Department of Chemistry

Programme: B.Sc	Year:1	**Semester:I**

Name of Faculty:

Mrs. Upasna Devi **Unit I, II,III**

Ms Shireen **Unit IV, V, VI, VII**

Ms. Kehkashan **Unit VIII**

Paper-1**Subject:Chemistry**

CourseCode:B020101T	**CourseTitle:**Fundamentals of Chemistry	Credits -4

Course outcomes:

There is nothing more fundamental to chemistry than the chemical bond. Chemical bonding is the language of logic forchemists. Chemical bonding enables scientists to take the 100-plus elements of the periodic table and combine them inmyriad ways to form chemical compounds and materials. Periodic trends, arising from the arrangement of the periodictable, provide chemists with an invaluable tool to quickly predict an element's properties. These trends exist because ofthe similar atomic structure of the elements within their respective group families or periods, and because of the periodicnature of the elements. Reaction mechanism gives the fundamental knowledge of carrying out an organic reaction in astep-by-step manner. This course will provide a broad foundation in chemistry that stresses scientific reasoning andanalytical problemsolvingwith a molecular perspective.Students will gainanunderstandingof

- Moleculargeometries,physicalandchemicalpropertiesof themolecules.
- Current bonding models for simple inorganic and organic molecules in order to predict structures and importantbondingparameters.
- ThechapterRecapitulationofbasicsoforganicchemistrygivesthemost primaryandutmostimportantknowledgeand concepts oforganic Chemistry.
- This course gives a broader theoretical picture in multiple stagesin an overall chemical reaction. It describesreactiveintermediates,transitionstatesandstatesofall thebondsbrokenandformed.It enablestounderstandthereactants,catalyst, steriochemistryand major andminor productsofanyorganicreaction.
- It describes the types of reactions and the Kinetic and thermodynamic aspects one should know for carrying outanyreaction andthe ways howthereaction mechanismcan bedetermined.

ThechaptersSteriochemistrygivestheclearpictureoftwo-dimensionalandthree-dimensionalstructureofthemolecules,andtheirrole inreaction mechanism.

Credits: 4	Elective
Max.Marks: 25+75	Min.PassingMarks-

TotalNo.ofLectures=60

Unit	**Topics**	**No. ofLectures**

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I	*Introduction to Indian ancientChemistry and contribution of Indian Chemists, in context to theholisticdevelopment of modernscienceandtechnology,shouldbeincludedunderContinues Evaluation(CIE)* **MolecularpolarityandWeakChemicalForces:** Resonance and resonance energy, formal charge, Van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interaction, dipole moment and molecular Structure (Diatomicand polyatomic molecules), Percentage ionic character from dipole moment, polarizing power andpolarizability. Fajan's rules and consequences of polarization. Hydrogen bonding, van der Waalsforces, ion-dipole forces, dipole-dipole interactions, induced dipole interaction. Effects of weakchemical forces, melting and boiling points, solubility, energetics of dissolution process. Latticeenergyand Borrn-Haber cycle,solvationenergy, and solubilityofionic solids.	10
II	**SimpleBondingtheoriesofMolecules** Atomic orbitals, Aufbau principle, multiple bonding (σ and π bond approach) and bond lengths, thevalence bond theory (VBT), Concept of hybridization, hybrid orbitals and molecular geometry,Bent's rule, Valence shell electron pair repulsion theory (VSEPR), shapes of the following simplemoleculesandionscontainginglonepairsandbondpairsofelectrons:H_2O,NH_3,PCl_5,SF_6,SF_4, ClF_3,I_3^-,ClF_2^- andSO_4^{2-} andH_3O^+.Molecularorbitaltheory(MOT).Molecularorbitaldiagrams bondordersofhomonuclearandheteronucleardiatomicmoleculesandions(N_2,O_2,C_2,B_2,F_2,CO,NO,and theirions)	10
III	**Periodicproperties ofAtoms(withreferencetos&p-block)**: Briefdiscussion,factorsaffectingandvariationtrendsoffollowingpropertiesingroupsandperiods. Effectivenuclearcharge,shieldingorscreeningeffect,Slaterrules,Atomicandionicradii,Electronegativity,Pauling's/AllredRochow'sscales,Ionizationenthalpy,Electrongainenthalpy.	05
IV	**Recapitulation of basics of Organic Chemistry:** Hybridization, bond lengths and bond angles,bond energy, localized and delocalized chemical bonding, Van der Waals interactions, inclusioncompounds, Clatherates, Charge transfer complexes, hyperconjugation, Dipole moment; ElectronicDisplacements: Inductive,electromeric,resonancemesomericeffectsandtheirapplications	05
V	**Mechanism of Organic Reactions:** Curved arrow notation, drawing electron movements withallows, half-headed and double-headed arrows, homolytic and heterolytic bond fission, Types ofreagents–electrophilesandnucleophiles, Typesoforganicreactions,Energy considerations.Reactiveintermediates–Carbocations,carbanions,freeradicals,carbenes,arynesandnitrenes(withexamples).Assigningformalchargesonintermediatesandotherionicspecies.Methodsofdeterminationofreactionmechanism(productanalysis,intermediates,isotopeeffects,kineticand stereochemicalstudies).	10

