Amrita Values Programme I	1 0 0	1	
	TOTAL		**23**	

SEMESTER IV

Course Code	Course Title	L T P	Cr	ES
18CHY212	Physical Chemistry II	3 1 0	4	
18CHY213	Organic Chemistry I	3 1 0	4	
18MAT219	Integral Transforms	3 1 0	4	
18PHY214	Waves and Optics	3 1 0	4	
	Open Elective A*	3 0 0	3	
18CHY282	Basic Organic Qualitative Lab.	0 0 3	1	
18SSK211	Life Skills II	1 0 2	2	
18AVP211	Amrita Values Programme II	1 0 0	1	
	TOTAL		**23**	

SEMESTER V

Course Code	Course Title	L T P	Cr	ES
18CHY301	Physical Chemistry III	3 1 0	4	
18CHY302	Inorganic Chemistry II	3 1 0	4	
18CHY303	Organic Chemistry II	3 1 0	4	
	Elective A	3 0 0	3	
18CHY383	Basic Physical Chemistry Lab.	0 0 3	1	
18CHY384	Organic Synthesis and Estimation Lab.	0 0 3	1	
18CHY390	Live-in-Lab.@ / Open Elective B*	3 0 0	3	
18SSK301	Life Skills III	1 0 2	2	
	TOTAL		**22**	

SEMESTER VI

Course Code	Course Title	L T P	Cr	ES
18CHY312	Basics of Analytical Chemistry	3 1 0	4	
18CHY313	Organic Chemistry III	3 1 0	4	
18CHY314	Inorganic Chemistry III	3 1 0	4	
18CHY317	Basic Spectroscopic Techniques	3 1 0	4	
	Elective B	3 0 0	3	
18CHY385	Inorganic Quantitative Lab. – Gravimetric Analysis	0 0 5	2	
18CHY386	Physical Chemistry Lab. – Instrumental Analysis	0 0 5	2	
	TOTAL		**23**	
18CHY399	Project (for Exit-option students)		6	
			29	
	TOTAL (for Exit-option students)	**145**		

SEMESTER VII

Course Code	Course Title	L T P	Cr	ES
18CHY501	Quantum Chemistry	3 0 0	3	
18CHY505	Group Theory and its Applications	3 0 0	3	
18CHY502	Concepts in Inorganic Chemistry	3 1 0	4	
18CHY503	Principles in Organic Chemistry	3 0 0	3	
18CHY504	Coordination Chemistry	3 0 0	3	
18CHY581	Inorganic Semi-micro Qualitative Analysis Lab.	0 0 5	2	
18CHY582	Organic Quantitative Analysis Lab.	0 0 5	2	
	TOTAL		**20**	

SEMESTER VIII

Course Code	Course Title	L T P	Cr	ES
18CHY511	Chemical Thermodynamics and Equilibria	3 1 0	4	
18CHY512	Molecular Spectroscopy	3 1 0	4	
18CHY513	Organic Reaction Mechanism	3 1 0	4	
18CHY514	Heterocyclic and Natural Products Chemistry	3 0 0	3	
18CHY515	Organometallic Chemistry	3 0 0	3	
18CHY583	Advanced Physical Chemistry Lab.	0 0 5	2	
18CHY584	Inorganic Quantitative Analysis Lab.	0 0 5	2	
	TOTAL		**22**	

SEMESTER IX

Course Code	Course Title	L T P	Cr	ES
18CHY601	Electrochemistry, Kinetics and surface Chemistry	3 1 0	4	
18CHY602	Synthetic Strategies and Reagents	3 1 0	4	
18CHY603	Solid State Chemistry and Materials Science	3 0 0	3	
18CHY604	Bioinorganic Chemistry	3 0 0	3	
	Elective	3 0 0	3	
18CHY681	Organic Qualitative Analysis Lab.	0 0 5	2	
18CHY682	Instrumental and Analytical Methods Lab.	0 0 5	2	
	TOTAL		**21**	

SEMESTER X

Course Code	Course Title	L T P	Cr	ES
18CHY696	Dissertation		14	
	TOTAL		**14**	
	TOTAL	**216**		

Electives

Course Code	Course Title	L T P	Cr	ES
18CHY331	Batteries and Fuel Cells	3 0 0	3	E
18CHY332	Corrosion Science	3 0 0	3	E
18CHY333	Green Chemistry	3 0 0	3	E
18CHY334	Industrial Catalysis	3 0 0	3	E
18CHY335	Introduction to Food Chemistry	3 0 0	3	E
18CHY336	Polymer Chemistry	3 0 0	3	E
18CHY337	Surface Science and Coating Technology	3 0 0	3	E
18CHY353	Forensic Science	3 0 0	3	E
18CHY631	Applied Electrochemistry	3 0 0	3	E
18CHY632	Bioanalytical Chemistry	3 0 0	3	E
18CHY633	Chemistry of Biomolecules	3 0 0	3	E
18CHY634	Industrial Chemistry	3 0 0	3	E
18CHY635	Industrial Stoichiometry	3 0 0	3	E
18CHY636	Material Science and Nanochemistry	3 0 0	3	E
18CHY637	Medicinal Chemistry	3 0 0	3	E

18CHY638	Supramolecular Chemistry	3 0 0	3	E
18CHY639	Nanomaterials for Biomedical Applications	3 0 0	3	E
18CHY640	Industrial Metal Finishing Processes	3 0 0	3	E
18CHY641	Biosensors: Fundamentals and Applications	3 0 0	3	E
18CHY642	Computational Chemistry	3 0 0	3	E
18CHY643	Sustainable Chemical Science	3 0 0	3	E
18CHY644	Sustainable techniques in Chemical Sciences	3 0 0	3	E

Open Electives

Course Code	Course Title	L T P	Cr
18OEL231	Advertising	3 0 0	3
18OEL232	Basic Statistics	3 0 0	3
18OEL233	Citizen Journalism	3 0 0	3
18OEL234	Creative Writing for Beginners	3 0 0	3
18OEL235	Desktop Support and Services	3 0 0	3
18OEL236	Development Journalism	3 0 0	3
18OEL237	Digital Photography	3 0 0	3
18OEL238	Emotional Intelligence	3 0 0	3
18OEL239	Essence of Spiritual Literature	3 0 0	3
18OEL240	Film Theory	3 0 0	3
18OEL241	Fundamentals of Network Administration	3 0 0	3
18OEL242	Gender Studies	3 0 0	3
18OEL243	Glimpses of Indian Economy and Polity	3 0 0	3
18OEL244	Graphics and Web-designing Tools	3 0 0	3
18OEL245	Green Marketing	3 0 0	3
18OEL246	Healthcare and Technology	3 0 0	3
18OEL247	History of English Literature	3 0 0	3
18OEL248	Indian Writing in English	3 0 0	3
18OEL249	Industrial Relations and Labour Welfare	3 0 0	3
18OEL250	Introduction to Ancient Indian Yogic and Vedic Wisdom	3 0 0	3
18OEL251	Introduction to Computer Hardware	3 0 0	3
18OEL252	Introduction to Event Management	3 0 0	3
18OEL253	Introduction to Media	3 0 0	3
18OEL254	Introduction to Right to Information Act	3 0 0	3
18OEL255	Introduction to Translation	3 0 0	3
18OEL256	Linguistic Abilities	3 0 0	3
18OEL257	Literary Criticism and Theory	3 0 0	3
18OEL258	Macro Economics	3 0 0	3
18OEL259	Managing Failure	3 0 0	3
18OEL260	Media Management	3 0 0	3

18OEL261	Micro Economics	3 0 0	3
18OEL262	Micro Finance, Small Group Management and Cooperatives	3 0 0	3
18OEL263	Negotiation and Counselling	3 0 0	3
18OEL264	New Literatures	3 0 0	3
18OEL265	Non-Profit Organisation	3 0 0	3
18OEL266	Personal Effectiveness	3 0 0	3
18OEL267	Perspectives in Astrophysics and Cosmology	3 0 0	3
18OEL268	Principles of Marketing	3 0 0	3
18OEL269	Principles of Public Relations	3 0 0	3
18OEL270	Science, Society and Culture	3 0 0	3
18OEL271	Statistical Analysis	3 0 0	3
18OEL272	Teamwork and Collaboration	3 0 0	3
18OEL273	The Message of Bhagwad Gita	3 0 0	3
18OEL274	Understanding Travel and Tourism	3 0 0	3
18OEL275	Videography	3 0 0	3
18OEL276	Vistas of English Literature	3 0 0	3
18OEL277	Web-Designing Techniques	3 0 0	3
18OEL278	Organic Farming	3 0 0	3
18OEL279	Basic Legal Awareness on Protection of Women and Rights	3 0 0	3
18OEL280	Ritual Performances of Kerala	3 0 0	3
18OEL281	Documenting Social Issues	3 0 0	3
18OEL282	Fabrication of Advanced Solar Cell	3 0 0	3
18OEL283	Basic Concepts of X-ray Diffraction	3 0 0	3
18OEL284	Introduction to FORTRAN and GNUPLOT	3 0 0	3
18OEL285	Introduction to Porous Materials	3 0 0	3
18OEL286	Forensic Science	3 0 0	3
18OEL287	Introduction to solar Physics	3 0 0	3
18OEL288	Recycling Recovery and Treatment Methods for Wastes	3 0 0	3
18OEL289	Acting and Dramatic Presentation	2 0 2	3
18OEL290	Computerised Accounting	2 0 2	3
18OEL291	Kerala Mural Art and Painting	2 0 2	3
18OEL292	Painting	2 0 2	3
18OEL293	Reporting Rural Issues	3 0 0	3

LANGUAGES

Paper I

Course Code	Course Title	L T P	Cr	ES
18HIN101	Hindi I	1 0 2	2	B
18KAN101	Kannada I	1 0 2	2	B
18MAL101	Malayalam I	1 0 2	2	B

18SAN101	Sanskrit I	1 0 2	2	B
18TAM101	Tamil I	1 0 2	2	B

Paper II

Course Code	Course Title	L T P	Cr	ES
18HIN111	Hindi II	1 0 2	2	B
18KAN111	Kannada II	1 0 2	2	B
18MAL111	Malayalam II	1 0 2	2	B
18SAN111	Sanskrit II	1 0 2	2	B
18TAM111	Tamil II	1 0 2	2	B

* **Two Open Elective** courses are to be taken by each student, one each at the **4th and the 5th** semesters, from the list of Open electives offered by the School.

[@] Students undertaking and registering for a Live-in-Lab project, can be exempted from registering for an Open Elective course in the fifth semester.

Evaluation Pattern

50:50 (Internal: External) (All Theory Courses)

Assessment	Internal	External
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

80:20 (Internal: External) (Lab courses and Lab based Courses having 1 Theory hour)

Assessment	Internal	External
*Continuous Assessment (CA)	80	
End Semester		20

70:30(Internal: External) (Lab based courses having 2 Theory hours/ Theory and Tutorial)
Theory- 60 Marks; Lab- 40 Marks

Assessment	Internal	External
Periodical 1	10	
Periodical 2	10	
*Continuous Assessment (Theory) (CAT)	10	
Continuous Assessment (Lab) (CAL)	40	
End Semester		30

65:35 (Internal: External) (Lab based courses having 3 Theory hours/ Theory and Tutorial)
Theory- 70 Marks; Lab- 30 Marks

Assessment	Internal	External
Periodical 1	10	
Periodical 2	10	
*Continuous Assessment (Theory) (CAT)	15	
Continuous Assessment (Lab) (CAL)	30	
End Semester		35

*CA – Can be Quizzes, Assignment, Projects, and Reports.

Letter Grade	Grade Point	Grade Description
O	10.00	Outstanding
A+	9.50	Excellent
A	9.00	Very Good
B+	8.00	Good
B	7.00	Above Average
C	6.00	Average
P	5.00	Pass
F	0.00	Fail

Grades O to P indicate successful completion of the course

$$CGPA = \frac{\sum (C_i x Gr_i)}{\sum C_i}$$

Where

C_i = Credit for the i^{th} course in any semester

Gr_i= Grade point for the i^{th} course

Cr. = Credits for the Course

Gr. = Grade Obtained

Integrated MSc Chemistry

SYLLABI

(Effective from 2018 Admission Onwards)

18ENG101 **Communicative English** **2-0-2-3**

Objectives:

To help students obtain an ability to communicate fluently in English; to enable and enhance the students skills in reading, writing, listening and speaking; to impart an aesthetic sense and enhance creativity

Course Contents:

Unit I

Kinds of sentences, usage of preposition, use of adjectives, adverbs for description, Tenses, Determiners- Agreement (Subject – Verb, Pronoun- Antecedent) collocation, Phrasal Verbs, Modifiers, Linkers/ Discourse Markers, Question Tags

Unit II

Paragraph writing – Cohesion - Development: definition, comparison, classification, contrast, cause and effect - Essay writing: Descriptive and Narrative

Unit III

Letter Writing - Personal (congratulation, invitation, felicitation, gratitude, condolence etc.) Official (Principal / Head of the department/ College authorities, Bank Manager, Editors of newspapers and magazines)

Unit IV

Reading Comprehension – Skimming and scanning- inference and deduction – Reading different kinds of material –Speaking**:** Narration of incidents / stories/ anecdotes- Current News Awareness

Unit V

Prose: John Halt's 'Three Kinds of Discipline*'* [**Detailed**]
Max Beerbohm's 'The Golden Drugget' [**Detailed**]
Poems: Ogden Nash- *'*This is Going to Hurt Just a Little Bit' [**Detailed**]
Robert Kroetsch– 'I am Getting Old Now', Langston Hughes- 'I, Too' [**Detailed**]
Wole Soyinka- 'Telephone Conversation' **[Non- Detailed**]
Kamala Das- 'The Dance of the Eunuchs' [**Non-Detailed**]
Short Stories: Edgar Allan Poe's 'The Black Cat*',* Ruskin Bond's 'The Time Stops at Shamili*'* **[Non-Detailed**]

<u>Course Outcomes</u>

CO1: Demonstrate competency in all the four linguistic skills, viz. listening, speaking, reading and writing
CO2: Apply different styles of communication in professional context
CO3: Participate in different planned & extempore communicative activities
CO4: Interpret and discuss facts and information in a given context

CO5: Develop an appreciation for human values

CORE READING:

1. *Ruskin Bond, Time Stops at Shamli and Other Stories, Penguin Books India Pvt Ltd, 1989*
2. *Syamala, V. Speak English in Four Easy Steps, Improve English Foundation Trivandrum: 2006*
3. *Beerbohm, Max, The Prince of Minor Writers: The Selected Essays of Max Beerbohm (NYRB Classics), Phillip Lopate (Introduction, Editor), The New York Review of Book Publishers.*
4. *Edger Allan Poe. The Selected Works of Edger Allan Poe. A Running Press, 2014.*
5. *Online sources*

References:

1. *Ruskin Bond, Time Stops at Shamli and Other Stories, Penguin Books India Pvt Ltd, 1989*
2. *Martinet, Thomson, A Practical English Grammar, IV Ed. OUP, 1986.*
3. *Murphy, Raymond, Murphy's English Grammar, CUP, 2004*
4. *Online Sources*

18CHY101 GENERAL CHEMISTRY I 3 1 0 4

Unit 1 Atomic Structure I

Dalton's atomic theory and its failure, Thomson's experiment charge on electron - Millikan's Oil Drop Technique,e/m ratio of an electron- Chadwick's experiment atomic number,Rutherford's and - limitations of Rutherford's model - Maxwell's electromagnetic theory of radiation and s model, Bohr's model of hydrogen atom - Bohr's theory and Ritz combination principle, spectra – emission and absorption - Hydrogen spectrum, Bohr-Sommerfeld theory.

Unit 2 Atomic Structure II

Planck's quantum theory of radiation, dual character of electrons - de Broglie's equation and experiment- Heisenberg's uncertainty principle - photoelectric effect, Compton, Zeeman and Stark effects, Schrodinger wave equation, eigen values, significance of wave function (ψ and ψ^2) and quantum numbers, Schrodinger wave equation for hydrogen and hydrogen-like systems (no derivations, only the final equation), probability distribution of electrons around the nucleus - distribution of 1s, 2s & 2p electrons or orbitals, shapes of atomic orbitals - s, p, d and f, aufbau principle, Hund's rule, Pauli's exclusion principle, electronic configuration of elements.

Unit 3 Chemical Bonding I

Electrovalency and ionic bond formation, ionic compounds and their properties, lattice energy, Born-Lande equation and its application, Born-Haber cycle and its application, solvation enthalpy and solubility of ionic compounds, covalent bond, covalency, formation of H_2 in terms of decrease of energy, orbital theory of covalency - sigma and pi bonds - formation of covalent compounds and their properties.

Unit 4 Chemical Bonding II

Hybridization and geometry of covalent molecules - VSEPR theory - polar and non-polar covalent bonds, polarization of covalent bond - polarizing power, polarisability of ions and Fajan's rule, dipole moment, percentage ionic character from dipole moment, dipole moment and structure of molecules, co-ordinate covalent compounds and their characteristics, metallic bond - free electron, valence bond and band theories, weak chemical bonds – inter and intra molecular hydrogen bond - van der Waals forces.

Unit 5 Chemical analysis and stoichiometric calculation

Titrimetry - Fundamental concepts – Theory behind acid base, redox, precipitation and complexometric titrations – problems based on stoichiometry - gravimetry principle and model calculations involving estimation of barium, calcium and nickel - data analysis, significant figures, precision and accuracy – types of errors - mean and standard deviation.

Course Outcomes

CO1: To understand orbital concept and atomic structure based on accepted atom models.

CO2: Predict chemical bonding and molecular geometry based on the existing theories.

CO3: Develop of analytical skills for performing volumetric and gravimetric analysis of given samples.

TEXTBOOKS:

1. *F. A. Cotton, G. Wilkinson and P. L. Gaus, 'Basic Inorganic Chemistry', 5th edition, John Wiley, 1987.*
2. *C. N. R. Rao, 'University General Chemistry', Macmillan, India, 2000.*

REFERENCES:

1. *B. R. Puri, L. R. Sharma, M. S. Pathania, 'Principles of Physical Chemistry', Vishal Publishing Co., 2008*
2. *Manas Chanda, 'Atomic Structure and Chemical Bond', 4th edition, Tata McGraw-Hill, New Delhi, 2000.*
3. *Peter Atkins and Julio de Paula, 'Elements of Physical Chemistry', 5th edition, Oxford University Press. 2009.*

18CSA100 PROBLEM SOLVING AND COMPUTER PROGRAMMING 3 0 0 3

Introduction to problem solving: algorithm development and flowchart. Introduction to Computer terminologies and computer languages. C Fundamentals: structure of C program: directives, functions, statements, printing strings, comments; compilation and execution, Programming errors and debugging. Variables and assignment, reading input; data types, constants, identifiers, keywords, operators - arithmetic, logical, relational, assignment; expressions - precedence and associativity, type cast-implicit and explicit; selection statements:- if, if else, nested if, if else ladder, switch. Case. Iterative structures: entry controlled and exit controlled loop, exiting from a loop: break, continue, goto; nested loops. Functions: library functions, user defined functions: defining and calling

functions, function declaration, passing arguments to a function, returning values from function. Storage classes - auto, extern, static, register variables, scope of a variable. Recursion. Number systems: binary, octal and hexadecimal. Bitwise operators and enumeration.
Arrays: one dimensional numeric arrays, initialization, accessing and usage, two dimensional numeric arrays, initialization, accessing and usage. Introduction to multidimensional arrays. Strings: literal, variables: initialization, reading, writing and accessing. String handling functions. Array of strings. Passing arrays and strings to functions.

Course Outcomes

CO1: Understand the structured programming constructs: Data types, Control, selection, recursion thereby to understand a given program.

CO2: Understand and analyze a given program by tracing, identify coding errors and debug them.

CO3: Apply structured programming constructs and modularity appropriately for given problem Scenarios.

CO4: Develop Computer programs that implement suitable algorithms for problem scenarios and application performance.

CO5: Understand the efficient way of storing and retrieving data.

TEXTBOOK:

Jeri Hanly and Elliot Koffman, "Problem solving and program design in C", Fifth Edition, Addison Wesley (Pearson), 2007.

REFERENCE:
Reema Thareja, "Computer Fundamentals and programming in C", Oxford University Press, 2012.

18MAT105 Introduction to Calculus and Matrix Theory 3 1 0 4

Course Outcome:

CO1: Understand the basic concepts of functions, limits, continuity, derivatives and analyze them.
CO2: Apply the concept of differentiability to find the extreme values of the given function and analyze the derivatives to sketch the graph of the given function.
CO3: Recall the terms, facts and basic concepts of definite integrals and the techniques of obtaining antiderivatives.
CO4: Understand the notion of eigenvalues and eigenvectors, analyze the possibility of diagonalization and hence compute a diagonal matrix, if possible.
CO5: Apply the knowledge of diagonalization to transform the given quadratic form into the principal axes form and analyze the given conic section.
CO6:Understand the advantages of the iterative techniques and apply it to solve the system of equations and finding eigenvectors.

Employability / Skill Development:

Modelling mathematically theScience problems where eigenvalues and eigenvectors are needed. Obtaining Eigenvectorsfor largr size matrices.Helps students to acquires basic knowledge about differential equations and functions of several variables which enable them to face the following exams namely GATE, JAM, SET, etc.

Calculus on a Single variable (Based on Text book 1)

Graphs- Functions and their graphs. Shifting and scaling of graphs. Limit and Continuity- Limit of Functions, One sided limits and limits at infinity, Continuous Functions, Discontinuities. Applications of Derivative-Extreme values of functions, Concavity and Curve Sketching. Integration- Definite Integrals, Properties of definite integrals. Integration techniques. Fundamental theorem of Calculus.

Numerical Methods- Trapezoidal and Simpson's rules.

(Sections: 1.3, 1.5, 2.3, 2.4, 2.5, 2.6, 4.1, 4.4, 5.3, 5.4, 8.7)

Matrix Eigen Value problems (Based on Text book 2)

Linear Independence and rank of a matrix, Eigen values and Eigen vectors-Definitions and properties. Some applications of eigenvalue problems, Symmetric ,Skew Symmetric and Orthogonal matrices, Eigenbases, Diagonalization, Quadratic forms. (Sections: 8.1-8.4)

Numerical Methods-Power Method for Eigen Values and Eigen Vectors. (Sections: 20.8)

Text Books:

1. Calculus, G.B. Thomas, Pearson, 2009, Eleventh Edition.
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley India, Tenth Edition, 2015.

Reference Books;

1. George Turrell, Mathematics for Chemistry and Physics, Academic Press, 2002.
2. Herbert S. Wilf, Applied Mathematics for Physical Chemistry, 2nd Edition, Prentice Hall, 1998.

18PHY102 **Mechanics** **3 1 0 4**

Course Objectives:

The objective of this course is to learn the principles of mechanics through application of Newton's laws, understand the concept of force, work, energy, momentum and their relationship with each other and their

conservation laws. This course also imparts knowledge to apply these concepts to describe the motion of objects.

Unit 1 Motion

Motion in 1D; vectors, motion in 2D & 3D, projectile and uniform circular motion; relative motion and relative velocity.

Unit 2 Forces and dynamics

Force, mass, Newton's laws, inertial mass, examples of forces, free body diagram analysis for simple applications; friction and contact forces, drag force and terminal speed, uniform circular motion.

Unit 3 Work, Energy, Collisions

Work, kinetic energy, work-kinetic energy theorem, work done by gravitational and spring forces, power; Work and potential energy, conservative forces, conservation of mechanical energy, potential energy curve; Center of mass, Newton's law for system of particles, linear momentum and its conservation, Impulse forces, collisions - elastic and inelastic collisions in 1D and 2D; systems with variable mass - rockets.

Unit 4 Rotational Motion

Rotational variables, linear and angular variables, rotational kinetic energy, rotational inertia; torque, Newton's law for rotation, work, rolling – combined translation and rotation, angular momentum, Newton's law in angular form, system of particles, conservation of angular momentum.

Unit 5 Oscillatory motion

Small oscillations in physical systems; determination of frequency; simple harmonic motion; damped oscillations, resonance.

TEXTBOOK:

Halliday, Resnick, and Walker, Fundamentals of Physics, 8th Extended Ed., Wiley Indian Reprint, 2008, Chap. 1-12, 15

REFERENCES:

1. Young and Freedman, University Physics, 11th Ed, Dorling Kindersley India, 2006

2. Halliday, Resnick, and Krane, Physics, Vol. 1, 5th Ed., Wiley Indian Reprint, 2007

3. Feynamn, Leighton and Sands, "The Feynman Lectures on Physics", Narosa, 1E, 2008.

The students will be able to

CO1. Analyze and solve two and three dimensional translational motion problems.

CO2: Understand Newton's three laws relating forces and motion as well apply it to solve problems involving friction.

CO3: Interrelate momentum and impulse; understand conservation of energy, momentum; apply momentum to collisions.

CO4: Understand simple harmonic motion, properties of waves such as wave functions, dynamics, power and its superposition .

18CSA180 PROBLEM SOLVING AND COMPUTER PROGRAMMING LAB 0 02 1

Basic Linux commands, programs using input/output statements, operators, control structures and loops. Programs using functions and recursions. Programs using numeric one-dimensional array, two-dimensional array. Programs using strings, string handling functions and string arrays. Programs using passing arrays and strings to functions.

Course Outcomes

CO1 To understand the operating System Environment.
CO2 Develop computer programs for a given problem Scenario using imperative constructs.
CO3 Develop computer programs handling different data types.
CO4 Develop Modular Solutions for a given Scenario.

18PHY181 PHYSICS LAB. I 0 0 2 1

The objective of this lab course is to make students to understand the application of basic physical concepts like center of mass, rigid body dynamics, modulus of elasticity, waves and oscillations and fluid dynamics to determine the mechanical and optical properties of matter.

Skill: Acquire scientific knowledge of verifying the first principle of basic sciences through experiment. The students will be able to interpret the experimental data to determine the material properties by using appropriate formula and present the result of analysis in the form of graphs and tables which improves their presentation skill. Acquire analytical skills, precise thinking and clarity of thought to apply knowledge of physical concepts for practical situations.

List of experiments:

1. Surface Tension – Capillary Rise Method.

2. Coefficient of Viscosity - Stoke's Method.

3. The Torsion Pendulum.

a. Moment of Inertia of the Disc.

b. The Rigidity Modules of the Material of Wire.

4. Young's Modulus – Uniform Bending.

5. Spectrometer – Dispersive Power.

6. Liquid Lens – Refractive index of liquid.

7. Laser - Wave length of Laser beam.

8. Laser - Slit Width of the given slit.

9. Magnetometer – Measurement of magnetic flux.

Course outcomes

CO1: Apply knowledge of first principle of basic sciences to do careful measurements of material properties.

CO2: Able to estimate uncertainties and draw appropriate conclusions of material properties based on experimental data

CO3: Interpret the experimental information in diagrams, graphs and tables to draw conclusions.

CO4: Acquire analytical skills, precise thinking and clarity of thought to apply knowledge of physical concepts to practical situations.

18CUL101 CULTURAL EDUCATION I 2 0 0 2

Unit 1

Introduction to Indian Culture - Introduction to Amma's life and Teachings - Symbols of Indian Culture.

Unit 2

Science and Technology in Ancient India - Education in Ancient India - Goals of Life – Purusharthas - Introduction to Vedanta and Bhagavad Gita.

Unit 3

Introduction to Yoga - Nature and Indian Culture - Values from Indian History - Life

and work of Great Seers of India.

Course Outcomes

CO1: Gain a positive appreciation of Indian culture, traditions, customs and practices
CO2: Understand the foundational concepts of Indian civilization like purusharthas, law of karma, etc, which contributes towards personality growth.
CO3: Understand the cultural ethos of Amrita Vishwa Vidyapeetham, and Amma's life and vision of holistic education
CO4: Imbibe spirit of living in harmony with nature
CO5: Get guidelines for healthy and happy living from the great spiritual masters

TEXTBOOKS:

1. The Glory of India (in-house publication)
2. The Mother of Sweet Bliss, (Amma's Life & Teachings)

18ENG121 Professional Communication 1- 0-2-2

Objectives:

To convey and document information in a formal environment; to acquire the skill of self projection in professional circles; to inculcate critical and analytical thinking.

Unit I

Vocabulary Building: Prefixes and Suffixes; One word substitutes, Modal auxiliaries,Error Analysis: Position of Adverbs, Redundancy, misplaced modifiers**,** Dangling modifiers – Reported Speech

Unit II

Instruction, Suggestion & Recommendation - Sounds of English: Stress, Intonation
- Essay writing: Analytical and Argumentative

Unit III

Circulars, Memos – Business Letters - e - mails

Unit IV

Reports: Trip report, incident report, event report - Situational Dialogue - Group Discussion

Unit V

Listening and Reading Practice - Book Review

Course Outcomes

CO1: Demonstrate competency in oral and written communication
CO2: Apply different styles of communication in professional context
CO3: Participate in different planned & extempore communicative activities
CO4: Interpret and discuss facts and information in a given context
CO5: Develop critical and analytical thinking

References

1. *FelixaEskey. Tech Talk, University of Michigan. 2005*
2. *Michael Swan. Practical English Usage, Oxford University Press. 2005*
3. *Anderson, Paul. Technical Communication: A Reader Centered Approach, V Edition, Hercourt, 2003.*
4. *Raymond V. Lesikar and Marie E. Flatley. Basic Business Communication, Tata Mc Graw Hill Pub. Co. New Delhi. 2005. Tenth Edition.*
5. *Thampi, G. Balamohan. Meeting the World: Writings on Contemporary Issues. Pearson, 2013.*
6. *Lynch, Tony. Study Listening. New Delhi: CUP, 2008.*
7. *Kenneth, Anderson, Tony Lynch, Joan Mac Lean. Study Speaking. New Delhi: CUP, 2008.*
8. *Marks, Jonathan. English Pronunciation in Use. New Delhi: CUP, 2007.*

Syamala, V. Effective English Communication For You (Functional Grammar, Oral and Written Communication): Emerald, 2002

18CHY111 GENERAL CHEMISTRY II 3 1 0 4

Unit 1 Nuclear Chemistry

Size, structure and stability of the nucleus - n/p ratio, packing fraction, mass defect and binding energy - nuclear fission and fusion, atom bombs -hydrogen bomb – radioactivity, alpha, beta particles and gamma radiation - Soddy-Fajan displacement law, half and average life period - Geiger-Muller Counter and Wilson Cloud Chamber. applications of radioactivity - in medicine, agriculture, carbon and fossil dating - isotopes, isobars, isotones, isodiapheres and nuclear isomers - natural and artificial radioactivity, artificial transmutation of elements, induced radioactivity, preparation of transuranic elements, Q values, nuclear coulombic barrier **.**

Unit 2 Solid State

Crystalline and amorphous solids, isotropy and anisotropy, elements of symmetry in crystal systems indices - Miller indices, space lattice and unit cell, Bravais lattices, the seven crystal systems and their Bravais lattices, X-ray diffraction - Bragg's equation and experimental methods (powder method and rotating crystal technique), types of crystals - molecular, covalent, metallic and ionic crystals - close packing of spheres – hexagonal, cubic and body centered cubic packing, interstices in packing - types of crystals – molecular, covalent, metallic crystals - defects in crystals – stoichiometric, non-stoichiometric, extrinsic and intrinsic defects.

Unit 3 Liquid state

Properties of liquids-viscosity, surface tension, capillary action, evaporation, vapour pressure, boiling point and distillation, heat transfer involving liquids

Unit 4 Acids, Bases and Non-aqueous solvents

Concepts of acids and bases – hard and soft acids and bases - Pearson's concept, HSAB principle and its application - basis for hard - hard and soft - soft interactions - non-aqueous solvents - general characteristics of non-aqueous solvent - melting point, boiling point, latent heat of fusion and vaporization, and dielectric constant - reactions such as complex formation, redox, precipitation and acid base type in non-aqueous solvents like liquid ammonia, liquid SO_2 and liquid HF.

Unit 5 Water Technology

Soft and hard water – Hardness – units of hardness – alkalinity - dissolved oxygen – water for various types of industries – treatment of water by ion exchange process - boiler feed water – boiler compounds – internal and external conditioning - water for drinking - municipal water treatment – desalination by RO and electro dialysis.

Course Outcomes

CO1 Understand the properties of atomic nuclei, theories governing the stability and its application in analytical, medical and industrial energy production.

CO2 Understand the fundamentals of crystal structure for predicting properties of materials

CO3 Develop sound knowledge in acidic nature of chemicals and understand the science of non-aqueous solvents and their reactivity.

CO4 Evaluate the quality of water for industrial and domestic use and develop skill in water purification.

TEXTBOOKS:

1. Marion Clyde Day Jr, Joel Selbin, Harry H Sisler, '*Theoretical Inorganic Chemistry'*, LLC, 2012
2. F. A. Cotton and G. Wilkinson*, 'Advanced Inorganic Chemistry', 5th edition, John Wiley and Sons, New York, 1987*
3. *B. R. Puri, L. R. Sharma, Kalia, 'Principles of Inorganic Chemistry', Vishal Publishing Co., 2008*

REFERENCES:

1. *H. S. Arnicker, 'Essentials of Nuclear Chemistry', 4th edition, New Age International Publishers, 2005.*
2. *L. V. Azaroff, "Introduction to Solids", Mc Graw Hill, New York, 2009*
3. *B. R. Puri, L. R. Sharma, M. S. Pathania, Principles of Physical Chemistry', Vishal Publishing Co., 2008*
4. *Gurdeep Raj, 'Advanced Inorganic Chemistry', 31st edition, Goel Publishing House, 2008.*

18CSA116 ADVANCED COMPUTER PROGRAMMING 3 0 0 3

Unit 1

Structures: structures variables - declaration, bit fields, initialization and operation on structures, typedef, nested arrays and structures: arrays in structures, nested structures, arrays of structures.

Unit2
Pointers– Declarations, Passing arguments by call by reference, Functions returning pointer, Pointer Arithmetic. Pointer to pointer, Pointers and Arrays – pointer to array, array of pointers, Dynamic memory allocation – malloc(), calloc(), deallocation: free(), dangling pointers.

Unit 3
Pointers and structures, structures and functions: passing structure as argument and returning structure from functions, self-referential structure, unions.

Unit 4
Files - file pointers, standard streams and redirection, text files, binary files, file operations: open, mode, close; Input and output - character I/O, line I/O, formatted I/O. Random file access, Command line arguments.

Unit 5
Preprocessor – Macros. User defined libraries and headers, introduction to the graphics library.

Course Outcomes

CO	Description
CO1	Understand the way of representing, retrieving and processing Heterogeneous data using structures.
CO2	Understand the memory representations of the given data and its manipulation.
CO3	Understand the methods of storing data using files.
CO4	Develop programs using predefined and user defined libraries..

TEXTBOOK:
Jeri Hanly and Elliot Koffman, "Problem solving and program design in C", Fifth Edition, Addison Wesley (Pearson), 2007.

REFERENCE:
Reema Thareja, "Computer Fundamentals and programming in C", Oxford University Press, 2012

18MAT114 Ordinary Differential Equations and Vector Calculus 3 1 0 4

Course Outcome :

CO1:Understand the basic concepts of ODE, apply them in modeling and solving first order equations.
CO2:Recall the techniques of solving second order linear homogeneous ODE with constant coefficients. Understand and modify the above techniques for solving Euler-Cauchy equations. Understand and apply methods of undetermined coefficients and variation of parameters to solve the second order linear nonhomogeneous differential equations.
CO3:Understand and apply the techniques of solving system of linear ODE Understand and analyze the critical points and stability of the system.
CO4:Understand the vector functions, scalar and vector fields. Understand the derivatives of vector functions and its physical and geometrical interpretations. Understand the concept of gradient, divergence and curl and apply.
CO5:Under the concept of line integrals and analyze the independence of path.
CO6:Understand the concept of multiple integrals. Apply Green's theorem for plane, Gauss Divergence theorem and Stokes' theorem to evaluate the integrals of vector functions over the curves, regions and surfaces.

Ordinary Differential Equations

First Order Differential Equations-Basic concepts, Exact ODEs and Integrating factor, Orthogonal trajectories, Second Order Differential Equations- Review of linear homogeneous ODE of second order with constant coefficients. Euler-Cauchy Equations. Solution of second order linear non-homogeneous ODE by method of Undetermined Coefficients and by method of Variation of Parameters. System of ODEs- Homogeneous and Non-homogeneous systems with Constant Coefficients. (Sections 1.1, 1.4, 1.6, 2.1, 2.2, 2.5, 2.7, 2.10, 4.1, 4.2, 4.6)

Numerical Methods- Euler's methods, Runge-Kutta method. (Sec: 21.1)

Vector Calculus

Vector and Scalar Functions, fields, derivatives, Curves, Tangent and normal vectors, Arc Length, gradient, divergence and curl (Sections: 9.4, 9.5, 9.7, 9.8, 9.9).

Line Integral, Line Integrals Independent of Path, Double integrals, Green's Theorem in the Plane, Surfaces for Surface Integrals, Surface Integrals, Triple Integrals – Gauss Divergence Theorem, Stoke's Theorem. (Sections: 10.1-10.7 and 10.9).

Text Book:

5. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley India, Tenth Edition, 2015.

Reference Books:

1. George Turrell, Mathematics for Chemistry and Physics, Academic Press, 2002.

2. Robert G. Mortimer, Mathematics for Physical Chemistry, 3rd Edition, Elsevier, 2005.

18PHY114 ELECTRICITY AND MAGNETISM 3 1 0 4

Course Objective

The course introduces the fundamental laws of electricity and magnetism and its application in calculating the electric and magnetic field. It also describes the physics of capacitors, induction and self-induction and their importance in solving problems using Faraday's and Lenz's laws. It also helps the students in analyzing the RL circuits and circuits consisting of resistors and batteries.

Skill: The student acquire skill to solve problems with moderate mathematical complexity related to electric and magnetic force and field, electric charge, electric potential, current, voltage and resistance, capacitors.

Unit 1 Electric forces and fields

Electric forces, charges, conservation of charge, superposition of electric forces; electric fields, calculation of electric fields of static discrete and continuous charge distributions; Gauss' law and determination of electric fields of simple symmetric charge distributions.

Unit 2 Electric potential and Capacitors

Electrical potential energy and electric potential of discrete and continuous distributions of charges; calculating electric field from potential; potential energy of system of point charges; capacitors and dielectrics.

Unit 3 Magnetostatics

Force due to magnetic fields, Hall effect, circular and helical orbits, magnetic force on a current carrying wire, torque on a current loop, magnetic dipole moment; calculation of magnetic field from current sources using Biot-Savart's law and Ampere's law; solenoids and toroids.

Unit 4 Changing magnetic fields

Faraday's law, Electromagnetic Induction, Self & mutual inductance; Magnetism in matter and Maxwell's equations.

Unit 5 DC and AC Circuits

Electric current, resistance, resistivity, microscopic view; DC circuits involving resistance and capacitance; AC Circuits, RLC circuits, transformers.

Course Outcomes

At the end of the course, the students can

CO1: Gain knowledge of fundamental laws of electrostatics and apply it to calculate the electric field and electric potential.

CO2: Understand the magnetic forces that act on moving charges and apply it to determine the magnetic field.

CO3: Acquire knowledge of concepts of induction, magnetism in matter and apply them to solve related problems.

CO4: Understand the physics of capacitors, resistance and develop skills to solve various electric circuits.

TEXTBOOK:

1. Halliday, Resnick, and Walker, Fundamentals of Physics, 8th Ed., Wiley Indian Reprint, 2008, Chapters 22-33.

REFERENCES:

1. Halliday, Resnick, and Krane, Physics, Vol. 1, 5th Ed., Wiley Indian Reprint, 2007

2. Young and Freedman, University Physics, 11th Ed, Dorling Kindersley India, 2006

3. Edward Purcell, Electricity and Magnetism, 2e, Tata-McGraw Hill, 2011.

4. Feynamn, Leighton and Sands, "The Feynman Lectures on Physics", Narosa, 1E, 2008

18CHY184 Inorganic Quantitative lab –Volumetric Analysis 0 0 2 1

Acid base titrations

1. Preparation of standard sodium carbonate solution, and standardization of hydrochloric acid (methyl orange indicator). Estimation of sodium hydroxide in solution using phenolphthalein indicator.
2. Preparation of standard oxalic acid solution and standardization of sodium hydroxide solution. Estimation of sulphuric acid in solution.
3. Estimation of sodium hydroxide and sodium carbonate in a mixture (analysis of commercial caustic soda) by double indicator method.

Redox titrations

Permanganometry

4. Preparation of standard oxalic acid solution and standardization of potassium permanganate solution. Estimation of ammoniumIron (11) sulphate in solution.
5. Preparation of standard oxalic acid solution and standardization of potassium permanganate solution. Estimation of hydrogen peroxide solution.
6. Estimation of calcium.

7. Estimation of Ferrous iron.

Dichrometry

8. Estimation of ferrous iron using external and internal indicators.
9. Estimation of ferric iron using external and internal indicators.

Iodimetry and Iodometry

10. Standardisation of sodium thiosulphate using potassium iodate, Electrolytic copper and potassium dichromate.
11. Estimation of As_2O_3 and arsenite
12. Estimation of copper sulphate.
13. Estimation of iron in the given sample of haematite by dichromate method.
14. Estimation of copper in bronze by iodometric method.
15. Estimation of tin in solder using EDTA.

Course Outcomes

CO1: To understand the distinction between qualitative and quantitative chemical analyses
CO2: To acquire theoretical knowledge on quantification of an analyte present in a sample through volumetric titrations
CO3: To perform volumetric experiments using conventional equipment/apparatus, instrumentation and techniques
CO4: To attain skills in laboratory data collection, formal documentation and interpretation of the collected data

002 1

18CSA181 ADVANCED COMPUTER PROGRAMMING LAB

Programs to demonstrate functions call by reference and returning values by reference. Programs using pointer arithmetic operations and handling pointers. Programs to demonstrate dynamic memory allocation and de-allocation. Programs to show structure and union operations. Programs using files, command line arguments and macros. Programs using user defined libraries and graphics library.

Course Outcomes

CO	Description
CO1	Develop programs using efficient methods for storing and handling heterogeneous data.
CO2	Develop programs by handling heterogeneous data using modularity.
CO3	Develop Computer programs using advanced programming constructs like pointers and dynamic memory allocations.
CO4	Develop program using macros and user defined libraries.

18PHY182 **PHYSICS LAB. II** **0 0 2 1**

The objective of this lab course is to make students to acquire practical knowledge of calculation of fill factor and efficiency of solar cell form I-V curve, electric field from lines of constant electric potential and magnetic field due to current using Biot- Savart law, potentiometer and its applications and evaluation of thermal, electrical and optical properties of materials.

Course outcomes, the students will

CO1: Apply knowledge of basic physical concepts to do careful measurements to study the nature of electric and magnetic field lines and evaluate the thermal, electrical, optical, and photovoltaic properties of materials.

CO2: Able to estimate uncertainties and draw appropriate conclusions of material properties based on experimental data

CO3: Interpret the experimental information in diagrams, graphs and tables to draw conclusions.

CO4: Acquire analytical skills, precise thinking and clarity of thought to apply knowledge of physical concepts to practical situations.

Ø Skill acquired: The students will be able to identify the suitable mathematical formulae required by using first principles of basic sciences to study the nature of electric and magnetic field lines and evaluate the thermal, electrical, optical, and photovoltaic properties of materials. Based on experimental data, the students will be able to draw appropriate conclusions of material properties. They understand the relation between observation and theory and acquire analytical skills, precise thinking and clarity of thought to apply knowledge of physical concepts to practical situations.

List of experiments:

1. Lee's disc – Thermal Conductivity of a bad conductor.

2. Solar cell characteristics.

3. Potentio meter – Comparison of emfs.

4. Conversion of galvanometer to Voltmeter.

5. Field along the axis of a coil.

6. Measurement of Laser beam divergence.

7. Spectrometer - i – d – curve.

8. Newton's rings.

9. Meter bridge - Resistance measurement.

10. Ref. index of a Transprent bar.

11. Elective field distribution.

18CUL111 CULTURAL EDUCATION II 2 0 0 2

Unit 1

1. Relevance of Sri Rama and Sri Krishna in this Scientific Age
2. Lessons from the Epics of India
3. Ramayana & Mahabharata

Unit 2

4. Who is a Wise Man?
5. A Ruler's Dharma
6. The Story of King Shibi

Unit 3

7. Introduction to the Bhagavad Gita
8. Bhagavad Gita – Action without Desire

Unit 4

9. Role and Position of Women in India
10. The Awakening of Universal Motherhood

Unit 5

11. Patanjali'sAstanga - Yoga System for Personality Refinement
12. Examples of Heroism and Patriotism in Modern India

Course Outcomes

CO1: Get an overview of India and her contribution to the world in the field of science and literature
CO2: Understand the foundational concepts of ancient Indian education system and practices associated with them
CO3: Learn the important concepts of Vedas, Bhagavad-Gita and Yogasutras and their relevance to daily life
CO4: Familiarize themselves with the inspirational characters and anecdotes from the epics and Indian history
CO5: Gain a rational understanding of the underlying principles of Indian spirituality

TEXTBOOKS:

1. *Common Resource Material II (in-house publication)*
2. *Sanatana Dharma - The Eternal Truth (A compilation of Amma's teachings on Indian Culture)*

18CHY202 PHYSICAL CHEMISTRY I 3 1 0 4

Unit 1 Kinetic Theory of Gases

Kinetic molecular model of gases –Maxwell distribution of velocities and its use in calculat-ing molecular velocities (average rms and most probable velocity and average kinetic energy) -Collision diameter, mean free path and viscosity of gases including their pressure and tem-perature dependence –Relation between mean free path and coefficient of viscosity –behav-iour of real gases –deviation of gases from ideal behaviour –compressibility factor –van der Waal's equation of state -its derivation and application in explaining ideal gas behaviour –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 Waal's iso-therms –Determination of molecular mass by limiting density method –critical phenomena –critical constants anddetermination.

Unit 2 First law of thermodynamics and Thermo chemistry

System and surrounding –isolated, closed and open systems -state of the system -Intensive and extensive variables. Thermodynamic processes -reversible and irreversible, isothermal and adiabatic processes -state and path functions -exact and inexact differentials, concept of heat and work. First law of thermodynamics –statement. Relation between Cp and Cv, calcu-lation of w, q, dE and dH for expansion of ideal and real gases under isothermal and adia-batic conditions of reversible and irreversible processes. Thermochemistry Enthalpy change of a reaction and different enthalpy changes -relation between enthalpy of reaction at con-stant volume (qv) and at constant pressure(qp) -temperature dependence of heat of reaction -Kirchoffs equation -of solution and dilution bond energy and its calculation from thermo chemical data -Integral and differential heats.

Unit 3 Second and Third laws of Thermodynamics age

Second law of thermo dynamics -different statements of the law -Carnot's cycle and effi-ciency of heat engine -Carnot's theorem -thermodynamic scale of temperature -concept of entropy -definition and physical significance of entropy -entropy as a function of P, V and T -entropy changes during phase changes -entropy of mixing -entropy criterion for spontane-ous and equilibrium processes in isolated system -Gibb's free energy (G) and Helmholtz free energy (A) -variation of A and G with P, V and T -Gibb's -Helmholtz equation and its ap-plications -thermodynamic equation of state -Maxwell's relations..
Unit 4Chemical equilibriaLaw of mass action -equilibrium constant –Relation between Kp, Kc and Kx –Thermody-namic treatment of the law of mass action –vant Hoff reaction isotherm –Temperature de-pendence of the equilibrium constant –The van'tHoffs equation –Pressure dependence of the equilibrium constant Kp and Kc–Factors that change the state of equilibrium -Le-chatelier's principle and its application to chemical and physical equilibria.Unit 5SolutionsMixture, homogeneous and heterogeneous mixtures, solution, solvent, solute -concentration of a solution, methods for expressing concentration -concept of activity and activity coeffi-cients -completely miscible liquid systems -benzene and toluene. Duhem -Margules equa-tion, azeotropes -HCl –water and ethanol -water systems -partially miscible liquid systems -phenol -water, triethanolamine -water and nicotine -water systems. Lower and upper CSTs -effect of impunities on CST -completely immiscible liquids -Nernst distribution law –derivation. Applications -determination of formula of a complex (KI + I2= KI3).solvent extraction principle and derivation of a general formula of the amount unextracted -colliga-tive properties -relative lowering of vapour pressure, elevation of boiling point, depression in freezing point and osmotic pressure (quantitative treatment), molecular weights from col-ligative properties.

Course Outcomes

CO1: Know the fundamental properties, laws governing the state and the liquefaction of gaseous molecules.
CO2: Provide analytical skills to predict the properties of molecules in real time cases and design experimental procedures for gas molecular reactions.
CO3: Develop sound knowledge in thermodynamic principles (both theoretical and analytical) to predict the spontaneity of chemical and physical processes and exploring their application in industrial processes.
CO4: Attain good theoretical and analytical knowledge in the formation of solutions and phase transformations for real time applications.
CO5: Attain sound knowledge in the thermodynamics of chemical equilibrium and its application in predicting suitable conditions for chemical reactions in industrial scale.

TEXTBOOKS:

1.Gurdeep Raj, 'Advanced Physical Chemistry', 35thedition, Goel Publishing House, 2009.

2.Puri, Sharma &Pathania, 'Principles of Physical Chemistry', 42ndedition, Vishal Publishing & Co, 2007.REFERENCES:1.R. Stephen Berry, Stuart A. Rice & John Ross, 'Physical Chemistry', 2ndedition, Ox-ford University press, 2000.2.Levin, 'Physical Chemistry', 6thedition, Tata Mcgraw-Hill Education, 2011.

18CHY203 INORGANIC CHEMISTRY I 3 1 0 4

Course Outcomes

CO1- Acquiring firm foundation in the fundamentals of periodic tables

CO2: Understanding the properties of elements in periodic tables

CO3: Gaining knowledge about the compounds of s,p,d,f block elements

CO4: Able to understand the various metallurgical processes

Unit 1 s block elements General characteristics – atomic and ionic radii – ionization energies – electropositive character – reducing properties – hydration of ions – flame coloration – lattice energies – chemical properties – extraction of alkali and alkaline earth metals – uses of alkali and alkaline earth metals – complexes of alkali and alkaline earth metals – compounds of alkali and alkaline earth metals and their applications.
Unit 2 p block elements General characteristics – metallic and non-metallic character – diagonal relationship – extraction – Lewis acids – back bonding – boron compounds. Catenation – structure of graphite – intercalation compounds – metal carbonyls – carbides – silica, silicates, glass manufacturing – zeolites. Allotropy in P and S. compounds of N and P - hydrazine – hydrazoic acid – hydroxyl amine – phosphazines. Anomalous behavior of oxygen, structure of ozone. Hydrides, halides, oxides, oxoacids, persulfuric acids, nitrides of group VI and VII elements. Inter halogen compounds and their structure. Isolation of noble gases – preparation, properties, structure and uses of noble gas compounds.
Unit 3 d block elements Transition metals: Transition metals – general characteristics – metallic character – oxidation states – size – density – melting and boiling points – ionization energy –color – magnetic properties – reducing properties – catalytic properties – Non stoichiometric compounds – complex formation – alloy formation – difference between first row and other two rows. Chemistry of Zr, Ti, V and Mo compounds.

Unit 4 f block elements Position in the Periodic Table - General characteristics of Lanthanides and Actinides - Lanthanide contraction and its consequences. Isolation of Lanthanides from Monazite including the Ion exchange resin method. Actinides - occurrence and preparation, comparison with lanthanides. Chemistry of Thorium and Uranium - Important compounds - preparation, properties and uses of Uranyl nitrate, Uranium hexafluoride, Thorium dioxide.

Unit 5 Metallurgy Occurrence of metals based on standard electrode potential – concentration of ores – calcination, roasting and smelting – reduction using carbon and other reducing agents – electrolytic reduction – hydrometallurgy – Ellingham diagram. Refining of metals – electrolytic refining – oxidative refining – zone refining – Van Ankel method. Extractive metallurgy of Li, Ni – Ferrous metallurgy – manufacture of steel by open hearth process – Alloys – composition and uses of German silver, Brass, Bronze, Gunmetal, Alnico.

TEXTBOOKS:

1. Puri B R, Sharma L R, Kalia K K, 'Principles of Inorganic Chemistry', 23rd edition, Shoban Lal Nagin Chand & Co, New Delhi, 1993.
2. Lee J. D., 'Concise Inorganic Chemistry', Black Well Science, UK. 2006
3. Soni P. L., 'Text Book of Inorganic Chemistry', S, Chand & Co, New Delhi, 2006.

REFERENCE BOOKS:

1. Madan R. D., Tuli G. D and Malik S. M., 'Selected Topics in Inorganic chemistry', S. Chand & Co, New Delhi, 2006.
2. S. F. A. Kettle, 'Physical Inorganic Chemistry', Spectrum, 1996.
3. B. E. Dogulas DH McDaniel's and Alexander, 'Concepts and Models of Inorgani Chemistry', Oxford IBH, 1983.

18ENV300 ENVIRONMENTAL SCIENCE AND SUSTAINABILITY 3 0 0 3

Unit 1

State of Environment and Unsustainability, Need for Sustainable Development, Traditional conservation systems in India, People in Environment, Need for an attitudinal change and ethics, Need for Environmental Education, Overview of International Treaties and Conventions, Overview of Legal and Regulatory
Frameworks.

Environment: Abiotic and biotic factors, Segments of the Environment, Biogeochemical Cycles, Ecosystems (associations, community adaptations, ecological succession, Food webs, Food chain, ecological pyramids), Types of Ecosystems – Terrestrial ecosystems, Ecosystem Services, Economic value of ecosystem services, Threats to ecosystems and conservation strategies.

Biodiversity: Species, Genetic & Ecosystem Diversity, Origin of life and significance of biodiversity, Value of Biodiversity, Biodiversity at Global, National and Local Levels, India as a Mega-Diversity Nation (Hotspots) & Protected Area Network, Community Biodiversity Registers. Threats to Biodiversity, Red Data book, Rare, Endangered and Endemic Species of India. Conservation of Biodiversity. People's action.
Impacts, causes, effects, control measures, international, legal and regulatory frameworks of: Climate Change, Ozone depletion, Air pollution, Water pollution, Noise pollution, Soil/ land degradation/ pollution

Unit 2

Linear vs. cyclical resource management systems, need for systems thinking and design of cyclical systems, circular economy, industrial ecology, green technology.

Specifically apply these concepts to: Water Resources, Energy Resources, Food Resources, Land & Forests, Waste management.

Discuss the interrelation of environmental issues with social issues such as: Population, Illiteracy, Poverty, Gender equality, Class discrimination, Social impacts of development on the poor and tribal communities, Conservation movements: people's movements and activism, Indigenous knowledge systems and traditions of conservation.

Unit 3

Common goods and public goods, natural capital/ tragedy of commons, Cost benefit analysis of development projects, Environment Impact Assessment (EIA), Environment Management Plan (EMP), Green business, Eco-labeling, Problems and solutions with case studies.

Global and national state of housing and shelter, Urbanization, Effects of unplanned development case studies, Impacts of the building and road construction industry on the environment, Eco-homes/ Green buildings, Sustainable communities, Sustainable Cities.
Ethical issues related to resource consumption, Intergenerational ethics, Need for investigation and resolution of the root cause of unsustainability, Traditional value systems of India, Significance of holistic value-based education for true sustainability.

Course Outcomes

CO1: Integrate facts and concepts from ecological, physical and social sciences to characterize some common socio-environmental problems.
CO2: Develop simple integrated systems and frameworks for solving common interconnected socio-environmental problems.
CO3: Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.
CO4: Identify the ethical underpinnings of socio-environmental issues in general.

TEXTBOOKS/ REFERENCES:

1. *R. Rajagopalan, Environmental Studies: From Crisis to Cure. Oxford University Press, 2011, 358 pages. ISBN: 9780198072089.*
2. *Daniel D. Chiras, Environmental Science. Jones & Bartlett Publishers, 01-Feb-2012, 669 pages. ISBN: 9781449645311.*
3. *Andy Jones, Michel Pimbert and Janice Jiggins, 2011. Virtuous Circles: Values, Systems, Sustainability. IIED and IUCN CEESP, London. URL:http://pubs.iied.org/pdfs/G03177.pdf*
4. *Annenberg Learner, The Habitable Planet, Annenberg Foundation 2015. URL: http:// www.learner.org/courses/envsci/unit/pdfs/textbook.pdf.*

18MAT207 **Introduction to Probability and Statistics** 3 1 0 4

Course Outcome:

CO1: Understand the basic concepts of probability and probability modeling.

CO2: Gain knowledge about statistical distributions and their properties

CO3: Get in-depth knowledge about statistical distributions and their real time applications.

CO4: Understand some approximation theorems on probability and distributions.

CO5: Know the importance of estimating the parameters of probability models.

CO6: Ability to make decisions under uncertainties using statistical testing of hypotheses.

Probability Concepts: Review of probability concepts - conditional probability- Bayes theorem.

Random Variable and Distributions: Introduction to random variable – discrete and continuous random variables and its distribution functions- mathematical expectations – moment generating function and characteristic function - Binomial, Poisson, Geometric, Uniform, Exponential, Normal distribution functions (moment generating function, mean, variance and simple problems) – Chebyshev's theorem.

Correlation and Regression: Scatter diagram, simple correlation and simple regression for data.

3. Theory of Estimation: Population and sample — sampling distributions – determination of sample size – t, F and Chi-square distributions – theory of estimation – types of estimation- point estimation and properties of point estimator - interval estimation methods based on normal, t, F and chi-square distributions.

Testing of Hypothesis: Central limit theorem, large sample tests for mean, variance and proportions - small sample tests for mean and variances–tests based on Chi-square distribution (tests for independence of attributes and goodness-of-fit).

Analysis of Variance (ANOVA): Introduction- analysis of variance – one-way analysis of variance – two way analysis of variance - Latin square design – Two factor factorial design.

Text Books:

1. Douglas C. Montgomery and George C. Runger, *Applied Statistics and Probability for Engineers*, (2005) John Wiley and Sons Inc.
2. J. Ravichandran, "*Probability and Statistics for Engineers*", Revised Edition 2012, Wiley India.

Reference Books:

4. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, Probability and Statistics for Engineers and Scientists, 8th Edition, Pearson Education Asia, 2007.
6. Sheldon M Ross, *Introduction to Probability and Statistical Inference*, 3rd Edition, Academic Press.

18PHY305 **BASIC ELECTRONICS** **3 1 0 4**

Course Objective

This course provides the student with the fundamental skills to analyze analog circuits and working of semiconductor devices like diode, transistor, FET, MOSFET and operational amplifier. It will build mathematical and numerical background for design of electronic circuits and circuit minimization. Students equipped with the knowledge and training provided in the course will be able to participate in design and development of electronic device.

Course Outcomes

At the end of the course students are able to

CO1: Understand and analyze the analog circuits

CO2: Describe the working of semiconductor diodes and their applications as Full and half wave rectifiers, clippers and clampers.

CO3: Describe the transistors configuration, characteristics and application towards amplification.

CO4: Understand the working of operational amplifier and their applications

CO5: Acquire knowledge on essentials of logical digital circuits and the circuit minimization.

Unit 1 Resistors, Current, Voltage - basics Voltage and current - resistors, voltage dividers, voltage and current sources, Thevenin's theorem, sinusoidal signals, signal amplitudes and decibels, other signals, logic levels, signal sources.

Unit 2 Semiconductor diodes and application Conduction in metals, semiconductors and insulators, intrinsic semiconductors, n and p materials, conduction by drift and diffusion, The p-n junction, Fermi level of pn junction, diode equation, Hall effect, diode characteristics, capacitance of a p-n junction, rectification, rectifier configurations for power supplies, circuit applications of a diode-as a switch, clipping, clamping, different types of diodes - Zener diodes, LEDs, diode lasers, photodiodes, etc

Unit 3 Bipolar Junction Transistor and Amplifiers Transistors - npn and pnp, transistor characteristics - CB, CE and CC configurations, relation , transistor switch, transistor biasing. Feedback circuits. Transistor action,g and b, abetween emitter follower, Transistor applications as amplifier, RC coupled amplifier.

Unit 4 Operational Amplifiers Transistor as an oscillator, FET, JFET, MOSFET, etc. Operational amplifiers; differential amplifier, inverting and non-inverting amplifiers. Op-amp applications-integrator, differentiator, adder etc. ICs – examples.

Unit 5 Digital electronics: Digital versus analog, logic gates, truth table, discrete circuits for gates, logic identities, minimization and Karnaugh maps.

TEXTBOOK:

1. Mitchel. E .Schultz, Grob's Basic Electronics, 10th Edition, McGraw Hill Education, 2017.

2. Donald P Leach, Albert Paul Malvino, Goutam Saha, Digital Principles and applications, 8 th Edition, McGraw Hill Education,

2014.

REFERENCES:

1. Robert L. Boylestad and Louis Nashelsky, Electronic Fundamentals and Applications, 11th edition, Pearson Education India, 2015.

2. Charles K. Alexander, Matthew N.O. Sadiku, Fundamentals of Electric Circuits, 5th Edition, McGraw Hill Education, 2013.

3. Thomas L Floyd, Digital Fundamentals, 10th edition, Pearson Education India, 2011.

4. Paul Horowitz, Winfield Hill, "The Art of Electronics", 2nd revised edition, Cambridge University Press, 2006.

18CHY281 Inorganic Qualitative Lab 0 0 3 1

Course Outcomes

CO1: Development of skill to perform classical qualitative analysis of cations and anions in a mixture of inorganic salts/compounds.
CO2: Development of skill to prepare/synthesis inorganic salts/compounds/complexes.
CO3: Development of adequate knowledge of the chemistry involved in the analysis of inorganic mixtures as well as preparation/synthesis of inorganic compounds.
CO4: Attainment of knowledge and skill in activities related with effective and safe functioning of a chemistry lab.

I. Qualitative Analysis:

Analysis of mixtures containing two anions (one simple and one interfering) and two cations (of different groups) from the following:

Anions - HCO_3^-, CO_3^{2-}, Cl^-, F^-, Br^-, I^-, NO_3^-, BO_3^{3-}, SO_4^{2-} and PO_4^{3-}

Cations - Pb^{2+} Bi^{3+}, Cd^{2+}, Al^{3+}, Fe^{2+}, Fe^{3+}, Mn^{2+}, Zn^{2+}, Ca^{2+}, Sr^{2+}, Ba^{2+}, Mg^{2+}, K^+, Na^+ and NH_4^+, Cu^{2+}, Mn^{2+}.

Note:

1. Mixtures requiring elimination of phosphate and borate radicals should not be given (avoid cat ions like Ba^{2+}, Sr^{2+}, Ca^{2+} and Mn^{2+} when phosphate and borate are given).
2. Combinations like Cl^- and Br^-, $I^-$and Cl^- and NO_3^- and Br^- shall be avoided.
3. Salts that yield $SrSO_4$, $BaSO_4$, $CaSO_4$, $PbSO_4$ and $FeSO_4$ on double decomposition shall be avoided.
4. The two cations in the mixture should belong to different groups. However, combinations like Mg^{2+} and NH_4^+, K^+ and NH_4^+ can be given.

II. Preparations: *(Any six from the following)*

1. Ferrous ammonium sulphate
2. Tetrammine copper (II) sulphate

3. Potassium trisoxalato chromate
4. Prussian Blue
5. Hexammine Cobalt (II) chloride
6. Nickel dimethyl glyoximate
7. Potassium trisoxalato ferrate (III)
8. Tristhioureacopper (I) sulphate
9. Ferric alum
10. Potash alum
11. Mohr Salt from Kipp's waste.

TEXTBOOKS:

1. A. I.Vogel, 'A text book of Qualitative Analyses', 4th edition, Longmans publications, 1985.
2. V. V. Ramanujam, 'Inorganic Semi Micro Qualitative Analysis', 3rd edition, The National Publishing Company, 1974.

REFERENCES:

1. G. Pass & H. Sutcliffe, 'Practical Inorganic Chemistry', 2nd edition, Chapman & Hill, 1974.
2. D. A.Skoog and D. M.West, 'Analytical Chemistry - An Introduction', 4th Edition, CBS Publishing Japan Ltd., 1986.

18SSK201 LIFE SKILLS I 1 0 2 2

Soft skills and its importance: Pleasure and pains of transition from an academic environment to work-environment. Need for change. Fears, stress and competition in the professional world. Importance of positive attitude, self-motivation and continuous knowledge upgradation.

Self Confidence: Characteristics of the person perceived, characteristics of the situation, Characteristics of the Perceiver. Attitude, Values, Motivation, Emotion Management, Steps to like yourself, Positive Mental Attitude, Assertiveness.

Presentations: Preparations, Outlining, Hints for efficient practice, Last minute tasks, means of effective presentation, language, Gestures, Posture, Facial expressions, Professional attire.

Vocabulary building: A brief introduction into the methods and practices of learning vocabulary. Learning how to face questions on antonyms, synonyms, spelling error, analogy etc. Faulty comparison, wrong form of words and confused words like understanding the nuances of spelling changes and wrong use of words.
Listening Skills: The importance of listening in communication and how to listen actively.

Prepositions and Articles: A experiential method of learning the uses of articles and prepositions in sentences is provided.

Problem solving; Number System; LCM &HCF; Divisibility Test; Surds and Indices; Logarithms; Ratio, Proportions and Variations; Partnership; Time speed and distance; work time problems;

Data Interpretation: Numerical Data Tables; Line Graphs; Bar Charts and Pie charts; Caselet Forms; Mix Diagrams; Geometrical Diagrams and other forms of Data Representation.

Logical Reasoning: Family Tree; Linear Arrangements; Circular and Complex Arrangement; Conditionalities and Grouping; Sequencing and Scheduling; Selections; Networks; Codes; Cubes; Venn Diagram in Logical Reasoning.

Course outcomes

CO1	At the end of the course, the students would have developed self-confidence and positive attitude necessary to compete and challenge themselves. They would also be able to analyse and manage their emotions to face real life situations.
CO2	At the end of the course, the students shall learn to examine the context of a Group Discussion topic and develop new perspectives and ideas through brainstorming and arrive at a consensus.
CO3	At the end of the course, the students will have the ability to prepare a suitable resume. They would also have acquired the necessary skills, abilities and knowledge to present themselves confidently. They would be sure-footed in introducing themselves and facing interviews.
CO4	At the end of the course the students will have the ability to analyse every question asked by the interviewer, compose correct responses and respond in the right manner to justify and convince the interviewer of one's right candidature through displaying etiquette, positive attitude and courteous communication.
	Aptitude:
CO5	At the end of the course, the student will have acquired the ability to analyse, understand and classify questions under arithmetic, algebra and logical reasoning and solve them employing the most suitable methods. They will be able to analyse, compare and arrive at conclusions for data analysis questions.
CO6	At the end of the course, students will be able to interpret, critically analyse and solve logical reasoning questions. They will have acquired the skills to manage time while applying methods to solve questions on arithmetic, algebra, logical reasoning, statistics and data analysis and arrive at appropriate conclusions.
	Verbal:
CO7	At the end of the course, the students will have the ability to understand the nuances of English grammar and apply them effectively.
CO8	At the end of the course, the students will have the ability to relate, choose, conclude and determine the usage of right vocabulary.
CO9	At the end of the course, the students will have the ability to decide, conclude, identify and choose the right grammatical construction.

TEXTBOOKS:

1. A Communicative Grammar of English: Geoffrey Leech and Jan Svartvik. Longman, London.
2. Adair J (1986) - "Effective Team Building: How to make a winning team", London, U.K: Pan Books.
3. Gulati S (2006) - "Corporate Soft Skills", New Delhi, India: Rupa& Co.
4. The Hard Truth about Soft Skills, by Amazone Publication.

REFERENCES:

1. Quantitative Aptitude, by R S Aggarwal, S Chand Publ.
2. Verbal and Non-verbal Reasoning, R S Aggarwal, S Chand Publ.
3. Data Interpretation, R S Aggarwal, S Chand Publ.
4. Nova GRE, KAPAL GRE, Barrons GRE books;
5. Quantitative Aptitude, The Institute of Chartered Accountants of India.
6. More Games Teams Play, by Leslie Bendaly, McGraw-Hill Ryerson.
7. The BBC and British Council online resources
8. Owl Purdue University online teaching resources
9. www.thegrammarbook.com online teaching resources
10. www.englishpage.com online teaching resources and other useful websites.

18AVP201 /	**Amrita Values Programme I /**	**1 0 0 1**
18AVP211	**Amrita Values Programme II**	**1 0 0 1**

Amrita University's Amrita Values Programme (AVP) is a new initiative to give exposure to students about richness and beauty of Indian way of life. India is a country where history, culture, art, aesthetics, cuisine and nature exhibit more diversity than nearly anywhere else in the world.

Amrita Values Programmes emphasize on making students familiar with the rich tapestry of Indian life, culture, arts, science and heritage which has historically drawn people from all over the world.

Students shall have to register for any two of the following courses, one each in the third and the fourth semesters, which may be offered by the respective school during the concerned semester.

Courses offered under the framework of Amrita Values Programmes I and II

Message from Amma's Life for the Modern World

Amma's messages can be put to action in our life through pragmatism and attuning of our thought process in a positive and creative manner. Every single word Amma speaks and the guidance received in on matters which we consider as trivial are rich in content and touches the very inner being of our personality. Life gets enriched by Amma's guidance and She teaches us the art of exemplary life skills where we become witness to all the happenings around us still keeping the balance of the mind.

Lessons from the Ramayana

Introduction to Ramayana, the first Epic in the world – Influence of Ramayana on Indian values and culture – Storyline of Ramayana – Study of leading characters in Ramayana – Influence of Ramayana outside India – Relevance of Ramayana for modern times.

Lessons from the Mahabharata

Introduction to Mahabharata, the largest Epic in the world – Influence of Mahabharata on Indian values and culture – Storyline of Mahabharata – Study of leading characters in Mahabharata – Kurukshetra War and its significance - Relevance of Mahabharata for modern times.

Lessons from the Upanishads

Introduction to the Upanishads: Sruti versus Smrti - Overview of the four Vedas and the ten Principal Upanishads - The central problems of the Upanishads – The Upanishads and Indian Culture – Relevance of Upanishads for modern times – A few Upanishad Personalities: Nachiketas, SatyakamaJabala, Aruni, Shvetaketu.

Message of the Bhagavad Gita

Introduction to Bhagavad Gita – Brief storyline of Mahabharata - Context of Kurukshetra War – The anguish of Arjuna – Counsel by Sri. Krishna – Key teachings of the Bhagavad Gita – Karma Yoga, Jnana Yoga and Bhakti Yoga - Theory of Karma and Reincarnation – Concept of Dharma – Concept of Avatar - Relevance of Mahabharata for modern times.

Life and Message of Swami Vivekananda

Brief Sketch of Swami Vivekananda's Life – Meeting with Guru – Disciplining of Narendra - Travel across India - Inspiring Life incidents – Address at the Parliament of Religions – Travel in United States and Europe – Return and reception India – Message from Swamiji's life.

Life and Teachings of Spiritual Masters India

Sri Rama, Sri Krishna, Sri Buddha, Adi Shankaracharya, Sri Ramakrishna Paramahamsa, Swami Vivekananda, Sri Ramana Maharshi, Mata Amritanandamayi Devi.

Insights into Indian Arts and Literature

The aim of this course is to present the rich literature and culture of Ancient India and help students appreciate their deep influence on Indian Life - Vedic culture, primary source of Indian Culture – Brief introduction and appreciation of a few of the art forms of India - Arts, Music, Dance, Theatre.

Yoga and Meditation

The objective of the course is to provide practical training in YOGA ASANAS with a sound theoretical base and theory classes on selected verses of Patanjali's Yoga Sutra and Ashtanga Yoga. The coverage also includes the effect of yoga on integrated personality development.

Kerala Mural Art and Painting

Mural painting is an offshoot of the devotional tradition of Kerala. A mural is any piece of artwork painted or applied directly on a wall, ceiling or other large permanent surface. In the contemporary scenario Mural painting is not restricted to the permanent structures and are being done even on canvas. Kerala mural paintings are the frescos depicting mythology and legends, which are drawn on the walls of temples and churches in South India, principally in Kerala. Ancient temples, churches and places in Kerala, South India, display an abounding tradition of mural paintings mostly dating back between the 9th to 12th centuries when this form of art enjoyed Royal patronage. Learning Mural painting through the theory and practice workshop is the objective of this course.

Course on Organic Farming and Sustainability

Organic farming is emerging as an important segment of human sustainability and healthy life. Haritamritam' is an attempt to empower the youth with basic skills in tradition of organic farming and to revive the culture of growing vegetables that one consumes, without using chemicals and pesticides. Growth of Agriculture through such positive initiatives will go a long way in nation development. In Amma's words "it is a big step in restoring the lost harmony of nature".

Benefits of Indian Medicinal Systems

Indian medicinal systems are one of the most ancient in the world. Even today society continues to derive enormous benefits from the wealth of knowledge in Ayurveda of which is recognised as a viable and sustainable medicinal tradition. This course will expose students to the fundamental principles and philosophy of Ayurveda and other Indian medicinal traditions.

Traditional Fine Arts of India

India is home to one of the most diverse Art forms world over. The underlying philosophy of Indian life is 'Únity in Diversity" and it has led to the most diverse expressions of culture in India. Most art forms of India are an expression of devotion by the devotee towards the Lord and its influence in Indian life is very pervasive. This course will introduce students to the deeper philosophical basis of Indian Art forms and attempt to provide a practical demonstration of the continuing relevance of the Art.

Science of Worship in India

Indian mode of worship is unique among the world civilisations. Nowhere in the world has the philosophical idea of reverence and worshipfulness for everything in this universe found universal acceptance as it in India. Indian religious life even today is a practical demonstration of the potential for realisation of this profound truth. To see the all-pervading consciousness in everything, including animate and inanimate, and constituting society to realise this truth can be seen as the epitome of civilizational excellence. This course will discuss the principles and rationale behind different modes of worship prevalent in India.

Temple Mural Arts in Kerala

The traditional percussion ensembles in the Temples of Kerala have enthralled millions over the years. The splendor of our temples makes art enthusiast spellbound, warmth and grandeur of color combination sumptuousness of the outline, crowding of space by divine or heroic figures often with in vigorous movement are the characteristics of murals.

The mural painting specially area visual counterpart of myth, legend, gods, dirties, and demons of the theatrical world, Identical myths are popular the birth of Rama, the story of Bhīma and Hanuman, Shiva, as Kirata, and the Jealousy of Uma and ganga the mural painting in Kerala appear to be closely related to, and influenced by this theatrical activity the art historians on temple planes, wood carving and painting the architectural plane of the Kerala temples are built largely on the pan-Indians almost universal model of the Vasthupurusha.

Organic Farming in Practice

Organic agriculture is the application of a set of cultural, biological, and mechanical practices that support the cycling of farm resources, promote ecological balance, and conserve biodiversity. These include maintaining and enhancing soil and water quality; conserving wetlands, woodlands, and wildlife; and avoiding use of synthetic fertilizers, sewage sludge, irradiation, and genetic engineering. This factsheet provides an overview of some common farming practices that ensure organic integrity and operation sustainability.

Ayurveda for Lifestyle Modification:

Ayurveda aims to integrate and balance the body, mind, and spirit which will ultimately leads to human happiness and health. Ayurveda offers methods for finding out early stages of diseases that are still undetectable by modern medical investigation. Ayurveda understands that health is a reflection of when a person is living in harmony with nature and disease arises when a person is out of harmony with the cycles of nature. All things in the universe (both living and nonliving) are joined together in Ayurveda. This leaflet endow with some practical knowledge to rediscover our pre- industrial herbal heritage.

Life Style and Therapy using Yoga

Yoga therapy is the adaptation of yogic principles, methods, and techniques to specific human ailments. In its ideal application, Yoga therapy is preventive in nature, as is Yoga itself, but it is also restorative in many instances, palliative in others, and curative in many others. The therapeutic effect comes to force when we practice daily and the body starts removing toxins and the rest is done by nature.

Insights into Indian Classical Music

The course introduces the students into the various terminologies used in Indian musicology and their explanations, like Nadam, Sruti, Svaram – svara nomenclature, Stayi, Graha, Nyasa, Amsa, Thala,- Saptatalas and their angas, Shadangas, Vadi, Samavadi, Anuvadi. The course takes the students through Carnatic as well as Hindustani classical styles.

Insights into Traditional Indian Painting

The course introduces traditional Indian paintings in the light of ancient Indian wisdom in the fields of aesthetics, the Shadanga (Sixs limbs of Indian paintings) and the contextual stories from ancient texts from where the paintings originated. The course introduces the painting styles such as Madhubani, Kerala Mural, Pahari, Cheriyal, Rajput, Tanjore etc.

Insights into Indian Classical Dance

The course takes the students through the ancient Indian text on aesthetics the Natyasastra and its commentary the AbhinavaBharati. The course introduces various styles of Indian classical dance such as

Bharatanatyan, Mohiniyatton, Kuchipudi, Odissy, Katak etc. The course takes the students through both contextual theory as well as practice time.

Indian Martial Arts and Self Defense

The course introduces the students to the ancient Indian system of self-defense and the combat through various martial art forms and focuses more on traditional Kerala's traditional KalariPayattu. The course introduces the various exercise technique to make the body supple and flexible before going into the steps and techniques of the martial art. The advanced level of this course introduces the technique of weaponry.

Social Awareness Campaign

The course introduces the students into the concept of public social awareness and how to transmit the messages of social awareness through various media, both traditional and modern. The course goes through the theoretical aspects of campaign planning and execution.

Temple Mural Arts in Kerala

The traditional percussion ensembles in the Temples of Kerala have enthralled millions over the years. The splendor of our temples makes art enthusiast spellbound, warmth and grandeur of color combination sumptuousness of the outline, crowding of space by divine or heroic figures often with in vigorous movement are the characteristics of murals.

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Course Outcomes

CO1: Understanding the impact of itihasas on Indian civilization with reference to Mahabharata

CO2: Enabling students to appreciate the relevance of Mahabharata and Bhagavad-Gita in the modern world.

CO3: Understanding the four goals of life (Purusharthas) as presented in the Mahabharata

CO4: Assimilating the positive qualities of the characters depicted in the itihasa.

CO5: Analysis of the critical events and turning points in the Mahabharata with emphasis on the underlying values and principles.

18CHY212 PHYSICAL CHEMISTRY II 3 1 0 4

Course Outcomes

CO1 Understand the science of surface reactions and colloids for practical applications.
CO2 Develop deep knowledge in determine the rate of chemical reactions and assessing the suitable experimental conditions for better yield in reactions.
CO3 Understand the theory behind the working of catalysis and explore its applications
CO4 Develop sound understanding of electrochemistry principles and apply for industrial applications

Unit 1 Phase Equilibria

Definition of terms: Phase, components and degrees of freedom – Derivation of Gibbs phase rule - application of phase rule to one component system: Water, carbondioxide and sulphur system – Reduced phase rule - Two component system: Simple eutectic system: Pb-Ag system, Pattinson's process. Thermal analysis and cooling curves, Compound formation with congruent melting point Zn – Mg,. and incongruent melting point Na – K system. Metal systems forming continuous solid solutions and solid solutions with minimum and maximum melting points.

Unit 2 Chemical Kinetics

Molecularity and order of a reaction, rate law expression and rate constant - first, second, third and zero order reactions, pseudo-first order reactions (pseudo-unimolecular reactions), complex reactions - equilibrium and steady state approximations - mechanism of these reactions - effect of temperature on reaction rates - Arrhenius equation and its derivation, activation energy, characteristics of activated complex Theories of reaction rates – collision theory – derivation of rate constant of bimolecular gases reaction – failure of collision theory – Lindemann's theory of unimolecular reaction. Theory of absolete reaction rates – derivation of rate for a bimolecular reaction – significance of entropy and free energy of activation.

Unit 3 Catalysis

Catalysis – homogeneous and heterogeneous – homogeneous catalysis – kinetic of acid – ase reaction and mechanism - theory of homogeneous and heterogeneous catalysis. Heterogeneous catalysis – adsorption – types – chemical and physical, characteristics of adsorption. Different types of adsorption isotherms – Freundlich and Langmuir - enzyme catalysis, difference between enzyme catalysis and general heterogeneous catalysis, factors affecting the rate of enzyme catalyzed reactions.

Unit 4 Electrochemistry I

Electrolysis, Faraday's laws of electrolysis, strong and weak electrolytes specific, equivalent and molar conductance, equivalent conductance at infinite dilution and their measurement - Kohlrausch's law and its applications - calculation of equivalent conductance at infinite dilution for weak electrolytes, degree of dissociation of weak electrolytes - solubility of sparingly soluble salts - applications of conductivity measurement - conductometric titrations - acid-base precipitation and complexometric titrations, Ostwald's dilution law and its limitations, common ion effect and its application, concept of pH, indicators, theories of indicators – buffers and their pH - Henderson equation, hydrolysis and example of hydrolysis - relation between K_h, K_b and K_w, transport number (Hittorf number) and its experimental determination - Hittorf's method and moving boundary method.

Unit 5 Electrochemistry II

Potential and its origin – electrical double layer and equilibrium – single electrode potential, standard hydrogen electrode - EMF series and its significance – Galvanic cells, IUPAC notation - reversible and irreversible cells, electrodes, calomel and Ag/AgCl reference electrodes - indicator and ion selective

(pungor) electrodes and their applications, Computation of cell EMF, Calculation of thermodynamic quantities of cell reactions (ΔG, ΔH and K) Concentration cells -variation of potential with concentration, Nernst equation and its applications, potentiometric titrations - acid-base, redox and precipitation titrations..Corrosion –basic concept - electrochemical corrosion and its mechanism - Cathodic and anocic protection-Inhibitors

TEXTBOOKS:

3. *Puri, Sharma &Pathania, 'Priniciples of Physical Chemistry', 42nd edition, Vishal Publishing Co, 2007.*
4. *Gurdeep Raj, 'Advanced Physical Chemistry', 35th edition, Goel Publishing House, 2009.*

REFERENCES:

1. *Glasstone and Lewis, 'Elements of Physical Chemistry', 2nd edition, Macmillan, 1982.*
2. *P. C.Rakhit, 'Physical Chemistry', 7th edition, Sarat Book House, 2001.*
3. *R. Stephen Berry, Stuart A. Rice & John Ross, 'Physical Chemistry', 2nd edition, Oxford University press, 2000.*

18CHY213 ORGANIC CHEMISTRY I 3 1 0 4

Course Outcomes

CO1: To be able to analyse organic compounds in qualitative and quantitative manner
CO2: To develop strong knowledge in nomenclature and in the art of writing mechanisms for simple organic reactions
CO3: To gain experience to draw all sorts of isomers under organic chemistry and understand stereochemistry
CO4: To understand the chemistry of alkanes, alkenes, alkynes and aromatic compounds by applying the fundamental organic concepts.

Unit 1 Basic concepts in Organic Chemistry
Composition of organic compounds – detection and estimation of elements – carbon, hydrogen, nitrogen, oxygen, sulphur, phosphorous, halogens – Calculation of empirical and molecular formula - determination of molecular weights – physical and chemical methods - empirical formula and molecular formula – Classification and Nomenclature of organic compounds.
Unit 2 Organic reactions and their mechanisms
Electron displacement effects – inductive, electromeric, mesomeric and hyperconjugative. Reactive intermediates – carbocations, carbanions, free radicals and carbenes – electrophiles and nucleophiles – hemolytic and heterolytic reactions – Substitution reactions (SN1 and SN2) – addition reaction – electrophilic and nucleophilic, elimination – E1 and E2 and rearrangement reactions – inter and intramolecular - condensation reactions – reduction and oxidation reactions.
Unit 3 Isomerism and Stereochemistry
Structural isomerism - chain, position, functional and metamerism, geometrical isomerism – determination of configuration, optical isomerism, Asymmetry, dissymmetry and chirality, enantiomers – Fischer projections – absolute and relative configurations – R and S systems – resolution of racemic mixtures – asymmetric synthesis.
Unit 4 Alkanes, cycloalkanes, alkenes and alkynes
Structure, nomenclature, isomerism in alkanes, alkenes and alkynes. General methods of preparation of alkanes, cycloalkanes, alkenes and alkynes. Physical and chemical properties alkanes, cycloalkanes, alkenes and alkynes. Conformation of alkanes.
Unit 5 Homocyclic Aromatic compounds and Aromaticity

Structure of benzene – nomenclature of aromatic compounds – general methods of preparation – physical chemical properties – Electrophilic and nucleophilic substitution reactions – orientation in aromatic disubstitution - Aromaticity – Huckel's rule – anisotropic ring current – aromatic – nonaromatic and antiaromatic compounds.

TEXTBOOKS:

1. *Organic Chemistry*, T. W. Graham Solomons, Craig B. Fryhle, John Wiley & Sons; 10th edition (December, 2009)
2. *Morrison and R. N. Boyd, 'Organic Chemistry', 6th Edition, Prentice Hall, 1992.*
3. *D. Nasipuri 'Stereochemistry of Organic Compounds', 2nd Edition, New Age International (P) Ltd., Publishers, 1994.*

REFERENCES:

1. *Peter Sykes, 'A Guide book to Mechanism in Organic Chemistry', 6th Edition, Pearson Education, 2009.*
2. *P. S. Kalsi' 'Organic Reactions and their Mechanisms'', New Age International Publishers, 2009.*
3. *J. Clayden, N. Greeves, S. Warren and P. Wothers, 'Organic Chemistry', 2nd edition, Oxford University Press, 2012.*
4. *K. S. Tewari and N. K. Vishnoi 'Organic Chemistry', 3rd Edition, Vikas Publishing House, 2005.*

18MAT219 **Integral Transforms** 3 1 0 4

Course Outcome :

CO1: Understand the concepts of Laplace and Fourier transforms and its properties to transform a function from time domain to the frequency domain.
CO2: Obtain the Laplace and Fourier transform and its inverse transform of impulsive, discontinuous and some complicated periodic signals.
CO3: Solve the initial value problems' using Laplace and Fourier transforms on signals arising by changing over to frequency domain.
CO4: Define the Fourier series for periodic functions and determine the Fourier coefficients.
CO5:Understand the formation of partial differential equations and apply some standard methods to obtain its solutions.
CO6: Apply Fourier series technique to solve the heat, wave and Laplace equations.

Laplace Transform:

Laplace Transforms, Inverse Transforms, Linearity, Shifting, Transforms of Derivatives and Integrals, Differential Equations, Unit Step Function, Second Shifting Theorem, Dirac's Delta Function. Differentiation and Integration of Transforms. Convolution, Integral Equations, Partial Fractions, Differential Equations, Systems of Differential Equations. (Sections: 6.1 to 6.7)

Fourier Series and Fourier Transform:

Fourier series, Half range Expansions, Parseval's Identity, Fourier Integrals, Fourier integral theorem. Sine and Cosine Integrals. Fourier Transforms, Sine and Cosine Transforms, Properties, Convolution theorem**.** (Text book-1, Sections: 11.1 -11.3, 11.7-11.9)

Applications of Partial Differential Equations
Basic Concepts, Modeling; Vibrating String, Wave Equation, Separation of Variables, Use of Fourier Series, Heat Equation; Solution by Fourier Series. (Sections: 12.1, 12.2,12.3, 12.4)

Text Book:

16. Advanced Engineering Mathematics, E Kreyszig, John Wiley and Sons, Tenth Edition, 2015.

Reference Books:

4. George Turrell, Mathematics for Chemistry and Physics, Academic Press, 2002.
5. Donald Allan McQuarrie, Mathematics for Physical Chemistry, University Science books, 2008.

18PHY214 **WAVES AND OPTICS** **3 1 0 4**

Course Outcomes:

After completion of the course, students will have knowledge and skills to:

CO1 Understand the basics of reflection, refraction, image formation with mirrors, spherical refracting surfaces, lens systems and aberrations using ray theory of light and describe working of optical instruments.

CO2 Understand the Simple Harmonic Motion (SHM) and explain the nature of wave motion, superposition of waves and working real systems.

CO3 Comprehend optical phenomena such as interference, diffraction and polarization, birefringence in terms of the wave model.

CO5 Understand the operation of optical devices, including, polarizers, retarders, modulators and interferometers.

Skills acquired: Students will be exposed to geometrical and wave optics. Acquire knowledge on propagation of light through matter, image formation with optical elements and optical instruments.

Unit 1

Review of Geometrical Optics: Fermat's principle, laws of reflection and refraction from Fermat's principle. Refraction at a spherical surface, Linear and lateral magnifications, Refraction through a thick lens. Focal lengths of thick and thin lenses. Combination of two lenses. Cardinal points.

Unit 2

Wavemotion: Simple Harmonic Oscillation (SHO), differential equation for SHO and its general solution, super position of two or more SHOs, Damped and forced oscillators, resonance. Wave equation, travelling and standing waves in one dimension, energy density and energy transmission in waves, Group velocity and phase velocity.

Unit 3

Interference: Wave nature of light, Spatial and temporal coherence, coherent sources, interference of light by division of wave front: Fresnel's biprism, interference of light by division of amplitude: interference in thin films, fringes of equal inclination, airwedge, Newton's rings and Michelson's interferometer. Multiple beam Interference -Fabry-Perot interferometer, multilayer thinfilms: AR and HR coatings.

Unit 4

Diffraction: Fresnel and fraunhoffer diffraction, diffraction grating, Rayleigh criterionand resolving power. Polarisation: linear, circular and Elliptic polarization, double refraction and optical rotation. Propagation of light through matter, dispersion and absorption, Nonlinear optics, second harmonic generation, integrated optics (qualitative only).

Unit 5

Fiber optics: Introduction to optical fiber, the numerical aperture, coherent bundle, pulse dispersion in step index fiber, graded index fiber, single mode fiber, multimode fiber, fiber optic sensors - examples - fiber optic communication (qualitative), Advantages of fiber optic communication system.

REFERENCES:

1. E.Hecht & A.R.Ganesan, Optics, Pearson, 2008

2. Jenkins and White, Fundamentals of Optics, TMH India, 4E, 2011

3. A K Ghatak, Introduction to Modern Optics, Tata-McGraw Hill, 4E, 2008

4. G R Fowles, Introduction to Modern Optics, Dover, 2E, 1989

18CHY282 Basic Organic Qualitative Lab. 0 0 2 1

Course Outcomes

CO1: Capability in engaging in safe laboratory practices of handling laboratory glassware, equipment, and chemical reagents.

CO2: Ability to analyse systematically the functional group of a simple organic compound and characterization with a derivative.

1. Basic idea on the preparation of reagents used in organic analysis. (Borshes reagent, Schiff's reagent, phenolphthalein, Neutral FeCl3, Tollens reagent, Fehlings solution),
2. Determination of boiling point and melting point – capillary method,
3. Methods of re-crystallisation,
4. Tests for elements: Nitrogen, Halogens and Sulphur
5. Tests for unsaturation. Tests for aromatic character.
6. Study of the reactions of the following functional groups: alcohol, aldehyde, ketone, carboxylic acid, 1,2 dicarboxylic acid, ester, primary and secondary amines,
7. Systematic analysis of the following organic compounds containing one functional group and characterization with a derivative - alcohol, aldehyde, ketone, carboxylic acid, 1,2 dicarboxylic acid, ester, primary and secondary amines.