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VI	**Steriochemistry**-Concept of isomerism, Types of isomerism; Optical isomerism – elements ofsymmetry,molecularchirality,enantiomers,stereogeniccenter,opticalactivity,propertiesofena ntiomers, chiral and achiral molecules with two stereogenic centers, disasteromers, threo anderythrodiastereomers,mesocompounds,resolutionofenantionmer,inversion,retentionandrec emization. Relative and absolute configuration, sequence rules, D & L and R & S systems ofnomenclature. Geometric isomerism – determination of configuration of geometric isomers, E & Zsystem of nomenclature, geometric isomerism in oximes and alicyclic compounds. Conformationalisomerism – conformational analysis of ethane and n-butane; conformations of cyclohexane, axialandequatorialbonds,conformationofmonosubstitutedcyclohexanederivatives,Newmanpr ojectionandSawhorseformulae,Fischer NewmanprojectionandSawhorseformulae,Fischerandflyingwedgeformulae,Differencebetwee n configurationandconformation	10
VII	**BasicComputersystem(inbrief)-** HardwareandSoftware;Inputdevices,Storagedevices,Outputdevices,CentralProcessingUnit(C ontrolUnitandArithmeticLogicUnit);Numbersystem(Binary,Octal and Hexadecimal Operating System); Computer Codes (BCD and ASCII)**;** Numeric/Stringconstants and variables. Operating Systems (DOS, WINDOWS, and Linux); Software languages:LowlevelandHighLevellanguages(Machinelanguage,Assemblylanguage;QBASIC, FORTRANandC++);SoftwareProducts(Office,chemsketch,scilab,matlab,hyperchem,etc.),int ernet application.	**05**
VIII	**MathematicalConceptsforChemistry** Logarithmic relations, curve sketching, linear graphs and calculation of slopes, differentiation offunctions like Kx, e^x, X^n , sin x, log x; maxima and minima, partial differentiation and reciprocityrelations, Integration of some useful/relevant functions; permutations and combinations, Factorials,Probability	**05**

SuggestedReadings:

1. Lee,J.D.ConciseInorganicChemistry,PearsonEducation2010
2. Huheey,J.E.,Keiter,E.A.,Keiter,R.L.,Medhi,O.K.InorganicChemistry,PrinciplesofS tructureandReactivity,Pearson Education 2006.
3. Douglas,B.E.andMcDaniel,D.H.,Concepts&ModelsofInorganicChemistry,Oxford,1970
4. Shriver,D.D.&P.Atkins,*InorganicChemistry2ndEd.*, Oxford UniversityPress,1994.
5. Day,M.C.andSelbin,J.TheoreticalInorganicChemistry,ACSPublications1962.
6. SinghJ.,YadavL.D.S.,AdvancedOrganicChemistry,PragatiEdition

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7. Morrison,R.N.&Boyd,R.N. *OrganicChemistry*,DorlingKindersley(India) Pvt.Ltd.(PearsonEducation).
8. Carey,F.A.,Guiliano,R.M.*OrganicChemistry*,Eighthedition,McGrawHillEducation,2012.
9. Loudon,G.M.*OrganicChemistry*,Fourthedition,OxfordUniversityPress,2008.
10. Clayden,J., Greeves, N. &Warren, S.*Organic Chemistry*,2nd edition, Oxford UniversityPress, 2012.
11. GrahamSolomons, T.W.,Fryhle, C. B. *Organic Chemistry*,JohnWiley&Sons,Inc.
12. Sykes,P.*AguidebooktoMechanism inOrganicChemistry*,PearsonEducation,2003
13. Francis**,P.G.**MathematicsforChemists,Springer,1984

Note:FortheпromotionofHindilanguage,coursebookspublishedinHindimaybeprescribed bytheUniversity

Suggested online links:http://heecontent.upsdc.gov.in/Home.aspx

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Department of Chemistry

Programme: B.Sc	Year:1	**Semester:II**

Name of Faculty:

Mrs. Manisha Singhal- Unit I

Dr. Deeksha Yajurvedi Unit IV, V

Mrs. Upasna Devi Unit VI, VII

Ms Shireen Unit II

Ms. Mariya SaghirUnit VIII

Ms. Kehkashan Unit III

Paper-1**Subject:Chemistry**

CourseCode:B020201T	**CourseTitle:Bioorganicand MedicinalChemistry**

Courseoutcomes: Biomoleculesareimportantforthefunctioningoflivingorganisms.Thesemoleculesperformortriggerimportantbiochemicalreactionsinlivingorganisms.Whenstudyingbiomolecules,onecanunderstandthephysiologicalfunctionthatregulatesthepropergrowthanddevelopmentofahumanbody.Thiscourseaimstointroducethestudentswithbasicexperimentalunderstandingofcarbohydrates,aminoacids,proteins,nucleicacidsandmedicinalchemistry.Uponcompletionofthiscoursestudentsmaygetjobopportunitiesinfood,beverageand pharmaceuticalindustries.

Credits: 4	Elective
Max.Marks: 25+75	Min.PassingMarks-

TotalNo.ofLectures=60

Unit	**Topics**	**No. ofLectures**
I	**Chemistry of Carbohydrates** : Classification of carbohydrates, reducing and non-reducingsugars, General Properties of Glucose and Fructose, their open chain structure. Epimers,mutarotation and anomers. Mechanism of mutarotation Determination of configuration ofGlucose (Fischer's proof). Cyclic structure of glucose. Haworth projections. Cyclic structureoffructose.Interconversionsofsugars(ascendinganddescendingofsugarseries,conversionof aldoses to ketoses). Lobry de Bruyn-van Ekenstein rearrangement; stepping–up (Kiliani-Fischermethod)andstepping–down(Ruff's&Wohl'smethods)ofaldoses;end-group-interchangeofaldosesLinkagebetweenmonosachharides,structureofdisacharrides(sucrose,maltose,lactose)andpolysacharrides(starchandcellulose)excludingtheirstructureelucidation	10

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II	**ChemistryofProteins:**Classification*ofaminoacids,*zwitterionstructureandIsoelectricpoint.Overviewofprimary,secondary,tertiaryandquaternarystructureofproteins.Determinationofprimarystructureofpeptides,determinationofN-terminalaminoacid(byDNFBandEdmanmethod)andC–terminalaminoacid(bythiohydantoinandwithcarboxypeptidase enzyme). Synthesis of simple peptides (upto dipeptides) by N-protection &C-activating groups and Merrifield solid phase synthesis. Protein denaturation/ renaturationMechanismofenzymeaction,factorsaffectingenzymeaction,Coenzymesandcofactorsand theirroleinbiologicalreactions,Specificityofenzymeaction(Includingstereospecifity),	10
III	**Chemistry of Nucleic Acids:**Constituents of Nucleic acids: Adenine, guanine, thymine andCytosine(Structureonly),Nucleosidesandnucleotides **(nomenclature**),Synthesisofnucleicacids,Structureofpolynucleotides;StructureofDNA(Watson-Crickmodel)andRNA(**typesofRNA**),GeneticCode,BiologicalrolesofDNAandRNA:Replication,Transcriptionand Translation	05
IV	**IntroductoryMedicinalChemistry:**Drugdiscovery,designanddevelopment;BasicRetrosynthe ticapproach.Drugaction-receptortheory.Structure–activityrelationshipsofdrugmolecules, binding role of –OH group,-NH_2 group, double bond and aromatic ring, Synthesisoftherepresentativedrugsofthefollowingclasses:analgesicsagents,antipyreticagents,anti-inflammatory agents (Aspirin, paracetamol); antibiotics (Chloramphenicol); antibacterial andantifungalagents(Sulphonamides;Sulphanethoxazol,Sulphacetamide);antiviralagents(Acyclovir),CentralNervousSystemagents(Phenobarbital,Diazepam),Cardiovascular (Glyceryltrinitrate),HIV-AIDSrelateddrugs(AZT-Zidovudine	10
V	**SolidState** Definition of space lattice, unit cell. Laws of crystallography – (i) Law of constancy ofinterfacialangles,(ii)Lawofrationalityofindicesandiii)Symmetryelementsincrystalsandlaw ofsymmetry.X-ray diffractionbycrystals.DerivationofBraggequation.Determination ofcrystalstructureofNaCl,KClandCsCl (Laue'smethod andpowder method).	05
VI	**IntroductiontoPolymer** Monomers, Oligomers, Polymers and their characteristics,Classification of polymers :Naturalsynthetic,linear,crosslinkedandnetwork;plastics,elastomers,fibres,Homopolymers and Co-polymers, Bonding in polymers : Primary and secondary bond forcesin polymers ; cohesive energy, and decomposition of polymers. Determination of Molecularmassofpolymers:NumberAveragemolecularmass(Mn)andWeightaveragemolecular mass(Mw) of polymers and determination by (i) Viscosity (ii) Light Scattering method (iii)	10