REFERENCES:

1. F. G.Mann and B. C.Saunders, 'Practical Organic Chemistry' 4th edition, Pearson Education, 2009.
2. V. K.Ahluwalia and S. Dhingra 'Comprehensive Practical Organic Chemistry' Universities Press, 2000.
3. B. S.Furnis, A. J.Hannaford, P. W. G. Smith and T. R.Tatchell, 'Vogel's Text book of Practical Organic Chemistry', ELBS/Longman, 1989.
4. S. P. Bhettani&ArunaChhikara, 'Practical organic chemistry (qualitative analysis)', Ane books (India) Pvt Ltd, 2008.
5. O. P. Pandey, D.N Bajpai, S. Gini, 'Practical Chemistry, for I, II & III BSc. Students', S. Chand & Company Ltd reprint, 2009.
6. V. K.Ahluwalia, SunithaDhingra, AdarshGulate, 'College Practical Chemistry', Universities Press (India) Pvt Ltd, 2008.

18SSK211 LIFE SKILLS II 1 0 2 2

Professional Grooming and Practices: Basics of Corporate culture, Key pillars of Business Etiquette. Basics of Etiquette: Etiquette – Socially acceptable ways of behaviour, Personal hygiene, Professional attire, Cultural Adaptability. Introductions and Greetings: Rules of the handshake, Earning respect, Business manners. Telephone Etiquette: activities during the conversation, Conclude the call, To take a message. Body Language: Components, Undesirable body language, Desirable body language. Adapting to Corporate life: Dealing with people.

Group Discussions: Advantages of Group Discussions, Structured GD – Roles, Negative roles to be avoided, Personality traits to do well in a GD, Initiation techniques, How to perform in a group discussion, Summarization techniques.

Listening Comprehension advanced: Exercise on improving listening skills, Grammar basics: Topics like clauses, punctuation, capitalization, number agreement, pronouns, tenses etc.

Reading Comprehension advanced: A course on how to approach middle level reading comprehension passages.
Problem solving – Money Related problems; Mixtures; Symbol Based problems; Clocks and Calendars; Simple, Linear, Quadratic and Polynomial Equations; Special Equations; Inequalities; Functions and Graphs; Sequence and Series; Set Theory; Permutations and Combinations; Probability; Statistics.
Data Sufficiency: Concepts and Problem Solving.
Non-Verbal Reasoning and Simple Engineering Aptitude: Mirror Image; Water Image; Paper Folding; Paper Cutting; Grouping Of Figures; Figure Formation and Analysis; Completion of Incomplete Pattern; Figure Matrix; Miscellaneous.
Special Aptitude: Cloth, Leather, 2D and 3D Objects, Coin, Match Sticks, Stubs, Chalk, Chess Board, Land and geodesic problems etc., Related Problems

Course Outcomes:

CO1: Soft Skills: At the end of the course, the students will have the ability to communicate convincingly and negotiate diplomatically while working in a team to arrive at a win-win situation. They would further develop their inter-personal and leadership skills.
CO2: Soft Skills: At the end of the course, the students shall learn to examine the context of a Group Discussion topic and develop new perspectives and ideas through brainstorming and arrive at a consensus.
CO3: Aptitude: At the end of the course, students will be able to identify, recall and arrive at appropriate strategies to solve questions on geometry. They will be able to investigate, interpret and select suitable methods to solve questions on arithmetic, probability and combinatorics.
CO4: Verbal: At the end of the course, the students will have the ability to relate, choose, conclude and
CO5: Verbal: At the end of the course, the students will have the ability to utilise prior knowledge of grammar to recognise structural instabilities and modify them.
CO6: VerbalAt the end of the course, the students will have the ability to comprehend, interpret, deduce and logically categorise words, phrases and sentences. They will also have the ability to theorise, discuss, elaborate, criticise and defend their ideas.

TEXTBOOKS:

1. A Communicative Grammar of English: Geoffrey Leech and Jan Svartvik. Longman, London.

2. Adair J (1986) - "Effective Team Building: How to make a winning team", London, U.K: Pan Books.
3. Gulati S (2006) - "Corporate Soft Skills", New Delhi, India: Rupa& Co.
4. The Hard Truth about Soft Skills, by Amazone Publication.

REFERENCES:

1. Quantitative Aptitude, by R S Aggarwal, S Chand Publ.
2. Verbal and Non-verbal Reasoning, R S Aggarwal, S Chand Publ.
3. Quantitative Aptitude by AbjithGuha, Tata McGraw hill Publ.
4. More Games Teams Play, by Leslie Bendaly, McGraw-Hill Ryerson.
5. The BBC and British Council online resources
6. Owl Purdue University online teaching resources
7. www.thegrammarbook.com online teaching resources
8. www.englishpage.com online teaching resources and other useful websites.

18CHY301 Physical Chemistry III 3 1 0 4

Course Outcomes

CO1: Understand the dual nature of electron, significance of the Schrodinger equation and its application.
CO2: Obtain knowledge about the symmetry of molecules, point groups and formation of Group multiplication table.
CO3: Acquire the knowledge of different statistical methods to derive the thermodynamic properties.
CO4: To understand and apply the concept of photophysical, photochemical reactions, photosensitized reaction and chemi-luminescence.
CO5: To acquire a sound knowledge about adsorption- types and mechanism and derivation of adsorption isotherms, colloids – types, preparation, properties and applications.

Unit 1 Introduction to Quantum Chemistry
Introduction to quantum mechanics, Planck's quantum theory of radiation, photoelectric effect - dual nature of radiation, de Broglie's hypothesis - dual character of matter, uncertainty principle, Schrodinger wave equation - time dependent and time independent (no derivation), wave function ψ and its physical meaning, application of Schrodinger equation - particle in a one-dimensional box with two infinite potential barriers (energy of the particle, quantum number and quantization, momentum of the particle, energy level diagram, zero point energy, forms of the wave, node) and utility of this model, application of quantum mechanics to problems in chemistry - quantum chemistry (mention a few applications).

Unit II – Basics of Group Theory
Symmetry- Elements of symmetry and symmetry operations – identity, proper axis of rotation, plane of symmetry, improper axis of rotation and center of inversion. Group and group theory- brief mathematical introduction, abelian and cyclic groups. Molecular point groups, classification and nomenclature of point groups- conditions and examples of non-axial, axial, dihedral and infinite point groups. Algebra of symmetry operations, matrix representations of symmetry operations, group multiplication table.

Unit 3 Irreversible and Statistical Thermodynamics
Reversible and irreversible thermodynamics, examples for irreversible processes, postulate or assumption of local equilibrium, entropy production - entropy production in heat flow and in matter flow, forces and

fluxes, introduction to statistical thermodynamics, system, assembly, ensemble, canonical and microp'[;/-canonical ensemble, Boltzmann distribution law (no derivation), partition function, qualitative and basic ideas of Maxwell-Boltzmann statistics, Bose-Einstein statistics and Fermi-Dirac statistics, bosons and fermions].

Unit 4 Photochemistry

Photochemistry - Consequences of light absorption - The Jablonski diagram – non-radiative transitions - radiative transitions – laws of photochemistry - Lambert's law, Beer's law and Beer-Lambert law, deviation from Beer's law, Grotthus - Draper law - The Stark Einstein law of photochemical equivalence - Quantum efficiency (quantum yield). Energy transfer in photochemical reactions – photosensitisaiton - Photosynthesis in plants - Chemiluminescence - fluorescence and phosphorescence – lasers - uses of lasers. Photochemical reactions -Kinetics of hydrogen-bromine reaction - decomposition of HI - photoelectric cells, photosensitization and photosensitiser, photosynthesis.

Unit 5 Surface Chemistry and Colloids

Adsorption – physical and chemical - adsorption isotherms, Freundlich and Langmuir isotherms, positive, negative and electrostatic adsorption, applications of adsorption, colloidal state, dispersed phase, dispersion medium, types of colloidal systems, sols, gels and foams - lyophobic and lyophilic colloids, preparation by mechanical and electrical dispersion and chemical methods, purification by electrodialysis, and ultrafiltration, properties - colour, optical and electrical properties, qualitative idea of electrical double layer (Helmholtz-Perrin theory, Gouy-Chapman theory, Stern's theory), stability of lyophobic and lyophilic sole, isoelectric point, protection of colloids - protective colloids, Gold Number, Hofmeister series, coagulation or flocculation - addition of electrolytes, continuous dialysis and salting out, Hardy-Schulze law, coacervation, sensitization, micelle and critical micellisation concentration, application of colloids.

TEXTBOOKS:

1. *R. K.Prasad, 'Quantum Chemistry', 3rd edition, New Age International Publishers, 2006.*
2. *Puri, Sharma &Pathania, 'Principles of Physical Chemistry', 42nd edition, Vishal Publishing Co, Delhi, 2007.*
3. *Gurdeep Raj, 'Advanced Physical Chemistry', 35th edition, Goel Publishing House, 2009.*

REFERENCES:

1. *Donald A McQuarrie, "Quantum Chemistry", Viva Books Private Ltd.*
2. *Glasstone and Lewis, 'Elements of Physical Chemistry', 2nd edition, Macmillan, 1982.*
3. *R. Stephen Berry, Stuart A. Rice & John Ross, 'Physical Chemistry', 2nd edition, Oxford University press, 2000.*

18CHY302 INORGANIC CHEMISTRY II 3 1 0 4

Course Outcomes

CO1: Understanding the salient features of coordination compounds, this includes coordination number, oxidation number, electronic configuration, nomenclature, ligands, structure and bonding.

CO2: Acquiring the knowledge of spectral and magnetic properties of complexes through CFT and MOT.

CO3: Describing the stability of metal complexes by the use of formation constants and to calculate the thermodynamic parameters from them.

CO4: Gaining the knowledge of organometallic compounds and to apply the concept of isomerisation in the above compounds.

CO5: Imparting the basic knowledge of catalytic cycle of organometallic compounds and bio-inorganic elements and metal toxicity.

Skill: The students will acquire knowledge in coordination compounds, its spectral and magnetic properties, isomerism, bio-inorganic elements and organometallic compounds.

Unit 1 Coordination Chemistry I

Werner's theory – Electronic interpretation of co-ordination compounds - EAN rule – types of ligands – Nomenclature, isomerism – stability of complexes – factors influencing stability – Application of coordination compounds in qualitative and quantitative analysis. Theories of bonding in coordination compounds – VBT, CFT and MOT. VBT – merits and demerits – CFT – crystal field splitting in tetrahedral and octahedral complexes – factors affecting crystal field splitting – CFSE of complexes – spectrochemical series – Explanation of geometry, magnetism and colour on the basis of the above theories.

Unit 2 Coordination Chemistry II

Spectral and magnetic properties of metal complexes - Electronic absorption spectrum of $[Ti\ H_2O)_6]^{3+}$ ion. Types of magnetic behavior, spin-only formula, calculation of magnetic moments. Reactivity of metal complexes - Labile and inert complexes, ligand substitution reactions – SN_1 and SN_2 substitution reactions of square planar complexes – Trans effect and applications of trans effect.

Unit 3 Organometallic compounds

Definition, classification and nomenclature of organometallic compounds, Ylides, classification on the basis of hapticity. Catalytic properties of organometallic compounds - alkene hydrogenation, synthesis of water gas – shift reaction, Zeigler-Natta polymerisation, Wilkinson catalyst - 18 electron rule, metal-alkene complexes, metal-alkyne complexes, carbene and carbyne complexes. Metal nitrosyls and dinitrogen complexes. Metallocenes – ferrocene (preparation and structure only). Dibenzene chromium. Zeise's salt – preparation, properties and structure.

Unit 4 Metal Carbonyls and Metal clusters

Preparation and properties of mononuclear carbonyls. Structures of Mo $(CO)_6$, Fe $(CO)_5$ and $Ni(CO)_4$. Polynuclear carbonyls, bridged carbonyls and bonding in metal carbonyls. Preparation and properties of carbonyls of Fe and Ni. Metal clusters - carbonyl and halide clusters, low nuclearity carbonyl clusters and high nuclearity carbonyl clusters, electron counting schemes for $Rh_6(CO)_{16}$ and $[Os_6(CO)_{18}]^{2-}$ metal only clusters (Zintl ions).

Unit 5 Bioinorganic Chemistry

Essential and trace elements in biological systems, myoglobin and haemoglobin, role of myoglobin and haemoglobin in biological systems, mechanism of oxygen transport, cooperativity, Bohr effect. Vitamin B12 (structure not expected) Metalloenzymes of zinc, inhibition and poisoning of enzymes. Electron carriers – cytochromes. Role of alkali and alkaline earth metals in biological systems, Photosynthesis, Na/K pump. Biological function and toxicity of metals – Fe, Cu, Zn, Cr, Mn, Ni, Co, Cd, Hg and Pb, treatment of metal toxicity. Anti cancer drugs – cisplatin and carboplatin.

TEXTBOOKS:

1. *Puri B R, Sharma L R, Kalia K K, 'Principles of Inorganic Chemistry', 23rd edition, Shoban Lal Nagin Chand & Co, New Delhi, 1993.*
2. *Lee J. D., 'Concise Inorganic Chemistry', Black Well Science, UK. 2006*

3. *Soni P. L., 'Text Book of Inorganic Chemistry', S, Chand & Co, New Delhi, 2006.*

REFERENCES

1. J.E. Huheey, R.A. Keiter, R.L. Keiter, 'Inorganic Chemistry-Principles of Structure and Reactivity', 4th Edn., Prentice Hall, 1997.
2. *F. A. Cotton, G. Wilkinson, C. A. Murillo & M. Bochmann, 'Advanced Inorganic Chemistry', 6th edition, John Wiley, 1999.*

18CHY303 ORGANIC CHEMISTRY II 3 1 0 4

Course Outcomes

CO1: To attain a firm foundation in the basic concepts of organic chemistry and become fluent in writing appropriate mechanisms for reactions

CO2: To acquire understanding on properties, synthesis and chemical behavior of organic halogen compounds, alcohols, ethers and phenols

CO3: To learn synthetic methodologies, properties and reactivity of carbonyl compounds, carboxylic acids and carboxylic acid derivatives

CO4: To be able to design synthetic methodologies and to understand properties and reactivity of amines, nitro compounds and nitriles

Unit 1 Alkyl Halides, aryl halides and Organometallic compounds

Structure, nomenclature, preparation of alkyl and aryl halides. Chemical and physical properties – SN1 and SN2 reactions – di, tri and tetra halogen derivatives – unsaturated halogen derivatives. Aryl halides – preparation, physical and chemical properties and uses - Addition halogen compounds – Chlorobenzene – DDT. Aralkyl halides – preparation and properties. Grignard reagents – preparation – chemical and physical properties – organolithium compounds.

Unit 2 Alcohols and Phenols

Alcohols: Nomenclature – preparation and properties. Conversion to tosylates – oxidation. Tests for hydroxyl groups. Industrial importance of various alcohols. Synthesis and properties of polyhydric alcohols.

Phenols: Preparation, properties, reactions (oxidation) to quinones, Riemer-Tiemann reaction – Bromination, Nitration, Liebermann's nitroso reaction, preparation of phenolphthalein, Kolbe's reaction – Pinacol–Pinacolone rearrangement. Industrial importance of picric acid, quinol and nitro phenols.

Ethers: Nomenclature, preparation and reactions - Claisen rearrangement, Zeisel's method – crown ether structure. Thioalcohols - general physical and chemical characteristics.

Unit 3 Aldehydes and Ketones

Nomenclature, classification and preparation of aldehydes and ketones – reactivity of carbonyl groups – acidity of alpha H. Reactions – Oxidation, reduction, metal hydride reduction, nucleophilic addition, Wittig reaction, Grignard reagent, Michael addition, Cannizaro, Aldol, Perkin, Knoevenagel, Benzoin, Claisen, Reformatsky, Beckmann rearrangement, stobbe condensation (with mechanism).

Unit 4 Carboxylic acids, Acid derivatives and Active methylene compounds

Nomenclature. Classification of aliphatic and aromatic carboxylic acids. Preparation and reaction – acidity – reduction (mechanisms) substitution in alkyl/aryl group. Fischer esterification reaction. Decarboxylation reactions.

Dicarboxylic acids – preparation of oxalic, malonic, succinic, glutaric, adipic, phthalic acids and unsaturated acids (acrylic, crotonic and cinnamic, maleic and fumaric).

Active methylene compounds: Synthesis and application of ethyl acetoacetate, diethyl malonate and cyano aceto esters.

Acid derivatives: Preparation/reaction of acid chlorides, acid anhydrides, amides, esters, acid/alkaline hydrolysis of esters, trans-esterification.
Derivatives of carbonic acids: Preparation, properties and structure of urea, manufacture of urea and thiourea, preparation and basicity of guanidine.

Unit 5 Organic compounds containing Nitrogen
Nitro compounds – Nomenclature, preparation and properties of aliphatic and aromatic nitro compounds. Reduction of nitro benzene under various conditions. Di and tri substituted aromatic nitro compounds – synthesis of o-, m-, p- dinitrobenzenes and tri nitrobenzene. Amino compounds – nomenclature and classification. Carbylamine reaction, diazotization – comparison of aliphatic and aromatic amines. Reductive amination of aldehydic and ketonic compounds.
Diazonium salts – preparation and reactions. Diazoalkanes and azides Cyan compounds.

TEXTBOOKS:

1. *Morrison and R. N. Boyd, 'Organic Chemistry', 6th Edition, Prentice Hall, 1992.*
2. *K.S. Tewari and N.K. Vishnoi 'Organic Chemistry', 3rd Edition, Vikas Publishing House, 2005.*
3. *T.H.Lowry, K.S.Richardson, 'Mechanism and Theory in Organic Chemistry', 3rd edition, Harper Colins, New York, 1987.*

REFERENCES:

1. *L.G. Wade, J.R., 'Organic Chemistry', 5th edition, Pearson Education, Singapore, 2004.*
2. *Solomons & Fryhle, 'Organic Chemistry', 7th edition, Wiley India Pvt. Ltd., 2004.*
3. *John McMurry, 'Fundamental of Organic Chemistry', 7th edition, Brook and Cole, 2011*

18CHY383 Basic Physical Chemistry Lab 0 0 5 2

Course Outcomes

CO1: Acquiring skills in different methods of finding the molecular weights.
CO2: Acquiring the concept of miscibility of liquids and perform the experiment.
CO3: Gaining knowledge on how impurity affects the physical characteristics of a compound and using that to find the CST, Eutectic temperature and molecular weight.
CO4: Imparting the skill in obtaining data and to derive the adsorption isotherm for adsorption processes.
CO5: Skillful performance of the experiments and to derive the kinetics of acid/base catalyzed ester hydrolysis.

1. Determination of CST of phenol-water system - effects of KCl/ NaCl salts on CST.
2. Phase diagram of simple eutectic system.
3. To determine the molecular weight of a high polymer by viscosity method.
4. To determine the molecular weight of a solute by Rast method using naphthalene or diphenyl as solvent using Beckmann thermometer.
5. To determine the solubility of benzoic acid at different temperatures and to determine ΔH of the dissolution process.
6. Determination of rate constant of acid catalyzed hydrolysis of an ester.
7. To study the adsorption of acetic acid from its aqueous solution by charcoal.
8. To determine the distribution coefficient of iodine between water and carbon tetra chloride.
9. Determination of transition temperature of the given salt hydrate.

18CHY384 Organic Synthesis and Estimation Lab 0 0 2 1

Course Outcomes

CO1: Able to calculate limiting reagent, theoretical yield, and percent yield of simple organic reactions.
CO2: Able to perform common laboratory techniques including reflux, distillation, recrystallization, vacuum filtration, and thin-layer chromatography

1. Basic concepts on theoretical yield, practical yield, samples % conversion etc, Organic preparations including recrystallisation,
2. Synthesis of a) Acetanilide to p-nitroacetanilide b) Acetanilide to p-bromoacetanilide c) Benzyl chloride to Benzoic acid,
   d) Nitrobenzene to dinitrobenzene e) Ester hydrolysis f) Benzoylation (phenol to phenyl benzoate);
3. Separation Techniques: Thin Layer Chromatography, Column chromatography

REFERENCES:

1. *F. G.Mann and B. C.Saunders, 'Practical Organic Chemistry' 4th edition, Pearson Education, 2009.*
2. *V. K.Ahluwalia and S. Dhingra 'Comprehensive Practical Organic Chemistry' Universities Press, 2000.*
3. *B. S.Furnis, A. J.Hannaford, P. W. G. Smith and T. R.Tatchell, 'Vogel's Text book of Practical Organic Chemistry', ELBS/Longman, 1989.*
4. *O. P. Pandey, D.N Bajpai, S. Gini, 'Practical Chemistry, for I, II & III BSc. Students', S. Chand & Company Ltd reprint, 2009.*
5. *V. K.Ahluwalia, Sunitha Dhingra, Adarsh Gulate, 'College Practical Chemistry', Universities Press (India) Pvt Ltd, 2008.*

18SSK301 LIFE SKILLS III 1 0 2 2

Team Work: Value of Team work in organisations, Definition of a Team, Why Team, Elements of leadership, Disadvantages of a team, Stages of Team formation. Group Development Activities: Orientation, Internal Problem Solving, Growth and Productivity, Evaluation and Control. Effective Team Building: Basics of Team Building, Teamwork Parameters, Roles, Empowerment, Communication, Effective Team working, Team Effectiveness Criteria, Common characteristics of Effective Teams, Factors affecting Team Effectiveness, Personal characteristics of members, Team Structure, Team Process, Team Outcomes.

Facing an Interview: Foundation in core subject, Industry Orientation/ Knowledge about the company, Professional Personality, Communication Skills, activities before interview, upon entering interview room, during the interview and at the end. Mock interviews.

Advanced Grammar: Topics like parallel construction, dangling modifiers, active and passive voices, etc.

Syllogisms, Critical reasoning: A course on verbal reasoning. Listening Comprehension advanced: An exercise on improving listening skills.

Reading Comprehension advanced: A course on how to approach advanced level of reading, comprehension passages. Exercises on competitive exam questions.

Specific Training: Solving campus recruitment papers, National level and state level competitive examination papers; Speed mathematics; Tackling aptitude problems asked in interview; Techniques to remember (In Mathematics). Lateral Thinking problems. Quick checking of answers techniques; Techniques on elimination of options, Estimating and predicting correct answer; Time management in aptitude tests; Test taking strategies.

Course Outcomes:

CO1: Soft Skills: At the end of the course, the students will have the ability to prepare a suitable resume (including video resume). They would also have acquired the necessary skills, abilities and knowledge to present themselves confidently. They would be sure-footed in introducing themselves and facing interviews.

CO2: -Soft Skills: At the end of the course, the students will have the ability to analyse every question asked by the interviewer, compose correct responses and respond in the right manner to justify and convince the interviewer of one's right candidature through displaying etiquette, positive attitude and courteous communication.

CO3: Aptitude: At the end of the course, students will be able to interpret, critically analyze and solve logical reasoning questions. They will have acquired the skills to manage time while applying methods to solve questions on arithmetic, algebra, logical reasoning, and statistics and data analysis and arrive at appropriate conclusions.

CO4: Verbal: At the end of the course, the students will have the ability to understand and use words, idioms and phrases, interpret the meaning of standard expressions and compose sentences using the same.

CO5: Verbal: At the end of the course, the students will have the ability to decide, conclude, identify and choose the right grammatical construction.

CO6: Verbal: At the end of the course, the students will have the ability to examine, interpret and investigate arguments, use inductive and deductive reasoning to support, defend, prove or disprove them. They will also have the ability to create, generate and relate facts / ideas / opinions and share / express the same convincingly to the audience / recipient using their communication skills in English.

TEXTBOOKS:

1. A Communicative Grammar of English: Geoffrey Leech and Jan Svartvik. Longman, London.

2. Adair J (1986) - "Effective Team Building: How to make a winning team", London, U.K: Pan Books.

3. Gulati S (2006) - "Corporate Soft Skills", New Delhi, India: Rupa& Co.

4. The Hard Truth about Soft Skills, by Amazon Publication.

REFERENCES:

1. Speed Mathematics, Secrets of Lightning Mental Calculations, by Bill Handley, Master Mind books;

2. The Trachtenberg Speed System of Basic Mathematics, Rupa& Co., Publishers;

3. Vedic Mathematics, by Jagadguru Swami Sri BharatiKrsnaTirthayi Maharaja, MotilalBanarsidass Publ.;

4. How to Ace the Brainteaser Interview, by John Kador, Mc Graw Hill Publishers.

5. Quick Arithmetics, by Ashish Agarwal, S Chand Publ.;

6. Quicker Maths, by M tyra& K Kundan, BSC Publishing Co. Pvt. Ltd., Delhi;

7. More Games Teams Play, by Leslie Bendaly, McGraw-Hill Ryerson.

8. *The BBC and British Council online resources*
9. *Owl Purdue University online teaching resources*

10. www.thegrammarbook.com online teaching resources

11. www.englishpage.com online teaching resources and other useful websites.

18CHY312 BASICS OF ANALYTICAL CHEMISTRY 3 0 0 3

Course Outcomes

CO1- Understanding of principle and working of the range of instrumental methods in analytical chemistry

CO2- Developing skills in contemporary methods of separation and appropriate selection of instruments for the successful analysis of chemical compounds

CO3-Imparting skills in the scientific method of planning, conducting, reviewing, reporting experiments and problem solving in chemical analysis.

Unit 1 Theoretical principles of qualitative and quantitative analysis Types of analytical methods - Importance of analytical methods in qualitative and quantitative analysis - chemical and instrumental methods - advantages and limitations of chemical and instrumental methods. Data Analysis - Types of errors, minimization of errors, propagation of errors, accuracy and precision, least square analysis, average standard deviation, coefficient of variance, significant figures.

Unit 2 Chromatographic Techniques Theory of separation, chromatographic separation, chromatographic techniques - Column chromatography, thin layer chromatography, Paper chromatography, Ionexchange chromatography, gas chromatography - principle, Significance of Rfvalues. HPLC, GC-MS, bioseparation - electrophoresis, centrifugation, DNA/protein separation, purification, polymer separation, green separation process, separation using zeolite and polymer membranes.

Unit 3 Thermal Analysis Principle of thermo gravimetry (TGA), differential thermal analysis (DTA), differential scanning calorimetry (DSC) - Instrumentation and Characteristics of TGA and DTA curves, factors affecting TGA and DTA curves. Applications - TGA of calcium oxalate monohydrate, DTA of calcium acetatemonohydrate - determination of purity of pharmaceuticals by DSC, Thermometric titrations.

Unit 4 Electroanalytical Techniques Conductometry - ion selective electrodes. Potentiometry, Amperometry, coulometry, polarography, voltametry - cyclic voltametry and anodic stripping voltametry - Principle and analysis of samples.

Unit 5 Crystallographic and Microscopic Techniques XRD, X-ray crystallography, SAXD Optical microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy, Scanning Transmission Electron Microscopy, Atomic Force Microscopy.

TEXTBOOKS:

1. Douglas A. Skoog and Donald M. West, F.J. Holler, 'Fundamentals of Analytical Chemistry', 7th edition, 7th edition, Suanders College publishers, 1995.
2. Usharani S., Analytical Chemistry, Macmillan, 2001.

REFERENCES:

1. Mendham J., Denney R.C., Barnes J.D., Thomas M., 'Vogel's Text book of Quantitative Chemical analysis', 7th edition, Pearson education, 2008.
2. Sharma, B.K., 'Instrumental Methods of Chemical Analysis', Goel Publishing House, Merrut, 1997.
3. Gopalan. R., Subramaniam P.S. and Rengarajan K., 'Elements of Analytical Chemistry', Sultan Chand and Sons, 2004.

18CHY313 ORGANIC CHEMISTRY III 3 1 0 4

Course Outcomes

CO1: Ability to get an idea of the chemistry behind aromatic polycyclic and heterocyclic compounds
CO2: Capacity to provide an overview on synthesis, properties and reactions of pivotal biomolecules
CO3: Capability to gain insight into source, properties and applications of alkaloids, terpenoids, polymers, fats, oils and detergents
CO4: To obtain a brief idea on the basics of organic photochemistry

Unit 1 Polycyclic and Heterocyclic Aromatic Compounds

Classification – reactions and structure of naphthalene, anthracene and phenanthrene. Elementary idea of naphthyl amines, naphthols, naphthaquinone and anthraquinone. Five-membered heterocycles with one hetero atom – Nomenclature - Pyrroles – synthesis (knorr synthesis, Paal-Knorr synthesis etc), Furan – synthesis, Thiophene – synthesis. Six-membered heterocycles with one hetero atom - Pyridines – synthesis. Quinoline and isoquinolines – synthesis. Reaction mechanisms of electrophilic and nucleophilic substitutions, oxidation/reduction reactions. Resonance structures of heterocyclic compounds, applications. Fused ring heterocycles – Synthesis, Structure and reactivity.

Unit 2 Carbohydrates

Classification and nomenclature. Preparation, properties and structural elucidation. Glucose – structure and configuration of mono saccharide, interconversion, mutarotation, epimerization, cyclic structure. Disaccharide – sucrose, maltose – structure. Polysaccharide – starch, cellulose, glycogen – structure and utility. Reducing and non-reducing sugars.

Unit 3 Amino acids, Proteins, vitamins and Nucleic acids

Amino acids: Classification, structure and stereochemistry of amino acids, preparation and reactions of β, γ - amino acids. Essential and non-essential amino acids, zwitter ion, isoelectric point. Peptides: structure and synthesis (Carbo benzoxy method, Sheehan method only). Proteins: - Structure of proteins, denaturation and colour reactions. Biosynthesis of protein. Nucleic acids: Classification and structure of DNA and RNA. Replication of DNA, Genetic Codes. Vitamins – Classification and important sources, physiological action and deficiency symptoms of vitamin A, B1, B2, and B12. C, D, E and K

Unit 4 Alkaloids, terpenes, enzymes and Photochemistry

Alkaloids – General properties and classification – Quinine – nicotine. Terpenes – isoprene rule – classification – examples – citral – geraniol. Enzymes: General nature and classification, specificity of enzymes. Photochemistry - Basic principles of photochemistry – Jablonskii diagram, photochemical reactions of carbonyl compounds.

Unit 5 Synthetic polymers, oils, fats and detergents

Synthetic polymers: Addition polymerization – mechanism – condensation polymerization – terylene – nylon 6,6- phenolic resins – natural and synthetic rubbers. Colour dyes and pigments. Dyes: Theory of colour and constituents, classification of dyes, synthesis of methy orange, malachite green, phenolphthalein alizarin, indigo. Oils and fats – structure and composition – physical and chemical properties – analysis of fats and oils. Soaps and detergents - composition - mechanism of cleaning action of soap – soap manufacture – detergents – advantages – preparation.

TEXTBOOKS;

1. *Morrison and R. N. Boyd, 'Organic Chemistry', 6th Edition, Prentice Hall, 1992.*

2. *I.L. Finar, "Organic Chemistry", 7th edition Vol I & II, Longmann, 2009.*

3. *S M Mukherji & S P Singh, "Reactions, Mechanisms of Organic Chemistry", 3rd edition, Macmillan Publishers India Ltd., 2009.*

REFERENCES:

1. *L.G. Wade, J.R., 'Organic Chemistry', 5th edition, Pearson Education, Singapore, 2004.*

2. *Solomons and Fryhle, Organic Chemistry, 7th edition, Wiley India Pvt. Ltd., 2004.*

3. *John McMurry, 'Fundamental of Organic Chemistry', 7th edition, Brook and Cole, 2011.*

18CHY314 Inorganic Chemistry III 3 1 0 4

Course Outcomes

CO1: Capacity to describe the chemistry of inorganic polymers and its commercial applications

CO2: Ability to understand the inorganic nanomaterials of gold, rhodium, palladium, platinum, iron and silver and their chemical synthesis

CO3: Capability to depict chemistry beyond the molecules through weak interaction and its application in supramolecular chemistry and molecular recognitions

CO4: Capacity to describe the basics of chemical aspects of soil

Unit 1 Inorganic Polymers

Properties of Inorganic polymers - silicones - composition, manufacture, structure properties and uses, silanes and their polymers, applications of phosphazenes, silicates and their polymers - classification into discrete anions - one, two and three dimensional structures with examples - composition, properties and uses of beryl, asbestos, talc, mica, zeolites and ultramarines.

Unit 2 Inorganic Nanomaterials

General introduction to nanomaterials and emergence of nanotechnology; Moore's law; synthesis of nanoparticles of gold, rhodium, palladium, platinum, iron and silver; Synthesis of nanoparticle semiconductors, nanowires and nanorods; Techniques of synthesis: electroplating and electrophoretic deposition, conversion through chemical reactions and lithography; Thin films: Chemical vapor deposition and Atomic layer deposition techniques; Carbon fullerenes and Nanotubes - applications of nanoparticles.

Unit 3 Molecular Recognition

The concepts of Molecular Recognition, Host, Guest receptor systems. Forces involved in Molecular Recognition – Hydrogen bonding, ionic bonding, p-stacking, van der Waal's and hydrophobic interaction.

Unit 4 Supra molecular Chemistry

Supra molecular Chemistry - Introduction to molecular receptors - design principles - tweezers, cryptands and carcerands – cyclophanes - cyclo dextrins and calixarenes - typical examples for Molecular Recognition and catalysis - catalysis by cation receptor, anion receptor and cylophanes - Molecular Recognition in DNA and protein structure.

Unit 5 Chemical Aspects of Soil

Origin of soil - igneous - metamorphic and sedimentary rocks - rock systems – weathering of rocks and minerals - main components of soil - organic, inorganic, liquid and gaseous phase - Physical properties of soil - Factors affecting soil pH – Soil pH and nutrient availability - Causes of soil degradation. Origin of problem soils, their properties - acid, alkali and saline soils - diagnosis - remediation of acid and salt affected soils - Quality of irrigation water – causes for poor quality waters for irrigation, their effects in soils and crops. Soil testing - concept, objectives and basis - soil sampling, collection processing, despatch of soil and water samples. soil organic matter - its decomposition and effect on soil fertility - source of organic matter in soil - maintenance and distribution - soil organism - their role - nitrification - denitrification, nitrogen fixation in soils - biological nitrogen fixation - microbial interrelationship in soil - microbes in pest and disease management - Bio-conversion of agricultural wastes.

TEXTBOOKS:

1. F. A. Cotton, G. Wilkinson, C. A. Murillo & M. Bochmann, 'Advanced Inorganic Chemistry', 6th edition, John Wiley, 1999.
2. J.E. Huheey, 'Inorganic Chemistry - Principles, Structure and Reactivity', 4th edition, Harper Collins, New York, 1993. 3. Daji, A.J. 'A Textbook of Soil Science', Asia Publishing House, Madras, 1970.

REFERENCE BOOKS:

1. Jonathan W. Stead, David R. Turner andkarl. J. Wallace., 'Core concepts in Supramolecular Chemistry and Nanochemistry', John Wiley sons Ltd, 2007.
2. R. W. Hay, 'Bioinorganic chemistry', Halsted Press, 1984.
3. Tisdale, S.L., Nelson, W.L. and Beaton, J. D, 'Soil Fertility and Fertilizers', Macmillian Publishing Company, New York, 1990.

18CHY317 Basic Spectroscopic Techniques 3 1 0 4

CO1: Capacity to understand and imply the knowledge of electromagnetic radiation in spectroscopy techniques
CO2: Ability to demonstrate the functional group analysis, both quantitative and qualitative analysis of small organic molecules and coordination compounds.
CO3: Capability to interpret the structure of small organic molecules using 1H and 13C NMR and mass spectra.

Unit 1 - Electromagnetic spectrum Introduction – Definition of spectrum - Electromagnetic radiation - regions of spectrum, quantization of different forms of energies in molecules (translational, rotational, vibrational and electronic) - Born Oppenheimer approximation.

Unit 2 - Electronic Spectroscopy Principle - Absorption laws. Calculations involving Beer Lambert's law -instrumentation - photo colorimeter and spectrophotometer - block diagrams with description of components - theory - types of electronic transitions - chromophore and auxochromes - Absorption bands and intensity - factors governing absorption maximum and intensity. Calculation of ?max using Woodward fischer rule for simple molecules.

Unit 3 - Vibrational Spectroscopy Principle – vibrational frequency – fundamental vibrations - modes of vibration of diatomic, triatomic linear (CO2) and nonlinear triatomic molecules (H2O) - stretching and bending vibrations - selection rules. Hooks law. Instrumentation - sampling techniques. Applications of IR Spectroscopy – interpretation of the spectra of alcohols, aldehydes, ketones and esters – aliphatic and aromatic.

Unit 4 - NMR Spectroscopy Principle of nuclear magnetic resonance – basic instrumentation - number of signals - chemical shift - shielding and deshielding. Spin-spin coupling and coupling constants. TMS as

NMR standard. Introduction to H1 and C13 NMR spectrum. Interpretation of Proton NMR spectra of simple organic compounds such as Acetone, Anisole, Benzaldehyde, Ethyl acetate, Ethylamine, Ethyl Bromide, Toluene and Isopropyl phenyl ketone.

Unit 5 - Mass spectrometry Basic principles - instrumentation - molecular ion peak, base peak, metastable peak, isotopic peak their uses. Fragmentation pattern – Nitrogen rule - determination of molecular formulae – Types of mass analysis. Interpretation of mass spectra of simple organic compounds such as Acetone, Anisole, Benzaldehyde, Ethyl acetate, Ethylamine, Ethyl Bromide, Toluene and Isopropyl phenyl ketone. Mc-Lefferty Rearrangement.

TEXTBOOKS:

1. P.S.Kalsi, 'Spectroscopy of Organic Compounds', 6th edition, New age international publishers, 2005.
2. W. Kemp, 'Organic Spectroscopy, Macmillan, 1987

REFERENCE BOOKS:

1. R. M. Silverstein, F. Webster and D. Kiemle, 'Spectroscopic Identification of Organic Compounds', 7th edition, J. Wiley and Sons, 2005
2. C. N. Banwell, 'Fundamentals of Molecular Spectroscopy', 4th edition, Mcgraw-Hill College, 1994. 3. Dyer John.R, 'Applications of Absorption Spectroscopy of Organic Compounds', PHI learningpublishers, 1965,

18CHY385 Inorganic Quantitative Lab-Gravimetric Analysis 0 0 5 2

CO1: Ability to gain skill in estimating the given unknown substance by simple precipitation method
CO2: Develop skills in preparing, collecting, treating, and weighing a precipitate
CO3: Develop skills for producing accurate and reliable results

1. Gravimetric estimation of barium as barium sulphate.
2. Gravimetric estimation of iron as iron (III) oxide.
3. Estimation of sulphate as barium sulphate.
4. Gravimetric estimation of copper as copper (I) thiocyanate.
5. Gravimetric estimation of nickel as nickel dimethyglyoximate.
6. Gravimetric estimation of magnesium as magnesium 8-hydroxy quinolate.
7. Estimation of iron in the given sample of haematite by dichromate method.
9. Estimation of copper in bronze by iodometric method.
10. Estimation of tin in solder using EDTA.

TEXTBOOKS:

1. *G.H.Jeffery, J.Bassett, J.Mendham and R.C.Denny 'Vogel's Text Book of Quantitative Chemical Analysis', 5th Edition, ELBS, 1989.*
2. *D.A.Skoog and D.M.West 'Analytical Chemistry-An Introduction', 4th Edition, CBS Publishing Japan Ltd., 1986.*

REFERENCES:

1. *E.J.Meehan, S.Bruckenstein and I.M.Kolthoff and E.B.Sandell, 'Quantitative Chemical Analysis', 4th Edition, The Macmillan Company, 1969.*
2. *R.A.Day (Jr) and A.L.Underwood, 'Quantitative Analysis', 6th Edition, Prentice Hall of India, 1991.*

18CHY386 Physical Chemistry Lab –Instrumental Analysis 0 0 3 1

Course Outcomes

CO1: Develop skills in working with analytical instruments and understanding its working principle and different applications in analytical chemistry.
CO2: Analyze the effect of different electrochemical parameters for industrial anodization and learning the selection of proper reaction conditions.
CO3: Apply the principles of electrolyte conductance and electrode potential for analytical applications.
CO4: Evaluate the optical properties of chemical species for analytical applications.
CO5: Understand the rate of electrochemical reactions and apply it for minimizing industrial corrosion.

1. Determination of cell constant and equivalent conductivities of different electrolyte by conductometrically.
2. Determination of the strength of strong and weak acids in a given mixture conductometrically.
3. Determination of the velocity constant, order of the reaction and energy of activation for specification of acetate by sodium hydroxide conductometrically.
4. Determination of solubility and solubility product of sparingly soluble salt by (e.g. $PbSO_4$, $BaSO_4$) conductometrically.
5. Determination of the strength of strong and weak acids in a given mixture using a potentiometer.
6. Determination of the strength of strong and weak acids in a given mixture using a pH meter.
7. Determination of unknown concentration using photoelectric calorimeter.
8. Determination of pKa of acetic acid using pH meter.
9. Determination of concentration of an electrolyte by Nernst equation.
10. Determination of concentration of ions by Spectrophotometer.\
11. Determination of concentration of potassium and sodium ion by flame photometry.
12. Determination of transport number of silver ion.

TEXTBOOKS:

1. *R.C. Das and B.Behara, 'Experiments in Physical Chemistry', Tata McGraw-Hill, 1983.*
2. *Alexander Findly,' Practical Physical Chemistry', 9th edition, Wiley, 1972.*

REFERENCE BOOKS:

1. *Gilbert William Castellam,' Physical Chemistry', Addison-Wesley Publishing Company, 1964.*
2. *James Brierley Firth, 'Practical Physical Chemistry', D. Van Nostrand Company, 1916.*
3. *Dr.J.B.Yadav, 'Advanced Practical Physical Chemistry', Krishna Prakashan Media, 29th edition, 2010.*

18CHY501 QUANTUM CHEMISTRY 3 0 0 3

Course Outcomes

CO1: Thorough understanding of the fundamentals of quantum chemistry
CO2: Capability to provide innovative solutions (in the language of quantum chemistry) for problems of chemical interest.
CO3: Development of familiarity with computational techniques and tools which finds extensive applications in practical quantum chemistry
CO4: Become convinced about the greenness of the theoretical methods in chemistry

Unit I: Quantum Chemistry - Introduction
Origin of quantum mechanics, de Broglie relationship, the uncertainty principle (no derivation); Postulates of quantum mechanics: postulate I – wave functions, postulate II- Operators in quantum mechanics, operator algebra, postulate-III – eigen values, eigen value equations, postulate IV – Expectation value, postulate V – time dependent and time independent Schrodinger equation

Unit II: Applying Schrodinger equation to various general systems
Translational motion of a quantum entity (particle in one dimensional box and three dimensional box); vibrational motion (harmonic oscillator); rotational motion (rigid rotator, particle on a ring and particle on a sphere); angular momentum.

Unit III: Atomic structure and chemical bonding
Hydrogen and hydrogen-like atoms; Multi electron systems- variation methods, perturbation methods, application to the ground state of Helium atom, SCF method, the exclusion principle
Chemical bonding: Hydrogen molecule ion and hydrogen molecule - molecular orbital and valence bond theory, homo and hetero nuclear diatomic molecules from VB and MO theory, the concept of directed valences and hybridization; quantum mechanics in band theory of metallic solids

Unit IV: Electronic structure of polyatomic systems: Computational quantum chemistry
Semi empirical and ab-initio methods; QM approximations, **Details of HMO and EHMO** and its application to chemical bonding in unsaturated molecules(ethylene, 1,3butadiene etc) ; **Details of SCF** procedure, Hartree and Hartree Fock methods (up to ground and excited states of hydrogen molecule); the basis sets, STOs and GTOs, nomenclature of basis sets, basis set errors, introductory ideas on DFT.

Unit V: Molecular properties: Computational quantum chemistry

Calculations of molecular properties like atomic charges, dipole moments, electronic distributions, vibration frequencies, NMR chemical shift etc using Gaussian program, specification of molecular geometry using Cartesian coordinates and internal coordinates, Z-matrix, Z-matrix of some simple molecules, structure of a Gaussian input file

TEXTBOOKS:

1. *Ira N. Levin, 'Quantum Chemistry', 6th Edition, Prentice-Hall, 2008*
2. *Peter Atkins, Ronald Friedman, 'Molecular Quantum Mechanics', 4th edition, Oxford university press*
3. *R K Prasad, 'Quantum Chemistry', New Age International (P) LTD publishers*

REFERENCES:

1. *Andrew R Leech,' Molecular Modeling – Principles and Applications', 2nd Edition, Pearson Education.*
2. *Donald A. McQuarrie, 'Quantum Chemistry', Viva Books 2016.*

18CHY505 GROUP THEORY AND ITS APPLICATIONS 3 0 0 3

Course Outcomes

CO1: Development of sound knowledge on fundamentals of group theory as applied in chemistry

CO2: Ability to apply group theory in various applied and allied areas of chemistry (such as spectroscopy and chemical bonding.

CO3: Development of capability to utilize the principles of group theory to provide innovative solutions for problems of chemical interest.

Unit I Introduction to molecular point groups

Definition of a mathematical group, Symmetry in molecules, elements of symmetry, , matrix representation of symmetry operations, molecular point groups, , abelian group, cyclic group, symmetry operations as group elements, similarity transformation and classes, group multiplication table, symmetry classification of molecules into pointgroups (Schoenflies symbol)

Unit II Construction and interpretation of character tables

Reducible and irreducible representations, Great Orthogonality Theorem and its consequences, character tables, reduction formula, construction of character tables for point groups with order ≤6, interpretation of character tables.

Unit III Applications of Group theory - I (vibrational and electronic spectroscopy)

Infrared and Raman activity of molecular vibrations in H_2O, N_2F_2, BF_3, AB_4type molecules (Td and D_4h) and AB_6 type (Oh) of molecules; selection rules; Electronic structure of free atoms and ions, splitting of terms in a chemical environment, construction of energy level diagrams, estimations of orbital energies, selection rules and polarizations, double groups, a brief idea on electronic spectra of transition metal complexes – selection rules, Orgel diagrams, Tanabe Sugano diagrams.