	Gelpermeationchromatography(iv)Osmometryand Ultracentrifuging. **SiliconesandPhosphazenes**–Siliconesandphosphazenesasexamplesofinorganic polymers,natureofbondingintriphosphazenes	
VII	**KineticsandMechanismofPolymerization** Polymerization techniques, Mechanism and kinetics of copolymerization,Addition or chain-growthpolymerization,Freeradicalvinylpolymerization,ionicvinylpolymerization,Ziegler-Nattapolymerizationandvinylpolymers,Condensationorstepgrowth-polymerization, Polyesters,polyamides,phenolformaldehyderesins,ureaformaldehyderesins,epoxyresin andpolyurethanes,Naturalandsyntheticrubbers,Elementaryideaoforganicconducting polymers	05
VIII	**SyntheticDyes:**Colourandconstitution(electronicConcept),Classificationofdyes,Chemistryandsynthesisof Methylorange,Congored,Malachitegreen,crystalviolet, phenolphthalein, fluorescein, AlizarinandIndigo	05

SuggestedReadings:

1. Davis,B.G.,Fairbanks,A.J.,*CarbohydrateChemistry*,OxfordChemistryPrimer,OxfordUniversityPress.
2. Finar,I.L.*OrganicChemistry*(*Volume2)*,DorlingKindersley(India)Pvt.Ltd.(PearsonEducation).
3. Nelson,D.L.&Cox,M.M. *Lehninger'sPrinciplesofBioch*emistry*7thEd.*,W. H.Freeman.
4. Berg,J.M.,Tymoczko, J.L.&Stryer, L. *Biochemistry 7th Ed.*, W. H. Freeman.
5. Morrison,R.T.&Boyd,R. N.*OrganicChemistry*,DorlingKindersley(India) Pvt.Ltd.(PearsonEducation).
6. Patrick,G.L.IntroductiontoMedicinalChemistry,OxfordUniversityPress,UK,2013.
7. Singh,H.&Kapoor,V.K.MedicinalandPharmaceuticalChemistry,VallabhPrakashan,Pitampura,NewDelhi,2012.
8. Atkins,P.W.&Paula,J.deAtkin'sPhysicalChemistryEd.,OxfordUniversityPress13(2006).
9. Ball,D.W. Physical ChemistryThomson Press,India (2007).
10. Castellan,G.W.PhysicalChemistry4thEd. Narosa(2004).
11. R.B.Seymour&C.E.Carraher:*PolymerChemistry:AnIntroduction*,MarcelDekker,Inc.NewYork,1981.
12. G.Odian: *Principles of Polymerization*, 4thEd.Wiley, 2004.
13. F.W. Billmeyer:*Textbookof Polymer Science*, 2nd Ed. WileyInterscience,1971.
14. P.Ghosh:PolymerScience &Technology,Tata McGraw-HillEducation,1991

Note:FortheпromotionofHindilanguage,coursebookspublishedinHindi maybeprescribedbytheUniversity

Suggested online links:http://heecontent.upsdc.gov.in/Home.aspxhttps://nptel.ac.in/courses/104/105/104105124/https://nptel.ac.in/courses/103/106/105106204/https://nptel.ac.in/courses/104/105/104105034/https://nptel.ac.in/courses/104/103/104103121/https://nptel.ac.in/courses/104/102/104102016/https://nptel.ac.in/courses/104/106/104106106/https://nptel.ac.in/courses/104/105/104105120/

SuggestedContinuousEvaluationMethods: tests, assignments, presentations

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Department of Chemistry

Programme: B.Sc II	Year: 2	**Annual**
Name of Faculty: Ms. Mariya Saghir	Paper-1	**Subject: Chemistry**
Course Code: B-206	**CourseTitle: Inorganic Chemistry**	

Course outcomes: Upon successful completion students should be able to:

- To explain the position of transition elements in periodic table.
- To explain the position of inner transition elements in periodic table.
- To explain the formation of different types of bonding and nature of metal ligand bond in complexes
- To explain the concepts of nomenclature and isomerism of coordination compounds.
- Understand the study of Arrhenius, Bronsted-Lowery, and Lux-Flood solvent system of acids and bases.
- Understand valence bond theory for coordination compounds.
- Gain knowledge about Non-aqueous Solvents.

Credits: -	Elective-
Max.Marks: 50	Min.Passing Marks-
Total No.of Lectures =	

Unit	**Topics**	**No. of Lectures**
I	**I. Chemistry of Elements of First Transition Series** Characteristic properties of d-block elements. Binary compounds (hydrides, carbides and oxides) of the elements of the first transition series and complexes with respect to relative stability of their oxidation states, coordination states, coordination number and geometry. **II. Chemistry of Elements of Second and Third Transition Series** General characteristics, comparative treatment of Zr/Hf, Nb/Ta, Mo/W in respect of ionic radii, oxidation states, magnetic behavior, spectral properties and stereochemistry.	**8** **7**
II	**III. Coordination Compounds** Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.	**15**