Unit IV: Applications of Group theory (Chemical bonding - Hybridization and molecular orbital formation)

Group theory to explain hybridization - wave functions as bases for irreducible representations, construction of hybrid orbitals for AB_3 (planar), AB_4 (Td), AB_5 (D_{3h}) and AB_6 (O_h) type of molecules, symmetry adapted linear combinations, projection operators, application of projection operators to pi-bonding in ethylene, cyclopropenyl systems and benzene, application of symmetry to predict polar and chiral compounds;

Unit V: Symmetry in solid state

Symmetry elements and operations in solid state – proper axis of rotation, mirror planes of symmetry, roto- reflection and roto-inversion axes of symmetry, screw axes of symmetry, glide planes; a brief introduction to the crystallographic point groups and space groups

TEXTBOOKS:

1. *F.Albert Cotton, 'Chemical Applications of Group Theory', 3rd Edition, John Wiley, 1990.*
2. *A Salahuddin Kunju, G Krishnan ; 'Group theory and its application in chemistry', second edition, PHI Learning private limited-2015*

REFERENCES:

1. *Robert L Carter, 'Molecular symmetry and Group theory', John Wiley & Sons, Inc.*
2. *V.Ramakrishnan and M.S.Gopinathan, 'Group Theory in Chemistry', 2nd reprint edition, Vishal Publications, 1996.*
3. *P.H.Walton, "Beginning Group Theory for Chemistry", Oxford University Press Inc., New York, 1998.*

18CHY502 Concepts in Inorganic Chemistry 3 1 0 4

Course Outcomes

CO1: Capacity to describe the structure of nucleus, stable and unstable atomic nuclei, nuclear reactions and different modes of radioactive decay, kinetics of nuclear reactions
CO2: Ability to understand the fundamentals of radiochemistry, isotopic chemistry, radiation chemistry and the applications of these in measuring technology, kinetics, radical chemistry, biotechnology and methods for measurements of radioactivity.
CO3: Capacity to distinguish the structure, bonding and reactivity of clusters, cages and simple organometallic compounds of alkali, alkaline earth elements, boron and carbon.
CO4: Impeccable understanding in structure and reactivity of inorganic chains, rings and cages of sulfur, nitrogen and phosphorus compounds
CO5: Capability to demonstrate the basic knowledge of chemistry of the f-block elements. Both chemical and physical properties of these elements and their compounds, with an emphasis on the relationship between properties and underlying electronic structure

Unit 1 Nuclear Chemistry

Nuclear structure, mass and charge, mass defect, binding energy, stability rules, magic numbers, nuclear quantum numbers, nuclear parity and statistics, models of nucleus, shell model, liquid drop model, , semi empirical mass equation, equations of radioactive decay and growth, half-life, average life determination of half-lives, nuclear reactions, energetics of nuclear reactions, types of nuclear reactions, spontaneous and induced fission, neutron capture cross sections- critical size principle and working of nuclear reactor. Numerical problems relevant to each session.

Unit 2 Radiation Chemistry

Radioactive elements, decay kinetics, parent-daughter decay relationships, radioactive equilibrium - transient and secular equilibrium, alpha and beta decay, gamma emission, Radiochemical methods - measurement of radioactivity, measurement of radiations - ionization chamber, proportional counter, the Geiger counter, scintillation counter, semiconductor detectors. Applications of nuclear and radiation

chemistry, isotope dilution analysis - activation analysis, radioactive tracers, radiometric titrations, radiation dosimetry, hydrated electron.

Unit 3 Inorganic materials I

Alkali and alkaline earth metals, their compounds, crown ethers and cryptands as complexing agents for alkali metal ions, Be and Mg compounds, boron cage compounds, boron hydrides, structure and bonding, 3-centre-2-electron bonds, styx numbers, the importance of icosahedral frame work of boron atoms in boron chemistry, closo, nido and arachno structure, carboranes, metallocene carboranes, B-N compounds, interstitial compounds, metal carbides, nitrides and hydrides, fullerenes, functionalized fullerenes, C-nanotubes .

Unit 4 Inorganic materials II

Inorganic chains and polymers, rings, cages, and clusters, sulphur-nitrogen compounds, polymeric sulphur nitride, isopoly anions, heteropoly anions, Keggin and Dawson polyoxometallates, borazines, metal clusters, nature of Si-Si bonds, silicates, silicates with zero-, one-, two- and three-dimensional structures, structure of elemental P, phosphonitrilic compounds, polymers with P-N bonds, interhalogen and pseudo halogens, intercalation chemistry, intercalation in layered materials like graphite, xenon fluorides & other xenon compounds.

Unit 5 Chemistry of f-block elements

The lanthanides and actinides, stable oxidation states, the lanthanide and actinide contractions, the f-orbitals, spectral and magnetic properties - comparison with inner transition and transition metals, separation of lanthanides, use of lanthanide compounds as shift reagents, photo-emission of lanthanide compounds, organometallic compounds of lanthanides and actinides and their structural features, reactions of lanthanide and actinide compounds, mineral sands of south west India - Ilmenite, Monazite, etc.

TEXTBOOKS:

1. H J Arnikar, Essentials of Nuclear Chemistry, 4th revised edition, New Age International (P) Limited publishers, 2015.
2. H J Arnikar, Nuclear Chemistry through Problems, New Age International Publishers.
3. J. Huheey, Inorganic Chemistry: Principles of Structure and Reactivity, 4th edition, 2006.
4. F.A. Cotton, Advanced Inorganic Chemistry, Wiley; 6th Edition edition (22 April 1999)
5. J.D. Lee Concise Inorganic Chemistry, Oxford University Press, 5th edition, 2008

REFERENCES:

1. Gregory R. Choppin, Jan-Olov Liljenzin and Jan Rydberg, Radiochemistry and Nuclear Chemistry (Third Edition), Elsevier, 2002
2. Walter D. Loveland, David J. Morrissey, Glenn T. Seaborg, Modern nuclear chemistry, A JOHN WILEY & SONS, INC., PUBLICATION, 2017.
3. **Shriver and Atkins' Inorganic Chemistry, Oxford; 5 edition, 2009**

18CHY503 Principles in Organic Chemistry 3 0 0 3

Course Outcomes

CO1: Be able to understand the concepts of aromaticity and field effects
CO2: Understand and reproduce accepted mechanisms of organic reactions including all intermediates, arrows, charges, and resonance structures.
CO3: Be able to draw all the stereoisomers of organic compound and recognize enantiomers, diastereomers, mesocompounds
CO4: Discuss the relative stability of conformational isomers of cyclohexanes and related compounds
CO5: Predict the major and minor products of a variety of organic reactions with appropriate stereochemistry and regiochemistry.

Unit 1 Aromaticity: Review of inductive and field effects – Resonance effects. Criteria for aromaticity – structural and electronic. Types – Huckel and Craig's rule, homo (Five, Six, seven and eight, membered rings), hetero (furan, thiophene and pyrrole) and nonbenzenoid aromatic systems. Aromaticity of fused rings, annulenes, catenanes, rotaxanes, mesoionic compounds, metallocenes, cyclic carbocations and carbanions.

Unit 2 Structure activity relationships – Orientation effects of substituent, Quantitative treatment of structure on reactivity - free energy relationships – Hammet equations, Taft equation.
Reactive Intermediates: Generation, structure and reactivity - reactions and rearrangement involving) of carbocations - non-classical carbocations, carbanions, carbon radicals, radical ions, carbenes, nitrenes, isonitrenes, arynes.

Unit 3 Mechanism and methods to determining them: Thermodynamic and kinetic requirement, Baldwin rules for ring closure – Kinetic and thermodynamic control – Hammond postulates, microscopic reversibility, Marcus theory, methods of determining reaction mechanisms - solvents and their effect on course of a reaction.
Acids and Bases: Bronsted and Lewis acids - HSAB concept and bases, pH and pKa, effect of structure on acidity and basicity, effect of medium.

Unit 4 Stereochemistry
Optical and geometrical isomerism, absolute and relative configuration, Cahn-Ingold-Prelog system, prochirality, prochiral centre, atoms, groups and faces, designations. Atropisomerism, optical isomerism in biphenyls, allenes, spirans and "ansa" compounds, compounds containing chiral nitrogen and sulfur atom, geometrical isomerism of cyclic compounds, cumulenes and oximes. Asymmetric synthesis, stereospecific and stereoselective synthesis, regioselective and regiospecific reactions.

Unit 5 Conformational Analysis
Conformational analysis of cyclic and acyclic systems with special emphasis on six membered rings, conformational effects on the reactivity of acyclic and cyclic systems - elimination, substitution and addition, strain, structure and stability of small, medium, and large rings, anomeric effect - cycloalkenes and cycloalkynes - kinetically and thermodynamically favoured products stereochemistry of SN1, SN2, SNi, E1 and E2
Selectivity in organic reactions: Chemoselectivity, regioselectivity, enantio- and stereo-selectivity. Stereoaspects of the addition of X_2, HX, boranes and hydroxylation to C=C systems. *Cis*- and *trans*-hydroxylation of cycloalkenes.

TEXT BOOKS

1. Michael B Smith, "March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure", 7th edition, Wiley (2015).

2. Francis A.Carey and Richard J. Sundberg, "Advanced Organic Chemistry - Part A: Structure and Mechanisms", 5th Edition, Springer, 2008
3. P. S. Kalsi, "Stereochemistry, Conformation and Mechanism", New Age Publications, 2008.

REFERENCES

1. E. L. Eliel and S. H. Wilen, "Stereochemistry in Organic Compounds", John Wiley, 2008.
2. D. Nasipuri, "Stereochemistry of Organic Compounds - Principles and Applications", 4th Revised Edition, New Academic Science, 2012.
3. Peter Sykes, "A Guidebook to Mechanism in Organic Chemistry", Pearson Education; 6 edition, 2003.

18CHY504 Coordination Chemistry 3 0 0 3

Course Outcomes

CO1: Understanding the nature of bonding in co-ordination complexes

CO2: Acquiring wide knowledge of reaction mechanism, stereochemistry, thermodynamic and kinetic stability of the octahedral and square planar complexes

CO3: Indispensable knowledge about the coordination behavior, shape, geometry, oxidation state, stereochemistry and reaction mechanism of f-block elements.

CO4: Developing the skill in analyzing the electronic spectra of transition metal complexes.

CO5: Acquiring the knowledge of magnetic properties of metal complexes and the recent advancement in the coordination complex based magnets.

Unit 1 Theories and Concepts on *d*-block Coordination Compounds

Introduction - ligands, nomenclature of coordination compounds, coordination compounds of *d*-block ions with coordination numbers of 2, 3, 4, 5, 6, 7 and 8. Werner's coordination theory, Valence bond theory (VBT), Crystal field theory (CFT), CFSE, effects of CFSE on hydration energies and spinel groups (normal and inverse), types of ligands – spectrochemical series, spectral and magnetic properties (spin-only magnetic moments), nephelauxetic effect. Crystal field splitting patterns in complexes having Oh, Td, square planar, square pyramidal and trigonal pyramid geometries, factors affecting the magnitude of CFSE, various types of isomerism in coordination complexes, Jahn-Teller (JT) distortion, manifestation of JT on spectral properties. Molecular orbital theory (MOT), ligand field theory (LFT), molecular orbital energy level diagram for octahedral complexes without pi-bonding, metal-ligand pi-bonding, metal-metal multiple bonds, *d*-orbital based metal-metal σ, π and δ bonds in compounds like $[Re_2Cl_8]^{2-}$, $[Os_2Cl_8]^{2-}$, $Cr_2(CH_3COO)_4$ and R-Cr(I)-Cr(I)-R. Application of group theory to coordination compounds.

Unit 2 Reaction Mechanism

Complex equilibrium - formation constants, chelate and macrocyclic effects, factors affecting stability of complexes, methods of determination of stability constants, stability of complex ions in solutions, inert and labile complexes, mechanisms of ligand displacement and addition reactions in octahedral

complexes and square planar complexes of platinum *cis*- and *trans*-effect, substitution reactions, mechanisms of substitution, kinetic consequences of reaction pathways, dissociation, interchange, association, dissociation, linear free energy relationships, conjugate base mechanism, stereochemistry of reactions (substitution in *trans*-complexes and substitution in *cis*-complexes), isomerisation of chelate rings, sigma-bonding and pi-bonding effects, oxidation-reduction reactions, inner and outer sphere electron transfer reactions, conditions for high and low oxidations numbers, reactions of coordinated ligands, hydrolysis of esters, amides and peptides, template reactions, electrophilic substitution, photochemical reactions of coordination compounds.

Unit 3 Coordination Chemistry of Inner-transition (*f*-block) Elements

f-block metal ions – oxidation states preferences, ligand preferences, coordination numbers and the geometry of the complexes, influence of lanthanide contraction and actinide contraction in their coordination behaviour, shapes of *f*-orbitals (4*f* and 5*f*), nature of bonding of *f*-orbitals with ligands, various types of coordination compounds of lanthanides and actinides, stereochemistry and reaction mechanism of *f*-block metal complexes.

Unit 4 Spectral Properties

Stabilization of unusual oxidation states, electronic spectra of transition metal complexes – color wheel, Russell-Saunders coupling schemes, term symbols for various d^n ions, Orgel diagrams for d^n systems, ligand field parameters, *Dq*, Racah parameter *B* and nephelauxetic constant *b*, Tanabe-Sugano (TS) diagrams, evaluation of *Dq* and other parameters from electronic spectra of transition metal complexes using TS diagrams, charge-transfer transitions, MLCT and LMCT, selection rules and band intensities, Laporte- and spin- selection rules, symmetry, spin-orbit and vibronic coupling effects. Photochemistry of transition metal complexes like $[Ru(bipy)_3]^{2+}$, spectral behaviour of *f*-block coordination complexes, special features of their absorption and emission properties.

Unit 5 Magnetic Properties

Magnetic properties of coordination complexes - magnetic susceptibility, contribution of spin-orbit coupling on μ_{eff}, types of magnetic behavior - para-, ferro, anti-ferro and ferri-magnetic systems, Curie law, Curie-Wise law, Guoy, Faraday and superconducting quantum interference device (SQUID) methods, Kotani plots, giant magnetoresistance (GMR), anisotropic magnetoresistance (AMR) effect, effects of temperature on magnetic behavior, tunnelingmagnetoresistance (TMR). Magnetism of coordination complexes by multinuclear homo- and heterometallic 3*d* systems (also with exclusive 4*d* and 5*d* metal ions), mixed 3*d*-4*f* systems, importance of 4*f*-metal ions for functional applications. Nanoscale magnetic systems based on coordination complexes - Single Molecule Magnets (SMMs), Single Ion Magnets (SIMs), Single Chain Magnets (SCMs), Spin-crossover complexes, magnetic refringents (magnetic coolers), magnetic storage systems - magnetic random access memory (MRAM).

TEXTBOOKS:

1. F. A. Cotton and G. Wilkinson, 'Advanced Inorganic Chemistry', John Wiley & Sons, 2009.
2. James E. Huheey, Ellen A. Keiter and Richard L.Keiter, 'Inorganic Chemistry, Principles of Structure and Reactivity', Pearson education, 5th edition, 2009.
3. J. D. Lee, 'Concise Inorganic Chemistry', 5th edition, John Wiley & Sons, 2009.
4. P Atkins, T. Overton, J. Rourke, M.Weller, F. Armstrong, "Shriver & Atkins Inorganic chemistry", 4th Edition, Oxford University Press, 2008.

REFERENCES:

1. B. Douglas, D. McDaniel and J. Alexander "Concepts and Models in Inorganic Chemistry", 3rd Edition, Wiley, 2006.
2. SushantaDattagupta, 'A Paradigm Called Magnetism', World Scientific Publishing Co. Pte. Ltd., 2008.
3. Helen C. Aspinall, 'Chemistry of the *f*-Block Elements', Volume 5 of Advanced chemistry texts, CRC Press, 2001.
4. N. N. Greenwood and A. Earnshaw, 'Chemistry of Elements', Butterworth and Heinemann, 2nd Edition, 2002
5. J. E. House, "Inorganic Chemistry", Academic Press, 2008.
6. T. Shinjo (Editor), 'Nanomagnetism and Spintronics', Elsevier, USA, 2nd Ed., 2014.
7. R. A. Layfield and M. Murugesu (Editors), 'Lanthanides and Actinides in Molecular Magnetism', Wiley-VCH Verlag& Co., 2015.

18CHY581 INORGANIC SEMI-MICRO QUALITATIVE ANALYSIS LAB **0 0 6 2**

Course Outcomes

CO1: Development of skill to perform classical qualitative analysis of cations in a mixture of inorganic salts/compounds.

CO2: Development of adequate knowledge of the chemistry involved in the cation analysis.

CO3: Attainment of knowledge and skill in activities related with effective and safe functioning of a chemistry lab.

Semi micro analysis of mixtures

The mixture will include 4 cations including two common (eg. Cations of metals like Cu, Mn, Zn, Ni, Ca, Ba, Mg etc) and two less common cations (eg. Cations of metals like Ti, Zr, V, W, Li, Ce, Th etc).

(The student has to successfully analyze a minimum of 10 mixtures).

TEXTBOOKS:

1. *A.I.Vogel, 'A text book of Qualitative Analyses', 4th edition, Longmans publications, 1985.*
2. *V.V. Ramanujam, 'Inorganic Semi-Micro Qualitative Analysis', 3rd edition, The National Publishing Company, 1974.*

REFERENCES:

1. *G.H.Jeffery, J.Bassett, J.Mendham and R. C. Denney, 'Vogel's Text Book of Qualitative Chemical Analysis', 5th edition, John Wiley & Sons Inc, 1989.*
2. *G.W. Parshall, 'Inorganic Synthesis', Vol. 15, Tata McGraw-Hill Education, 1974.*

18CHY582 Organic Quantitative Analysis Lab **0 0 6 2**

Course Outcomes

CO1: Understanding in calculation of limiting reagent, yield, and percent yield. Also, ability to summarize findings in a clear and concise manner.

CO2: Actively engage in safe laboratory practices handling laboratory glassware, equipment, and chemical reagents including how to perform common laboratory techniques, including reflux, distillation, steam distillation, recrystallization, vacuum filtration, aqueous extraction, thin layer chromatography, column chromatography.

CO3: Wide knowledge in prediction of outcome and mechanism of some simple organic reactions, using a basic understanding of the relative reactivity of functional groups.

CO4: Basic knowledge in basic characterization of organic molecules by physical and spectroscopic means, including melting point, boiling point, Infrared red spectroscopy and NMR.

CO5: Capability to estimate the amount of organic compounds

A. Estimations: 1. Estimation of equivalent weight of an acid 2. Estimation of glucose 3. Estimation of phenol 4. Estimation of acetone 5. Estimation of acid value of an oil 6. Estimation of iodine value and sap value of an oil 7. Estimation of Nitrogen – Kjeldahl method 8. Estimation of formaldehyde 9. Estimation of aniline 10. Estimation of ester
B. Preparations of Organic Compounds Double stage preparations (a) m-nitro benzoic acid from ethyl benzoate (b) p-bromobenzanilide from aniline (c) p-nitro acetanilide from aniline Single stage preparations (a) Benzimidazole (b) Benzophenone oxime (c) Dibenzilidene acetone (chalcone) (d) Benzalacetophenone (e) Benzanilide (f) Acetanilide (g) Acetyl salicylic acid (aspirin)

Name Reactions (a) Benzil-Benzilic acid rearrangement (b) Cannizaro reaction (c) Claisen condensation
For all preparations 1. TLC to be done and Rf values of each compound to be reported 2. Melting point of pure compounds to be found 3. A small portion should be recrystallised from suitable solvent 4. Purified products to be displayed 5. Mechanisms for each preparation should be suggested

REFERENCES:
1. P.W.G. Smith, A.J.Hannaford, B.S.Furnis and A.R. Tatchell, "Vogel's Textbook of Practical Organic Chemistry", ELBS/Logman, 1989.
2. Ralph L. Shriner, Christine K. F. Hermann, Terence C. Morrill, David Y. Curtin, Reynold C. Fuson, 'Systematic Identification of Organic Compounds', John Wiley & Sons, 2003.
3. Mann and Saunders, 'Practical Organic Chemistry', Pearson edition, 2009

18CHY511 CHEMICAL THERMODYNAMICS AND EQUILIBRIA 3 1 0 4

Course Outcome

CO1: Thorough understanding of the fundamental concepts in classical, statistical and irreversible thermodynamics as needed for a chemist.

CO2: Development of capability to apply the knowledge in thermodynamics to solve problems of chemical interest.

CO3: Utilize the acquired knowledge in thermodynamics to formulate innovative solutions for problems connected with applications in the field of chemistry and allied branches.

Unit 1 Chemical Thermodynamics

First and second laws of thermodynamics, thermodynamic functions, heat capacity, thermo chemistry, need for second law of thermodynamics, entropy and free energy functions, calculation of changes in thermodynamic function for ideal and non-ideal gases in isothermal and adiabatic process, relation between thermo dynamic functions - Maxwell relations, Joule Thomson effect, coefficient of thermal expansion and compressibility factor, applications of free energy function to physical and chemical changes, equilibrium in chemical reactions, third law of thermodynamics - need for third law, calculation of absolute entropy, unattainability of absolute zero, thermodynamic systems of variable composition - fugacity functions, partial molar quantities, thermodynamics of ideal solutions, real solutions and regular solutions, dilute solutions of nonelectrolytes, Henry's law, Raoult's law, Gibbs-Duhem equations, Gibbs-Duhem-Margules equations, and activity and standard states of non electrolytes.

Unit 2 Irreversible Thermodynamics

Examples for irreversible process, entropy production, non-equilibrium, steady state and near equilibrium conditions, linear relation, phenomenological coefficients, Onsagar reciprocal relations, one component systems with heat and matter transport, application of irreversible thermodynamics to thermal diffusion, thermal osmosis etc., electro kinetic effects, the Glansdorf-Pregogine equation.

Unit 3 Statistical Thermodynamics

Statistical concept, probability and thermodynamic states, entropy and probability, canonical ensemble, Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein Statistics, electron gas concept, Bose-Einstein condensation, relation among MB, FD & BE Statistics, partition function, partition function for free linear motion, free motion in a shared space, linear harmonic vibration, translational, rotational and vibrational partition function, molecular partition functions, partition functions and thermodynamic properties, calculation of equilibrium constant, heat capacity of gases, mono atomic solids, Einstein's and Deby's theory.

Unit 4 Equilibrium

Gibb's free energy, direction of spontaneous change of a reaction, chemical potential, chemical potential and equilibrium, ΔG in terms of K, equilibrium constants – real gases and real reactions, equilibrium respond to catalyst, temperature, pressure and $_{P}H$, application of ΔG and K – extraction of metals from their oxides, Ellingham diagram, and thermodynamics of ATP & respiration, biological energy conversion.

Unit 5 Phase Equilibrium

Gibb's Phase rule, one component system, two component systems, vapour pressure diagrams and their interpretation, lever rule, temperature-composition diagrams, liquid-liquid phase diagrams, distillation of partially miscible liquids, azeotropes, liquid-solid phase diagrams, phase diagram for the system Na/K/Na_2K, phase diagram - steel, alloys, Fe-C system, zone refining, three component system, triangular coordinates, three component system – partially miscible liquids - $H_2O/CHCl_3/CH_3COOH$, phase diagram - $NH_4Cl/(NH_4)_2SO_4/H_2O$

TEXTBOOKS:

1. Robert J. Silbey, Robert A. Alberty, Moungi G. Bawendi, Physical Chemistry 4th Edition, Wiley, 2004

2. Samuel H. Maron, Carl F. Prutton Principles of Physical Chemistry, The Macmillan Company; 4th edition (1970)
3. *Samuel Glasstone, 'Thermodynamics for Chemists', Lightning Source Incorporated, 2007.*

REFERENCES:

1. Francis Weston Sears and Gerhard L.Salinger, 'Thermodynamics, kinetic theory and statistical thermodynamics' 3rd edition, Addison-Wesley Publications, 1975.
2. Prigogine, 'Introduction to Thermodynamic Irreversible Processes', Interscience Publishers, 3rd edition, 1968.
3. R.P.Rastogi and R.R.Misra, 'An Introduction to Chemical Thermodynamics', 6th Revised edition, Vikas Publishing House Pvt. Ltd., 2006.
4. F.W.Sears, 'Introductions to Thermodynamics, Kinetic Theory of Gases and Statistical Mechanics', Addison Wesley Pub., Cambridge, 1972.

18CHY512 MOLECULAR SPECTROSCOPY 3 1 0 4

Course Outcomes

CO1: Thorough understanding of the fundamental theoretical concepts of spectroscopy, based on quantum chemistry, group theory and statistical thermodynamics.

CO2: Thorough understanding of the fundamentals of instrumentation of spectroscopic techniques.

CO3: Development of capability to apply the knowledge spectroscopy to provide analytical solutions for problems of chemical interest.

Unit 1 Rotational and Vibrational Spectroscopy

Introduction to spectroscopy, rotation spectra - diatomic and polyatomic molecules, selection rules, intensities of spectral lines, stark effect, instrumentation of micro wave spectroscopy, applications and structural determinations, vibration spectra of diatomic molecules, harmonic and anharmonic vibrations, diatomic vibrating rotor, selection rule, breakdown of Born Oppenheimer approximation, rotational character of vibration spectra, different modes of vibrations, vibration-rotation spectra, Fermi resonance, vibration spectra of polyatomic molecules, IR spectra of organic and inorganic compounds, phase, temperature and solvent dependence, FTIR technique, instrumentation, Raman spectra (including the use of laser) - theory, relation with IR spectroscopy, mutual exclusion principle, resonance Raman, stimulated hyper and inverse Raman effects, instrumentation and applications of Raman spectroscopy.

Unit 2 UV-Visible and Fluorescence Spectroscopy

Electronic spectra of atoms - single and multi electron systems, j-j and L-S coupling, electronic spectra of diatomic and polyatomic molecules, its relation to electronic arrangement and symmetry of molecules, application of group theory in electronic spectra, selection rules, nature of electronic excitation, principles of absorption spectroscopy, Beer-Lambert law, presentation of spectra, chromophores, forbidden transition, different types of electronic transitions, p-p*, n-p* etc transitions, nature of transitions in carbonyl compounds, the effect of conjugation, effect of conjugation on alkenes, HOMOs and LUMOs,

Woodward-Fieser rules for dienes, spectra of carbonyl compounds, enones, Woodward rule for enones, spectra of aromatic compounds, effect of substituents, structural information from electronic spectra, excited states of molecules, fluorescence and phosphorescence, Jablonski diagram in detail, lifetime of excited states, quantum yields, photosensitization, application of UV-Visible and Fluorescence Spectroscopy for structural elucidation of organic compounds, diffuse reflectance spectra.

Unit 3 NMR Spectroscopy

Nuclear magnetic resonance phenomenon - theory, relaxation effects, NMR uses active nuclei, Fourier Transformation in NMR, measurement of relaxation time, chemical shift, magnetic anisotropic effect, multiplets in NMR, spin-spin splitting, n + 1 rule, Pascal's triangle, tree-diagram, spin-spin splitting constant, J, ^{2}J and ^{3}J and long-range coupling, measurement of J, Karplus relationship, first and second order spectra, AX, AB, AX_2, AX_3, A_2X_3, AMX type spectra, double resonance and spin tickling, chemical shift reagents, spectra in higher fields, spectra of conformational isomers, homotopic, enantiotopic and diastereotopic systems, C^{13} spectra, factors related to ^{13}C spectra, ^{1}H coupled ^{13}C spectra, ^{1}H decoupled ^{13}C spectra, chemical shift values, nuclear Overhauser effect (NOE), cross-polarization, off-resonance resonance decoupling, application of ^{1}H and ^{13}C NMR spectroscopy for the structural elucidation of organic compounds, ^{11}B, ^{15}N, ^{19}F and ^{31}P NMR spectra, spectra of paramagnetic complexes, magnetic susceptibility, contact shift, fluxional molecules and their studies using NMR, solid state NMR.

Unit 4 ESR, NQR and Mossbauer Spectroscopy

ESR spectroscopy - theory, hyperfine and superfine splitting, ESR active simple organic systems, ESR of inorganic systems like Cu^{2+} and VO^{2+} complexes, 'g' markers like DPPH and TCNE, evaluation of spin Hamiltonian like A, g_{ll}, g-, covalency factor in Cu^{2+} complexes, analysis of ESR spectra of VO^{2+} complexes, NQR spectroscopy - theory, relationship between electric field gradient and molecular structure, quadrupole coupling constant and structural information of compounds, Mossbauer spectroscopy, principle, Doppler effect, isomer shift, Zeeman splitting, quadrupole splitting, application of Mossbauer spectroscopy for studying Fe and Sn compounds and phase transformation, application of ESR spectroscopy.

Unit 5 Mass Spectrometry and PES

Mass spectroscopy, base peak and molecular ion peak, isotope ratio data, fragmentation patterns of alkanes, alkenes, alkynes, aromatic hydrocarbons, alcohols, phenols, aldehydes, ketones, esters, carboxylic acids, amines, methods of desorption and ionization (EI, CI, LD, MALDI, PD, FAB, SIMS), MS/MS and determination of molecular formula, metastable ions and their significance, study of fragmentation pattern, application of MS in structural elucidation and other frontiers of science, application of MS for quantitative analysis, photoelectron spectroscopy (PES), principle, application of PES. Structure determination using IR, UV-visible, NMR, MS and ESR spectral techniques.

TEXTBOOKS:

1. *Colin N. Banwell and Elaine M. McCash, 'Fundamentals of Molecular Spectroscopy', 4th Edition, Tata McGraw Hill, 2007.*
2. *W. Kemp, Organic Spectroscopy, 3rd Edition, McMillan International Higher Education*
3. *D. L. Pavia, G. M. Lampman, G. A. Kriz, and J. R. Vyvyan, Introduction to Spectroscopy, 5th Edition, Brooks-Cole, 2009*

4. *G. M. Barrow, 'Introduction to Molecular Spectroscopy', McGraw Hill, 1962.*
5. *R. M. Silverstein, F. X. Webster, D.J. Kiemle, Spectroscopic identification of organic molecules, 7th Edition, John Wiley*
6. P. S. Kalsi, Spectroscopy of Organic Compounds: New Age International Pvt Ltd 6th edition edition,, 2006

REFERENCE:

1. *Hollas, J.M., Modern Spectroscopy, John Wiley & Sons, Fourth Edition, 2004*
2. *J. Keeler, Understanding NMR spectroscopy, Wiley, 2009*
3. *D. A. Skoog, F. J. Holler and S. R. Crouch, 'Principles of Instrumental Analysis', 6th Edition, Thomson Brooks/Cole, 2007.*
4. *W. Kemp, NMR in Chemistry, McMillan, 1988*
5. *J. E. Wertz and J. R. Bolton Electron Spin Resonance, Springer Science*

18CHY513 Organic Reaction Mechanism 3 1 0 4

Course Outcomes

CO1: Capacity to understand nuclephile and electrophile groups and their properties
CO2: Ability to describe and demonstrate the importance of molecular rearrangements in organic compound synthesis and understand the basics of photochemistry and pericyclic reactions
CO3: Ability to describe the interaction of excited states with their surroundings and analyse photo-induced electron transfer/excitation energy transfer reactions.

Unit 1 Nucleophilic Substitution:
SN1, SN2, and Borderline (ion pair), SNi, SET mechanisms, Neighboring group participation, substitution at allylic carbons, substitution at aliphatic trigonal carbon, substitution at vinylic carbon. Effect of substrate structure, nucleophile, leaving group and medium on reactivity. Ambident nucleophiles and substrates. Aromatic nucleophilic substitution: SNAr, SN1, benzyne and SRN1 mechanisms. Effect of substrate structure, leaving group and attacking nucleophile on reactivity.

Unit 2 Electrophilic substitution:
SE2 and SEi, SE1, substitution accompanied by double bond shift. Effect of substrate, leaving group, and solvent on reactivity. Aromatic electrophilic substitution: Arenium mechanism, Structure – reactivity relationship, substituent effect, o/p ratio, ipso substitution, orientation and reactivity, quantitative treatment.
Free radical reactions: Radical addition. Effect of substrate (aliphatic, aromatic, bridgehead), nature of the radical and solvent on reactivity.

Unit 3 Addition reactions:
Mechanism of Electrophilic, nucleophilic and radical addition. Addition to conjugated systems. Orientation and reactivity. Addition of hydrogen halides, Oxymercuration, halogenation, sulfenylation,

selenylation, addition involving epoxides, addition via organoborane. Addition of water, alcohol, sulfides, to aldehydes, ketones, imines, isothiocyanates, nitrocompounds, nitriles. Mannich reaction,
Elimination reactions: Mechanism of elimination reactions E2, E1, E1CB, steric effect. Effect of substrate structure, base, leaving group and medium on reactivity. Mechanism of pyrolytic elimination.

Unit 4 Rearrangement reaction:
Mechanism of Nucleophilic, electrophilic and radical rearrangements. Nature of migration, migratory aptitudes, memory effects. Wagner-Meerwein, Pinacol, Demyanov, dienone-phenol, Benzil-Benzilic acid, Favorskii, Wolff, Neber, Hofmann, Curtius, Lossen, Schmidt, Beckmann, Baeyer-Villiger, Stevens, benzidine, Hofmann-Loffler and Chapman rearrangements and their mechanisms.

Unit 5 Photochemistry and pericyclic reactions:
General principles – Fate of excited state – Jablonsky diagram - chemical process – Photochemistry of alkenes, dienes and polyenes, Carbonyl compounds, Norrish type 1 and Type 2, Patterno –Buchi reaction.
Pericyclic reactions: Cyclo addition - Diels-Alder reaction, Substituent effect on reactivity, regioselectivity and stereochemistry, Catalysis of Lewis acids, Synthetic applications, Enantio selective Diels alder reactions, Intramolecular Diels-Alder reactions. 1,3 Dipolar Cycloaddition – reactivity, regio and stereoselectivity, Applications. [2+2] cycloaddition – ketenes and alkenes – photochemical Electrocyclic reactions, Orbital symmetry, charged species. Sigmatropic rearrangements – [1,3], [1,5], and [1,7] sigmatropic shifts – [3,3] sigmatropic rearrangements – Cope, Oxy-Cope and Claisen rearrangement. [2,3] rearrangements – oxides and ylides –Wittig and aza – Wittig rearrangements, Cheletropic reactions.

TEXT BOOKS

1. Michael B Smith, "March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure", 7th edition, Wiley (2015).
2. Francis A.Carey and Richard J. Sundberg, "Advanced Organic Chemistry - Part A: Structure and Mechanisms", 5th Edition, Springer, 2008
3. Francis A.Carey and Richard J. Sundberg, "Advanced Organic Chemistry - Part B: Reactions and Synthesis", 5th Edition, Springer, 2008.
4. Singh S P and SM Mukherji, "Reaction Mechanism in Organic Chemistry", 2014

REFERENCES

1. Reinhard Bruckner, Advanced Organic Chemistry, Reaction Mechanisms, Elsevier, 2002
2. R.O.C. Norman and J.M. Coxon, "Principles of organic synthesis", CRC press, 2014
3. Ian Fleming, Frontier Orbitals and Organic Chemical Reactions 1st Edition, Wiley, 1991

18CHY514 Heterocyclic and Natural Product chemistry 3 0 0 3

Course Outcome

CO1: able to explain on mechanistic level reactions and synthesis of important nitrogen/oxygen/Sulphur containing heterocycles; pyrroles, pyridines, diazoles, diazines, benzo-condensed analogs, furan and thiophenes
CO2: Understand the fundamentals of carbohydrate chemistry
CO3: Provide an overview of field of biochemistry and natural product chemistry, their occurrence, structure, total synthesis, biosynthesis and properties.

Unit 1 Heterocyclic compounds
Nomenclature and general characteristics of heterocyclic compounds, study of three and four-membered ring heterocyles containing one heteroatom, structure and synthesis of penicillin and cephalosporin-C, structure and synthesis of reserpine, heteroaromatic compounds (five and six-membered rings) containing one and two heteroatoms, fused ring compounds - indole, quinoline, isoquinoline, coumarin, flavones, purine and pyrimidine, bases present in nucleosides.

Unit 2 Carbohydrates and nucleic acids
Nomenclature – aldoses, ketoses, furanoses, pyranoses. Classification – monosaccharides, disaccharides and polysaccharides. Structure (Fischer, Haworth and chair projection) of ribose, glucose, fructose, maltose, sucrose, lactose, starch, cellulose and cyclodextrins. Preparation of alditols, glycosides, deoxysugars. Biosynthesis of vitamin C from glucose. Structure and synthesis of nucleic acids, genetic code, recombinant DNA. biosynthesis of shikimic acid

Unit 3 Chemistry of Natural Products
Alkaloids - classification, structure elucidation based on degradative reactions (quinine atropine), Terpenoids - classification, structure elucidation and synthesis of abietic acid, terpenoids. Total synthesis of quinine and papavarine (morphine, heroin)

Unit 4 Steroids
Steroids - classification, structure of cholesterol, conversion of cholesterol to progesterone, androsterone and testosterone, classification, structure and synthesis of prostaglandins, biosynthesis of fatty acids, prostaglandins, and steroids.

Unit 5 Amino acids, Peptides and Enzymes
Synthesis of amino acids - Strecker and azlactone synthesis, reactions of amino acids, structure of proteins, introduction to enzymes and coenzymes with special reference to the function of chymotrypsin, NAD, thiamine, pyridoxal, solid phase synthesis – choice of resin, classification and reactions leading to peptide formation.

TEXT BOOKS:

1. I.L. Finar Organic Chemistry vol 2 (3rd.ed.) Longmans Green & Co. 1964
2. Sujata V. Bhat, Bhimsen A. Nagasampagi, Meenakshi Sivakumar, Chemistry of Natural Products, Springer 2005

REFERENCES:

1. K. C. Nicolaou, Eric J. Sorensen, Classics in Total synthesis, Wiley, 1996.
2. Ashutosh kar, Chemistry of Natural Products, (Volume I and II), CBS

18CHY515 Organometallic Chemistry 3 0 0 3

Course Outcomes

CO1: Ability to describe the chemistry of metal carbonyls, their synthesis and nature of bonding.
CO2: Capability to understand the fundamentals of types of organometallic compounds, their structure, bonding.
CO3: Ability to demonstrate the stereochemistry of organometallic compounds using multinuclear magnetic resonance spectroscopy and important chemical transformation using organometallic reagents.

Unit 1: Concepts and Metal Carbonyls
History and overview on organometallic compounds. Classification and nomenclature – hapticityof fragments, 18-electron and 16-electron organometallic compounds. Structure prediction based on '18 electron rule'. Metal carbonyls – synthesisand bonding of metal carbonyls (based on MO theory), donor and acceptor properties of CO, different types of binding modes of CO, poly-nuclear carbonyls with and without bridging groups, metal-metal bonding in M-CO clusters, cluster valence electron (CVE) count, CVE based structure prediction. IR spectral features of metal carbonyls, activation of CO by bonding with metal ions.

Unit 2: Types of organometallic compounds
Metal phosphines compounds of transition metals, M-N_2 (metal dioxygen), M-O_2 (metal dioxygen), M-NO (metal nitrosyl) and M-CN (metal cyanide/isocyanide) complexes, bonding and structural features. Organometallic compounds with π-donor ligands like olefins, acetylenes and allyl moieties. Metal derivatives of cyclic π-donors (metallocenes, sandwich/half-sandwich compounds, bent metallocenes), metal-carbon σ-donors (metal carbenes – Fischer carbenes, Schrock carbenes and *N*-heterocyclic carbenes, metal polyenes, metal carbines, metal alkyl/aryl derivatives). Organometallic chemistry of lithium and magnesium, aluminum alkyls and all other main-group organometallics. Structural features and nature of bonding in above compounds.

Unit 3: Structure and Bonding
Fragment molecular orbitals (FMO) of various organic and inorganic moietieslike CH_3, CH_2, CH, BH_2, BH, NH_2, NH. FMO's (π-orbitals) of C_3H_5, C_4H_4, C_4H_6, C_5H_5, C_6H_6, C_8H_8. Inorganic fragments MLn with varying number of L's. Symmetry and shape of their FMO's. Isolobal concept, iso-electronic and isolobal relationships between various organic and inorganic (ML_n) fragments. Structure and bonding between various organic and inorganic fragments based on MO level diagrams – metal-olefins, ML_n-cyclobutadiene, ML_n-carbene, ML_n-carbyne, ML_n-cyclopentadienyl systems, compounds with metal-metal multiple bonds (metal-metal σ, π and δ bonds).

Unit 4: Stereochemistry and reactions
Stereochemically non-rigid molecules, fluxional nature of organometallic compounds (including Li-C, Mg-C), characterization of non-rigidity of organometallic compounds by NMR spectroscopy. Difference in NMR spectra of fluxional organometallic compounds at high and low temperatures. Characterization techniques of organometallic compounds (by NMR – ^{1}H, ^{13}C and ^{31}P NMR spectroscopy, Dynamic NMR, Mass spectrometry). Reactions involving various organometallic compounds - oxidative addition reactions, reductive elimination reactions, migratory insertion reactions, 1,1-type and 1,2-type insertion reactions, elimination reactions, β-hydride elimination reactions. Conditions for organometallic compounds to exhibit above reactions, cyclo-metalation and ortho-metalation reactions, agostic interactions.

Unit 5: Organometallic Catalysis

Alkene hydrogenation using Wilkinson's catalyst, water-gas shift reaction, Mosanto process, Cativa Process. Reaction steps in the above catalytic processes. Hydro-formylation reactions, catalytic addition of molecular oxygen to alkenes (Wacker process), Ziegler-Natta polymerization of alkenes, Fischer-Tropsch process, olefin-metathesis (types of Grubbs catalysts and Hoveyda–Grubbs catalysts), oligomerization of alkynes, aluminum alkyls in polymerization of olefins. Palladium based reactions such as Heck, Stille, Suzuki, Sonogashira, Buchwald-Hartwig couplings; Tsuji-Trost C-C bond formations. Homogeneous vs. heterogeneous organometallic catalysis (principles, mechanism and their applications). Organometallics - in industry, in medicine, in agriculture and in environmental science.

TEXTBOOKS:

1. J.E. Huheey, R.A. Keiter, R.L. Keiter, 'Inorganic Chemistry-Principles of Structure and Reactivity', 4th Edn., Prentice Hall, 1997.
2. P. Atkins, T. Overton, J. Rourke, M. Weller, F. Armstrong,' Shriver and Atkins Inorganic Chemistry', 4th Edn., Oxford University Press, 2006.
3. F.A. Cotton, G. Wilkinson, C.A. Murillo, M. Bochmann, 'Advanced Inorganic Chemistry', 6th Edn.,Wiley-Interscience, 1999.
4. Anil Elias, Gupta B.D., "Basic Organometallic Chemistry", Universities Press; 2nd Edition 2013
5. J.D. Atwood, 'Inorganic and Organometallic Reaction Mechanism', 2nd Edn., Wiley-

REFERENCES:

1. R. H. Crabtree, 'Organometallic Chemistry of the Transition Metals', John Wiley & Sons, 6th Ed.
2. VCH, 1997.
3. J. Tsuji, 'Transition metal reagents and catalyst innovations in organic synthesis', John-Wiley- & Sons, Ltd, New York, 2000
4. B.E. Douglas, D.H. McDaniel, J. J. Alexander, Concepts and Models of Inorganic Chemistry, 3rd Edn., Wiley-India, 2007.
5. M. Bochmann, Orgaonometallics: Complexes with Transition Metal-Carbon Sigma Bonds, Oxford University Press, 1994.
6. J. P. Collman, R G Finke and and J R Norton "Principles and Applications of Organo-transition metal Chemistry" University Science Books, 1987.
7. W.K. Li, G.D. Zhou, T. Mak, Advanced Structural Inorganic Chemistry, Oxford University Press, 2008.
8. K. C. Nicolaou, 'Classics in Total Synthesis', Vols I-III, Wiley-VCH, 1996; 2003; 2011

18CHY583 ADVANCED PHYSICAL CHEMISTRY LAB 0 0 5 2

Course Outcomes

CO1: Development of skill to evaluate the kinetics of different chemical reactions and to determine the activation energy for reactions.
CO2: Ability to analyse the thermodynamic parameters in phase equilibrium
CO3: Learn the optical properties of materials and apply this for analytical applications
CO4**:** Acquire knowledge to create experiments to evaluate physical chemistry concepts.

Experiments:

1. Construction of phase diagram for three component system.
2. Determination of equivalent conductance at infinite dilution of weak electrolytes.
3. Determination of order of reaction for ion exchange reaction.

4. Extraction efficiency of solute from a solution by immiscible solvent method.
5. Determination of calorific value using Bomb calorimeter.
6. Kinematic viscosity of lubricants using Bomb calorimeter.
7. Determination of the formation constant of silver-ammonia complex and stoichiometry of the complex potentiometerically.
8. Determination of flash point, fire point of a lubricant.
9. Determination of cloud point and pour point of a lubricant.

TEXTBOOKS:

1. *Alexander Findly, 'Practical physical chemistry', 9th edition, Wiley, 1972.*
2. *R.C.Das and B.Behera, 'Experimental Physical Chemistry', Tata McGraw-Hill, 1983.*

REFERENCE BOOKS:

1. *J.B.Yadav, 'Advanced Practical Physical Chemistry', Krishna Prakashan Media, 29th edition, 2010.*
2. *Francis William Gray, 'A Manual of Practical Physical Chemistry' Macmillan and Co., Limited, 1914.*

18CHY584 INORGANIC QUANTITATIVE ANALYSIS LAB 0 0 6 2

Course Outcomes

CO1: Development of skill to perform classical quantitative analysis of metals in a mixture of inorganic compounds

CO2: Development of adequate knowledge of the chemistry involved in the estimations of various compounds in commercial samples.

CO3: Attainment of knowledge and skill in activities related with effective and safe functioning of a chemistry lab.

1. Estimation of Calcium (Permanganometry)
2. Estimation of Barium (Iodometry)
3. Estimation of Calcium as Calcium Carbonate (Gravimetry)
4. Estimation of Zinc using oxine (Gravimetry)
5. Estimation of Iron as Ferric Oxide (Gravimetry)
6. Analysis of Brass
7. Estimation of Copper and Nickel in a Mixture
8. Estimation of Copper and Iron in a Mixture
9. Preparation and Determination of Ferrous Oxalate
10. Estimation of Different Types of Hardness in the Given Water Sample
11. Estimation of Different Types of Alkalinities in the Given Water Sample
12. Estimation of Dissolved Oxygen in the Given Water Sample
13. Complexometric Estimations

TEXTBOOKS:

1. *G. Svehla, 'Vogel's Qualitative Inorganic Analysis', 7th Edition', Prentice Hall, 1996.*

2. D.A.Skoog and D.M.West ,'Analytical Chemistry - An Introduction', 4th Edition, CBS Publishing Japan Ltd., 1986.

REFERENCES

1. *E.J.Meehan, S.Bruckenstein and I.M.Kolthoff and E.B.Sandell, 'Quantitative Chemical Analysis', 4th Edition, The Macmillan Company, 1969.*
2. *R.A.Day (Jr) and A.L.Underwood, 'Quantitative Analysis', 6th Edition, Prentice Hall of India, 1991*

18CHY601 ELECTROCHEMISTRY, ENERGY, SYSTEMS AND KINETICS 3 1 0 4

Course Outcomes

CO1: Attainment of sound theoretical knowledge in the science, applications and characterization of surfaces and colloidal state.
CO2: Development of sound theoretical and analytical knowledge in electrochemical principles (both in ionics and electrodics)
CO3: Ability to apply the electrochemical principles for solving problems and fabrication of energy storage devices and electrolysis processes.
CO4: Development of analytical skills to predict the speed of chemical reactions and the conditions for reactions with high yield.
CO5**:** Sound theoretical knowledge in catalysis and photochemical reactions and exploring its applications in improving the product yield.

Unit 1 Surface Chemistry
Different types of interfaces, molecular and atomic surface structure, surface chemical reactions, surface tension of solutions, surface excess, thermodynamics of surfaces, Gibbs equation and its derivation, surface films, surface potential, adsorption by solids, Langmuir isotherm - its kinetic and statistical derivation, Freundlich equation, multilayer adsorption, BET isotherm - its kinetic derivation, measurement of surface area, colloids - their preparation, purification, stability & electro kinetic phenomena, Donnan membrane equilibrium, micro and nano emulsions, surface analysis using photoelectron spectroscopy, surface imaging techniques like SEM, TEM, AFM etc., sputter coating, ion beam principles, design of surfaces with novel properties.

Unit 2 Electrochemistry I
Faraday's law, conductivity of electrolytes, applications of conductivity measurements, ionic mobility, transference number, Debye-Huckel-Onsagar equation of conductivity and its validity for aqueous and nonaqueous solutions, deviations from the Onsagar equation, activity and activity coefficients in electrolytic solution, Debye-Huckel theory and its tests and improvements, Onsager equation, electrochemical potential, electric potential at interfaces,

Unit 3 (a) Electrochemistry II
Electrochemical cells, standard electrode potentials, reversible cell, concentration cells with and without transference, energetic of cell reactions, effect of ionic concentration, pressure and temperature on the energetic of cell reactions, applications of e.m.f. measurements, potentiometric measurement of pH, glass electrode and its structure, performance and limitations, double layer, charge transfer across interfaces, polarisation, concentration polarisation, decomposition potential, over potential (hydrogen, oxygen and metal decomposition over voltage), theories of over voltage, electrode kinetics - Butler Volnmer equation, Tafel equation, power generation, storage cells, theories of corrosion, fuel cells, diffusion potential, liquid

junction potential, Henderson's equation, electron transfer kinetics - Marcus theory, electrochemical impedance spectroscopy, electro organic chemistry - electro
oxidation, electro reduction, electro polymerisation.

Unit 3 (b) **Batteries and Fuel Cells**
Primary, secondary and reserve batteries, chemistry, fabrication, performance aspects, packing classification and rating of Zn-C, Mg, alkaline manganous dioxide, mercuric oxide, silver oxide batteries, Zn/air and Li button cells, solid electrolyte cells, secondary batteries - lead-acid, Ni-Cd, Ni-Zn, Li and Li+ batteries, rechargeable Zn-alkaline batteries, reserve batteries – zinc-silver oxide, lithium anode cell, thermal batteries, advanced batteries for electric vehicles – metal/air, Zn-Br, sodium-beta and lithium/iron sulpfide batteries, Fuel Cells – carbon, hydrogenoxygen, methanol, molten carbonate, solid polymer electrolyte and biochemical fuel cells, alkaline fuel cells, phosphoric acid fuel cells, solid oxide fuel cells, proton exchange membrane fuel cells, solar cells – photovoltaic and photo electrochemical
cells, photo biochemical conversion cell

Unit 4 Chemical Kinetics I
Reaction rates and order of reactions, determination of order of reactions, complex reactions, reversible, consecutive and concurrent reactions, reactions of variable order, steady state treatment, reaction mechanism and molecularity, theories of unimolecular reactions and termolecular reactions, Arrhenius equation, collision theory and transition state theory, comparative study of the theories of reaction rates, free energy of activation, effect of solvent on rate of reactions, ionic reactions and effect of ionic strength - salt effect, effect of pressure on velocity of gas reactions.

Unit 5 Chemical Kinetics II
Reaction dynamics, fast reactions, flash photolysis and relaxation methods, catalysis and inhibition, homogeneous catalysis, acid, base and enzyme catalysis, kinetics of enzyme catalyzed reaction - the Michaelis-Menten equation, photochemical kinetics, steady state treatment of photochemical reactions, Semenov-Hinshelwood theory of chain reactions and explosions, free radical reactions - the Rice-Herzfeld mechanism.

TEXTBOOKS:

1. *K. J. Laiddler, 'Chemical-Kinetics', 3rd Edition, McGraw Hill, New York, 2004.*
2. *Dell, Ronald M Rand and A.J David, 'Understanding Batteries', 1st edition, Royal Society of Chemistry, 2001.*

REFERENCES:

1. *M. Aulice Scibioh and B. Viswanathan, 'Fuel Cells-Principles and Applications', reprint,*
1. *University Press, India, 2006.*
2. *Gilbert W. Castellan, "Physical Chemistry", 3rd Edition, Narosa Publishing House, 2004.*
3. *Lindon David, 'Handbook of Batteries', 3rd edition, McGraw Hill, 2002.*
4. *W. J. Moore and R. G. Pearson, 'Kinetics and Mechanism', 2nd edition, Wiley, 1981.*

18CHY602 Synthetic Strategies and Reagents 3 1 0 4

Course Outcomes

CO1: Understand the principles, concept and application of reterosynthesis

CO2: Utilise organometallic chemistry and protecting group strategy in planning the synthesis of complex target compounds.

CO3: Understand the functional group interconversions and the formation of carbon-carbon, C-N, C-O bonds by using various reagents and protecting groups.

CO4**:** Appreciate the role of the synthetic organic chemist in pharmaceutical and agricultural research and development.

Unit 1 Synthetic Strategies

Synthetic strategies: Functional group inter-conversion – conversion of one functional group to other. Nitrogen, oxygen, sulphur protection and deprotection – utilization of protection groups in organic synthesis. Retro synthetic analysis, functional group equivalents, use of retrosynthesis in organic synthesis. Reversal of reactivity (Umpolung), Introduction to combinatorial chemistry. Application of phase transfer catalysts.

Unit 2 Oxidation and reduction:

PCC, DDQ, DMSO, Dess-Martin Reagent, TEMPO, osmium tetroxide, ruthenium tetroxide, selenium dioxide, peracids, hydrogen peroxide, singlet oxygen, aluminum isopropoxide, periodic acid, lead tetraacetate. Swern, Jones, Oppeneur oxidation, Woodward and Prevost hydroxylation, Sharpless asymmetric epoxidation, catalytic hydrogenations (heterogeneous and homogeneous), Clemmenson, Wolff Kishner, Rosenmund and MPV reductions, metal hydrides as reagents (aluminium/boron hydrides and hydroboration reaction), Birch reduction, Borche Reduction, hydrazine and diimide reduction.

Unit 3 Organometallic reagents: Preparation, properties and reactions of organo lithium, organosilicon, organozinc (Reformatsky reaction) and organomagnesium reagents (Barbier and Grignard), organocadmium, organo mercury reagents based organometallic reactions involving C-C bond formation. Selected functional group transformations in organic synthesis. Preparation and reactions of Organo copper, organopalladium,- Wacker process – Heck reaction, cross coupling, carbonylation reaction, organonickel, organo cobalt and organo rhodium reagents – Olefin metathesis reaction. Reactions and applications of Organoboron, organo silicon and organotin compounds.

Unit 4 C-C, bond formation

C-C bond formation – aldol, Arndt-Eistert, Bardhan-Sengupta, Baker-Venkataraman, Barbier, Baylis-Hillman, Benzoin, Heck, Fukuyama, Dieckmann, Friedel–Crafts, Michael, Perkin, Claisen, Robinson annulations, Vilsmeier, Wittig, Knoevnagel, Michael additions.

Unit 5 C-N, C-O bond formations

C-O bond formation – barton, Fischer esterification, Prins, Darzen, Baeyer-Villiger, Mitsunobu, Williamson's ether synthesis, Ullman Coupling with Boronic Acids.

C-N bond formation – Mannich, Fukuyama, Mitsunobu, Ritter, Gabriel Synthesis, Ugi, Doebner Reaction, Buchwald-Hartwig, Stork-enamine, formation of azides and hydrazines, formation of amides and peptides, coupling reactions.

TEXT BOOKS

1. Modern Organic Synthesis, Dale L. Boger, The Scripps Research Institute, Rush Press, San Diego, California, 2001
2. Francis A.Carey and Richard J. Sundberg, "Advanced Organic Chemistry - Part B: Reactions and Synthesis", 5th Edition, Springer, 2008.
3. R.O.C. Norman and J.M. Coxon, "Principles of organic synthesis", CRC press, 2014

REFERENCES

1. Stuart Waren, Designing Organic Synthesis: A programmed introduction to the synthon approach, JOHN WILEY & SONS, 2nd edition, 2008
2. Name Reactions: A collection of detailed Mechanisms and synthetic applications, Jie Jack Li, Springer, fourth edition (expanded edition), 2009.
3. Michael B Smith, "March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure", 7th edition, Wiley (2015).
4. Francis A.Carey and Richard J. Sundberg, "Advanced Organic Chemistry - Part A: Structure and Mechanisms", 5th Edition, Springer, 2008

18CHY603 Solid State Chemistry and Materials Science 3 0 0 3

Course Outcomes

CO1: Ability to understand the various modes of arrangement of atoms in a crystal system
CO2: Apply basic rules of **electron orbitals** to predict molecular structure and properties
CO3: Understand the various methods involved in the synthesis of solid state materials
CO4: Apply various analytical techniques for the characterization of solid state materials.

Unit 1 Introduction to Crystal Systems

Introduction to solids - solid state chemistry, close packing, hcp, fcc, density, coordination numbers, tetrahedral and octahedral holes, body centered and primitive structures, symmetry, proper rotation, mirror planes, inversion, improper axis symmetry elements, symmetry in crystals, Schoenflies and Hermann-Mauguin notations, unit cells, glide plane, screw axis, atom occupancy in cubic unit cells, seven crystal systems/classes, space groups, Miller indices, Bravais lattices, reciprocal lattice, inter-planar spacing in different crystal systems, fractional coordinates, ionic solids, structures of CsCl, NaCl, NiAs, zinc blende and wutzite structures, MX_2 type solids, fluorite and antfluorite structures, $CdCl_2$ and CdI_2 structures, rutile and anti-rutile, ReO_3, spinel and inverse spinel, pervoskite structures, ionic radii, crystal radii, radius ratio, Extended covalent array, diamond, graphite.

Unit 2 Bonding in Solids and Electronic properties

Bonding in crystals, metallic bonding, ionic bonding, covalent bonding, silicates, Born-Haber cycle, Hess's law, lattice energy (L) and calculation of L, free electron theory, density of states, electronic conductivity, molecular orbital theory, overlap and bonding, linear chain of H atoms, LCAO, Fermi Level, conductors, insulators and semiconductors, n- and p-type semiconductors, bands in compounds, band-gap energy, direct and indirect band gaps in semiconductors, band-gap measurements, electrical conductivity, photo-conductivity.

Unit 3 Magnetic and Optical Properties of Solids

Behaviour of substances in magnetic field, magnetic moments, para magnetism, diamagnetism, ferro- and anti-ferromagnetism, ferri-magnetism, effects of temperature of magnetism, Curie & Curie-Weiss

laws; mechanism of ferro- and anti-ferromagnetic ordering, super exchange. Luminescence and phosphorescence of solid materials, phosphors, lasers, non-stoichiometry and its effect in properties of solids, electronic properties of non-stoichiometric oxides. Defects in solids, Schottky defects, Frenkel defects, doping in crystals and colour features, ruby, diamond, organic conductors, preparation, mechanism of conduction in organic semiconductors, photoconductivity of polymers.

Unit 4 Materials Science-Structure and properties

Solid materials of importance. Structure and properties of SiO_2, ZrO_2, SiC, BN, ZnO, TiO_2, CdS, CdTe, GaAs, MoS_2. Band-gap properties of semiconductors like ZnO, TiO_2, CdS, CdSe, CdTe, GaAs, MoS_2 and $(CH_3NH_3)[PbX_3]$-type perovskites. Photo-catalytic properties of ZnO and TiO_2 – principle and applications. Inorganic-organic hybrid materials. High Tc superconductors (HTS) like Bi-Sr-Ca-Cu oxide based HTS (BSCCO) and Y-Ba-Cu-oxide (YBCO), their structure and properties. Metal-organic framework (MOF) materials, special features of MOF materials. Synthesis, special features and properties of MOF materials like HKUST-1 and MOF-8. Gas storage and emission properties of MOF materials. MOFs as sensors. Zeolites, their special features and properties.

Unit 5 Materials Science-Synthesis, processing and characterization

Sol and gel, their properties, xerogels. Sol-gel synthesis - synthesis of SiO_2 and TiO_2 through sol-gel process. Calcination and sintering. Characterization of processed materials, PXRD, IR, Raman, Uv-visible and solid state NMR spectral techniques. Understanding morphological features through, SEM, EDAX and TEM methods. Chemical vapour deposition (CVD) method. Solid state synthesis, synthesis of High Tc superconducting materials like YBCO and BSCCO. Synthesis of inorganic-organic hybrid materials. Solvo-thermal and high pressure synthesis.

TEXTBOOKS:

1. *L V Azroff , 'Introduction to Solids' , Tata McGraw-Hill publishing company*
2. L. E. Smart and E. A. Moore, Solid State Chemistry – An Introduction, 4th Edition, CRC Press, 2016.
3. A. R. West, Solid State Chemistry and its Applications, Wiley, 2014
4. C N R Rao, K Biswas, Essentials of Inorganic Materials Synthesis, John Wiley, 2014
5. C N R Rao Chemical Approaches to Synthesis of Materials, Wiley, 1994

REFERENCES

1. D. Jiles, "Magnetism and Magnetic Materials", Chapman and Hall, London, 1991.
2. R. E. Hummel, "Electronic Properties of Materials", 3rd ed., Springer-Verlag, New York, 2001.
3. Schubert, U. and Hüsing, N, Synthesis of Inorganic Materials, 3rd edn, VCH-Wiley Verlag GmbH, Weinheim, 2012
4. W.D. Kingery, H.K. Dowen and R.D. Uhlman, Introduction to Ceramics, John Wiley.
5. F.H. Norton, Elements of Ceramics,.
6. M.W. Barsoum, Fundamentals of Ceramics, McGraw Hill.
7. Material Science and Engineering, S.K. Hajra Choudhury, Indian Book Dist.
8. B D Fahlman, Materials Chemistry, 2nd Edition, Springer, 2011
9. Stefan Kaskel, The Chemistry of Metal–Organic Frameworks: Synthesis, Characterization, and Applications, Wiley-VCH Verlag GmbH, 2016

18CHY604 Bio-inorganic Chemistry 3 0 0 3

Course Outcomes:

CO1 Skill to apply the principles of coordination chemistry in understanding functions of biological systems.

CO2 Sound knowledge in the interaction of metal ions with biological environments.

CO3 Able to explain how the nature adapts certain properties of metal centres for specific applications and the role of metal ions in metalloenzymes for catalysing reactions that are energetically and stereo selectively very difficult.

CO4 Skill in understanding the mechanism of metalloenzymes by applying the suitable spectroscopic and other techniques

CO5 Understanding the role of metal ions as diagnostic and therapeutic agent. Also have the ability to explain the mechanism of metal toxicity.

Unit 1:

Basics in bio-inorganic chemistry

Essential elements in biological systems, transport of ions across biological membranes, active and passive transport, metal transport and metallochaperons, Na+/K+ pump and active transport. Metal complexation with biological molecules. Electron transport in biology, electron transport chain (ETC), role of ETC in biological systems. Amino acids, peptides and proteins, primary and secondary structure of proteins, α-helix and β-sheets forms of proteins and their special features; tertiary and quaternary structures of proteins the type of molecular interactions involved in them. Reactive oxygen species (ROS), generation and function of organic free radicals, action of ROS in biological systems, oxidative stress, antioxidants. Photosynthesis, PS-I and PS–II.

Unit 2:

Oxygen take-up, transport and storage proteins

Porphine, corrin, corrole, chlorin and bacteriochlorin. Myoglobin (Mb) and hemoglobin (Hb), their prosthetic groups and functions, mechanism for reversible binding of O2 in Mb and Hb. Cooperative effect in Hb and its consequence. Behaviour of bound O2 to Fe(II). Difference between O2 and CO binding to Hb and Mb, CN– poisoning. Structure and functions of haemerythrin (Hr) and haemocyanin (Hc), O2 binding nature in Hr and Hc, electron transfer processes in them. Cytochromes and their role in biology, cytochrome P-450, cytochrome Coxidase and oxygen transfer from O2 to non-activated substrates, monooxygenases, methane monooxygenase (MMO). Fe-S and other non-heme iron proteins, ferredoxins-their structure and special properties, transferrin, ferritin, siderophores, enterobactin, uptake, transport and storage of iron. Sickle-cell anemia

Unit 3:

Metallo-enzymes

Catalases – structure and properties reaction mechanism. Peroxidases- glutathione peroxidase, HRP, structure and properties and enzyme reaction mechanism. Cytochrome c peroxidase and lignin peroxidase. Copper enzymes-structure and function, azurin, plastocyanin. Type I, II and III copper proteins. Superoxide dismutase (SOD) - structure and enzymatic reaction mechanisms. Tyrosinase, reaction mechanism. Zn-containing enzymes, carbonic anhydrase and carboxy-peptidases-structure and enzymatic reactions. N2 fixation, nitrogenase enzyme, Fe-S clusters, Fe-protein structure, Mo-Fe protein structure, P-cluster and M-centre, their model compounds.

Unit 4:

Other functional roles of metal ions

Zn in biological systems, Zn-finger proteins – structural features and properties, classifications and their roles in biological systems. Ca2+ binding proteins, calmodulins. Metal ion based (Pt, V,

Au) drugs, anticancer agents. Cis-platin and its properties. Chelation therapy, macrocyclic antibiotics. Role of Mn, Ni, Mo and Cr in biological systems, metal toxicity and homeostasis, therapeutic complexes. Diseases caused by both excess and deficiency of metal ions, thalassaemia, Wilson disease. DNA intercalators, diagnostic agents, MRI imaging and contrast agents, the role of Gd3+ and other metal ions as contrast agents.

Unit 5:

Biomimetic compounds, metals in medicine

Porphyrins (H2P) and metalloporphyrins (MP), spectral, fluorescence and redox properties of H2P and MP. Biomimetic compounds. Fe(II), Co(II) and Cu(II) based model compounds model compounds of Mb and Hc –. 'picket-fence' porphyrin and its special features. Photodynamic therapy (PDT), principles and applications. Natural and synthetic ionophores, crown ethers, interaction and uptake of alkali metal and alkaline earth metal ions with crown ethers, cryptands and cryptates, calixarenes and their special properties, cyclo-dextrins and their special properties.

TEXTBOOKS:

1. J.E. Huheey, R.A. Keiter, R.L. Keiter, Inorganic Chemistry-Principles of Structure and Reactivity, 4th Edn., Prentice Hall, 1997.
2. F.A. Cotton, G. Wilkinson, C.A. Murillo, M. Bochmann, Advanced Inorganic Chemistry, 6th Edn., Wiley-Interscience, 1999.
3. P. Atkins, T. Overton, J. Rourke, M. Weller, F. Armstrong, Shriver and Atkins Inorganic Chemistry, 4th Edn., Oxford University Press, 2006.

REFERENCES

1. S. J. Lippard, J. M. Berg, Principles of Bioinorganic Chemistry, University Science Books, 1994.
2. J. D. Atwood, Inorganic and Organometallic Reaction Mechanism, 2nd Edn., Wiley-VCH, 1997.
3. B.E. Douglas, D.H. McDaniel, J. J. Alexander, Concepts and Models of Inorganic Chemistry, 3rd Edn., Wiley-India, 2007.
4. W. Kaim, B. Schwederski, Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life, John Wiley & Sons, 1994.
5. M. N. Hughes, The Inorganic Chemistry in Biological Processes, Wiley (1981

18CHY681 Organic Qualitative Analysis Lab 0 0 6 2

CO1: Ability to engage in safe laboratory practices handling laboratory glassware, equipments, and chemical reagents

CO2: Capacity in predicting the outcome of some simple organic reactions, using a basic understanding of the relative reactivity of functional groups.

1. Separation of binary mixtures

Includes separation, preliminary investigations, determinations of saturation/ unsaturation, detection of elements by Lassaigne's test, functional group identification, derivative preparation, determination of melting points of the derivatives and calculation of Rf values from TLC The following mixtures can be given: (a) Acid and hydrocarbon (b) Phenol and Aldehyde (c) Phenol and acid (d) Phenol and amine (e) Acid and ester (f) Halo compound and aldehyde (g) Acid and Aldehyde (h) Amine and aldehyde (i) Amine and ketone (j) Alcohol and hydrocarbon

2. Thin layer chromatography to determine Rf values of compounds

(a) 2-nitroaniline (b) 4-nitroaniline (c) Cinnamic acid and 2-nitroaniline (d) Acetophenone (e) Ethyl benzoate 3. Simple column chromatography to separate the components of binary mixtures (a) Hydrocarbon and ester (b) Aldehyde and amine

REFERENCES:

1. P.W.G. Smith, A.J.Hannaford, B.S.Furnis and A.R. Tatchell, "Vogel's Textbook of Practical Organic Chemistry", ELBS/Longman, 1989.
2. Ralph L.Shriner, Christine K.F.Hermann, Terence C.Morrill, David Y.Curtin, Reynold C.Fuson, 'Systematic Identification of Organic Compounds', John Wiley & Sons, 2003.
3. Mann and Saunders, 'Practical Organic Chemistry', Pearson edition, 2009

18CHY682 INSTRUMENTAL AND ANALYTICAL 0 0 5 2 METHODS LAB

CO1 Development of skill to analyze the effect of electrochemical parameters for industrial anodisation. CO2 Acquire the knowledge to apply the principles of electrolyte conductance and electrode potential for analytical applications. CO3 Attain the skill to evaluate the optical properties of chemical species for analytical applications. CO4 Understand the rate of electrochemical reactions and applying it for industrial corrosion.

1. Determination of strengths of halides in a mixture potentiometrically**.**
2. To find the redox potential of the given sample using cyclic voltametry.
3. Determination of half wave potential of Cd & Zn by polarography.
4. Determination of pKa of an indicator in aqueous and micellar medium using UV-Vis spectroscopy.
5. Determination of stoichiometry and stability constant of inorganic (ferric-salicylic acid) and organic (amineiodine) complexes using UV–Vis spectroscopy.
6. Determination of copper and cadmium in a mixture by electrogravimetry.
7. Determination of rate constant for enzyme kinetics-inversion of sucrose.
8. Determination of molecular weight of a polymer by Viscometry.
9. Determination of a molecular weight of a solute using Beckmann thermometer.
10. Refractrometric determination of composition of solutions.

TEXTBOOKS:

1. Alexander Findly, 'Practical physical chemistry', 9th edition, Wiley, 1972.

2. R.C. Das and B.Behera, 'Experimental Physical Chemistry', Tata McGraw-Hill, 1983.

REFERENCE BOOKS:

1. J.B.Yadav, 'Advanced Practical Physical Chemisty', Krishna Prakashan Media, 29th edition, 2010.

2. Francis William Gray, 'A Manual of Practical Physical Chemistry' Macmillan and Co., Limited, 1914

18CHY696 **Dissertation** **Cr 14**

Course Outcomes

CO1: Capacity to demonstrate the chemical experiments related to chemical industries in the field of research and development, production unit.

CO2: Ability to analyze the structural features of chemical compound and their properties and to apply in quality control area

Employability: An ability to conduct appropriate experimentations, analyse, interpret data and apply scientific judgements to draw conclusions. Finally this work should lead to good quality publication.

18CHY331 BATTERIES AND FUEL CELLS 3 0 0 3

Course Outcomes

CO1: Understand the fundamental concepts of electrochemistry through electrode potential and reaction kinetics

CO2: Learn the application of the electrochemical principles for the functioning and fabrication industrial batteries and fuel cells

CO3: Analysis of practical problem solving in fabricating batteries and fuel cells

CO4: Evaluation of comprehensive knowledge through problem solving

Origin of potential - electrical double layer - reversible electrode potential - standard hydrogen electrode - emf series - measurement of potential - reference electrodes (calomel and silver/silver chloride) indicator and ion selective electrodes - Nernst equation - irreversible processes - kinetic treatment - Butler-Volmer equation - Overpotential, activation, concentration and IR overpotential - its practical significance - Tafel equation and Tafel plots - exchange current density and transfer coefficients**.**

Unit 2 Batteries: Primary Batteries

The chemistry, fabrication and performance aspects, packing classification and rating of the following batteries: (The materials taken their function and significance, reactions with equations, their performance in terms of discharge, capacity, and energy density to be dealt with). Zinc-carbon (Leclanche type), zinc alkaline (Duracell), zinc/air batteries; Lithium primary cells - liquid cathode, solid cathode and lithium-ferrous sulphide cells (comparative account).

Unit 3 Secondary Batteries

Lead acid and VRLA (valve regulated (sealed) lead acid), nickel-cadmium, nickel-zinc, nickel-metal hydride batteries, lithium ion batteries, ultrathin lithium polymer cells (comparative account) Advanced Batteries for electric vehicles, requirements of the battery - sodium-beta and redox batteries**.**

Unit 4 Fuel Cells

Description, working principle, anodic, cathodic and cell reactions, fabrication of electrodes and other components, applications, advantages, disadvantages and environmental aspectsof the following types of fuel cells: Proton Exchange Membrane Fuel Cells, alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate, direct methanol fuel cells. **Membranes for fuel cells:** Nafion – Polymer blends and composite membranes; assessment of performance – recent developments.

Unit 5 Fuels For Fuel Cells

Hydrogen, methane, methanol - Sources and preparation, reformation processes for hydrogen – clean up and storage of the fuels – use in cells, advantages and disadvantages of using hydrogen as fuel.

TEXTBOOKS:

1. *Dell, Ronald M Rand, David AJ, 'Understanding Batteries', Royal Society of Chemistry, (2001).*
2. *M. Aulice Scibioh and B. Viswanathan 'Fuel Cells – principles and applications', University Press, India (2006).*

REFERENCES:

1. *Kanani N, 'Electroplating and electroless plating of copper and its alloy', ASM International, Metals Park, OH and Metal Finishing Publications, Stevenage, UK (2003).*
2. *Curtis, 'Electroforming', London, (2004).*
3. *F. Barbir, 'PEM fuel cells: theory and practice', Elsevier, Burlington, MA, (2005).*
4. *G. Hoogers, 'Fuel cell handbook', CRC, Boca Raton, FL, (2003).*

18CHY332 CORROSION SCIENCE 3 0 0 3

Course Outcomes

CO1: Development of skill in identifying the nature and type of corrosion
CO2: Understanding the mechanism of various types of corrosion
CO3: Analysing the problem and find out a solution to combat corrosion in any sort of environment.

Unit 1 Introduction to corrosion

Classification- chemical and electrochemical corrosion and its mechanism, Pilling-Bed worth ratio-types of oxide film, electrochemical and galvanic series and their significance. Forms of corrosion- Galvanic corrosion, Pitting corrosion, Intergranular corrosion, Waterline corrosion, Stress corrosion cracking, cavitation damage, caustic embrittlement, hydrogen damages, corrosion fatigue, fretting corrosion, exfoliation and soil corrosion..

Unit 2 Corrosion kinetics

Faradays laws of electrolysis and its application in determining corrosion rates, Corrosion kinetics, Evan's diagram, over potential- concentration and diffusion over potential, passivity. Mixed potential theory and its application, Resistance polarization, Determination of corrosion rates by electrochemical measurements- Linear polarisation (LPR), Tafel, A C impedance –units of corrosion.

Unit 3 Cathodic protection
Basis of cathodic protection, mechanism of cathodic protection, design parameters in cathodic protection, cathodic protection interferences, anodic protection, comparison of anodic & cathodic protection.

Unit 4 Corrosion prevention by design
Corrosive environment, stages in design processes, soldering and threading, crevices, flowing water systems, design for liquid containers, design in packaging, coating and design, storage of combat vehicles.

Unit 5 Selection of materials for corrosive environment
Factors affecting the performance of materials, materials classification, materials and fluid corrossivity, corrossion behavior of several materials.

TEXTBOOKS:

1. *Mars G.Fontana, 'Corrosion Engineering', 3rd edition, Tata Mcgraw-Hill, 2005.*
2. *P.E.Philip A.Schieitzer, 'Corrosion Engineering Handbook', 2nd edition, Inco alloys Internaional, 1996.*

REFERENCES:

1. *R.Winston Revie and Herbert H Uhlig, 'Corrosion and Corrosion Control', 4th edition, John Wiley & Sons, 2008.*
2. *Zaki Ahmad, 'Principles of Corrosion Engineering and corrosion', 3rd edition John Wiley & Sons, 2006.*
3. *Raj Narayana, "An introduction to metallic corrosion and its prevention, 1981.*
4. *Fontana and Mars,G, "Corrosion Engineering", Mc Graw Hill Publications, 3rd edition, 1987.*
5. *H.H Uhlig and R.W. Reviees, 'Corrosion and its Control', Wiley, 1985.*

18CHY333 GREEN CHEMISTRY 3 0 0 3

Course Outcomes

CO1 Develop fundamental understanding of the principles of Green Chemistry and a quantitative estimation of greenness of a chemical reaction through sustainability metrices.
CO2 Understand the alternate solvents systems and green solvents available for application in industrial reactions
CO3 Analyze industrial catalytic processes regarding sustainability.

Unit 1 Introduction to Green Chemistry
Introduction - inception and evolution of green chemistry - principles of green chemistry - the green chemistry expert systems - the measure of greenness - safety and risk indices - the hierarchial approach - green chemistry and sustainable development - pollution control to pollution prevention - Indian perspective on green chemistry - information technology and sustainable development.

Unit 2 Green reagents
Green reagents - safer solvents - green solvents - water as a solvent - solvent free conditions - supports reagents - ionic liquids and their applications - super critical systems (CO_2) as green solvents - hydrogen peroxide in green oxidation reactions - dimethyl carbonate, a green solvent and an ambient reagent.

Unit 3 Green chemical techniques I

Environmentally benign technologies by green chemistry (with examples) - microwave assisted synthesis - electro-organic synthesis - photochemical degradation as a green approach for waste treatment - catalysis and green chemistry - supported catalysts and reagents for green chemistry - heterogenized reactions for green chemistry - oxidation technology for waste water treatment - green chemistry using biocatalytic reactions.

Unit 4 Green chemical techniques II

Aqueous phase reactions, solid state reactions, enzymatic transformations, sonicated reactions - usual organic reactions (Benzoin condensation, Michael Addition, Heck Reaction, Darzen reaction, Heck reaction, Claisen arrangement) in a greener way.

Unit 5 Green industrial processes and operations

Cleaner production - industrial perspectives - reactions and reactor designs - micromixers - unit operations - reactions with separation processes alternate energy resources - inherent safety - green chemistry and industries - the pharmaceutical industries and green chemistry - the polymer industry - pesticides, antifoulants, and herbicides - solvents and green chemistry - the food and flavor industry - the maleic anhydride manufacturing process - chelants - the surfactant industry - industries in need of support to go green - the semiconductor manufacture industry - the dye industry - the textile industry - the tannery industry - the sugar and distillery industries - the paper and pulp industry - the paint industry - Green chemistry in future.

TEXTBOOKS:

1. *Mukesh Doble and AnilkumarKruthiventi, 'Green Chemistry and Processes', reprint, Science Press, 2007.*
2. *Paul T. Anastas and Tracy C. Williamson, 'Green chemistry: frontiers in benign chemical syntheses and processes', Oxford University Press, 1998.*

REFERENCES:

1. *V. K.Ahluwallia, 'Green Chemistry - Environmentally Benign Reactions', 1st edition, Ane books Pvt Ltd, 2009.*
2. *M. M. Srivastava, Rashmi Sanghi, 'Green Chemistry - Environment Friendly Alternatives', 2nd edition, Narosa Publishing House, 2005.*

18CHY334 Industrial Catalysis 3 0 0 3

Course Outcomes

CO1: Develop the fundamental understanding of catalyst working in different reactors

CO2: Understand the structure, composition, method of preparation and properties of supports used in catalytic systems

CO3: Analyze industrial catalytic processes regarding sustainability.

Unit 1 - Catalysis

An introduction, general principles of catalysis, activation energy plots for catalytic processes, classification for catalysis - heterogeneous and homogeneous catalysis, van't-Hoff's and Arrhenius treatment of homogeneous catalysis - kinetic aspects, adsorption and general principles of heterogeneous catalysis - kinetic aspects, determination of surface area and pore-structure of the catalyst, definition of performance criteria of catalysts, activity, selectivity, temperature response, catalyst life

Unit 2 - Catalysis in Solutions

Acid and base catalysis, catalysis in gas phase, catalysis in dilute aqueous solutions, catalysis in concentrated strong acid solutions, catalysis by bases, catalysis by metal ions, electron transfer catalysis, catalysis by co-ordination and organometallic compounds, catalysis in Ziegler-Natta, metallocene, metathesis, catalysis by enzymes

Unit 3 - Polymers and Zeolites in Catalysis

Catalysis by polymers, polymer supported catalysts, catalysis in polymer gels, phase transfer catalysis, catalysis in molecular scale cavities, zeolites - molecular sieves, shape selective and size selective catalysis

Unit 4 - Catalysis by Metals, Metal Oxides and Supported Metals

Electronic factors in catalysis by metals, valence bond and electron band theories, electronic factors in catalysis by semiconductors, co-operative electronics interactions and catalysis, localized interactions and catalysis, surface states and catalysis, role of supports, preparation and structure of supports, silica, alumina, silica-alumina, carbon, monolithic supports, surface properties, catalyst manufacture, catalyst size and shape, pretreatments, deactivation processes, sintering, poisoning and catalyst fouling

Unit 5 - Industrially Important Catalytic Processes

Catalysis and green chemistry, catalysis by ionic liquids, catalytic reforming, catalytic cracking, hydrotreatment, steam cracking, Fisher Tropsch process, mobil process for conversion of methanol to gasoline hydrocarbons, catalysis for environmental protection, removal of pollutants from exhausts, mobile and static sources, effluent clean up analysis, applications in the production of fertilizers, acetic acid, formaldehyde, washing powder additives, pharmaceuticals

Text books

1. Bruce G Gates, 'Catalytic Chemistry', John Wiley & Sons, 1992.
2. J. A. Jensen, K. B. Rider, Y. Chen, M. Salmeron and G. A. Somorjai,. and E. K.Rideal, 'Concepts in Catalysis', Academic Press, New York, 1968.
3. Alfred Clark, 'The Theory of Adsorption and Catalysis', Academic Press, 1970.

References

1. W.B.Innes, 'Experimental Methods in Catalytic Research', Volume 1, R.B.Anderson Academic Press, 1968.
2. J.M.Betty, 'Applied Industrial Catalysis', Volume 1, Academic Press, 1983.
3. Ronald Pearce, William R. Patterson , 'Catalysts and Chemical Processes', Wiley, 1981.
4. Michael Bowker, 'The Basis and Applications of Heterogeneous Catalysis', Oxford University Press, 1998.
5. J.C. Kuriacose, 'Catalysis', Macmillian India LTD, 1991

18CHY335 INTRODUCTION TO FOOD CHEMISTRY 3 0 0 3

Unit 1

IntroductionIntroduction: Definition of Food, major components of food, Physical States of Food -Dispersions true solutions, colloidal, emulsions, foam and gel, factors affecting stable dispersion of food ingredients, functions of emulsifiers and stabilizers. Water -Functions of water in food systems, hydrogen bonds, permanent dipole moment dielectric constant, theories of solvent action, water activity and food stability, absorption isotherm curve, roles of water in physical properties and chemical reactions in food theories and applications of different moisture determination methods.

Unit 2

Proteins and CarbohydratesProtein -Classifications, nomenclature, and structures of aminoacids, basic properties of protein, structure of proteins, protein functional groups and their chemical, hydrophobic, and hydrophobic properties, isoelelctric point and solubility as a function of pH, protein denaturation and its effects on food systems, nutritional quality of protein, theories & applications of analytical methods for protein and amino acids determination. Carbohydrates -Classification, nomenclature, and structures of Carbohydrates, isomers and absolute configurations of Carbohydrates, physical –chemical properties of Carbohydrates, sweetness of Carbohydrates, functions of Carbohydrates in foods, chemical reactions of Carbohydrates, analytical methods for Carbohydrate determination.

Unit 3

Lipids and mineralsLipids -Nomenclature and structures of fatty acids, classifications of lipids, physical and chemical characteristics of different fats, relationship between chemical structure and fat melting properties, analytical methods for determining different physical and chemical characteristics of fat, lipid oxidation mechanisms, principles and applications of analytical methods for the determination of fat content and fatty acid composotions of foods. Minerals -Ash determination methods, principles and applications of different methods for determining individual minerals –atomic absorption and flame spectrometry's, and chemical methods.

Unit 4

VitaminsVitamins -Water soluble and fat soluble vitamins, chemical reactions and losses of vitamins during processing and storage. Principles and techniques for the determination.

Unit 5

Pigments in food flavours, browing reaction in foods, Enzymes in foods, and food industry, bio-deterioration of foods, food contaminants, Food additives and toxin.

REFERENCE:

Fennema's Food Chemistry fourth edition,edited by S. Damodaran, K.L. Parkin, and O.R Fennema, 2007 published by CRC Press .SUGGESTED READINGS1.Aurand, L.W. and Woods, A.E. 1973. Food Chemistry. AVI, Westport2.Birch, G.G., Cameron, A.G. and Spencer, M.1986. Food Science, 3rdED.Pergamon Press, New york.3.Fennema O.R. Ed. 1976. Principles of Food Science: Part –I Food Chemistry. Marcel Dekker, New york.4.Meyer, L.H. 1973. Food Chemistry. East –West Press Pvt. Ltd., New Delhi.5.Potter, N.N. 1978. Food Science. 3rdEd. AVI, Westport

18CHY336 POLYMER CHEMISTRY 3 0 0 3

Unit 1

Introduction to polymers and polymerization History of polymer Science. Concept of macromolecules, Nomenclature and Classification. Polymer, monomer, oligomer, repeating unit, degree of polymerization, functionality, copol-ymer -random, alternating, graft, block, Tacticity. Polymerization processes. Free radical addition polymerization. Kinetics and mechanism. Chain transfer. Mayo-walling equation of the steady state. Molecular weight distribution and molecular weight control. Radical Atom Transfer and Fragmentation –Addition mechanism. Free radical living polymers. Cationic and anionic polymerization. Kinetics and mechanism, Polymerization without termination. Living polymers. Step Growth polymerization. Kinetics and mechanism. Molecular weight distribution. Linear vs cyclic polymerization, other modes of polymerization. Group Trans-fer, metathesis and ring opening polymerization. Copolymerization. The copolymerization equation, Q-e scheme, Gelation and Cross linking. Copolymer composition drifts Polymeri-zation techniques. Bulk Solution, melt, suspension, emulsion and dispersion techniques.

Unit 2

Polymer Stereochemistry and characterization Organizational features of polymer chains. Configuration and conformation, Tacticity, Re-peating units with more than one asymmetric center. Chiral polymers -main chain and side chain. Stereo regular polymers. Manipulation of polymerization processes. Zeigler-Natta and Kaminsky routes. Coordination polymerization. Metallocene and Metaloxide catalysts. Pol-ymer Characterization. Molecular weights. Concept of average molecular weights, Molecular weight distribution. Methods for determining molecular weights. Static and dynamic meth-ods, Light scattering and GPC. Crystalline and amorphous states. Glassy and Rubbery States. Glass transition and crystalline melting. Spherullites and Lamellar. Degree of Crystallinity, X-ray diffraction, Thermal analysis of polymers. TG/DTG, DTA/DSC, DMA/TMA/DMTA. Spectroscopy of polymers. Microstructure determination by IR, Raman, UV, NMR and MS techniques. Solid State NMR and polymer stereochemistry. Structure-property relationship. Elastomeric and Viscoelastic states. Rubber-like elasticity. Maxwell and Kinetic model of viscoelasticity.

Unit 3

Polymer Solutions Treatment of dilute solution data. Thermodynamics. Flory-Huggins equation. Chain dimen-sion -chain stiffness -End-to-end distance. Conformation-random coil, Solvation and Swell-ing. Flory-Reiner equation. Determination of degree of cross linking and molecular weight between crosslinks. Polymer structure -property relationship, crystalline and amorphous combinations.

Unit 4

Polymer additives, blends and compositesIntroduction -General principles, use of additives to enhance and protect properties of poly-mer, Classes of polymer additives -Type, Structure, Chemistry, Mechanism and suitability: for antioxidant-heat stabilizers -UV Stabilizers -HAL-antistatic -Blowing agents-lubri-cants nucleating agents -cross linking agent -flame retardant-compatibiliser. Fillers -effect and type of fillers -surface treatment and coupling agent. Coloration of polymers –pigment -colour measurement. Plasticizer –function -mode of operation -types. Compounding Eqmain types of colorant –uipments -internal mixer, two roll mill, Banbury mixer, single screw extruder, twin screw extruder -co rotating -counter rotating -intermeshing. Fabrica-tion methods, polymer blends, toughened plastics and phase separated blends, interpenetrat-ing network, mechanical properties, composite fabrication.

Unit 5

Industrial and speciality polymersSynthesis, Structure and applications of polyethylene, polypropylene, polystyrene. Homo and Copolymers. Dienerubbers. Vinyl and acrylic polymers. PVC, PVA, PAN, PA. Poly (vinyl carbazole), poly (vinylimidazole). PMMA and related polymers. Copolymers. EVA poly-mers. Flourine containing polymers. Polyacetals. Reaction polymers. Polyamides, polyesters. epoxides, polyurethanes, polycarbonates, phenolics, PEEK, Silicone polymers. Reactions of polymers. Polymers as aids in Organic Synthesis. Polymeric Reagents, Catalysts, Substrates, Liquid Crystalline polymers. Main chain and side chain liquid crystalline polymers. Phase morphology. Conducting polymers. Polymers with high bandwidth. Polyanilines, polypyr-rols, polythiophines, poly (vinylene phenylene). Photoresponsive and photorefractive poly-
mers. Polymers in optical lithography. Polymer photo resists. Electrical properties of Poly-mers, Polymers with NLO properties, second and third harmonic generation, and wave guide devises.

TEXTBOOKS:

1.F.W. Billmayer, ‘Textbook of Polymer Science’, 3rdEdition, Wiley. N.Y. 1991. 2.J.M.G Cowie, ‘Polymers: Physics and Chemistry of Modern Materials’, 2ndedition, Blackie Academic and professional, 1991. 3.P.J. Flory, ‘Principles of polymer chemistry’, reprint, Cornell University Press, 1953. REFERENCES: 1.F. Ullrich, ‘Industrial Polymers’, Kluwer, N.Y. 1993. 2.H.G.Elias, ‘Macromolecules, Vol. I & II’, Academic, 1991. 3.Harry A Allcock, Frederick W Lampe and James E Mark, ‘Contemporary Polymer Chemistry’, 3rdedition, Pearson Prentice Hall, 2003.

18CHY337 SURFACE SCIENCE AND COATING TECHNOLOGY 3 0 0 3

Unit 1

Introduction to Paints and Paint Technology General introduction to paint industry -definition of paints, varnishes and lacquers their con-stitution and functions, general classification of surface coatings -decorative and protective coatings -paint industries in India.

Unit 2

Pigments Dyes and Extenders Definition and classification of pigments and dyes -properties and evaluation of pigments such as crystal structure particle size and shape, refractive index and Hiding power, oil ab-sorption, colour, specific gravity and bulking value, UV and IR absorption, light fastness, resistance to heat water, alkali and acid, corrosion inhibition, toxicity, reducing power, tint-ing strength, flooding and floating, settling, volatile and water soluble matter, residue on sieve, bleeding -white pigments and colored pigments -organic and inorganic pigments -industrial manufacture of pigments -special effect pigments -Extenders -use and functions of extenders -examples for extenders.