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III	**IV. Chemistry of Lanthanide Elements** Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, ceric ammonium sulphate and its analytical uses. **V. Chemistry of Actinides** Electronic configuration, oxidation states and magnetic properties, chemistry of separation of Np, Pu and Am from U.	**8** **7**
IV	**VI. Oxidation and Reduction:** Electrode potential, electrochemical series and its applications, Principles involved in the extraction of the elements**.** **VII. Acids and Bases:** Arrhenius, Bronsted-Lowery, the Lux-Flood, solvent system and Lewis concept of acids and bases**.** **VIII. Non-aqueous Solvents:** Physical properties of a solvent, types of solvents and their general characteristics, Reaction in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2	**5** **5** **5**

SuggestedReadings:

Coordination Chemistry", Ajai Kumar
Purcell, K.F & Kotz, J.C. Inorganic Chemistry W.B. Saunders Co, 1977.
Huheey, J.E., Inorganic Chemistry, Prentice Hall, 1993.
Cotton, F.A. & Wilkinson, G, Advanced Inorganic Chemistry Wiley-VCH, 1999 73
Basolo, F, and Pearson, R.C. Mechanisms of Inorganic Chemistry, John Wiley & Sons, NY, 1967.
Greenwood, N.N. & Earnshaw A. Chemistry of the Elements, Butterworth-Heinemann, 1997.
Advanced Inorganic Chemistry", R.D.Madan
Concise Inorganic Chemistry" , J. D. Lee

SuggestedContinuousEvaluationMethods: tests, assignments, presentations

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Department of Chemistry

Programme: B.Sc II	Year:2	**Annual**

Name of Faculty: Dr. Deeksha Yajurvedi- Unit IV

Mrs. Upasna Devi - UnitI,II,III Paper-2 **Subject:Chemistry**

CourseCode:B-207	**CourseTitle: Organic Chemistry**

Courseoutcomes: Students will gain an understanding of:

- methods of preparation and reactions of alcohols, phenols,ethers epoxides aldehydes ketones, acids and their derivatives
- chemistry of nitrogen compounds.
- Electromagnetic spectrum, Spectroscopy, UV Vis, IR spectroscopy with reference to organic compounds.

Students are expected to apply their knowledge to problem-solve, deduce structures, and synthesize simple organic molecules using the studied reactions.

Credits: -	Elective-
Max.Marks: 50	Min.PassingMarks-

TotalNo.ofLectures= 60

Unit	Topics	No. ofLectures
I	**Electromagnetic spectrum absorption spectra** Ultraviolet (UV) absorption spectroscopy- absorption laws(Beer-Lambert's law), molar absoortivity, presentation and analysis of UV spectra, types of electronic transitions, effect of comjugatyion, concept of chromophore and auxochrome, bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones. Infra red (ir) absorption spectroscopy- molecular vibrations, Hooke;s law, selection rules, intensity and position of IR bands, measurement of IR Spectrum, fingerprint region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds	**10**
II	**Alcohols** Classification and nomenclature, monohydric alcohols , nomenclature, methods of formation by reduction of aldehydes, ketones carboxylic acids and esters, hydrogen bonding, acidic nature, reaction of alcohols Dihydric alcohols- nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage ($Pb(OAc)_4$ and HIO_4) and pinacol pinacolone rearrangement . trihydric alcohols- nomenclature, methods of formation , chemical reactions of glycerol.	**8**

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III	**Phenols**: Nomenclature, structure and bonding, preparation of phenols, physical properties and acidic character, comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion, reaction of phenols- electrophilic aromatic substitution, acylation and carboxylation, mechanisms of fries rearrangement, claisen rearrangement, gattermann synthesis, hauben hoesch reaction, ledere manasse reaction and Reimer–Tiemann reaction.	**8**
IV	**Ethers and Epoxides** Nomenclature of ethers and methods of their formation, physical properties, chemical reactions- cleavage and auto oxidation, ziesels method. Synthesis of epoxides. Acid and base catalysed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.	**2**
V	**Aldehydes and ketones**: nomenclature and structure of the carbonyl groups, synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1. 3 dithianes, synthesis of ketones from nitrites and from carboxylic acids, physical properties **Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin,** Structure, reactivity and preparation; Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonia derivatives with mechanism; Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation, condensation with ammonia and its derivatives, wittig reaction, mannich reaction, use of acetals as protecting group, oxidation of aldehydes, Baeyer villliger oxidation of ketones, , Cannizzaro reaction MPV, Clemmensen Wolff-Kishner, LiAlH4, NaBH4, reductions. Halogenation of enolizable ketones an introduction to alpha, beta unsaturated aldehydes and ketones Claisan-Schmidt, Perkin, Beckmann and Benzil-Benzilic acid rearrangements, haloform reaction and Baeyer Villiger oxidation, αsubstitution reactions, oxidations and reductions (,PDC and PGC); Addition reactions of unsaturated carbonyl compounds: Michael addition. Active methylene compounds: Keto-enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate.	**10**
VI **VII**	**Carboxylic Acids and their Derivatives** Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids. Reactions of carboxylic acids, Hell- Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids, mechanism of decarboxylation. Methods of formation and chemical reactions of halo acids, hydroxy acids- malic, tartaric, and citric acids. Methods of preparation and chemical reactions of unsaturated monocarboxylic acids. Dicarboxylic acids-methods of preparation and effect of heat and dehydrating agents. **Carboxylic acid derivatives**- Structure and nomenclature of acid chlorides, esters, amides (urea) and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Preparation of carboxylic acid	**12**