Unit 3

Binding media, solvents and additives in paintsFundamentals of film formers, chemical structure of monomers, functionality and its deter-mination, degree of polymerization and molecular weight, non-convertible and convertible film formers, linear, branched and cross linked film formers, homopolymers and copolymers -Manufacture, chemistry and applications of alkyd resins, Polyester resins, Phenolic Resins, amino resins, epoxy resins, polyamide resins, polyurethanes, silicone resins, vinyl and acrylic resins -emulsions -polystyrene and styrene-acrylic emulsions. Solvents, dryers, surfactants and other additives in paints.

Unit 4

Paint Formulation, Manufacture and application techniquesPrinciples of paint formulation, formulation elements, mathematics & steps: PVC, CM, P/B ratio, Sp gravity, etc; Typical formulations of primers, undercoats and finish coats -Steps in paint manufacturing, phenomenon of wetting, grinding and dispersion, important considera-tions in pigment dispersion and rheology -different miiling and mixing techniques -factors affecting effectiveness of milling such as size, speed and type of mill; volume, composition, size and shape of grinding medium -mill base. Surface preparation techniques -Physical and chemical surface treatment techniques -Common application techniques -packaging tech-nology.

Unit5

Colour Technology, Paint properties and Quality Control in Paint Industries

Colour science and technology -light spectrum, primary and complemenary colours, colour mixing, dimensions of colour and colour systems, colour measurements, computer colour matching - colour coding system -General properties of paints, classification of paint prop-erties -adhesion and cohesion properties, factors affecting adhesion wetting power, optical properties; colour, gloss, hiding, etc, physical, chemical and mechanical properties of paint films -factors affecting coating properties -rheological properties -Newtonian and non-Newtonian liquids, thixo-tropy, factors affecting viscosity, objectives of paint testing -Quali-ty control procedures, standard specifications and test methods -tests on liquid paints densi-ty, dispersion, viscosity and consistency, wet opacity and dry hiding, spreading capacity and spreading rim, wet and dry rim thickness, drying time, etc. -Tests of dried coatings, colour and colour fastness, light fastness, gloss, flexibility, adhesion impact test, hardness mar re-sistance, abrasion resistance water and moisture resistance; water vapour transmission, PAC and salt spray test resistance, resistance to chemicals and solvents, resistance to heat and fire, air permeability -evaluation of water based paints, biological effects on paint films. Analysis of paints and varnishes; volatile and nonvolatile matter pigment content, binder or solid vehi-cle content, water content, ash content, pigment binder and solvent analysis -Ageing proper-ties of coatings, weatherometery, natural outdoor durability test accelerated outdoor weather-ing, artificial weathering tests, defects observed in paint film on exposure.

TEXTBOOKS:

1. Australian OCCA, 'Surface Coating Technology Volume 1', Chapman and Hall, 1974.
2. W.M.Morgan, 'Outline of Paint Technology', John Wiley sons, 1990.

REFERENCES:

1. L. S. Pratt, 'Physics &Chemistry of Organic Pigments', Wiley, 1947.
2. H.Y. Payne, 'Organic Coating Technology Vol, 1 & 11', John Wiley & Sons, 1954.

18CHY353 FORENSIC SCIENCE 3 0 0 3

UNIT I-INTRODUCTION

Origin of forensic science, need for forensic science, trace and contact evidence, marks and impression, examination of documents, blood stain analysis, microscope in analysis, explo-sives, chemical analysis of explosives, forensic laboratories and courses in India.

UNIT II-NARCOTICS

Narcotics, classification of drugs, specific drugs-Psychotropic drugs, chemical screening of drugs, chemical extraction and sample preparation, chemical identification of drugs using analytical methods.

UNIT III –FINGERPRINTING and FIREARM ANALYSIS

History of fingerprinting, principles of fingerprinting, constituents of latent finger marks, fin-gerprint detection, chemical methods of detection, firearm examination, chemical analysis of firearm, analysis of gunshot residue.

UNIT IV –TOXICOLOGY

Introduction to Toxicology, alcohol and human body, testing of blood alcohol concentration, Toxins & Biological Poisons, Measuring Toxicity as LD50, sample and analysis, inorganic poisons, nerve agents, radioactive toxins, Pharmacokinetics and Toxicokinetics, tests for tox-ins, reported case studies.

UNIT V- POSTMORTEM TOXICOLOGY

Introduction, tissue and fluid specimens, specimen collection and storage, extraction proce-dure, analytical techniques, interpretation, case studies

Reference Books:

1.Lawrence Kobilinsky, Forensic Chemistry Handbook, John Wiley & Sons, New Jer-sey, 2012
2.David E. Newton, Forensic Chemistry, Facts On File, Inc, New York, 2007
3.Jay A. Siegel, Forensic Chemistry fundamentals and applications, Wiley Balckwell.
4.Suzanne Bell, Drugs, Poisons, and Chemistry, Facts On File, Inc. New York, 2009.

18CHY633 CHEMISTRY OF BIOMOLECULES 3 0 0 3

Course Outcomes

CO1: Understand the role of aminoacids, proteins and peptides in biology along with their application.
CO2: Able to describe the basic properties, mechanisms of action and applications of enzymes
CO3: Gain knowledge in nucleic acids, antibodies, recombtinant DNAand gene analyses.

Unit 1 Amino acids, Proteins and Peptides
Classification, Stereochemical aspects, physical properties, Ionic properties, spectral properties, essential and non essential amino acids, chemical reactions of amino acids, Industrial preparation and chemical synthesis of amino acids. Ionic properties of proteins, protein structure, protein purification, protein structure determination, proteomics and protein function, solid phase peptide synthesis, biologically important peptides.

Unit 2 Enzymes Introduction to Enzymes, Classification of enzymes, mechanism of enzyme action, immobilized enzymes and enzyme technology, enzyme analog built polymers, design of molecular clefts, enzymes in synthetic organic chemistry. Enzymes in biological systems

Unit 3 Molecular biology and bioinformatics
Structure of nucleic acids, genes and genome complexity, functions of nucleic acids, isolation and separation of nucleic acids, molecular analysis of nucleic acid sequences, nucleotide sequencing of DNA.

Unit 4 Immunochemical techniques
Production of antibpodies, purification and fragmentation of immunoglobulins, immunoprecipitatipon, labeling antibodies, immunoblotting, immunoassays, immunohisto/cytochemistry.

Unit 5 Recombinant DNA and genetic analysis
Constructing gene libraries, cloning vectors, hybridization and gene probes, application of gene cloning, expression of foreign genes, pharmacogenomics.

REFERENCES:

1. *Hermann Dugas, 'Bioorganic Chemistry - A Chemical Approach to Enzyme Action', 3rd edition, Springer.*
2. *Keith Wilson and John Walker, 'Principles and Techniques of Biochemistry and Molecular Biology', 6th edition, Cambridge University Press.*

18CHY634 INDUSTRIAL CHEMISTRY 3 0 0 3

Course Outcomes

CO1: To gain knowledge about various water treatment processes adopted in industries

CO2: To provide in-depth overview on production, refining and processing of various types of fuels
CO3: To understand the importance and preparative methods of explosives and chemical weapons
CO4: To learn the manufacturing process of paints and pigments and to develop ability to scale up the products prepared in the laboratory to the industrial level
CO5: To obtain a comprehensive knowledge of various energy resources used commercially
CO6: To calculate, analyse and execute different types of industrial processes

Unit 1 Water treatment

Softening of water, Ion exchange process, Lime soda process, Modified Lime soda process, Zeolite process, Chemical and physical method of sterilization, Desalination, Boiler problems. Corrosion of boiler units, industrial water treatment, water analysis.

Unit 2 Fuels

Calorific value, determination of Calorific value, classification of fuels, Solid fuels, Properties of fuels, classification of coal, coking and non-coking coals, advantages and disadvantages of solid fuels. Liquid fuels, gaseous fuels, analysis of fuel gases, Distillation of petroleum. Processing & purification of petroleum and petroleum products, Flash point, Fire point, Knocking, antiknocking, Cetane number, octane number, natural gasoline, cracking, polymerization, alkylation, isomerisation, rocket fuels, fossil fuel, nuclear fuels.

Unit 3 Energy resources

Renewable and non renewable sources of energy, conventional and non conventional sources of energy, solar energy, solar technology, solar photovoltaic cell - application, PV lantern system, Radiotelephone system, Application of solar energy, Environmental implication, Nuclear energy, nuclear fuel cycle in India, Energy conservation and waste heat boilers, Fuel cells, hydrogen cells.

Unit 4 Paints and Pigments

White pigment, blue, green, yellow, black and red pigments - manufacture, physical properties, characteristics, Manufacture of paints, setting of paints, requirement for good paints, emulsion paint, latex paint, luminescent paint, fire retardant paints, heat resistant paints, varnishes, manufacture of varnishes, enamels, lacquers.

Unit 5 Explosives and Toxic Chemical Weapons

Introduction, Classification. Deflagrating or low explosives. Characteristics of explosives, nitrocellulose, PETN, DNB, TNB, TNT, Picric Acid, Nitroglkycerine, Dynamite, Cirdite, Gun powder, RDX, EDNA, HMX,Tetryl, Pentryl, Hexyl, Dinol. Toxic chemical weapons, screening smokes, Incendiaries, Pyrotechniques, Explosives in India.

TEXTBOOKS:

1. *B.K.Sharma, 'Industrial Chemistry', Goel publishing.*
2. *James A Kent, 'Riegels Hand book of Industrial chemistry', 10th edition, Kluwer Academic/Plenum publishers, 2003.*

REFERENCES

1. *Alan Heaton, 'An Introduction to Industrial chemistry', 3rd edition, Blackie Academic and professional, 1996.*
2. *Chris A Clausen and Guy Mattson, 'Principles of industrial chemistry', 2nd edition Wiley, 1978.*
3. *Jonathan Steed, 'Core Concepts on supramolecular chemistry and nanochemistry', Wiley Eastern Publishers, 2006.*

18CHY637 MEDICINAL CHEMISTRY 3 0 0 3

Course Outcomes

CO1: To understand the physicochemical properties of drug and its metabolic pathways, adverse effect and therapeutic value of drugs.
CO2: To know the role of enzymes and vitamins in biological action.
CO3: To understand the chemistry of various drugs with respect to their pharmacological activity

Unit 1 Medicinal chemistry: Introduction, drugs – classification of drugs – mechanism of drug action. Drug-receptor complex, nomenclature – agonist,

Unit 2 Physicochemical properties of drugs in relation to biological action: solubility**,** Partition coefficient, dissociation constant, hydrogen bonding, ionization, drug shape, surface activity, complexation, protein binding, molar refractivity, bioisosterism – stereo chemical aspects of drug action.
Unit 2: Enzymes, hormones and Vitamins - representative cases, nomenclature, classification and characteristics of enzymes, mechanism of enzyme action, factors affecting enzyme action, co-factors and co-enzymes, enzymes in organic synthesis, mechanism of enzyme catalysis, enzyme inhibition. Hormones and vitamins – representative cases.

Unit 3 Essentials of drug design
Molecular mimetics, drug-lead modification, drug design using QSAR and computer assisted design, assessment of drug activity, receptors and drug action, mechanism of drug action, drug metabolism pathways, Drug potentiation, drug antagonism and drug resistance

Unit 4 Medicinal agents from natural products
History of the use of natural products as therapeutic agents, medicinal plants, active principle, Isolation methods of alkaloids, terpenes, antioxidants, natural oils from plants

Unit 5 Medicinal agents
Medicinal agents belonging to alkaloids, steroids, polypeptides, modified nucleic acid bases, sulphonamide and sulpha drugs, antibacterials - sulpha drugs, substituted sulphonamides, anticonvulsants, anticoagulants, antiamoebic agents, antihelmintic agents, anti-malarial agents, diuretics and cardio vascular agents, , medicinal agents affecting CNS, analgesics, antipyretics, antiseptics and disinfectants, Histamine and anti-histaminic agents. Infectious and non infectious diseases (malaria, AIDS, Cancer) introduction, mechanism of action types of cure,

TEXTBOOKS:

1. *John M beak and John H Block, 'T Wilson, O. Gisvold and R. F. Deorge - Text book of Organic, Medicinal and Pharmaceutical Chemistry', 7th edition, J.B. Lippincott Williams and Wilkons Company, 1977.*
2. *A.Burger, 'Medicinal Chemistry', 3rd edition, Wiley Interscience, 1970.*
3. *V.K.Ahluwalia and Madhu Chopra, 'Medicinal Chemistry', Ane Books pvt Ltd, 2008.*

REFERENCES

1. *V.Kothekar, 'Essentials of Drug Designing', 14th edition, Dhruv publications, 2005.*
2. *V.K.Ahluwalia, Lalita S.Kumar and Sanjiv Kumar, 'Chemistry of Natural Products', Ane Books India.*
3. *L.P.Graham 'An introduction to Medicinal Chemistry', 3rd edition, Oxford University Press, 2005.*

18CHY642 Computational Chemistry 3 0 0 3

Course Outcomes

CO1: Understand the Criteria for modeling the different methods available in computation.
CO2: Understand Quantum mechanical approach and to apply the mathematical skill and knowledge along with quantum mechanical approach to find the characteristics- reactivity, stability, etc., of the molecule and to calculate the energy of a system.
CO3: Ability to get a brief idea about molecular mechanics based calculations.
CO4: Capacity to get an idea about general methodology of molecular modeling.
CO5: Capability to get the basic idea of Density functional theory for the computation.

Unit 1 - Introduction

Introduction to computational chemistry (molecular modelling), questions commonly investigated computationally, principle and application of methods (tools) of computational chemistry - molecular mechanics, ab initio method, semiempirical methods, density functional theory and molecular dynamics, STOs, GTOs, basis sets, specification of molecular geometry using Cartesian coordinates and internal coordinates, Z-matrix, Z-matrix of simple molecules (water, ethanol), potential energy surface (PES), potential energy surface of diatomic molecules and triatomic molecules (H_2O and HOF) - hypersurface and process of "slicing", stationary points on apotential energy surface - potential energy surface of the isomerization reaction of ozone to isoozone, stationary points (ozone, isoozone and transition state), intrinsic reaction coordinate, minimum, relative minimum, saddle-shaped surface, saddle point, higher-order saddle point and mathematical treatment of stationary points, Born-Oppenheimer approximation and its significance and frozen-nuclei energy.

Unit 2 - Molecular Mechanics

Introduction to molecular mechanics, forcefield, developing a force field - expression for potential energy of a molecule, bond stretching term, angle bending term, torsional term and nonbonded interaction term,parameterizing a forcefield -parameterizingbond stretching term, angle bending term, torsional term and nonbonded interaction term, calculation using forcefield - compare the energies of two 2, 2, 3, 3-tetramethylbutane geometries, illustration of application (use) ofmolecular mechanics - calculation of geometries and energies of small-sized and medium-sized molecules, polymers and transition states (transition state for the Diels-Alder reaction of butadiene with ethene to form cyclohexene), in organic synthesis for predicting the more suitable path for carrying out the synthesis and calculation of normal-mode vibrational frequencies for characterizing a species as a minimum or a transition state or higher-order saddle point, for obtaining zero-point energies to correct frozen-nuclei energies and for interpreting or predicting IR spectra, strength (merit) and weakness (demerit) of molecular mechanics.

Unit 3 - Semiempirical methods - Part 1

Introduction to semiempirical (SE) methods, Simple Huckel Method (SHM) - theory - expression for calculating energy of a molecular species, expression for molecular wave function based on LCAO approximation, secular equations and the single matrix equation, H, C, S and ε matrices and their interpretation, the values of H_{ij} as zero, coulomb integral α and bond integral β and their physical significance, the H matrix in terms of α, β and zero for ethene system(ethene neutral molecule, ethene radical cation and ethene radical anion), propenyl system (propenyl cation, propenyl neutral radical and propenyl anion) and cyclobutadiene system (square cyclobutadiene dication, square cyclobutadiene neutral molecule and square cyclobutadiene dianion), the H matrix in terms of zero, $\alpha = 0$ and $\beta = -1$for ethene systems (ethene neutral molecule, ethene radical cation and ethene radical anion), propenyl system

(propenyl cation, propenyl neutral radical and propenyl anion) and cyclobutadiene system (square cyclobutadiene dication, square cyclobutadiene neutral molecule and square cyclobutadiene dianion), result of diagonalization of the H matrices written for ethene system, propenyl system and cyclobutadiene system, molecular orbital energy level diagrams and expressions for energy and molecular wave functionsfor ethene system, propenyl system and cyclobutadiene system based on the result of diagonalization of the H matrices, and molecular orbital energy level diagrams for ethene system, propenyl system and cyclobutadiene system showing ground state and excited state electronic configurations.

Unit 4 - Semiempirical methods - Part 2

Application of SHM - nodal properties of molecular orbitals and Woodward-Hoffmann orbital symmetry rule, stability towards oxidation and reduction of various species in ethene system, propenyl system and cyclobutadiene system, geometry of cyclobutadiene molecule as predicted by SHM and its Jahn-Teller distortion, aromaticity and Huckel's $(4n + 2)$ π electron rule,and calculation of resonance (stabilizing) energy, bond order and atomic charges of various species in ethene system, propenyl system and cyclobutadiene system, strength of SHM, weakness of SHM (detailed explanation) - basis set is limited to p orbitals (p_z orbitals), it treats only π electrons, and the overlap integrals, Fock matrix elements, electron spin and electron-electron repulsion are not calculated/accounted properly, Extended Huckel Method (EHM) - minimal valence basis set, calculation of Fock matrix elements, and calculation of overlap integrals by Lowdin orthogonalization, EHM procedure, EHM calculation on protonated helium molecule, application of EHM - an overall idea, strength and weakness of EHM, SCF SE methods - Pariser-Parr-Pople (PPP) method and Complete Neglect of Differential Overlap (CNDO) method - basic principle (an exhaustive treatment is **not** expected).

Unit 5 - Density Functional theory and ab initio method

(An exhaustive treatment is **not** expected)

Introduction to Density Functional theory and calculations, Kohn-Sham approach - the first and the second Hohenberg-Kohn theorems, introduction to ab initio method and calculation, basis sets for H, He and first, second and third row elements used in ab initio calculations - STO-3G, 3-21G, 3-21G$^{(*)}$ and 6-31G*****, these basis sets for a few molecular species (water, methane and carbene), basic principles of ab initio method (an idea only).

Text Book

1. Computational Chemistry-Introduction to the Theory and Applications of Molecular and Quantum Mechanics - Errol Lewars

18CHY643 Sustainable Chemical Science 3 0 0 3

Unit 1

Green Chemistry and SustainabilityHistory of green chemistry, Chemical composition of the, environment (Air, water & soil-Role of organic and inorganic molecules in pollution), the twelve principles of green chemistry (detailed description with examples), green chemistry as an expression of

envi-ronmental ethics (Thrift Chemistry),the concept of sustainability, from green to sustainable chemistry, sustainable use of chemical feedstock, water and energy, quantifying greenness of a chemical reaction, green chemistry metrics-mass based, energy and environmental metrics,designing greener process, life cycle assessment (introduction and scope),Green toxicology-the need, principles of toxicology, Disposition of Toxicants in Organisms, Non-Organ Sys-tem Toxicity, Mechanistic Toxicology, Quantitative Structure–Activity Relationships, (Envi-ronmental Toxicology-Persistence and bioaccumulation), Non-Cancer risk assessment, Can-cer risk assessment, stakeholders in sustainable policy implementation.

Unit 2

Chemistry in waterDefinition and attributes of a green solvent, the principle and reasons for use of water in green chemistry-hydrophobicity-cyclodextrin chemistry, Lewis acids in aqueous media, Michael addition in water using triflates, green processes with base in water, green oxida-tions and reduction in water, on water conditions, use of water in microwave and ultrasonic technology.

Unit 3

Green solventsIonic liquids as green solvents-definitionand notation-properties, synthesis and use in organic reactions, oxidation, oxidative carbonylation of aniline,Friedel–crafts reaction, Michael addition, Fischer Indole synthesis, Benzoin condensation, dimethyl carbonates syn-thesis in ionic liquids.Super critical fluids-super critical water and carbondioxide-properties and organic transformations.(Diels Alder, Clasen rearrangement, Fisher Indole, Friedel–crafts reaction, oxidation and hydrogenation.Properties and application in organic transformation of green solvents like polyeth-ylene glycol, glycerol, cyclopentyl methyl ether, 2-methyltetrahydro furan, Perfluorinated (Fluorous) Solvents-FluorousBiphase Concept and dimethyl carbonate.

Unit 4

Green Chemistry and CatalysisImportance of catalysis, turn over number and frequency, the basis of catalysis-kinetic phenomenon, basics of homogeneous, heterogeneous and biocatalysis, sabatier's principle, catalyst -deactivation, sintering, thermal degradation, inhibition and poisoning, cat- alyst promoters, modifiers, supported catalysts and reagents for green chemistry-heterogen-ized reactions for green chemistry, preparation of solid catalyst-slurry and co-precipitation, impregnation, hydrothermal synthesis-drying, calcination, activation and forming, selecting the right support, catalyst characterization-surface characterization methods, temperature programmed techniques, spectroscopyand

microscopy.Common mechanism in enzyme ca-talysis immobilized enzymes, developing biocatalyst-rational design and directed evolution, non-enzymatic biocatalysts.

Unit 5

Green Chemistry Technologies and Alternate Energy SourcesDesign for Energy Efficiency, Photochemical Reactions Advantages of and Challenges Faced by Photochemical Processes (Examples)Microwaves as energy source in chemistry-properties of microwaves, microwave heating (Effects), Approaches to Microwave-assisted Organic Chemistry-solvent free meth-ods, MORE chemistry, continuous microwave reactor (CMR)-microwave batch reactor (MBR), examples of organic transformations.Sonochemistry and Green Chemistry-Theoretical Basis-Cavitation Inception, Nu-cleation-Bubble Dynamics-examples of organic transformations, Sono-chemical synthesis of nano-structured materials, Electrochemical Synthesis-materials manufactured using the process, organic elec-trosynthesis-3-bromothiophen from thiopheneRenewable Sources of Energy, Solar Energy, Wind Power, Geothermal Solution, Hy-dropower (Sources, Merits and Difficulties in widespread applications), Indian Energy sce-nario-Energy Conservation act (2001)-features.

Reference

1.Green chemistry and engineering A Pathway to Sustainability, Anne E. Marteel-Parrish, Martin A. Abraham, American Institute of Chemical Engineers, Inc, John Wiley & Sons, Inc 2014.

2.Synthetic organic Sonochemistry, Jean-Louis luche, Springer Science+Business Me-dia New York, 1998

3.New Methodologies and Techniques for a Sustainable Organic Chemistry, Ales-sandro Mordini and FerencFaigl, Springer, 2008.

4.Green chemistry, Fundamentals and Applications, Suresh C. Ameta and RakshitAme-ta, CRC press, Taylor & Francis Group, 2013

5.Handbook of Green Chemistry, Vol5 Green Solvents-Reactions in Water, PualT An-astas, Chao Jun Li

6.Sonochemistry: theory, reactions, syntheses, and applications, Filip M. Nowak, Nova Science Publishers, Inc, 2010.

7.Green Chemistry Metrics, A Guide to Determining and Evaluating Process Green-ness, Dicks, Andrew, Hent,Andrei, SpringerBriefs in Green Chemistry for Sustaina-bility, 2015

8.Catalysis: concepts and applications, Gadi Rothenberg,Wiley-VCH Verlag& Co. KGaA, Weinheim, Germany, 2008

18CHY644 Sustainable Techniques in Chemical Sciences 3 0 0 3

Unit 1 From Industrial to Sustainable Chemistry

IndustrialSustainable Chemistry-Managing Intraorganizational Sustainability, Man-aging Horizontal Interorganizational Sustainability, Managing Vertical Inter organizational SustainabilityIntegrated Pollution Prevention and Control-Best Available Techniques reference documents(BREFs), From Industrial Emissions Directive (IED) to Voluntary Systems, Poli-cy Drivers for Sustainable Chemistry (Transition Concept), Development of a CSR Man-agement System FrameworkSustainability Assessment Methods and Tools-Sustainability Assessment Frame-work, Impact Indicators and Assessment Methodologies, Environmental Impact Assessment, Economic Impact Assessment, Social Impact Indicators, Understanding Industrial Symbiosis-Cluster Management Sustainability of Logistics in the Chemical Sector, Basic Principles of Chemical Leas-ing (ChL), Differences between Chemical Leasing and Other Alternative Business Models for Chemicals, Sustainable Chemical Warehousing-Risk Management in the Chemical Warehouse, F3-Factory concept, Indian energy security scenarios (IESS) 2047.

Unit 2 Process Intensification I

Opportunities and Perspectives for a Sustainable Process Design Definition and Con-cept, Reaction Engineering, Mixing Principles, Transport Processes, Enhanced Transport Processes, Integrating Process Steps.Moving from Batch to Continuous Processing, Spinning Disc Reactor (Design, Oper-ating Features and Characteristics of SDRs-Green Synthesis of Nanoparticles using SDR),Micro Process Technology-Transport Intensification, Chemical Intensification, Pro-cess Design IntensificationOscillatory Baffled Reactors-Design and operationsMonolith Reactors for Intensified Processing-Design, Hydrodynamics, Advantages and Applications-CleanerProduction of Fuels and Removal of Toxic EmissionsCavitational Reactors, Mechanism, Reactor Configurations, Transesterification of Vegetable Oils Using Alcohol using Cavitation

Unit 3 Process Intensification II

Membrane Technology-Definitions, functions and operations, Biocatalytic Mem-brane Reactors (Entrapment, Gelification and Chemical Attachment), Biofuel Production Us-ing Enzymatic TransesterificationMembrane Technology in Metal Ion Removal fromWaste Water, Membrane Opera-tions for the Production of Optically Pure Enantiomers, Integrated Membrane Processes for Water DesalinationReactive Distillation Technology and Reactive Extraction Technology-Principles, control

design and applicationsReactive Absorption Technology in Carbon Dioxide Capture, removal of Nitrogen Oxides, Desulfurization, and in Sulfuric and Nitric Acid production

Unit 4 Computer Applications in Catalytic Research

Computers as research tools in catalysis-a brief overview, a short over view of mod-elling methods, Data-mining methods in catalysis (PCA, PLS and Artificial Neural networks)

Unit 5 Successful Example of Sustainable Industrial Chemistry

Detailed Process Chemistry of the current technologies and routes for the following chemicals in industry.

Industrial Propene OxideProduction (CHPO (Chlorohydrin) Technology, PO/TBA Technology, PO/SM Technology, PO-only Routes)

Synthesis of Adipic Acid (Current Technologies for AA Production-Two-Step Trans-formation of Cyclohexane, Alternatives for AA Production)

Ecofining-New Process for Green Diesel Production from Vegetable Oil

Direct Oxidation of Benzene to Phenol, Friedel–Crafts Acylation of Aromatic Ethers Using Zeolites, Sustainable Chemistry in the Production of Nicotinates

Homogeneous catalysis: The Shell higher olefin process (SHOP) and Du Pont synthe-sis of AdiponitrileHeterogeneous catalysis: The BP AVADA ethyl acetate process

Reference

1.Management Principles of Sustainable Industrial Chemistry, Genserik L.L. Reniers, Kenneth Sorensen,¨ and Karl Vrancken (Eds), Wiley-VCHVerlag& Co. KGaA, Boschstr. 12, 69469 Weinheim, Germany, 2013

2.Sustainable Development in Practice, Azapagic, A., Perdan, S. (eds.), Wiley-VCH Verlag& Co. KGaA, Boschstr. 12, 69469 Weinheim, Germany, 2011

3.The Art of Process Chemistry, Yasuda, N. (ed.), Wiley-VCH Verlag& Co. KGaA, Boschstr. 12, 69469 Weinheim, Germany, 2011

4.Sustainable Industrial Chemistry, Centi, G., Trifiro, F., Perathoner, S., Cavani, F. (eds.), Wiley-VCH Verlag& Co. KGaA, Boschstr. 12, 69469 Weinheim, Germany, 2009

5.Green chemistry, Fundamentals and Applications, Suresh C. Ameta and RakshitAme-ta, CRC Press, Apple Academic Press, Inc, Taylor & Francis Group, 2013

6.Catalysis: concepts and applications, Gadi Rothenberg,Wiley-VCH Verlag& Co. KGaA, Weinheim, Germany, 2008

OPEN ELECTIVES

18OEL231 ADVERTISING 3 0 0 3

Unit 1

Evolution of advertising; Social and economic effects of advertising; Advertising agency system; advertising budget; Legal and ethical aspects of advertising;

Unit 2

Marketing; Market segmentation; Social marketing; Consumer behaviour; Factors influencing consumer behaviour, buying behaviour, buying decision process;

Unit 3

Planning advertising campaigns; Advertising copy, visualization, illustration, layout, headline, body, colour, trademarks, slogans; Television and Radio commercials; Media selection, newspaper, magazines, radio, television, Internet, outdoor, direct mail;

Unit 4

Industrial advertising; Retail adverting; Corporate advertising; Public service advertising;

Unit 5

Evaluation of advertising effectiveness, methods of measurement. Pre-testing and post – testing methods.

BOOKS RECOMMENDED:

1. *B.S. Rathor; Advertising management*
2. *Chunnawala: Advertising theory and Practice*
3. *Sandage and others: Advertising: Theory and Practice*
4. *Thomas Russell and Glenn Verrill: Otto cleppner's advertising Procedure*
5. *Manendra Mohan: Advertising Management: Concepts and cases*
6. *Philip Kotler: Marketing Management*
7. *David Aaker and George day: Marketing Research*
8. *Mahendra Mohan: Advertising Management; Concepts and Cases*
9. *Frank Jefkins: Advertising Made Simple*

18OEL232 BASIC STATISTICS 3 0 0 3

Objectives: *To develop an understanding of problem solving methods, to understand the basicconcepts of statistics and to apply the results to real life problems.*

Unit 1

Introduction to Statistics: Meaning and scope of statistics, limitations of statistics, purpose and scope of inquiry.

Unit 2

Methods of collecting data - primary and secondary data, classification of data, tabulation of data, frequency table.

Unit 3

Presenting data by diagrams and graphs - bar diagram - simple, multiple, component and percentage bar diagram, pie diagram, histogram, frequency polygon and frequency curve, less than ogive and greater than ogive.

Unit 4

Measures of central tendency: Arithmetic mean, median, mode.

Unit 5

Dispersion: Quartile deviation, standard deviation, coefficient of variation.

REFERENCES:

4. *P.R Vittal - Business mathematics and statistics, Margham Publications, Chennai.*
5. *Dr.C Satyadevi - Quantitative Techniques, S. Chand & Company Pvt. Ltd., New Delhi.*
6. *Dr. S.P Gupta - Statistical Methods, Sultan Chand & Sons, New Delhi.*

18OEL233 CITIZEN JOURNALISM 1 0 2 3

Objective: *The course is aimed at encouraging young educated rural men and women tohighlight local issues and imparting the required skills to articulate them in the media.*

Unit 1

Introduction: Highlighting development problems of rural areas; pathetic condition of infrastructure in rural areas.

Unit 2

Lack of connectivity – bad roads or lack of roads.

Unit 3

Lack of potable water – women having to trek distances to fetch drinking water for the family.

Unit 4

The story of electrification of villages – Official claims and reality, Schools without teachers, primary health centres without doctors.

Unit 5

Farmers caught in between labour shortage, high wages, rising cost of inputs and indebtedness due to crop failure and middlemen taking the profit from farm products.

Outcomes:

By the end of the course the students will be able to:

CO1: Define Citizen Journalism and explain the genre.
CO2: Explain the boundaries of the genre
CO3: Develop an understanding of the platforms available for citizen activism and intervention
CO4: Critically reflect on the aspects of safe media practices involved in citizen reporting
CO5: Identify appropriate strategies and tools to reach a defined target audience

REFERENCES:

1. *Allan, S. (2009). Citizen journalism: Global perspectives (Vol. 1). Peter Lang.*
2. *Thorsen, E., & Allan, S. (2014). Citizen Journalism: Global Perspectives - Volume 2. Peter Lang International Academic Publishers.*
3. *Wall, M. (2012). Citizen Journalism: Valuable, Useless, Or Dangerous?. International Debate Education Association.*
4. *Allan, S. (2013). Citizen witnessing: Revisioning journalism in times of crisis. John Wiley & Sons.*

18OEL234 CREATIVE WRITING FOR BEGINNERS 1 0 2 3

Overview of the Course: *The course focuses on those elements of writing that enhances thevivid and effective writing skill among students across genres like fiction, poetry, essay and drama drawing their attention to significant details, lyrical language and memorable images; inventive metaphor and simile; authentic voice, dialogue and characterization.*

Objectives: *To develop students talent for creative writing in English in order to enable them touse language effectively; to introduce the concept of creative writing; to acquaint students with the basic principles and techniques involved in writing poetry, fiction and drama.*

Unit 1

Introduction to Creative Writing – meaning and context of using creative writing, Difference between creative writing and functional writing.

Importance of reading – Reading practice for closer observation of the elements of creative writing.

Unit 2

Imaginative writing – idiomatic expression, use of imagery, figurative language, playing with words.

Reading from poetry and short stories – illustration of the use of imagery, allusion, figures of speech, allegory and fables.

Unit 3

Narrating anecdotes, blog writing, and discussion through SMS / WhatsApp.

Unit 4

Short story writing – Narration and description – setting the plot, rising action, climax, falling action, resolution.

Unit 5

Poetry writing – rhythm and rhyme, Types of poems – Narrative, Dramatic, Lyric.

REFERENCE BOOKS:

6. *Janet Burroway, Imaginative Writing: The Elements of Craft, Longman, 1st Ed. ISBN: 0321081919*
7. *Anjana Neira Dev, Anuradha Marwah Swati Pal, Creative writing : A Beginner's Manual, Delhi, Pearson Longman, 2009*
8. *Robert Scholes, Nancy R Comely, Carl H. Klaus, Michael Silverman, Elements of Literature : Essay, Fiction, Poetry, Drama Film, Delhi, OUP, 2007*
9. *Write from the Heart: Unkenling the power of your creativity, Hal Zina Bennet, California Wew World Library, 2001*

18OEL235 DESKTOP SUPPORT AND SERVICES 1 0 2 3

Objectives: *To create an awareness in Non Computer science background students to enablethem; to generate the Computer Hardware Professionals; to Train the lower order Technicians; to generate man power at different level to unable the country to face the challenge of world modern I.T. and Instrumentation.*

Unit 1

Fundamentals of computers
Data & Information, Computer Architecture, CPU & Memory Organization, History of Computer, Generation of Computer, I/O Devices, Number System, Logic Gates.

Unit 2

Internal devices - Study of PC ATATX System Pentium Core, Core 2 Cord, Core2 Duo, I3, I5, I7 Processor, Mother Board, MB Types, Expansion Slots, Processor, Memory, Hard Disk, CD-R, RW, DVD-RW. SMPS.

Unit 3

External Devices - Dot Matrix Printer, Inkjet Printer, Laser Printer, Modem, Portsand Connectors, Batteries, Power supply, Pen Drives. Scanner: Photo Scanner, Documents Scanner, Bar Cord Scanner Introduction of Expansion Card, Assembling of Personal Computer.

Unit 4

Operating System
Basics & Installation - Introduction to OS, Types of Operating systems, System files FAT and NTFS, Dos 6.22, Windows, XP, Windows Vista, Windows7 and Windows 8and RedHat Linux and Multi Boot Operating System.

Unit 5

Trouble shooting - Complete introduction & Troubleshooting, Antivirus free andpaid version, Downloading the Drivers from Internet, Installation of Drivers.

REFERENCES:

5. *PC AND CLONES Hardware, Troubleshooting and Maintenance B. Govindarajalu, Tata Mc-graw-Hill Publication*
6. *PC Troubleshooting and Repair Stephen J. Bigelow, Dream tech Press, New Delhi*

LAB Requirements

1. *Required Accessories for Hardware Course*
2. *Basic Measuring Instruments Multi-meters*
3. *Minimum two nos. Computer for Hardware Practice.*
4. *All generations Motherboard, Processor, Ram.*
5. *Expansion Card and Cables.*
6. *All Ports, SMPS and UPS.'*
7. *Hard disk, Floppy disk, Pen drive, CD ROM, DVD writer.*
8. *Printer, Monitor, Speakers.*
9. *Keyboard, Mouse, Modem.*
10. *Installation Kit (Bootable CD, Windows CD, All Software CD.)*
11. *Tool Kit.*
12. *Secure Driver with all bit.*
13. *Soldering with Solder and Paste.*
14. *De-soldering Pump.*
15. *Digital and Analog Multi-Meter.*
16. *Screw driver set*
17. *Internet connectivity.*

18OEL236 DEVELOPMENT JOURNALISM 2 0 1 3

Unit 1

Large-scale migration from rural to urban areas: causes and consequences. Statistics, unemployment, education, health, insurgency (lack of security), lack of infrastructure.

Unit 2

'Pull' and 'Push' factors: Urban centres provide better scope for earning livelihood through employment in industries, transport, construction, trade, services etc. They act as magnets by offering modern facilities and 'pull' people from the rural areas, while unemployment, hunger and starvation and lack of means of livelihood "push" people out of villages into towns and cities.

Unit 3

Migration from rural areas and their impact on agricultural production due to shortage of labour in those areas.

Unit 4

Mass migration into metropolitan cities – Delhi, Kolkatta, Mumbai and Chennai – and their impact on civic amenities in the cities – increasing slums, decline in standard of living and environmental degradation.

Unit 5

Nuclear family - A side effect of urbanization - Changes in family system brought about by urbanization.

Outcomes:

By the end of the course the students will be able to:

CO1: Understand the dynamics and dimension of migration
CO2: Become aware of the barriers, vulnerabilities and anxieties for the migrants.
CO3: Understand how migration affects agriculture
CO4: Understand migration in terms of civic engagement.
CO5: Understand effects and social impacts of urbanization on the family.

REFERENCES:

Effects of internal Migration and Net Emigration on a City – Smriti Chand 4 Major causes of Migration in India – Smriti Chand Human Migration (Cause, Kinds and Theories) - Negi Mohita
UN state of the World Population Report - 2007

18OEL237 DIGITAL PHOTOGRAPHY 1 0 2 3

Objective: *This course introduces the students to different aspects of photography and enablesthem to understand their role as a photographer.*

Unit 1

Introduction to photography, role of photographer, Types of cameras - Film camera, Digital Camera, image file types.

Unit 2

SLR - Camera functions and Types of Lenses.

Unit 3

Rules of composition, Types of shots.

Unit 4

Lighting, Natural lighting, flash, studio lights, creative lighting etc.

Unit 5

Types of photographers, Post processing, image editing.

TEXTBOOKS:

1. *The Basic Book of Photography by Tom Grimm and Michele Grimm, 4th Edition*
2. *The Manual of Photography: Photographic and Digital Imaging by Ralph E Jacobson, Sidney*
3. *F Ray, Geoffrey G Attridge, Norman R Axford, 9th Edition*

REFERENCES:

1. *The Basic Photography, 1973, Focal press*
2. *Advanced Digital Photography by Tom Ang, Mitchell Beazley*

18OEL238 EMOTIONAL INTELLIGENCE 1 0 2 3

Unit 1

Emotional Intelligence: Intelligence Quotient - IQ, Concept of EmotionalIntelligence, History and origin of Emotional Intelligence, Science of Emotional Intelligence, Scope of Emotional Intelligence

Unit 2

Components of Emotional Intelligence: Importance of emotions, Self-awareness, Self-regulation, Self-motivation, Social awareness, Social skills.

Unit 3

Models of Emotional Intelligence: The Ability-based Model, The Trait Model ofEmotional Intelligence, Mixed Models of Emotional Intelligence.

Unit 4

Emotional Intelligence at Work place: Importance of Emotional Intelligence atWork place Cost – savings of Emotional Intelligence, Emotionally Intelligent Leaders, Case Studies

Unit 5

Measuring Emotional Intelligence: Emotional Intelligence Tests, Research onEmotional Intelligence, Developing Emotional Intelligence

REFERENCES:

1. *Daniel Goleman (1996). Emotional Intelligence - Why it can Matter More than IQ. Bantam Doubleday Dell Publishing Group*
2. *Geetu Bharwaney (2008) . Increase your Emotional Intelligence - Strategies for EI Living, Jaico Publishing House*
3. *Jyotsna Codaty (2012) . Understanding Emotional Intelligence - Pustak Mahal.*

18OEL239 ESSENCE OF SPIRITUAL LITERATURE 3 0 0 3

Objectives: *To eradicate superstition to establish moral and ethical values; to check unscrupulousexploitation of nature; bring to fruition Amma's dream of the world as one village; an overview of spirituality the world over.*

Unit 1

Indian Spirituality - Bhagvath Gita: Chapter 10; Upanishad – Isavasyopanishad; Vedic Hymns.

Unit 2

Western Spirituality - The Bible.

Unit 3

Oriental Spirituality - Chinese: Confucianism - Japanese: Shinto-Buddhism.

Unit 4

Others - Jewish-Sufism – Zoroastrianism.

Unit 5

Yoga and Meditation - The Power of Meditative practices - How to Practise the power of transcendental awareness - Revising Negative trends into positive - Scientific nature of Sadhana - Spiritual Psychology - Human energy systems – Chakras.

REFERENCES:

1. Max Muller, The Upanishad, Max Muller, Vedic Hymn
2. Swami Chinmayanada - Bhagavath Gita
3. The Gospel of Jesus Christ.
4. Legge James, Confusionism
5. Kushner, Lawerence, Jewish Mystical Spirituality
6. Rahula, Walpola, What the Buddha Taught
7. Lings Martin, What is Sufism
8. Iyenga B.K.S, Light on Yoga
9. Harish Johari, Chakras: Energy Centers of Transformation

18OEL240 FILM THEORY 2 1 0 3

Objective: *The objective of this paper is to help student to have basic understanding ofcinema, study different aspects of cinema world thereby enabling him to develop the analyzing skill in visual world.*

Unit 1

Introduction - Basic stages of cinema production, Pre-production, Production, Post-production, Introduction to Lighting.

Unit 2

Indian Cinema - Early Indian cinema, History of Malayalam cinema, Key directors in Malayalam cinema, Key technicians in Malayalam cinema

Unit 3

Theoretical Perspective - Expressionism, Realism, neo-realism, new wave, Auteur theory, Narrative theory.

Unit 4

Different Genres in Cinema and its Features - westerns, musicals horror, fictions, historical, Documentary.

Unit 5

Film Screening - Citizen Kane, Nanook of the north, Children of heaven, Modern times, Psycho, Dreams, Home (Documentary), Samsara (Documentary).

TEXTBOOKS:

1. *Film Art: An Introduction - David Bordwell, Kristin Thompson*
2. *Malayala Cinemayude Katha - Vijayakrishnan*

REFERENCES:

3. *The Art and Science of Cinema - Anwar Huda*
4. *Key Concepts in Cinema Studies - Susan Hayward*
5. *Film as Art - Rudolf Arnheim*
6. *Chalachithrathinte Porul - Vijayakrishnan*
7. *Movies and Meanings - Stephen Prince*

18OEL241 FUNDAMENTALS OF NETWORK ADMINISTRATION 2 0 1 3

Objectives: *To understand the basic networking components and installations; to have anindepth knowledge on network topologies; to understand the network layers and protocols implementation.*

Unit 1

Network Components:

Introduction of Network Cable like UTP, STP, Fiber Optics, Hub, Unmanageable Switch, Manageable Switch, Router, Modem, Wi-Fi, Access Point, PCI Wireless Card, USB Wireless Device, Print Server, USB Network Sharer, Backup Device, Server Hardware etc.

Unit 2

Basic Network Introduction & Installation - Introduction About Network, Installing Network Operating System - Windows Server versions, Cable Crimping, Network Sharing and user Permission, Internet Connection, E-Mail, Google Drive, Dropbox etc.

Unit 3

Transmission Media and Topologies - Media types: STP cable, UTP cable, Coaxial cable, Fiber cable, Base band and Broadband transmission, Cables and Connectors, Physical and logical topologies, Bus, Star, Ring and Mesh topologies.

Unit 4

Network protocols - HTTP, FTP and other Different types of protocols, OSI Model, Media Access Method, DNS services, DHCP services, web services, Proxy Services etc.

Unit 5

IP addressing - Introduction to TCP/IP and Sub-netting, configuring IP address and Network, Routing protocol basics.

REFERENCES:

5. Networking Complete, BPB Publication
6. Computer Networking - Andrew S. Tanenbaum

18OEL242 GENDER STUDIES 3 0 0 3

Objective: *To sensitize students with the contemporary discourses on gender with specialemphasis on India.*

Unit 1

Women Writing in India 600 B.C. to the Present: Volume I: 600 B.C. to the Early Twentieth Century (Introduction) - Susie Tharu and K Lalitha

Unit 2 Fiction

Othappu: The Scent of the Other Side - Sara Joseph and Valsan Thampu.

Unit 3 Fiction

One Part Woman - Perumal Murugan

Unit 4 Drama

Dance like a Man - Mahesh Dattani

Unit 5 Short story

Quilt - Ismat Chugtai

18OEL243 GLIMPSES OF INDIAN ECONOMY AND POLITY 3 0 0 3

Unit 1

General Introduction, Primitive Man and his modes of exchange – barter system, Prehistoric and proto-historic polity and social organization. Early India – the Vedic society – the Varnashramadharma – socio-political structure of the various institutions based on the four purusarthas.

Unit 2

The structure of ancient Indian polity – Rajamandala and Cakravartins – Prajamandala Socio-economic elements from the two great Epics – Ramayana and Mahabharata Sarasvati - Sindhu Civilization and India’s trade links with other ancient civilizations - states and cities of the Indo-Gangetic plain

Unit 3

The rise of Magadha, emergence of new religions – Buddhism and Jainism – and the resultant socio-economic impact. The emergence of the empire – the Mauryan Economy and Kautilya's Arthasastra. Of Politics and trade – the rise of the Mercantile Community. Elements from the age of the Kushanas and the Great Guptas. India's maritime trade. Dharma at the bedrock of Indian polity – the concept of Digvijaya: dharma-vijaya, lobha-vijaya and asura-vijaya. Glimpses into the South Indian Economies: political economies of the peninsula – Chalukyas, Rashtrakutas and Cholas. Medieval India – agrarian economy, non-agricultural production and urban economy, currency system.

Unit 4

The Indian Market and Economy before the arrival of the European traders. Colonisation – British attitude towards Indian trade, commerce and economy and the resultant ruining ofIndian economy and business – man-made famines – the signs of renaissance – the evolution of themodern banking system. Glimpses into British administration of India and administrative models. The National Movement and nationalist undertakings in business and industry. Modern India: the growth of large-scale industry – Irrigation and Railways – Money and Credit – Foreign Trade. Towards Partition – birth of two new nations – division of property.

Unit 5

The writing of the Indian Constitution – India becomes a democratic republic – a new polity is in place. India since Independence – the saga of socio-political movements. Indian Economy since Independence – the Fiscal System – the Five Year Plans – Liberalisation – the GATT and after Globalisation and Indian Economy. Impact of science and (new/ emerging) technology on Indian economy. Histories of select Indian business houses and business entrepreneurship.

REFERENCES:

1. *The Cultural Heritage of India. Kolkata: Ramakrishna Mission Institute of Culture.*
2. *Kautilya. Arthasastra.*
3. *Altekar, A.S. State and Government in Ancient India. New Delhi: Motilal Banarsidass.*
4. *Sircar, D.C. Studies in the Political and Administrative Systems in Ancient and Medieval Times. New Delhi: Motilal Banarsidass.*
5. *Dutt, R.C. The Economic History of India. London, 1902.*
6. *Dharampal. Collected Works (Volumes IV & V).*

18OEL244 GRAPHICS AND WEB DESIGNING TOOLS 1 0 2 3

Objectives:

To understand the basics of computer graphics; to understand the aspects ofimages and sound; to gain knowledge on designing aspects and to design web pages; to implement the web design using various tools and to learn about hosting websites.

Unit 1

Introduction to Computer Graphics Definition, Application, Pixel, Frame Buer, Raster and Random Scan display.

Unit 2

Images – Bitmaps and Grey Scale Images, Image Types – Color Graphics – Color Schemes – Palette Compositions.

Unit 3

Sound – Analog and Digital Sound – Quantization – Sampling – Sampling Rate – Sound Types.

Unit 4

Introduction to Adobe Photoshop – Image editing tools, Tracing, Static web page template designs creation – slicing – Various aspects of a static webpage.

Unit 5

Introduction to Dream viewer - tables and tools – Dynamic web page template design creation - Animations – 2D, 21/2 D and 3D perceptions with examples.

REFERENCES:

1. *Donald Hearn and M. Pauline Baker, Computer Graphics, PHI, New Delhi.*
2. *Tay Vaughan, Multimedia: Making it Work, Ninth Edition. Tata McGraw-Hill, 2014.*
3. *Edward Angel, Interactive Computer Graphics: A top-down approach with OpenGL, Fifth Edition. Addison Wesley, 2008.*
4. *Alan Watt, 3D Computer Graphics, Third Edition, Addison-Wesley, 2000.*
5. *Foley, van Dam, Feiner, Hughes. Computer Graphics Principles and Practice, Second Edition in C. Addison Wesley, 1996.*

18OEL245 GREEN MARKETING 3 0 0 3

Objectives: *This course shall examine the core principles required to create competitive advantagein the marketplace by implementing innovative green marketing strategies.*

Unit 1 Introduction to Green Marketing

Meaning - Definition - Evolution of green marketing - Assumptions of green marketing - Reasons for adopting green marketing and benefits of green marketing.

Unit 2 Green Marketing Mix (GMM) and Sustainability

Meaning - concept of GMM – Strategies - Challenges. The concept of Sustainability and Green Marketing/ Consumers and pioneering efforts in India - Guiding principles of Sustainability and Green Marketing/ Consumers - Common assumptions and myths of green marketing.

Unit 3 Methods of implementation of Sustainability and Green Marketing

Method of bringing sustainability in green marketing in India and rest of the world.

Case study analysis.

Unit 4 Role of functional groups in Green Marketing

Functions within the market, Role of Wholesalers and Retailers, Role of banking institutions, funders and donors. Difference between general marketing and green marketing.

Unit 5 Governance and Legal Institutions

Role of governance in sustaining green marketing, Implications of governance.

TEXTBOOKS AND REFERENCES:

4. Green Marketing Strategies - Amitabha Ghose
5. Green Marketing in Indian Retail Sector - Tanushree Purohit and A.K Das Mohapatra
6. Green Marketing Management - Robert Dahlstrom
7. Green Marketing, Theory, Practise and Strategies - Robert Dahlstrom
8. Green Marketing Strategies and Consumer Behavior - Monica Loss

18OEL246 HEALTHCARE AND TECHNOLOGY 3 0 0 3

Objective:
To provide students with a detailed understanding about technological applications inthe healthcare sector with an objective to promote better management of information regarding identification of biomedical and hospital technology planning, procurement and operation requirements.

Unit 1

Health information technology, Types of technology: Electronic Health Record, Personal health records (PHRs) Computerized provider order entry (CPOE), Application of HIT – case studies, Visualization of Medical Data.

Unit 2

Healthcare Improvement Using Analytics, Healthcare Transformation - Challenges and Opportunities, Fundamentals of Healthcare Analytics, Components of Healthcare Analytics, Advanced Analytics in Healthcare.

Unit 3

Foundations of Information Technology, Technological Innovations, Opportunities, and Challenges, Information Technology Assurance and Security.

Unit 4

Introduction to medical informatics, necessity of standards for e-health, security and cyber laws, ethical and medico legal issues in patient information exchange; Introduction to medical databases, electronic medical records, Decision Support Systems, Artificial Intelligence.

Unit 5

Integrated Health information systems, cost effectiveness; Networks, PSTN, ISDN, VSAT, TI, information compression, storage and transmission standards, wireless telemetry, e-health and telemedicine and applications.

TEXTBOOKS/ REFERENCES:

4. *Shortlife E. H. and Cimino J J, Biomedical Informatics: Computer Applications in Health Care and Biomedicine, Third Edition, Springer-Verlag, 2006.*
5. *Norris A C, Essentials of Telemedicine and Telecare, John Wiley & Sons, 2002.*
6. *Diffusion and Value of Healthcare Information Technology, Bower, Anthony G. RAND Corporation 2005*
7. *Healthcare Analytics for Quality and Performance Improvement. Strome, T.L., John Wiley & Sons, 2013.*

18OEL247 HISTORY OF ENGLISH LITERATURE 3 0 0 3

Objective:
To Introduce the evolution of English as a language and culture; to acclimatize thestudents with the history of English Literature; to make students aware of different movements and their effects on the society and literature.

Unit 1

The Social and Literary context: Medieval and Renaissance (Evolution of English Language and Literature).

Unit 2

Restoration to the Romantic Age (Social Background and its influences).

Unit 3

The Victorian Society and Literature (features, effects on the globe).

Unit 4

Modernism and after (Social transformation, Science, World Wars).

Unit 5

Assignment, Seminar Discussion & Term Test

REFERENCES:

2. *William J Long - English Literature, FQ Books Publication*
3. *Pramod K Nayar - A Short History of English Literature, Cambridge University Press*
4. *Ifor Evans - A Short History of English Literature, Penguin Books*
5. *George Sampson - The Concise Cambridge History of English Literature, Cambridge University Press*

18OEL248 INDIAN WRITING IN ENGLISH 3 0 0 3

Objectives:
To trace the rise, growth and development of Indian poetry, fiction and drama in English; to provide an overview of the various phases of the evolution of Indian writing in English, to introduce the students to the rich and varied literature available in regional languages; to expose them to the Indian mind both ancient and modern; to inculcate a sense of appreciation for the literary genius; to understand the fabric of Indian society and the cultural unity of its people.

Unit 1
Introduction to Indian writing in English - development and growth of poetry, fiction and drama - trends of Indian writing in English.

Unit 2 Poetry

Nissim Ezekiel: Goodbye party for Miss Pushpa T.S;

Kamala Das: An Introduction

A.K.Ramanujan: A River

Unit 3 Short Stories

Rabindranath Tagore: My Boyhood Days

Khushwant Singh: The Portrait of a Lady

Unit 4 Fiction

R.K.Narayan: The Vendor of Sweets

Unit 5 Drama

Girish Karnad: Nagamandala – Play with a Cobra

REFERENCES:

3. *K.R.Sreenivasa Iyengar - Indian Writing in English, Sterling: Delhi.*
4. *Poetry down the Ages: Orient Blackswan.*
5. *Best of Rabindranath Tagore: Gitanjali, My boyhood days, The Post Office, The Gardner Mashi and Other Stories.*
6. *Khushwant Singh - The Portrait of a Lady: Collected Stories.*

18OEL249 INDUSTRIAL RELATIONS AND LABOUR WELFARE 3 0 0 3

Objectives:
On successful completion of this course, the students should have understood theLegislations relating to Industrial Disputes and Labour welfare.

Unit 1

Industrial relations - industrial disputes - causes - handling and settling disputes - employee grievances - steps in grievance handling - causes for poor industrial relations - remedies.

Unit 2

Collective Bargaining: - Concept - Principles and forms of collective bargaining - Procedure - conditions for effective collective bargaining - worker's Participation in management.

Unit 3

Factories Act 1948 - The Workman's Compensation Act, 1923.

Unit 4

The Industrial Disputes Act 1947 - The Trade Union Act, 1926.

Unit 5

The Payment of Wages Act, 1936 - The Employee's State Insurance Act, 1948

REFERENCE BOOKS:

1. *P.C.Tripathi - Personnel Management & Industrial Relations, Sultan Chand*
2. *C.B.Mamoria - Dynamics of Personnel Management, Himalaya Publishing*
3. *N.G.Nair & Latha Nair - Human Resource Management, Sultan Chand & Sons.*
4. *P. Subbarao - Essentials of Human Resource Management and Industrial Relations, Himalaya Publishing*

18OEL250 INTRODUCTION TO ANCIENT INDIAN YOGIC AND VEDIC WISDOM 3 0 0 3

Objectives:
To understand the importance of adapting a healthy lifestyle; to realize the significanceof ancient Indian wisdom; to help in understanding the goal of human life

Unit 1

Ayurvedic, Yogic and Vedic Lifestyle: Introduction to Ayurveda, Yoga and Veda, life and lifestyle, daily routine according to Ayurveda, Yoga and Veda like ablution and food system.

Unit 2

Over view of Indian Philosophy: Introduction to Indian Philosophies, difference between Indian Philosophies and western Philosophies, Basic idea on various Indian Philosophies.

Unit 3

Human mind: States of mind, virtues & vice, causes for distraction, ways to gain one pointed mind.

Unit 4

Eight Limbs of Yoga: Introduction to Yoga Philosophy, benefits of Yoga, goal of yoga, explanation on Eight Limbs of Yoga.

Unit 5

Bhagavadgita: Glory of the Bhagavadgita, Human life according to the Bhagavadgita, solution for sufferings, self management.

REFERENCE BOOKS:

1. Bhagavad Gita – Commentary by Swami swarupananda, Advaita Ashrama
2. Paatanjala Yogasutra – Commentary by Swami Gambhirananda, Ramakrishna mission
3. Yogopanishath
4. Ayurvijnana Ratnakaraha – Yogendranath, Rashtriya Samkrita Samsthanam

18OEL251 INTRODUCTION TO COMPUTER HARDWARE 2 0 1 3

Objective:
The course aims to give a general understanding of the basic parts of computer andhow a computer works.

Unit 1

Hardware Basics – Generation of computers, Types of computers, Parts of a computer, and Functions of System Modules, Front and rear panel view of system, Safety information while disassembling PC – Internal structure of PC.

Unit 2

Motherboards: Components and Architecture, features, components, form factor, processor support, BIOS, IDE and SATA Connectors, External interfaces and connectors, troubleshooting and maintenance of Mother Boards.

Unit 3

Popular CPU Chips and their Characteristics, Processor Architecture - Processor specifications - installing and uninstalling processor - CPU Overheating issues – common problems and solutions.

Unit 4

Memory and Storage: Memory features – Types of memory – working - Installing and uninstalling memory modules – maintenance and troubleshooting – common problems and solutions.

Storage devices – Hard disk details – Working and parts of hard disks – Installing hard disks – maintenance and troubleshooting.

Unit 5

Power supply – SMPS – features – types – installing SMPS – Specification for SMPS.

Maintenance and Troubleshooting: Preventive Maintenance and Safety Procedures - Managing Replaceable Components.

TEXTBOOKS/REFERENCE BOOKS

1. *James K L,"Computer Hardware: Installation, Interfacing Troubleshooting and maintenance", PHI Learning Press (Eastern Economy Edition, 2013)*
2. *Manahar Lotia, Pradeep Nair, Payal Lotia, "Computer Hardware Course", BPB Publications*

18OEL252 INTRODUCTION TO EVENT MANAGEMENT 3 0 0 3

Unit 1

Why Event Management, Requirement of Event Manager, Analyzing the events, Scope of the Event, Decision-makers, Technical Staff, Developing Record-Keeping Systems, Establishing Policies & Procedures.

Unit 2

Preparing a Planning Schedule, Organizing Tasks, Assigning Responsibility, and Communicating, Using the Schedule Properly, The Budget, Overall Planning tips, Checklists, Expert Resources, Computer Software Required.

Unit 3

Who are the people on the Event, Locating People, Clarifying Roles, Developing content Guidelines, Participant Tips, Reference Checks, Requirement Forms, Introduction, Fees & Honorariums, Expense Reimbursement, Travel Arrangements, Worksheets.

Unit 4

Types of Events, Roles & Responsibilities of Event Management in Different Events, Scope of the Work, Approach towards Events.

Unit 5

Introduction to PR – Concept, Nature, Importance, Steps, Limitations, Objectives Media – Types of Media, Media relations, Media Management PR strategy and planning – identifying right PR strategy, Brain Storming sessions, Event organization, writing for PR.

REFERENCES:

1. *Devesh Kishore, Ganga Sagar Singh - Event Management: A Blooming Industry and an Eventful Career, Har-anand Publications Pvt. Ltd.*
2. *Swarup K. Goyal - Event Management, Adhyayan Publisher - 2009*

18OEL253 INTRODUCTION TO MEDIA 3 0 0 3

Unit 1

Introduction – Media Business - Media Classification - Mass Media – Niche Media - Addressable Media and Interactive Media - Media-Intrusiveness.

Unit 2

Print – Media – Newspaper - Principles of Newspaper Business - Classified Ads, Display Ad's Display Ad's – Coverage and Audience Measurement - Sales and Pricing – magazines. Directories.

Unit 3

Broadcast Media – Radio – Television - out of Home Media - out door Advertising - Cinema and Video Non-Traditional Media.

Unit 4

An overview of Media planning - problems of media planning – Developing media plan – Market Analysis and Target - Interactive and Digital Media.

Unit 5

Establishing media objectives - Developing and Implementing – Evaluation and Follow up - Computers in Media Planning - Characteristics of Media.

REFERENCE BOOKS:

1. *Tom Duncan - "Principles of Advertising and IMC", Tata McGraw Hill*
2. *Kruti shah and Alan D'souza - "Advertising and Promotion" – An IMC Perspective, Tata McGraw Hill.*
3. *Mehra – "Newspaper Management"*

18OEL254 INTRODUCTION TO RIGHT TO INFORMATION ACT 3 0 0 3

Unit 1

Introduction to RTI Act

The evolution of the Right to Information in India - the important terms and concepts used in the Act - the salient features of the Act.

Public Authorities and their Obligations under the Act

1. What is a Public Authority?
2. Who are the Public Authorities covered under the Act?
3. Which Public Authorities are exempted from the ambit of the Act?
4. Obligations of Public Authorities.

Unit 2

Role of Public Information Officers: PIOs and APIOs - Accepting Information Request, Processing and Disposing

The requirement for designation of Information Officers - PIOs / APIOs - in public authorities

- The specific Duties & Responsibilities of Information Officers.
- The liabilities of a PIO for non-compliance with the provisions of the Act.
- How to accept information requests and assist citizens in making information requests?
- What is the process for disposal of requests?
- The time limits for disposal of information requests.
- The fees and costs to be charged for providing information.
- The grounds on which requests can be rejected and the procedure for such rejection.

Unit 3

Exemptions from Disclosure of Information, Partial Disclosure and "Third Party" Information

1. Specific provisions of the Act which exempt certain kinds of information – the classification of such exempted information.
2. Application of public interest test with respect to exempted information.

3. *Grounds that* allow for partial disclosure of information.

The concept of 'Third Party' and the issues and considerations revolving around its involvement.

Unit 4

The roles and responsibilities of Appellate Officers within Public Authorities.

1. The process involved in making first appeals to designated Appellate Officers.
2. Timelines for making a first appeal and disposal of the appeal
3. First Appeals and Appellate Officers - Important Provisions

Unit 5

Information Commission: Powers and Functions

- The Role and Responsibilities of the Information Commissions.
- The relevant provisions in the RTI Act dealing with Complaints to the Information Commission and the specifications thereof.
- The "Second Appeal" process and the Commissions' mandate for the same.
- The power of Information Commissions with regard to enforcing compliance of public authorities with the provisions of the RTI Act, imposing penalty/ recommending disciplinary action against erring PIOs etc.

REFERENCES:

1. S P Sathe - Right To Information, Lexisnexis India Publication
2. Sarbjit Sharma - Right To Information, Authors Press Publication

18OEL255 INTRODUCTION TO TRANSLATION 3 0 0 3

Objectives:

Introduce students to translation studies as separate discipline of knowledge; tointroduce translations in diverse fields; to impart training in translation; increase students' awareness related to social functions of translation; develop students' contrastive knowledge and their critical thinking skills

Unit 1

What is Translation - History of translation - The rise and development of translation - Linguistic and Philological definition of translation.

Unit 2

Translation and Communication - Information and message; Communication channel - The sender and the receiver of the message Forms and types of translation.

Unit 3

Translating for the Media: print media – electronic media - Translating various News reports – Advertisements – editing – interviews – writing Screen Plays and Scripts for radio and T.V. – spoken media - symposia, conference, platform speech etc.

Unit 4

Translating for business: Translating Business Correspondence – Translating literature on consumer products – Technical writing.

Unit 5

Introducing various types of translation - Machine Translation - Computer aided translation etc. – Revising and rewriting – Proof reading – editing – submitting manuscript for publication – summary.

REFERENCE BOOKS AND SOURCES:

1. Bassnett, Susan - Translation Studies, London and New York, 1980 (revised edition 1991),
2. Routledge Bell, Roger T. - Translation and Translating, Theory and Practice, Longman, 1991
3. Callow, Kathleen - Man and Message: A Guide to Meaning-Based Text Analysis, 1998,
4. Cumulative Index of United Nations Legal Materials Produced and Applied in Kosovo 1999-2004,
5. Central European and Euroasian Law Institute, USAID Duff, Alan, Translation, OUP, 1997
6. Gërmizaj, Shykrane - Translation Theory in the Classroom, Prishtina, 2005

Websites: *(newspaper Selection of websites)*

http://www.fortunecity.com/business/reception/19 http://accurapid.com/journal/29accom.htm http://

www.ethnologue.com/show_products http://cslu.cse.ogi.edu/HL.Tsurvey/chnode4.html http:// fiat.gslis.utexas.edu/~palmquis/courses/project98/translation/mtlinks.htm http:// www.fortunecity.com/business/reception/19 http://language.home.sprynet.com/lingdex/pwood1.ht

18OEL25 LINGUISTIC ABILITIES 3 0 0 3

Objectives: *To encourage students to develop lifelong skills, including: the ability to communicateclearly, accurately and effectively; the use of a wide range of vocabulary and correct grammar, spelling and punctuation; a personal style and an awareness of the audience being addressed.*

Unit 1

Listening – Importance of listening - Types of listening - Basic skills of listening - Barriers of listening – Activities - listening to radio, TV or Internet - Transcript.

Unit 2

Speaking - body language – Pronunciation - Introducing yourself – storytelling - speak on any topic - social etiquette.

Unit 3

Reading - Different types of reading – comprehensive test - Vocabulary building.

Unit 4

Writing – structure – letter – circular – memo - Note making - Paragraph Writing précis - Writing – essay.

Unit 5

Practical Module - Creative writing - Play reading - Role play - Dialogue.

REFERENCES:

1. *O' Brien Terry - Modern Writing Skills, Rupa Publciation*
2. *O' Brien Terry - Effective Speaking Skills, Rupa Publication*
3. *Olson Judith F. Writing Skills - Success in 20 Minutes a Day, Goodwill Publishing House*
4. *Meyers Judith N. - Vocabulary and Spelling, Goodwill Publishing House*

18OEL257 LITERARY CRITICISM AND THEORY 3 0 0 3

Objectives:

To introduce basic theories of literary and cultural criticism, with emphasis on interdisciplinary. Target students: Students with no background in literary studies.

Unit 1

Feminism: Indian waves - Chandra Talpade Mohanty. 'Under Western Eyes: Feminist Scholarship and Colonial Discourses'.

Unit 2

Cultural studies: Bacon's 'Of Travel' - Indian context - Travel Culture ofKerala - Introducing seminal texts - forms of travel narratives - Road movies.

Unit 3

Post colonialism: Edward Said - Introduction of 'Orientalism'.

Unit 4

Comparative Indian Literature: Methodology - Literature and other disciplines - G. Arunima. 'Who is a Malayali Anyway? Language, Community and Identity in Precolonial Kerala' - A.K. Ramanujan. 'Three Hundred Ramayanas: Five Examples and Three Thoughts on Translation'.

Unit 5

Psychoanalysis: Freud - Critical tool in literary analysis - Norman N Holland.

'The Mind and the Book: A Long Look at Psychoanalytic Literary Criticism'.

REFERENCE BOOKS:

1. *Trilling, Lionel - "Freud and Literature". The Liberal Imagination: Essays on Literature and Society. London: Martin Secker and Warburg,*
2. *Richman, Paula. Ed. - Many Ramayanas: The Diversity of a Narrative Tradition in South Asia. University of California Press*
3. *Satish Saberwal, Mushirul Hasan - Assertive Religious Identities: India and Europe.*
4. *Bassnett, Susan - Comparative Literature: A Critical Introduction. Oxford: Blackwell, 1993.*

18OEL258 MACRO ECONOMICS 3 0 0 3

Unit 1

Introduction to Macroeconomics and National Income
Macro Economics – Goals – Government Policies – Components – Definition of National Income – Concepts – Methods of Measuring National Income – Uses – GDP and Welfare – Investment Theory.

Unit 2

Government Budget and the Economy
Government Budget – Meaning, Objectives and Components – Classification of receipts – Revenue and Capital Receipts – Classification of Expenditure - Revenue and Capital Expenditure – Measures of Government deficits – revenue, fiscal and primary deficit meaning.

Unit 3

Money and Banking
Money – Keynesian Approach – Money Market Equilibrium – Supply of Money – Money creation by the Commercial Banking system – Central Bank and its functions – Controller of Credit through CRR – SLR – Repo and Reserve Repo.

Unit 4

Macro Economic Problem
Introduction – Determinants of Consumption, Saving and Investment - Unemployment

– Types - Definition and Characteristics of Trade Cycles - Different phases of trade cycles - Definition and types of Inflation and Deflation - Causes and consequences of Inflation.

Unit 5

Public Finance
Meaning - Scope of Public Finance - Role and Types of Direct and Indirect Taxes in India - Role of Monetary and Fiscal Policies in maintaining real economic growth with stability – International Trade.

REFERENCE BOOKS:

1. *Principles of Economics – Deviga Vengedasalam and Karunagaran Madhavan, Third Edition – Oxford Publication Press.*
2. *Economics - Samuelson, Paul Anthony and William D. Nordhaus, 1998, Ed. 6, Tata McGraw Hill Publishing Company Ltd, New Delhi.*

18OEL259 MANAGING FAILURE 3 0 0 3

Objectives:

To prepare the individual/ student to face challenges of life; to impart insights forunderstanding the self and adjusting with work scenario in organizations so as to become a responsible global citizen.

Unit 1

Understanding the self - self awareness - Individual psychological processes - sculpting a unique socially desirable personality - spiritual/ ethical orientation.

Unit 2

SWOT analysis at the individual level - Developing individual competencies - surviving in a competitive environment - environment and sustainable development.

Unit 3

Emotional Intelligence - life skills - inter-personal relations - Social adjustments - Soft skills.

Unit 4

Managing at work situations - Profile of today's organization - Strategic context - environment challenges - Individual challenges and responsibilities.

Unit 5

Managing failures: Envisioning the future - managing change - unleashing creative and intuitive skills to meet failures - Remodeling individuals and organizations - Indian ethos for managing self and organizations ethically.

BOOKS FOR REFERENCE:

1) Soft Skills and Professional Communication - Francis, Mcgraw Hill

2) Personality Development and Soft skills - Barun Mitra, Oxford University Press

3) Social and Personality development - David R. Shaffer, Cengage learning.

4) Ethics in Management and Indian Ethos - Ghosh BB, Vikas publishing.

18OEL260 MEDIA MANAGEMENT 3 0 0 3

Objective:

The paper is aimed at giving an understanding of the media industry with the waythe organization functions. This course is an introductory course aimed at students of varied domains.

Unit 1

Introduction

Introduction to principles and practice of management - Business Models and Function - Mass Media Industry Structure Media Markets - Ownership - Monopolies, Oligopolies, Conglomerates, Mergers, and Acquisitions - Media Sales Promotion and Marketing Mix.

Unit 2

Types of Media Ownership – Features Advantages & Disadvantages

Sole proprietorship – Partnership - private limited companies - public limited companies - trusts, co-operatives - religious institutions (societies) - Franchisees (Chains).

Unit 3

Ownership Patterns of Mass-Media in India

Organizational structure of newspaper and magazine - Organizational structure of Radio - Organizational structure of Television.

Unit 4

Planning & Production

Planning and execution of programme production - production terms - control practices and procedures.

Unit 5

History & Law

Historical perspective of mass media laws in India -

Basic Legal concepts Constitutional provisions for Freedom of Speech and Expressions - Article 19(1) (a) Reasonable restrictions - Article 19(2) - Freedom of the press in India Law of Defamation, Obscenity, Cinematography Act - Official Secrets Act 1923 - Copyright Act - • Contempt of Court Act - Legislative Privileges and Contempt of Legislature - Working Journalist Act.

REFERENCE BOOKS:

1. Aggarwal S.K. - Press at the crossroads in India, UDH Pub House

2. William and Rucker - Newspaper Organization and Management, a State Pr. Publication

3. Frank Thayer - Newspaper Management - Appleton-Century Company; 1St Edition edition (1926)

18OEL261 MICRO ECONOMICS 3 0 0 3

Unit 1

Introduction to Microeconomics

Definition of economics – Scope – Scarce and End resource – Welfare Definition - Differences between Micro and Macro economics – Basic Economic Concepts and Problems – Economic Systems.

Unit 2

Consumer's Equilibrium Demand and Supply

Consumer Equilibrium – Meaning of Utility – Law of Equi-Marginal Utility – Demand – Law of Diminishing Marginal Utility - Law of Demand – Determinants – Types of Demands – Supply – Law of Supply – Elasticity of Demand and Supply.

Unit 3

Theory of Production

Production – Production function – Law of Production – Return to Scale – Economics and Diseconomies of Scale - Classifications – Short-run production function – Long-run production function – Isoquant Curve.

Unit 4

Cost Function

Cost and Revenue – Short run costs – Total cost – Total Fixed Cost – Variable Cost – Average Fixed – Average Variable cost and Marginal Cost – Meaning and their relationship – Average and Marginal Revenue.

Unit 5

Market Structure and Price Determination

Market – Classification of Markets – Nature – Perfect Competition - Market Structure (Monopoly, Monopolistic, Oligopoly, Duopoly) – Price Determination under Monopolistic Market – Price Discrimination.

REFERENCE BOOKS:

1. *Principles of Economics – Deviga Vengedasalam and Karunagaran Madhavan, Third Edition – Oxford Publication Press.*
2. *Economics - Samuelson, Paul Anthony and William D. Nordhaus, 1998, Ed. 6, Tata McGraw Hill Publishing Company Ltd, New Delhi.*

18OEL262 MICRO FINANCE, SMALL GROUP MANAGEMENT AND COOPERATIVES **3 0 0 3**

Objective: Self Help Group and other micro-level innovative credit systems contributed significantlyin Empowering underprivileged in India and abroad in recent times. Paper has two purposes—

(a) to acquaint students with the various institutional arrangements as well as recent contribution of various innovative credit systems at the micro-level for financing rural development sector;

(b) management of small groups involved in micro-finance for social and economic empowerment of their group members in particular and the society in general.

Unit 1

Financial institutions for rural development - Basic understanding of rural and development credit. Institutional structure for rural financing in India: policy and schemes of NABARD, recent financing scheme of the Government.

Unit 2

Development of cooperative banks in India with special reference to PACS, CCBs, LDBs. Rural financing through commercial banks - Policies and objectives before and after nationalization of banks, Branch expansion policy and programmes.

Unit 3

Emergence of RRBs policy, objectives, functions, progress and achievements. Micro finance at small group level: concept, emergence, objectives and thrust areas. Case studies of recent success stories.

Unit 4

Management of small groups, cluster and federation from credit and trade perspectives. Role of facilitating agencies. Linkages between small group and Banks.

Unit 5

Convergence of with development programmes and implementing departments of government. Withdrawal strategy for facilitating organizations.

SUGGESTED READINGS:

1. *V S Somnath – Microfinance, Excel Books*
2. *Panda - Understanding Microfinance, Wiley India*
3. *Craig Churchill & Cheryl Frankiewicz - Making Microfinance Work, International Labour Office Publication*

18OEL263 NEGOTIATION AND COUNSELLING 3 0 0 3

Objectives:

The objective of this course is to provide knowledge of concepts and issues ofnegotiation and counseling such that to equip the students with valuable skills, techniques and strategies in counseling.

Unit 1

Negotiation: Nature, Characteristics, Strategy and Tactics of Distributive Bargaining, Strategy and Tactics of Integrative Negotiation; Strategy and Planning for Negotiation.

Unit 2

Negotiation Sub processes: Perception, Cognition and Emotion Communication: What is communicated during negotiation and how people communicate in Negotiation.

Unit 3

Best Practices in Negotiation – Fundamental Structure of negotiation and BATNA. Case I - Role Negotiation at Bokaro Steel Plant (Understanding Organizational Behaviour. By Udai Pareek, Oxford, Second Edition Page 410-415).

Unit 4

International and Cross Cultural Negotiation: Context and Concept, Influence of Culture on Negotiation: Case II - The Dabhol Debacle (Negotiation Made Simple, SL Rao, Excel Books pp.30-35 and pp. 196-197).

Unit 5

Emergence & Growth of Counselling: Factors contributing to the emergence,
Approaches to Counselling: Behaviouristic, Humanistic Approaches and Rogers Self Theory Counselling Process: Steps in Counselling Process. Modern Trends in Counselling – Trends, Role of a Counsellor and Model of Counselling.

REFERENCE TEXTS:

1. Lewicki, Saunders & Barry – Negotiation, Tata McGraw Hill

2. B.D.Singh - Negotiation Made Simple, Excel Books, 1st Ed.
3. Rao S N - Counseling and Guidance, Tata Mc Graw Hill, 2nd Ed.
4. Singh Kavita - Counselling Skills for Manager, PHI, 1st Ed.
5. Welfel, Patternson - The Counselling Process, A Multi theoretical Integrative Approach, Thomson India, 6th Ed.
6. Pareek Udai - Understanding Organisational Behaviour, Oxford University Press

18OEL264 NEW LITERATURES 3 0 0 3

Objectives: *To introduce the emergent body of literature; to examine the approach of differentwriters towards the local and global social issues; to consider how literature undertakes the challenge of rethinking the world around us.*

Unit 1

Introduction to new literatures, experiments in style, narrative techniques, issues of identity, selfhood and location.

Unit 2

Fiction

Shyam Selvadurai – Cinnamon Gardens
Amitav Ghosh - The Hungry Tide

Unit 3 Poetry

Kamala Das – An Introduction
Derek Walcott – A Far Cry From Africa
Kishwar Naheed – We Sinful Women

Unit 4 Drama

Wole Soyinko – The Road

Unit 5

Assignments, Discussions, Term Test

REFERENCES:

1. G. H. Mair - English Literature, Discovery Publishing House
2. Kamaladas - The Old Playhouse and other Poem, Orient Blackswan
3. Derek Walcott - Selected Poems, Farrar, Straus and Giroux Publication
4. Judith Wright - Woman to Man, Angus and Robertson Publication

18OEL265 NON-PROFIT ORGANIZATION 3 0 0 3

Objectives:

To introduce the students to NGO Sector; to provide an overview of NGOs; tointroduce the Basic Concepts; to provide basic managerial skills for NGO personnel.

Unit 1

NGOs – An Introduction, Concepts and Functions, evolution in India, Types of non-profits, Issues in NGO Management, challenges of NGO Management.

Unit 2

Legal procedures for establishment of NGOs – Trust and Society and their differences. Formation of Trust and Society. Registration procedure for NGO.
Corporate Social Responsibility and Social Marketing.

Unit 3

Development issues, Development indicators, Poverty (Exploitation, Vulnerability and Powerlessness) and Development. HIV/AIDS, Child labor, Education and Tribal welfare. (This is to increase the level of awareness among students on issues).

Unit 4

Strategy and planning for NGOs – Elements of Strategy, SWOT analysis, Process of Management – Planning, Organization, Delegation, Co-ordination, Core-Competency and Capacity Building

Unit 5

NGOs and changing trends of development. State, market and third sector, Self-Help Group (SHG) and Empowerment of Women, Role of NGOs in Civil Society.

REFERENCE BOOKS:

1. *Management of Non -Governmental Organizations towards a Developed Civil Society, JM Ovasdi, ISBN 140392868 1 Macmillan India Lid,2006*
2. *Managing the Nonprofit organizations: Principles and Practices ,Peter F Drucker , ISBN –B : 9780060850049 Harper Collins publishers May 2006*
3. *Nonprofit Management: Principles and Practices, Michael, J Worth, The George Washington University, Sage publications, September 2008*

18OEL266 PERSONAL EFFECTIVENESS 3 0 0 3

Unit 1

Personal growth - Meaning and concepts, Self-awareness and self-esteem, Life Roles, Social roles and Organizational roles. Nature and scope of personal growth. Feeling, thinking and behaviours, Personality theories, Carl Jung's theory of personality types and Myers Briggs Type Indicator test (MBTI), Trait theories - Guilford Peogut, Emotional intelligence.

Unit 2

Pedagogy and Androgogy. Adult Learning Process; learning styles and its relatedness to personality development.

Unit 3

Attitudes, beliefs, Values and their impact on behaviour. Personal change - meaning, nature and requisites. Social adjustments and habit formation. Habits of personal effectiveness. Seven habits of highly effective people.

Unit 4

Basic functions of mind - Creativity and innovation. Blocks to creativity. Creativity processes and tools - convergent and divergent thinking. Neuro Linguistic Programming - Interpersonal relations and personal growth. Interpersonal needs, motivation and behavior - FIRO-B and Johari Window. Defense Mechanism in groups.

Unit 5

Transactional Analysis - Ego states, types of transactions and time structuring. Life position, scripts and game Experience learning methodologies - T-group, sensitivity training, encounter groups and human process labs (students may go through three days personal growth lab for experiential learning)

REFERENCE BOOKS:

1. *John. W. Newstrom and Keith Davis - Organizational Behaviour: Human Behavior at work, Tata McGraw Hill*
2. *Robert N. Lussier - Human Relations in organizations, Mc-Graw Hill Education*
3. *Whetten & Cameron - Development Management Skills, 7th Ed. Pearson, PHI.*
4. *Calvin S Hall Et Al - Theories of Personality, Wiley Publication*
5. *Stephen R Covey, Simon & Schuster - Seven Habits of Highly Effective People, Simon & Schuster*
6. *Training in Interpersonal Skills – tips for managing People at work, Stephen Robbins, Et al, Pearson, PHI.*

18OEL267 PERSPECTIVES IN ASTROPHYSICS AND COSMOLOGY 3 0 0 3

Unit 1

Historical Introduction - Copernicus, Galileo - Solar system-Planets, Comets, meteorites, asteroids, satellites, Constellations and Astrology. Olvers paradox.

Unit 2

Constellations, Distance scales and measurements - Parallax methods - Moving cluster, Statistical and Spectroscopic and dynamic parallax methods.

Unit 3

Introduction to Celestial Mechanics – Kepler's laws. Black body temperature of stars Hertz-Sprung Russel diagram - Stellar evolution - white dwarfs, red giants, neutron stars, pulsars, black holes.

Unit 4

Special Relativity – Minkowski space, Introduction to General Relativity - space-time curvature.

Unit 5

Cosmology - Red shift – Galaxies - CMBR Big bang, Various cosmic models - Horizon and Flatness problemDark matter and Energy. Anthropic Principle. Relation to Biology.

REFERENCES:

1. *Arnab Rai Choudhuri, Astrophysics for Physicists, Cambridge University Press, 2010.*
2. *An Introduction to Astrophysics, BAIDYANATH BASU, TANUKA CHATTOPADHYAY, 2nd Edition, PHI Learning Pvt. Ltd.*
3. *The New Physics and Cosmology Zanjoc, Oxford 2004.*
4. *An Introduction to Modern Astrophysics, 2nd Ed. by Caroll Ostie, Pearson, Addison Wesley*

18OEL268 PRINCIPLES OF MARKETING 3 0 0 3

Objective:

To provide exposure to the students about principles of marketing and the knowledgeof E-business.

Unit 1

Marketing, Introduction, Definition of market and marketing, Objects of marketing, features, Classification of markets, marketing and selling, Importance of marketing, modern marketing, features, marketing management, characteristics of marketing management, marketing management and sales management, Green Marketing, Market Segmentation and Target Marketing, Marketing mix, definition, elements of marketing mix, Marketing process, marketing functions, functions of exchange, functions of physical supply, facilitating functions.

Unit 2

Marketing Research, market research and marketing research, marketing research and marketing information system, procedure of marketing research.

Unit 3

Product, classification, product policies, product line, product mix, product life cycle, different stages in product life cycle, Pricing, pricing objectives, factors affecting price decisions, price determination procedure, types of pricing.

Unit 4

Promotion, objectives, forms of promotion, sales promotion, tools of sales promotion, advertising, definition, kinds of advertising media, personal selling, features, personal selling process, channels of distribution.

Unit 5

Consumer behaviour: introduction, market analysis, marketing strategy, factors influencing consumer behaviour, individual determinants, external environmental factors affecting consumer behaviour.

TEXTBOOKS:

1. *R.S.N. Pillai and Bagavathi – Modern Marketing Principles and Practices, S. Chand.*
2. *Brahm Canzer – E-Business and Commerce: Strategic Thinking and Practice, Biztantra Publishers, New Delhi*

REFERENCE BOOKS:

1. *Martin Khan – Consumer Behaviour, New Age International Publishers*
2. *Philip Kotler – Marketing Management, Prentice Hall of India*
3. *Stephen P Robbins, David A Decenzo – Fundamentals of Management of E–Business, Prentice Hall.*

18OEL269 PRINCIPLES OF PUBLIC RELATIONS 3 0 0 3

Unit 1

Purpose & Philosophy of PR, What PR Is, Objectives of Public Relations, the Primary Purpose of PR, Hostility, Prejudice, Apathy, Ignorance, Emergence of Public Relations, Public Relations Today, Public Relations and Propaganda, Defining Objectives and Planning a Programme.

Unit 2

Four Steps Public Relations Process, Defining PR Problems, Planning and Programming, Taking action and Communicating, Evaluating the Program, Elements of Public Relations, Human Relations, Empathy, Persuasion, Dialogue, Objectives of Public Relations.

Unit 3

Public Relations as a Profession, Overview, Profession, Codes of Professional Conduct, Functions of Public Relations Department, Policy, Publicity, Product Publicity, Relations with the Government, Community Relations, Shareholders Relations, Promotion Programmes, Donations, Employee Publications, Guest Relations, Establishment of Relations with the Public, The Need for Public Relations, Scope of Public Relations, Professional Code - Public Relations.

Unit 4

Ethics and Challenges of Public Relations, International Public Relations Association (IPRA) Code of Conduct, the European Code of Professional Conduct, All about Marketing, Advertising, Functions of Advertising, PR as a Component of Communication and Strategies, Strategic Management, Theories of Communication, Mass Communication Theory and Research. Functional Approach to Mass Communication Theory, Human Action Approach.

Unit 5

Models of Communication, Communication Models, The advantages ofModels, Limitations of Models, Classical Communication Models, Transmission Model and its Criticism, Report Writing, Copyright and Other Legal Issues.

REFERENCE BOOKS:

1. *Geroge E-Belch & Michael. A. Belch - "Advertising and Promotion", Tata McGraw Hill – Sixth Edition.*
2. *Kruti shah and Alan D'souza - "Advertising and Promotion", Tata McGraw Hill*
3. *Tom Duncan - "Principles of Advertising and IMC", Tata McGraw-Hill - Second Edition*

18OEL270 SCIENCE, SOCIETY AND CULTURE 3 0 0 3

Objectives: *This introductory paper is intended to acquaint the students with sociology as asocial science and the distinctiveness of its approach among the social science. It is to be organized in such a way that even students without any previous exposure to sociology could acquire an interest in the subject and follow it.*

Unit 1

The nature of Sociology

The meaning of Sociology: Origin, Definition, Scope, Subject matter, Nature and relation of sociology with other social Sciences. Humanistic orientation to Sociological study.

Unit 2

Basic concepts
Society, community, Institution, Association, Group, Social structure, status and role, Human and Animal Society.

Unit 3

Institutions.
Family and kinship, religion, education, State.

Unit 4

The individual and Society.
Culture, Socialization, Relation between individual and society.

Unit 5

The use of Sociology.
Introduction to applied sociology - Sociology and social problems, Ecology and Environment: Pollution, Global warming and Greenhouse effect. Impact of Industrialization and Urbanization on Environment.

REFERENCE TEXTS:

1. Harlambos, M - Sociology: Themes and perspectives, Oxford University Press.
2. Inkeles, Alex - What is Sociology, Prentice-Hall of India.
3. Jaiaram - What is Sociology, Macmillan
4. Johnson, Harry M, Sociology: A Systematic Introduction, Allied Publishers.

18OEL271 STATISTICAL ANALYSIS 3 0 0 3

Objective:

To understand the concepts of statistical analysis and to apply the results in reallife business problems.

Unit 1

Correlation Analysis: meaning and definition - positive correlation - negative correlation - no correlation - scatter diagram - Karl Pearson's correlation co-efficient - interpretation.

Unit 2

Regression Analysis: introduction – uses of regression analysis – regression lines - the two regression equations.

Unit 3

Time series Analysis: meaning – components of time series - methods of estimating trend – graphic method – semi-average method – moving-average method.

Unit 4

Probability: introduction - classical definition- relative frequency theory-subjective approach - Axiomatic approach to probability - Addition theorem - Multiplication theorem -- conditional probability.

Unit 5

Theoretical distributions: discrete and continuous distributions - Binomial distribution – Normal distribution.

REFERENCE BOOKS:

1. *S P Gupta – Statistical Methods, Sultan Chand & Sons, New Delhi.*
2. *Dr.P.R.Vittal &, V.Malini -Statistical and Numerical Methods, Margham Publications; 1 edition (2012)*

18OEL272 TEAMWORK AND COLLABORATION 2 0 1 3

Unit 1

Leadership – Meaning, Concepts and Myths about Leadership, Components of Leadership - Leader, Followers and situation. Assessing Leadership & Measuring Its effects.

Unit 2

Focus on the Leader – Power and Influence; Leadership and Values. Leadership Traits; Leadership Behaviour; Contingency Theories of Leadership; Leadership and Change.

Unit 3

Groups, Teams and Their Leadership. Groups – Nature, Group Size, Stages of Group Development, Group Roles, Group Norms, Group Cohesion.

Unit 4

Teams – Effective Team Characteristics and Team Building, Ginnetts Team Effectiveness Leadership Model.

Unit 5

Leadership Skills – Basic Leadership Skills, Building Technical Competency, Advanced Leadership Skills, Team Building for Work Teams, Building High Performance Teams.

REFERENCE TEXTS:

1. *Hughes, Ginnett, Curphy - Leadership, Enhancing The Lessons of Experience, Tata McGraw Hill, 5th Ed.*
2. *Yukl G - Leadership in Organisations, Pearson, 6th Ed.*
3. *West Michael - Effective Team Work, Excel Books, 1st Ed.*
4. *Sadler Philip – Leadership, Crest Publishing House*

18OEL273 THE MESSAGE OF BHAGAVAD GITA 3 0 0 3

Unit 1

Introduction: Background of the Bhagavad Gita – The Epic of Mahabharatha.
Arjuna Vishada Yoga: Scene at Kurukshetra – Arjuna's anguish and confusion.
Symbolism of the war within – Psychological analysis of the human condition.

Unit 2

Sankhya Yoga: Importance of Self-knowledge. Body–Mind-Intellect Chart, Concept of Pancha Kosas, Concept of Vasanas. Nature of the Self–Indestructibility of Consciousness.