	derivatives, chemical reactions. Mechanism of esterification and hydrolysis (acid and base)	
VIII	**Nitrogen Containing Organic Compounds** Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanism of nucleophilic substitution in nitroarenes and their reactions in acidic, neutral and alkaline media. Picric acid. Halonitroarenes-reactivity, structure and nomenclature of amines. Physical properties. Separation of mixture of primary, secondary and tertiary amines. Structural features affecting basicily of amines. Amine salts as phase-transfer catalysts. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel-phthalimide reaction, Hofmann bromamide reaction. Reaction of amines, electrophilic aromatic substitution in aryl amines, reaction of amines with nitrous acid. Synthetic transformations of aryl diazonium salts, azo coupling.	**10**

Recommended Books/references:

1. Solomons, T.W G., Fryhle, B. Craig. Organic Chemistry, John Wiley & Sons, Inc (2009).

2. McMurry, J.E. Fundamentals of Organic Chemistry, Seventh edition Cengage Learning, 2013.

3. P Sykes, A Guide Book to Mechanism in Organic Chemistry, 6th Edition (1997), Orient Longman, New Delhi.

4. Morrison R. T. and Boyd R. N. Organic Chemistry, Sixth Edition Prentice Hall India, 2003.

SuggestedContinuousEvaluationMethods: tests, assignments, presentations

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Department of Chemistry

Programme: B.Sc II	Year:2	**Annual**
Name of Faculty: Mrs. Manisha singhal	Paper-1**Subject:Chemistry**	
CourseCode:**B-208**	**CourseTitle: physical Chemistry**	

Course outcomes: Upon successful completion students should be able to:

- To understand and interpret concepts of thermodynamics, equilibrium and electrochemistry and phase equilibrium.

Credits: -	Elective-
Max.Marks: 50	Min.PassingMarks-17
Total No.of Lectures=60	

Unit	Topics	No. of Lectures
I	**Thermodynamics –I** Deftnitions of thermodynamic terms : System, suroundings etc. Types of systems, intensive and extensive properties, State and path functions and their diferentials, Thermodynamic processes, concept of heat and work. First Law of Thermodynamics : Statement, definition of intermal energy and enthalpy, Heat capacity, heat capacities at constant volume and pressure and their relationship, Joule's law- Joule-Thomson cocfficient and inversion temperature. Calculation of w, q, dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process. Thermochemistry : Standard state, standard enthalpy of formation-Hess's Law of heat summation and its applications, Hcat of reaction at constant pressure and at constant volume, Enthalpy of neutralízation, Bond dissociation energy and its calculation from therno-chemical data, temperature dependence of enthalpy, Kirchhoff's equation .	**10** **5**

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II	**II. Chemical Equilibrium** Equilibrium constant and free energy, Thermodynamic derivation of law of mass áction, Le Chatelier's principle Reaction isotherm and reaction isochore-Clapeyron-clausius equation and its applications. **III. Thermodynamics -II** Second Law of Thermodynamics : Need for the law, different statements of the law, Camot's cycle and its efficiency, Carnot's theorem. Thermodynamic scale of temperature. Concept ofentropy: Entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, cntropy change in physical change, clausius incquality, entropy'as a criteria of spontaneity and equilibrium, Equilibrium change in ideal gases and mixing of gases. GIbbs and Helmkoltz functions: Gibbs function (G) and Helmhotz function (A) as thermodynamic quantities, A & Gas criteria for themodynamic equilibrium and spontancity, their advantage over entropy change, Variation of G and A with P, Vand T. Third Law of Thermodynamics: Nernst heat theorem, statement and concept of residual entropy. Nernst distribution law - thermodynamic derivation, applications	**4** **10**
III	**IV. Electrochemistry - I:** Electrlcal transport:- Conduction in metals and in electrolyte solutions, specific conductance molar and equivalent conductance, measurement of equivalent conductance, variation of molar equivalent and specific conductance with dilution. Migration of ions and Kohirausch's law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law its uses and limitations, Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only), Transport number, definition and determination by Hittorf's method and moving boundary method. Applications of conductivity measurements: determination of degree of dissociáti0n, determination of K, of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations. **V. Solutions**: Liquid- Liquid mixtures- Ideal 1iquid mixtures, Raoult's and Henry's law, Nonideal system-azeotropes- HCI-H_20 and ethanol – water systems. Partially miscible liquidş- Phenol - water, trimethylamine - water, nicotine-water systems. Immiscible liquids, steam distillation. Head of the Chemistry Deptt. R.G. (P.G.) College, Meerut.	**10** **4**