Unit 3

Karma Yoga: Yoga of Action – Living in the Present – Dedicated Action without Anxiety over Results - Concept of Swadharma

Unit 4

Sthitaprajna: Qualities of a person established in wisdom. Dynamics of the Three Gunas: Tamas, Rajas, Sattva – Going Beyond the Three Gunas – Description of a Gunatheetha.

Unit 5

Other topics: Tuning the Mind – Quantity, Quality and Direction of Thoughts – Reaching Inner Silence. Yoga of Devotion – Form and Formless Aspects of the Divine – Inner Qualities of a True Devotee.

TEXTBOOKS/ REFERENCES:

1. *Swami Chinmayananda, "The Holy Geeta", Central Chinmaya Mission Trust, 2002.*
2. *Eknath Easwaran, "The Bhagavad Gita", Nilgiri Press, 2007.*

18OEL274 UNDERSTANDING TRAVEL AND TOURISM 3 0 0 3

Objectives:

To create a basic knowledge on the growth and development of tourism, to have anunderstanding of various national and international tourism organizations.

Unit 1

Growth and Development of Tourism

Tourism as an ancient phenomenon - pleasure travel - religion as a motivator Industrial revolution and development of tourism. Effects of Great World Wars on transport system - advent of jet and high speed trains. Causes of rapid growth - meaning, nature and components of tourism-basic travel motivations.

Unit 2

Need for Organization - factors influencing types of organization - theNational tourist organization - tourist organization in India - International organization of Tourism International Union on Official Travel Organization (IUOTO) - World tourism Organization (WTO) – Pacific Area Travel Association (PATA) – International Air Transport Association(IATA) – American Society of Travel Agents (ASTA).

Unit 3

Measurement of Tourism

Need for measuring tourism phenomenon - methods of measurement - importance of tourist statistics - types of tourist statistics. Definition of the terms tourist, domestic tourism and international tourism - tourism planning and development - planning for tourism. Assessment of tourist demand and supply - basic infrastructure - financial planning - human resources planning - tourism marketing - environmental and regional planning.

Unit 4

Tourism and Economic Development

Economic and social significance of tourism - economic benefits - multiplier effect - infrastructure development - regional development – employment opportunities - cultural tourism - international understanding.

Unit 5

Role of travel agencies in tourism

Thomas Cook and organization of travel - introduction of railway and air travel - travel agency - tour operator, Need for legislation - travel agencies in India – TAA.

TEXTBOOKS:

1. Vara V V Prasad - Travel and Tourism Management, Excel books

2. Ghosh, Biswanath – Tourism and Travel Management, Vikas Publishing House

REFERENCES:

1. Douglas Foster – Travel and Tourism Management, Palgrave MacMillan
2. B S Badan, Harish Bhatt – Travel Agencies and Tourism Management, Common Wealth Publishers

18OEL275 VIDEOGRAPHY 1 0 2 3

Unit 1

Fundamentals of TV production techniques; Principle of video; TV camera, components of camera lens, basic shots and its composition, sound and lighting and its types, special effects,

Unit 2

Lighting for television - types of lights, Three point and Multi-point lighting; Sound - Types of microphones and characteristics of sound; Sound recording - tape and tapeless;

Unit 3

Stages of TV programmes - pre-production, rehearsal and set-up, actual production and post-production, graphics-CG and VG, animation, ENG-DSNG and OB broadcasting.

Unit 4

Type of editing - Assemble and Insert; Modes of editing - Online, Offline, Linea and Non – linear type software's and graphics early.

Unit 5

W riting for television - script writing - genres of TV programmes - news, documentary, talk shows, panel discussion, quiz, current affairs and special audience programmes - women, children, youth - post production, reviews, sports, musical and dance programmes, phone-in programmes.

BOOKSRECOMMENDED:

1. *Allan Wurtzel: Television Production*
2. *Zettl Herbert: Television Production*
3. *Gerald Millerson: The Technique of Television Production*
4. *Hartwig, Robert: Basic TV Technology, digital and Analog*
5. *Chattedji P.C: Broadcast News*
6. *John Watkinson: An Introduction to Digital Video*

18OEL276 VISTAS OF ENGLISH LITERATURE 3 0 0 3

Unit 1

1 Introduction – What literature is – enjoyment of literature – Holding a mirror to life – Ages of literature – Different literatures

2 WH Auden – The Unknown Citizen

Unit 2

3 Rabindranath Tagore – The Child

4 RK Narayan – Sweets for Angels

5 Toru Dutt – Lakshman

Unit 3

6 Jane Austen – Pride and Prejudice (Chapter 1)

7 Sarojini Naidu – The Queen

8 AG Gardiner – A Fellow Traveller

Unit 4

9 Shakespeare – Macbeth: The Murder Scene

10 Oliver Goldsmith – The Man in Black

Unit 5

11 Robert Browning – My Last Duchess

18OEL277 WEB-DESIGNING TECHNIQUES 1 0 2 3

Unit 1

Introduction to web technologies, How the website works?, Client and Server scripting languages, Difference between a web designer and web developer, Types of websites (Static and Dynamic), Web standards and W3C recommendations.

Unit 2

HTML: Introduction to Internet, Understanding Browsers, Starting with HTML, HTML Page Structure. Defining Web Layout(Head & Body), Head Tags, BODY tag with Background color, Background with image and text color. Text formatting, Text attributes. Importance of heading tags (H1–H6). Marquee text with or without background, Blink the text attributes. Divide section using <HR> line with width, align, size.

Knowing Images format for web: Working with images, Images attributes. Working with Tables: Table attributes, Colspan, Rowspan, Table Border, Align, Valign, Table background image, color to cell, Nesting tables.

Unit 3

Using list: Ordered list, Unordered list. Working with Links: Internal Links, External Links, Anchor Link, Email Link, Linking with text, Links with images. Working with controls. Working with forms: knowing get and post action.

Unit 4

CSS: Introduction to Cascading Style Sheets, Types of Style Sheets , Class Selector, ID Selector, Absolute Relative Positioning, Inline menu, DIV + CSS Layout Design, PSD to CSS Conversion.

Unit 5

JavaScript: Introduction to JavaScript, Understanding variables & functions, Working with alert, confirm and prompt, Understanding loop, arrays, Creating rollover image, Working with operators.

TEXTBOOK/ REFERENCES:

1. *Ivan Bayross - Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP, BPB Publicationa*
2. *Dionysios Synodinos, Michael Bowers, Victor Sumner - Pro HTML 5 and CSS 3 Design Patterns, Springer India Publication*
3. *Jennifer Niederst Robbins - Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics, Shroff Publishers*
4. *David Pitt - Modern Web Essentials Using JavaScript and HTML5, InfoQ Publications*

18OEL278 ORGANIC FARMING 1 0 2 3

Unit I

Introduction to Organic farming:
Definition, Basic principles of Organic farming, Chemical intensive farming versus Organic farming, Advantages and disadvantages.

Organic inputs:
Advantages of using organic inputs, Organic manures, Biofertilizers, Biopesticides, Organic growth promoters, Biocontrol agents.

Unit II

Basics of Organic Vegetable cultivation:

Selection of varieties, seeds or seedlings, Liming of soil, Potting mixture preparation and filling of grow-bags/pots, Precautions during planting and transplanting, Details of Organic inputs required for cultivation and its application methods, 100 day schedule for organic vegetable farmers, Nutrient management and Plant protection measures.

Unit III

Land reclamation using green manuring crops:
Soil degradation due to chemical fertilizers, Crops used for green manuring, Benefits, ITK used by farmers in plant growth and protection.

Assessing the quality of organic inputs:
Quality of organic manures, Analysis-agencies involved

Quality standards, Governance and Legal Institutions Involved in Organic certification.

Unit IV

Introduction to organic livestock production:
Conventional farming versus Organic livestock production, Principles of Organic livestock production.

Safe egg and meat production in homesteads:
Selection of suitable poultry breeds, Housing requirements, Feeding management, Care and management, Vaccination and other routine medicines, Safe withholding periods, Common diseases and their management.

Unit V

Safe fish production in Homesteads:
Homestead fish farming methods, Location specific models, Stepwise Installation procedure, Species selection, Feeding and management, Culture-Package of Practice, Harvesting, storage and marketing.

Storage and Value addition of excess produce:
Refrigerated storage, Drying and dehydration, Pickles, Jam, Squash preparation, Home recipes.

Reference Books:

1. Palaniappan, Annadurai - Organic Farming: Theory and Practice, Scientific Publishers Journals Dept
2. Amitava Rakshit, HB Singh – ABC of Organaic Farming, Jain Brothers Publication
3. B. Subrahmanyeswari Mahesh Chander – Organic Livestock Farming, ICAR Publication
4. Handbook of Fishers and Aquaculture – ICAR Publication

18OEL279 BASIC LEGAL AWARENESS ON PROTECTION OF WOMEN AND RIGHTS **3 0 0 3**

***Objective**:*

This course is intended to give the students a basic awareness on Women's rights and the legal frame work for the protection of their rights.

Unit 1

Introduction/Overview: The meaning of law, social security legislations, free legal aid to the poor, Indian Evidence Act, various modes of dispute settlement mechanisms- Lok Adalats, Family Courts, Mahila Courts, Crime Against Women Cells, NCW, NHRC, State Commissions.

Women and the Constitution: Fundamental Rights, Constitutional Remedies (Writs), Electoral Law, Voting Rights for Women, participation in Panchayats and governance.

Unit 2

Women & Family Laws: Marriage Law, Separation, Divorce, Maintenance, Adoption, Right to Property and Succession, Guardianship, unmarried mother and the legitimacy of her children.

Unit 3

Criminal Law and Women: Major offences against women, Women in Custody- Arrest, grounds of arrest, kinds of offences (bailable and non-bailable), arrest warrant, powers of police, rights of arrested persons including the right to bail, the immediate procedure to be adopted in case of violation of rights.

Unit 4

Procedure in Action: Procedure for seeking redressal, Complaints to Police Station, Courts, Lok Adalat.

Unit 5

Rights under different laws: Rights at work place Equal Remuneration / Minimum Wages Act / Rights under Factories Act, Maternity Benefit Act, Mines and Plantation Act, Rules of work - in such specific areas, Sexual harassment at work place, Reproductive Health Rights - Foeticide, Infanticide, Preconception and Prenatal Diagnostic Techniques (Prohibition of Sex Selection) Act 1994, The Medical Termination of Pregnancy Act 1971.

18OEL280 Ritual Performances of Kerala 3 0 0 3

***Objectives**:*

To provide an overall view of Ritual Performances of Kerala in general and 'Padayani', 'Mudiyettu' and 'Theyyam' performances in particular. Land, people, social and political system and worldview are the deciding factors of ritual performances. The course aims to give a clear understanding of these performances and their unique features. The classes will be supported with PowerPoint and video clippings of the respective ritual performances.

Unit 1

Introduction:
Kerala – Land and People – social structure – Agrarian society – Kerala society today. Meta Physical World: mythology and religion and its relation to the festivals and rituals of Kerala – special reference to Kali.

Padayani:
Legend behind the dance ritual – description of performances – musical instruments and music of Padayani – rhythm of Padayani songs. Main Kolams in Padayani: – its artistic features of making marks – drawing on arecanut sheaths. Dance in Padayani: different Kolams and its dance features. Padayani as a Performance, Devotional Aspects, Eminent artists of this dance form.

Unit 2

Mudiyettu:
Geographical area of Mudiyettu – land and people – main centers of performances **–** a complete folk drama – myth behind Mudiyettu – Kali – Darika fight – scenes in Mudiyettu and its contents. Characters in Mudiyettu**:** Naradan, Darikan, Danavendran, Kali, Kooli, Koimbadaran. Abhinaya in Mudiyettu**:** Aangikam, Vachikam, Aaharyam. Rituals in Mudiyettu: Mudiyettu itself is a ritual – ritual inside Mudiyettu – drawing of Kolam, Kolam Pooja, uzhiyal, etc. Devotional aspects of Mudiyettu.

Unit 3

Teyyam:
Kolathunad – land and people – folk religion of Kolathunad and its features. Deities in Teyyam: Hindu Gods and Goddesses – heroine cult – deities defied after death – family deity – caste deity – local deity. Teyyam as a Ritual Performance – principles of bringing down deities – appease – bringing down – sending back. Ritual Acts: kodiyila vangal, kodiyila tottam, tottam/ vellattam, teyyam, mudiyazhikkal. Features of Tottam Songs – varavili, tottam songs – mumbsthanam. Ornaments and Decorations of Teyyam – thalachamayam kaikkaru, arachamayam kaikkaru. Mukhattezhuttu and Mekkezhuttu. Devotional Aspects of Teyyam.

Comparative aspects of Padayani, Mudiyettu and Teyyam – theme, decorative elements and form, dance, enactment, faith and other aspects.

REFERENCE BOOKS:

1. *Kadammanitta Vasudevan Pillai, 'Palayile Kolangal', Kerala Bhasha Institute.*
2. *Kadammanitta Vasudevan Pillai, 'Padayani'.*
3. *Chummar Chhondal, 'Mudiyettu'.*
4. *M V Vishnu Namboodiri, 'Teyyam', D C Books, Kottayam.*
5. *Raghavan Payyanad, 'Methodology for Folkloristics', English Dept., Farook College, Farook, 2013.*
6. *C Achutha Menon, 'Keralathile Kali Seva', Madras University, 1943.*
7. *M D Raghavan, 'Folk plays and Dances of Kerala'.*
8. *Sreedhara Menon, 'Cultural History of Kerala'.*

18OEL281 Documenting Social Issues 3 0 0 3

Objective:

Visual documentation of key social issues: The student will write the script and shoot a documentary film of 5-10 minutes, highlighting a key issue.

Unit 1

Screening documentary films on various social issues – gender discrimination, women empowerment, dowry, female infanticide and skewed sex ratios, maternal and child care, role of technology in transforming societies, changing caste and class barriers etc. etc.,

Unit 2

Selecting the topic: Migration of labour from other regions to the southern states due to labour shortage and their integration in the society as local youth turn away from traditional occupations of their families and go in search of white-collar jobs, alcohol consumption and rising crime, drug addiction among students etc. etc..

Unit 3

Data collection on the ground, interviews and shooting schedule.

Unit 4

Pre-production, production and post-production processes with approval from the guide.

Unit 5

Preview of the film & analysis.

Outcomes:

By the end of the course the students will be able to:

CO1: Develop critical thinking skills necessary to evaluate, organize and disseminate news
CO2: Identify problem of common man
CO3: Use data to create stories
CO4: Express themselves fluently and appropriately in social and professional contexts
CO5: Become able to produce documentaries using available data

REFERENCES:

1. *Aufderheide, Patricia (1997) Public Intimacy: The Development of First-Person Documentary, New York: Afterimage-Rochester. 25, 16-18.*
2. *Nichols, B. (2010). Introduction to documentary. Indiana University Press.*

3. *Rosenthal, Alan (1990) Writing, Directing, and Producing Documentary Films and Videos. Carbondale: Southern Illinois University Press.*
4. *Walker, J., & Waldman, D. (1999). Feminism and Documentary. University of Minnesota Press*

FILMS:

1. *Flaherty, Robert J (1922) Nanook of the North*
2. *Kauffman, R., and Briski, Z. (2005). Born into brothels. ThinkFilm.*
3. *Srinivasan, R R (2009) En Peyar Palaru*
4. *Srinivasan; R R (2000) Nadhiyin Maranam*

18OEL282 FABRICATION OF ADVANCED SOLAR CELL 3 0 0 3

Unit 1

The Solar Resource and types of solar energy converters, Requirements of an ideal photoconverter, Principles of a solar cell design, material and design issues; Revisions of Semiconductor Physics, Physics of semiconductor Junctions; p-n junction under dark and under illumination, effect on junction characteristics, Other device structures. Photovoltaic cell and power generation, Characteristic of the Photovoltaic Cell.

Unit 2

Silicon Solar cell, Mono -crystalline and poly–crystalline cells, Metallurgical Grade Si, Electronic Grade Si, wafer production, Mono–crystalline Si Ingots, Poly–crystalline Si Ingots, Si–wafers, Si–sheets, Solar grade Silicon, Si usage in solar PV, Commercial Si solar cells, process flow of commercial Si cell technology, Process in solar cell technologies, Sawing and surface texturing, diffusion process, thin film layers, Metal contact.

Unit 3

2nd generation solar cell, Thin film solar cell,Advantage of thin film, Thin film deposition techniques, Evaporation, Sputtering, LPCVD and APCVD, Plasma Enhanced, Hot Wire CVD, closed space sublimation, Ion Assisted Deposition, Substrate and Super-state configuration, Thin film module manufacturing, Thin film and Amorphous Si Solar cell, Cadmium Telluride Solar Cell, CIGS solar Cell, CZTS solar cell, New materials for thin film solar cell.

Optics in solar energy conversion: antireflection coatings, concentration of light: Light confinement, photon recycling, multiple exciton generation.

Unit 4

3rd generation Solar cell; **Advances in Photovoltaics**, Photochemical and photosynthetic energy conversion; DSSC,, Solution processed thin film, Organic Solar Cell, Hydride Perovskite solar cell and multi junction tandem solar cells;

Solar PV modules:
Series and Parallel connections, Mismatch between cell and module, Design and structure, PV module power output, PV system configuration, standalone system with DC / AC load with and without battery, Hybrid system, Grid connected systems.

Unit 5

Hand on experience on solar cell fabrication, DSSC fabrication, Perovskite solar cell fabrication, Thin-film solar cell fabrication.

TEXTBOOKS/ REFERENCES:

1. *Physics of Solar cells-Jenny Nelson, Imperial College Press (2006)*
2. *Crystalline Silicon Solar Cells, by A. Goetzberger, J. Knobloc h, and B. Voss (Wiley, 1998)*
3. *Third Generation Photovoltaics: Advanced Solar Energy Conversion, by M. A. Green (Springer, 2006)*
4. *Semiconductor Materials for Solar Photovoltaic Cells; Paranthaman, M.P. (et al.) (Eds.) (2016)*

18OEL283 BASIC CONCEPTS OF X-RAY DIFFRACTION 3 0 0 3

Unit 1

The geometry of the crystalline structure

Unit 2

X-RAY BASICS
The scattering of X-rays, Diffraction from a crystal
X-ray interaction with matter, X-ray sources, X-ray optics, X-ray detectors

Unit 3

X-RAYDIFFRACTOMETERS
High-ResolutionDiffractometers
Powder Diffractometers

Unit 4

Experimental Collection of Diffraction Data
The factors affecting the X-ray intensities

Unit 5

Determination of Space group and crystal structures
Accuracy and refinement process

REFERENCES:

1. *Emil Zolotoyabko; Basic Concepts of X-Ray Diffraction; John Wiley & Sons, 21-Apr-2014 - Science*
2. *M. M. Woolfson; An Introduction to X-ray Crystallography; Cambridge University Press*
3. *Werner Massa; Crystal Structure Determination; (March 31, 2004) ISBN-10: 3540206442*

18OEL284 INTRODUCTION TO FORTRAN AND GNUPLOT 3 0 0 3

Unit 1

Introduction
Introduction to Computing, Basic Fortran, Data Types, Constants and Variables, Naming Convention. Operation and Intrinsic Functions, Expressions and Assignment Statements, Logical Operators and Logical Expression.

Unit 2

Control Statements and I/O
IF statement and construct, nested if statement, GOTO, Case Construct, Do Loop, nested do loop, do while loop. Fortran I/O and External Files, Formatted Output, Formatted Input, File Processing.

Unit 3

Subroutines and Functions
Defining and referring subroutine and function, arguments, conditions on arguments, Dummy arguments or parameters and actual arguments, Scope of variables.

Unit 4

Arrays
Arrays and elements, Array properties, Array storage, Whole array assignment, Array section assignment, Array Operations, Array Processing, Mask Array, Allocatable Arrays, Functions Return Arrays.

Unit 5

Gnuplot
Introduction to gnuplot,function plot, data plot, analyse a function, various options in gnuplot, Scientific Graphic Library, Linking Fortran Programs to gnuplot Graphic Library.

TEXTBOOK:

1. *Stephen J. Chapman, "Fortran 95/2003 for Scientists and Engineers", McGraw-Hill (3rd edition).*

REFERENCES:

1. *Michael Metcalf and John Reid, "Fortran 90/95 Explained", Oxford University Press (2007).*
2. *Jeanne C. Adams, Walter S. Brainerd, Richard A. Hendrickson, Richard E. Maine, Jeanne T. Martin and Brian T. Smith, "The Fortran 2003 Handbook", Springer (2009).*
3. *Michael Metcalf, John Reid and Malcolm Cohen, "Modern Fortran Explained", Oxford University Press (2011).*
4. *William H. Press, Saul A. Teukolsky, William T. Vetterling and Brian P. Flannery, "Numerical Recipes in Fortran Vol. 1 & 2", Cambridge University Press (1996).*
5. *Documentation given with gnuplot software (2015).*
6. *Lee Phillips, "gnuplot Cookbook", Packt Publishing (2012).*

18OEL285 INTRODUCTION TO POROUS MATERIALS 3 0 0 3

Unit 1

General introduction to porous materials
Introduction to porous materials, Classification based on the pore size: microporous materials, mesoporous materials and nanoporous materials; Classification based on materials: Zeolites, Transition metal oxides, Metal organic frame works and types-new era of porous materials.

Unit 2

Metal organic frameworks, Mesoporous materials and Zeolites
Introduction, significance of metal organic frameworks, covalent organic frame works and their evolving applications at lab scale and industrial scale. Zeolites: Definitions, Structure, Chemical composition and Types, Mesoporous Materials: SBA-15, MCM-41

Unit 3

Characterization of porous materials
Introduction to adsorption, classification-physical and chemical adsorption, surface area, factors affecting the surface area, gas adsorption for surface area analysis, adsorption isotherms and their classification, Langmuir and BET adsorption isotherms, pore analysis: calculation of pore size and pore volume, mercury porosimetry.

Unit 4

Synthesis of porous materials
Sol-Gel Processing for synthesis of porous materials**:** factors affecting the sol gel process, xerogels and aerogels, Template based methods for the synthesis of porous materials: Brief introduction to the synthesis of porous materials like MCM 41 and SBA 15 and hydrothermal methods for the synthesis of MOFs and zeolites

Unit 5

Applications
Applications of mesoporous materials in catalysis, gas adsorption and drug delivery; importance of zeolites in petroleum industry, application of MOFs

REFERENCE BOOKS:

1. *Lowel, S., Shields, J. E., Thomas, M. A., Thommes, M., Characterization of Porous Solids and Powders: Surface area, Pore size and Density; SpringerPublications, 2004.*
2. *Liu, P.S., Chen, G.F., Porous Materials: Processing and Applications, First Edition, Elsevier Publications, 2014.*
3. *Ishizaki, K., Komarneni, S., Nanko, M., Porous Materials Processing Technology and Applications, First Edition, Springer Publications, 1998.*
4. *Kickelbick, G., (editor) Hybrid Materials: Synthesis, Characterization and Applications; First Edition, Wiley-VCH, 2007*
5. *Bruce, D.W., O'Hare, D., Walton, R.I.,(editors) Porous Materials (Inorganic materials series) First Edition, John Wiley and Sons, 2011*

18OEL286 FORENSIC SCIENCE 3 0 0 3

Unit 1

Introduction

Origin of forensic science, need for forensic science, trace and contact evidence, marks and impression, examination of documents, blood stain analysis, microscope in analysis, explosives, chemical analysis of explosives, forensic laboratories and courses in India.

Unit 2

Narcotics

Narcotics, classification of drugs, specific drugs- Psychotropic drugs, chemical screening of drugs, chemical extraction and sample preparation, chemical identification of drugs using analytical methods.

Unit 3

Fingerprinting and Firearm Analysis

History of fingerprinting, principles of fingerprinting, constituents of latent finger marks, fingerprint detection, chemical methods of detection, firearm examination, chemical analysis of firearm, analysis of gunshot residue.

Unit 4

Toxicology

Introduction to Toxicology, alcohol and human body, testing of blood alcohol concentration, Toxins & Biological Poisons, Measuring Toxicity as LD50, sample and analysis, inorganic poisons, nerve agents, radioactive toxins, Pharmacokinetics and Toxicokinetics, tests for toxins, reported case studies.

Unit 5

Postmortem Toxicology
Introduction, tissue and fluid specimens, specimen collection and storage, extraction procedure, analytical techniques, interpretation, case studies.

REFERENCE BOOKS:

1. *Lawrence Kobilinsky, Forensic Chemistry Handbook, John Wiley & Sons, New Jersey, 2012*
2. *David E. Newton, Forensic Chemistry, Facts On File, Inc, New York, 2007*
3. *Jay A. Siegel, Forensic Chemistry fundamentals and applications, Wiley Blackwell.*
4. *Suzanne Bell, Drugs, Poisons, and Chemistry, Facts On File, Inc. New York, 2009.*

18OEL287 INTRODUCTION TO SOLAR PHYSICS 3 0 0 3

Unit 1

Sun
Solar parameters: Mass, Radius, Distance and Luminosity, Spectral energy distribution, Construction of a Model, Conservation law, Equation of State, Nuclear Energy Source and Energy transport, Chemical composition of the Sun.

Unit 2

Tools for Solar Observation
High-Resolution Telescope, Spectrographs and Spectrometers, Filters and Monochromators, Polarimetry, Special purpose Instruments.

Unit 3

Sun's Oscillations and Rotations:
Linear Adiabatic Oscillations of Non-Rotating Sun, Helioseismology, Excitation and Damping, The Angular Velocity of Sun, Models of Rotating Convection Zone.

Unit 4

Magnetic properties of Sun:
Fields and Conducting Matter, Flux tubes, Sunspots and Solar Cycle.

Unit 5

Chromosphere, Corona and Solar Wind
Empirical Facts, Consequence of High Temperature, Outer Atmosphere, Energy Balance, Explosive Events.

TEXTBOOK:

1. *The Sun: An Introduction second edition by Michael Stix*

18OEL288 RECYCLING, RECOVERY AND TREATMENT METHODS FOR WASTES **3 0 0 3**

Unit 1

Biowaste
Agrowaste - Biopesticide from solid waste, biomass to bioethanol, biowaste as carbon source, other applications of agrowaste.

Animal waste – bio-digestor - generation of renewable energy, biogas from animal waste-daily consumption, Equipment sizing and design.

Food waste-management, anaerobic digestion of food waste – kitchen waste composting.

Unit 2

Plastic & Rubber
Recycling plastic fibre and packaging waste – methods of recycling – Erema Process, Erema vented process for recycling plastics.

Recycling of rubber – Devulcanisation - thermal, mechanical and microbial process - characterization of devulcanized rubber - products from rubber waste.

Pyrolysis of plastics and rubber - Catalytic process of treatment- plastic waste to fuel, oil and wax.

Unit 3

Utilized Products recycling
Paper recycling - types of paper, Mechanical and chemical re-pulping,

Glass waste - bottle recycling, cullet recycling, process in glass recycling

Metals - Iron & steel, iron & steel remanufacturing, Aluminium remanufacturing

Unit 4

Electronic waste
Electronic wastes – printed circuit board, monitors and batteries, Processing - hydrometallurgical and pyrometallurgical route. Recovery of heavy metals from electronic waste.

Unit 5

Biomedical & Hazardous Waste
Biomedical waste and its category, Treatment - autoclaving, shredding, deep burial & chemical treatment of biomedical waste

Radioactive waste – Nuclear waste type and source, long lived and short lived radionuclide, treatment of radioactive waste - immobilization-cement based material for disposal of waste.

REFERENCES:

1. *Thomas H. Christensen, Solid Waste Technology & Management, Vol.1, Blackwell Publishing Ltd, 2011.*
2. *Elena Cristina Rada, Biological Treatment Of Solid Waste, CRC press, 2016.*
3. *Martin Forrest, Recycling and Re-use of Waste Rubber, Smithers Rapra Technology Ltd, 2014.*
4. *Jonathan W.-C. Wong, Rajeshwar D. Tyagi, Ashok Pandey, Current Developments in Biotechnology and Bioengineering, Elsevier, 2017.*
5. *John scheirs and Walter kaminsky, Feedstock Recycling and Pyrolysis of Waste Plastics, John Wiley & Sons Ltd, 2006.*
6. *Ramesha Chandrappa, Diganta Bhusan Das, Solid Waste Management: Principles and Practice, Springer, 2012.*
7. *Shinya Nagasaki, Shinichi Nakayama, Radioactive Waste Engineering and Management, springer, 2011.*
8. *Ronald E. Hester, Roy M. Harrison, Electronic Waste Management, RSC publishing, 2009.*
9. *Hugo Marcelo Veit, Andréa Moura, Electronic Waste: Recycling Techniques, springer, 2015.*
10. *Lifeng Zhang, Gregory K. Krumdick, Recycling of Electronic Waste II: Proceedings of the Second Symposium, John Wiley & Sons, Inc, 2011.*

18OEL289 ACTING AND DRAMATIC PRESENTATION 2 0 2 3

Objective:

To cultivate communication skills of students through teaching of theory and skills of theatre and Dramatics.

Unit 1

Rasa theory in Bharata's Natyasastra. Classical theatre in India.

Practical: Warming-up exercises - Relaxation Exercises.

Unit 2

Greek drama and dramatic theories. Use of masks.

Practical: Voice modulation - Breath control.

Unit 3

Shakespearean theatre.

Practical: Practice in Monologues - Training in articulation of emotions through dramatic speech.

Unit 4

20^{th} century theatre. Stanislavskian method, and Brechtian epic theatre.

Practical: Developing body and facial expressions in drama - Articulating narratives through body movements - Building up a repertoire of gestures.

Unit 5

Theatre semiotics and dramaturgy.

Practical: Building up units of action to create a Theatrical Ensemble - Plotting movements of different characters within a scene.

TEXTBOOK:

The Semiotics of Theatre and Drama by Keir Elam

REFERENCES:

1. *Theatre as Sign System: A Semiotics of Text and Performance By Elaine Aston, George Savona*
2. *Theatre Semiotics: Text and Staging in Modern Theatre By Fernando de Toro*

3. *Acting For Real: Drama Therapy Process, Technique, And Performance By Renee Emunah*
4. *Natyasastra by sage Bharata.*

18OEL290 COMPUTERISED ACCOUNTING 2 0 2 3

Objectives:

The course will provide an understanding of the Accounting practices including the final accounts, inventory keeping practices, financial reporting and printing. Tally is proposed to be used as the mail tool.

Unit 1

Business, meaning, Book Keeping, Accounting – meaning, functions and importance and objectives – users of accounting – branches of accounting – accounting terminologies – Accounting Concepts and Conventions – Accounting Standards in India, Accounting Systems – Double Entry System and Single Entry System – Account – types of accounts – Rules for Debit and Credit – Accounting Equation – Journal – Journal entries – journalizing – compound entries – Banking transactions.

Unit 2

Sub Divisions of Journal or Subsidiary Books: Advantages of Subsidiary Books and limitations of journal – Purchase Day Book – Purchase Returns Book – Sales Book – Sales Returns Book – Cash Book – Petty Cash Book – Imprest System.
Ledger: Meaning and importance – preparation of ledger accounts or posting – balancing an account – account balance – Trial Balance – objectives and functions of trial balance.

Unit 3

Final Accounts: Trading and Profit and Loss Accounts, Balance Sheet – simple adjustments like outstanding expenses, prepaid expenses, bad debts, accrued income, unearned income.
Depreciation: Meaning and definition – causes of depreciation – need for depreciation – Fixed Installment Method and Diminishing Balance Method.

Unit 4

Getting started with Tally – Company information - Tally accounting - Chart of accounts – Ledgers and Groups - financial and trading vouchers – Voucher creation and entry.

Unit 5

Tally Inventory – inventory vouchers - Display and reporting – reporting and printing

Reference Books:

1. *Goyal and Ruchi Goyal – Financial Accounting, Prentice Hall India*
2. *Jain and Narang – Advanced Accounts Volume 1, Kalyani Publishers*
3. *Tally for everyone – Roopa, Add to Cart Publishing*
4. *Nadhani – Tally ERP 9 Training Guide – BPB Publication*

18OEL291 KERALA MURAL ART AND PAINTING 2 0 2 3

Objective:

Mural painting is an offshoot of the devotional tradition of Kerala. In the contemporary scenario Mural painting is not restricted to permanent structures and are being done even on canvas. Kerala Mural painting are the frescos depicting mythology and legends. Learning Mural painting through the theory and practical workshop is the objective of this course.

Unit 1

Introduction, history and evaluation, preparation method of pigments.

Unit 2

Technical details, methods and techniques of wall preparation, preparation of the colors and brushes.

Unit 3

Basics of mural drawing and traditional style, drawing anatomy and study of mural style.

Unit 4

Basics of mural painting.

Unit 5

Mural painting in acrylic colours, drawing and painting.

ReferenceBooks:

1. *Chithrasoothram - Translated by K.K. Warrier.*
2. *Chithralakshanam - K.K Warrier.*

18OEL292 **PAINTING** **2 0 2 3**

Objective:

Painting and artistry has become an effective media to propagate the messages to the community. The methodologies of imparting artistic skills have become highly scientific and technical. Our objective is to cultivate the artistic skills of matured adults through teaching of theory and skills of painting using different media, techniques and tools.

Unit 1

Introduction to Materials and Medium: Water colours, Oil colours, Acrylic colours, Gouache, Oil Pastels and Dry Pastels, Additives and Solvents, Brushes, Paper-types and texture, Canvas types.
Basic sketching with charcoal, pencil and pen.

Unit 2

Watercolour and Gouache Painting - Styles and techniques - wet on wet, wet on dry, ink and pen techniques, painting with water colour pencils, Wash techniques, Layer on Layer technique.

Unit 3

Oil Painting - stretching canvas, surface preparation with gesso; Styles and technique - Wet on wet, wet on dry, impasto, finishing touches.

Unit 4

Acrylic Painting - Acrylic on Paper; Acrylic on canvas, using acrylic retarders and medium, Wet on wet, wet on dry, impasto, finishing touches.

Unit 5

Oil and Dry Pastels, Pastels on Coloured Paper, Pre colouring, hatching and cross hatching, Blending techniques, Fixing techniques.

BOOKS RECOMMENDED:

1. *Reader's Digest - Complete Guide to Drawing and Painting ISBN-10: 0895779560 ISBN-13: 978-0895779564*

18OEL293 **REPORTING RURAL ISSUES** **3 0 0 3**

Objectives:

News coverage of rural areas: Issues ranging from health, education and civic amenities to government welfare schemes and the state of agriculture with farming losing its sheen among rural youth and

resultant urban migration. New trends like mechanization of farming due to shortage of labour, the growth of self-help groups and mushrooming cottage industries, changes in the social and political life of the rural communities, inter-caste and class dynamics and how technological penetration is changing rural life and aspirations, success stories, best practices in farming, growing consumerism and its impact on environment, rural businesses and innovations.

Unit 1

Reporting rural India - problems and prospects: Poor connectivity and infrastructure, electrification and drinking water supply, state of primary healthcare centres, growing literacy and education breaking down caste and class barriers

Unit 2

Role of women in rural areas, gender discrimination, female infanticide and patriarchy, women role models who have asserted themselves in social, political and economic life of the society overcoming all odds and helped breakdown social barriers.

Unit 3

Government development programmes for rural areas. Are they reaching the intended beneficiaries? Success and failure stories, women empowerment and youth upliftment programs.

Unit 4

Agriculture – shrinking areas under cultivation, drying irrigation sources, high cost of inputs, labour shortage and rising wages. Need to ensure fair prices for the farmers' produce by setting up agro-industries and cold storage chains in rural areas and introducing appropriate technology.

Unit 5

Role of media in highlighting rural issues so that authorities in the cities take note and take remedial measures.

Outcomes:

By the end of the course the students will be able to:

CO1: Analyze and clarify the long term tendencies in the rural area and agricultural development in Croatia
CO2: Participate in creating and implementing rural development and agricultural projects
CO3: Interpret measures of agricultural policy
CO4: Understand the Govt. projects and policies for the upliftment of Rural communities, women and children
CO5: Develop communication skill and critical way of thinking
CO6: Contribute towards the society as a mediator by analyzing their problems and creating awareness

REFERENCES:

1. *Bang, R., Khorgade, S., and Chinai, R (2010) Putting Women First: Women and Health in a Rural Community. New Delhi: Stree and Samya.*
2. *Fukuoka, M. (2009). The One-Straw Revolution: An Introduction to Natural Farming. New York: Review of Books.*
3. *Patra, S.C., and Vachhani, A. (2012). Socio Economic Profile of Rural India: Series II, Volume II: North East India (Assam, Manipur, Tripura and Nagaland). New Delhi: Concept Publishing.*
4. *Patil, D.A. (2010). Communication for Rural Development in India: From Green Revolution to 'E' Revolution. New Delhi: Serials Publications*
5. *Pokharapurkar, R. (1993). Rural Development Through Community Television (CISCED). New Delhi: Concept Publishing*
6. *Islam, N. (2006). Reducing Rural Poverty in Asia: Challenges and Opportunities for Microenterprises and Public Employment Schemes. New York, London, Oxford: Food Products Press*

VIDEOS:

The Noer
Faces of Prestea
Hotville Alabama

WEB REFERENCES:

http://www.un.org/en/ecosoc/docs/pdfs/an_integrated_approach_to_rural_development.pdf
http://www.epw.in/frontpage?0=ip_login_no_cache%3D4806b5974dc3439b9a9343b7b5674286
http://www.worldbank.org/en/news/feature/2012/05/17/india-agriculture-issues-priorities
https://www.youtube.com/watch?v=eCBIcWAwOds

18HIN101 HINDI I 1-0-2[2cr]

Unit-1

a)Introduction to Hindi Language, -other Indian Language's, Official Language, link Language Technical terminology..
b) Hindi alphabet: ParibhashaAurBhed.
c) Shabda: ParibhashaAurBhed, RoopantharkiDrishti se
d) Sangya -ParibhashaAurBhed,SangyakeRoopanthar-ling, vachan, karak
e) Sarvanaam- ParibhashaAurBhed.

Unit-2

a) Common errors and error corrections in Parts of Speech –with emphasis on use of pronouns, Adjective and verb in different tenses –gender& number
b) Conversations, Interviews, Short speeches.

Unit -3

a) Letter writing –ParibhashaAurBhed, Avedanpatra (request letter) & Practice
b) Translation-ParibhashaAurBhed, English to Hindi

Unit- 4

Peom :
a) Maithilisharangupth: sakhivemujsekahakarjaate
b) Suryakanthtripatinirala :Priyatam
c) Mahadevivarma- adhikaar
d) Shiyaramsharangupth:ekphoolkichah

Unit- 5

Kahani
a) Kafan - Premchand ,
b) Rajasthan ki Ek Gaav kee theerthyatra - Beeshmasahni
c) Raychandrabhai :By Mahathma Gandhi - Sathya ke prayog
d) Rajani - Mannu Bhandari

Course Outcomes

CO1: To understand the nature & culture of the language.
CO2: Ability to understand the structure of the language in different contexts. .
CO3: To understand the functional skills of the language.
CO4: Enhance the social contribution of modern literature.
CO5: Develop research and secondary reading ability.

18HIN111 HINDI II 1-0-2[2cr]

Unit -1

a) Visheshan- ParibhashaAurBhed.special usage of adverbs, changing voice and conjunctions in sentences.
b) kriya- ParibhashaAurBhed, rupantharkidrushti se-kaal
c) padhparichay.
d) Vigyapan Lekhan (Advertisement writing), Saar Lekhan (Precise writing).

Unit -2

Communicative Hindi – MoukhikAbhivyakthi –understanding proper pronunciation, Haptics …etc in Interviews ,short speeches .

Unit -3

Film review,Audio –Visual-Media in Hindi – Movies appreciation and evaluation.News reading and presentations in Radio and Tv channels in Hindi, samvaadhlekhan,

Unit -4

a) Harishankarparasaiyi- SadacharkaThavis

b) Jayashankarprasadh – Mamata
c) Mannubandari- Akeli
d) Habibtanvir- Karthus

Unit -5

Kavya Tarang

a) Himadri thung shrung se (poet- Jayasankar prasad)
b) Dhabba (poet- kedarnath sing) ,
c) Proxy (poet- Venugopal),
d) Machis(poet –Suneeta Jain) ,
e) Vakth. (poet – Arun kamal)
f) Fasal (poet- Sarveshwar Dayal Saxena)

Course Outcomes

CO1: Develop the creativity & language competence.
CO2: To improve the writing and analytical skillsTeaching
CO3: Enhancing critical thinking.
CO4: A good exposure with the different styles of literary writing.
CO5: To understand the post- modern trends of literature.

18KAN101 KANNADA I 1-0-2[2cr]

- To enable the students to acquire basic skills in functional language.
- To develop independent reading skills and reading for appreciating literary works.
- To analyse language in context to gain an understanding of vocabulary, spelling, punctuation and speech

UNIT – 1

- Railway Nildanadalli – K. S. Narasimha Swamy
- Amma, Aachara Mattu Naanu – K. S. Nisar Ahamad
- Kerege Haara – Janapada
- Simhaavalokana – H.S. Shivaprakash

UNIT – 2

- Dhanwantri Chikitse - Kuvempu
- Mouni - Sethuram
- Meenakshi Maneya Mestru - Kuvempu

UNIT – 3

- Sukha –H.G Sannaguddayya
- Mobile Thenkara Jen Nonagala Jhenkara – Nagesh Hegade
- Namma Yemmege Maatu Tiliyitu – Goruru Ramaswamy Iyangar

UNIT – 4

Language structure

- Usage of punctuation marks
- Introduction to words (right usage)
- Reading skills
- Sentence formation (simple & complex)
- Translation- English to Kannada

References:

1. Kannada Samskruti Kosha – Dr. Chi. C Linganna
2. Kannada Sanna Kathegalu – G H Nayak
3. Lekhana Kale – N. Prahlad Rao
4. Kannada Sahithya Charithre – R. Sri Mugali

18KAN111 KANNADA II 1-0-2[2cr]

Objectives:

- To enable the students to acquire basic skills in functional language.
- To develop independent reading skills and reading for appreciating literary works.
- To develop functional and creative skills in language.
- To enable the students to plan, draft, edit & present a piece of writing.

UNIT – 1

- Bettada Melondu Maneya Maadi – Akka Mahadevi
- Thallanisadiru Kandya – Kanakadasa
- Avva – P. Lankesh
- Neevallave – K. S. Narasimha Swamy

UNIT – 2

Gunamukha – Drama by P. Lankesh

UNIT – 3

Karvalo – Novel by Poornachandra Thejaswi

UNIT – 4

Letter Writing –

Personal (congratulation, invitation, condolence etc.)

- Official (To Principal, Officials of various departments, etc.,)
- Report writing
- Essay writing
- Precise writing

Prescribed text:

1. Gunamukha by P. Lankesh (Lankesh Prakashana)
2. Karvalo by Poornachandra Thejaswi (Mehtha publishing house)

Reference

1. Saamanyanige Sahithya Charitre (chapter 1 to 10) – Bangalore University Publication
2. Hosa Kannada Saahithya Charithre – L.S Sheshagiri Rao
3. Kacheri Kaipidi – Kannada Adhyayana Samsthe (Mysuru University)
4. Kannada Sahithya Charithre – R. Sri Mugali
5. H.S.Krishna Swami Iyangar – *Adalitha Kannada – Chetana Publication, Mysuru*

18SAN101 SANSKRIT I 1-0-2[2cr]

To familiarize students with Sanskrit language and literature.
To read and understand Sanskrit verses and sentences.
Self-study of Sanskrit texts and to practice communication in Sanskrit.
To help the students imbibe values of life and Indian traditions propounded by the scriptures.
To be able to speak in Sanskrit.

Module I

Introduction to Sanskrit language, Devanagari script - Vowels and consonants, pronunciation, classification of consonants, conjunct consonants, words – nouns and verbs, cases – introduction, numbers, Pronouns, communicating time in Sanskrit. Practical classes in spoken Sanskrit. (7 hours)

Module II

Verbs- Singular, Dual and plural — First person, Second person, Third person.
Tenses – Past, Present and future – Atmanepadi and parasmaipadi-kartharipraYoga.
(8hrs)

Module III

Words for communication and moral stories. (4 hrs)

Module IV

Chanakya Neethi first chapter (first 15 Shlokas) (6 hrs)

Module V

Translation of simple sentences from Sanskrit to English and vice versa.(5hs)

18SAN111 SANSKRIT II 1-0-2[2cr]

Module I

Seven cases, Avyayas, sentence making with Avyayas, Saptha kakaras.
(5hrs)

Module II

Kthavathu' Prathyayam, Upasargas, Kthvatha,Thumunnantha, Lyabantha Prathyayam. Three Lakaras – brief introduction, Lot lakara
(5hrs)

Module III

New words and sentences for the communication, Slokas, moral stories(panchathanthra) Subhashithas, riddles (Selected from the Pravesha Book) **(5hrs)**

Module IV

Introduction to classical literature, classification of Kavyas, classification of Dramas - Important five Maha kavyas
(5hrs)

Module V

Translation of paragraphs from Sanskrit to English and wise -verse
(5hrs)

Module VI

Bhagavad - Geeta fourteenth chapter (all 27 Shlokas) **(5hrs)**

Essential Reading:

1, Praveshaha; Publisher : Samskrita bharati, Aksharam, 8th cross, 2nd phase, girinagar, Bangalore -560 085
2, Sanskrit Reader I, II and III, R.S. Vadhyar and Sons, Kalpathi, Palakkad
3, PrakriyaBhashyamwritten and published by Fr. John Kunnappally
4, Sanskrit Primer by Edward Delavan Perry, published by Ginn and Company Boston
5, Sabdamanjari, R.S. Vadyar and Sons, Kalpathi, Palakkad
6, Namalinganusasanam by Amarasimha published by Travancore Sanskrit series
7, SubhashitaRatnaBhandakara by Kashinath Sharma, published by Nirnayasagarpress