IV	**VI. Electrochem istry - Il:** Types of reversible electrodes - gas-metal ion, metal-ion, metalinsoluble salt-anion and redox electrodes, Electrode reactions, Nernst equation, derivation of. cell E.M.F. and single electrode potential, strandard hydrogen electrode-reference clectrodes and their applications, standard electrode potential, sign conventions, clectrochemical series and its significánce. Bloctrolytic and Galvanic cellsTeversible and irreversible cells, conventional representation of electrochemical cells; EMF of a cell and its measurements, Computation of cell EMF, Calculation of thermodynamic quantities of cell reactions (ΔG, ΔH and K) Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiomettić titrations. Definition of pH and pk,, determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods; Buffers-Mechanism of bu ffer action, Henderson-Hazel equation,: application of buffer solution, Hydrolysis of salts **VII. Phase Equilibrium:** Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibb's phase rule, phase equilibria of one component system-water, 'C0,' and 'S' systems Phase equilibria of two component system - solid liquid equilibria simple eutectiç- Bi-Cd, Pb-Ag systems, desilverisation of lead. Solid solutions – compound formation with congruent melting point (Mg-Zn) and incongruent melting point, ($FeCl_3$-H_20) and ($CuSO_4$-H_20) system	**12** **5**

Suggested readings: Atkins, P.W.& paula,J.de atkins physical chemistry Ed.Oxford universitypress13.

Ball,D.W.physical chemistryThomson press, india

Castellan ,G.W. Physical chemistry4th Ed.Narosa(2004)

Text book of Chemistry by R.L. Madan.

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Department of Chemistry

Programme: B.Sc III	Year:3	**Annual**
Name of Faculty: Dr. Deeksha Yajurvedi	Paper-1**Subject:Chemistry**	
CourseCode:**B-306**	**CourseTitle: Inorganic Chemistry**	

Courseoutcomes: Upon successful completion students should be able to:

- To explain the formation of different types of bonding and nature of metal ligand bond in complexes
- To explain the concepts of geometry of simple molecules
- Understand the study of Lewis and HSAB concepts of acids and bases.
- Understand crystal field theory for coordination compounds and their electronic spectra
- Study magnetic, kinetic and thermodynamic aspects of transition metal complexes.
- Study the Bio-inorganic chemistry – metal ions in biological system, its toxicity; hemoglobin.
- Gain knowledge about organometallic chemistry.

Credits: -	Elective-
Max.Marks: 50	Min.PassingMarks-
TotalNo.ofLectures=	

Unit	**Topics**	**No. ofLectures**
I	**I. Metal-ligand Bonding in Transition Metal Complexes** Limitation of valence bond theory, an elementary idea of crystal-field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors. affecting the crystal Field Parameters	**12**
	II. Thermodynamic and Kinetic Aspect of Metal Complexes A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes	**5**
II	**III. Magnetic Properties of Transition Metal Complexes** Types of magnetic behavior, methods of determining magnetic susceptibility, eff values, orbitalμs and μspin-only formula. L-S coupling, correlation of contribution to magnetic moments, application of magnetic moment data for 3dmetal complexes.	**9**
	IV. Electron Spectra of Transition Metal Complexes Types of electronic transition, selection rules of d-d transitions, spectroscopic ground state, spectrochemical series. Orgel-energy level diagram for d1 and d9 states, discussion of the electronic spectrum of [Ti(H2O)6J 3+ complex ion	**6**

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III	**V. Organometallic Chemistry** Definition, nomenclature and classification of organometallic compounds. Preparation, properties, bonding and applications of alkyls and Aryls of Li, Mg, Al, Zn, Hg, Sn and Ti a brief account of metat- ethylene complexes and homogeneous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls. **VI. Silicones and Phosphazenes** Silicones and phosphazenes as examples of organic ploymers, nature of bonding	**10** **4**
IV	**VII. Hard and Soft Acids and Bases (HSAB)** Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and Softness. **VIII. Bioinorganic Chemistry** Essential and trace elements in biological processes, metallporphyrins with special reference to hemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca2+ , nitrogen fixation	**8** **6**

SuggestedReadings:

Purcell, K.F & Kotz, J.C. Inorganic Chemistry W.B. Saunders Co, 1977.
Huheey, J.E., Inorganic Chemistry, Prentice Hall, 1993.
Lippard, S.J. & Berg, J.M. Principles of Bioinorganic Chemistry Panima Publishing Company 1994.
Cotton, F.A. & Wilkinson, G, Advanced Inorganic Chemistry Wiley-VCH, 1999 73
Basolo, F, and Pearson, R.C. Mechanisms of Inorganic Chemistry, John Wiley & Sons, NY, 1967.
Greenwood, N.N. & Earnshaw A. Chemistry of the Elements, Butterworth-Heinemann, 1997.
Advanced Inorganic Chemistry", R.D.Madan
Inorganic Chemistry", P.L. Soni

SuggestedContinuousEvaluationMethods: tests, assignments, presentations

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Department of Chemistry

Programme: B.Sc III	Year:3	**Annual**
Name of Faculty: Mrs. Manisha singhal &Ms. Kehkashan	Paper-1**Subject:Chemistry**	
CourseCode:**B-307**	**CourseTitle: organic Chemistry**	

Course outcomes: Upon successful completion students should be able to:

- To interpret the NMR spectra of organic compounds.
- Gain knowledge about organometallic chemistry, Properties and synthesis of organosulphur compour heterocyclic compounds,
- To explain the classification nomenclature and properties of Carbohydrates,
- To understand basics of aminoacids, proteins,nucleic acids, Fats ,oils, and detergents, polymers, synthetic Dyes.

To understand the synthesis via enolates.

Credits: -	Elective-
Max.Marks: 50	Min.PassingMarks-17

Total No.of Lectures=60

Unit	Topics	No. o Lectur
I	**I. Spectroscopy** Nucelear Magnetic resonance (NMR) spectroscopy. Proton magnetic resonance (1H NMR) spectroscopy, nuclear shielding and deshielding chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2,-tribromoethane, ethyl acetate, toluene and acetophenone. Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and NMR spectroscopic techniques.	**12**
II	**II. Organometallic compounds** Organometallic Compounds:the Grignard reagents, formation, structure and chemical reactions. Organozinc compounds:formation and chemical reations. Organolithium compounds : formation and chemical reations	**6**
	III. Organosulphur compounds Nomenclature, structural formation, methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine.	**4**

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	IV.Heterocyclic Compounds: Introduction:Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine, Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophillic substitution, mechanism of nucleophillic substitution reaction in pyridine derivatives, comparison of basicity of pyridine, piperidine and pyrrole. Introduction to condensed five and six membered heterocycles. Preparation and reactions of indole, quinolineand isoquinoline with special reference to fisher indole synthesis, skraup synthesis and Bischler Nepieralski synthesis, mechanism of electrophillic substitution reactions of indole, quinoline,and isoquinoline.	**7**
III	**V. Carbohydrates:** Classification and nomenclature. Monosaccharides. mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosacchariedes. Erythro and threo diastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers and esters. Determination of ring size of monosaccharides. Cyclic structure of D(+)-glucose. Mechanism of mutarotation. Structrure or ribose and deoxyribose. An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides e.g. starch and cellulose (without involving structure determination.) **VI.Amino Acids, Peptides, Proteins and Nucleic Acids** Classification, structure and stereochemistry of amino acids. Acid base behavior, electrophoresis. Preparation and reactions of □-amino acids, structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure .determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis. solid-phase peptide synthesis. Structures of peptides and proteins, level of protein structure. Proteins denaturation/renaturation. Nucleic acids: Introduction, Constitution of nucleic acids-Ribnonucleosides and ribonucleotides. The double helical structure of DNA. '	**9** **8**

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IV	**V.Fats, Oil and Detergents** Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides. hydrogenation of unsaturated oils. saponification value, iodine value, acid value. Soaps, synthetic detergents, alkyl and aryl sulphonates. **VIII. Synthetic Polymers** Addition of chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegier-Natta polymerization and vinyl polymers. Condensation or step growth polymerization. Polyesters, polyamides, phenol-formaldehyde resins, urea- formaldehyde resins, epoxy resins and polyurethanes. **IX. Synthetic Dyes** Color and constitution (electronic concept). Classification of dyes. Chemistry and synthesis of Methyl orange, Congo red, Malachite green, Crystal violet, Phenolpthalein, Fluorescein, Alizarin and Indigo **X Organic Synthesis Via Enolates** Acidity of α-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate:, the Claisen condensation, Keto-enol tautomerism of ethyl acetoacetate. Alkylation of 1,3-dithianes.Alkylation and acylation of enamines.	**4** **4** **3** **3**

Suggested readings: Text books of organic chemistry by solomons.

Text book of Chemistry by R.L. Madan.

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Programme: B.Sc III	Year:3	**Annual**
Name of Faculty: Mrs. Manisha singhal	Paper-1**Subject:Chemistry**	
CourseCode:**B-308**	**CourseTitle: physical Chemistry**	

Course outcomes: Upon successful completion students should be able to:

- To understand and interpret Quantum mechanics, spectroscopy,Physical properties and molecular structure.
- Gain knowledge about rotational spectrum, vibrational spectrumIR, Raman and electronic spectrum.
- To understand the phenomenon of photochemistry.
- To understand colligative properties of solution and to find out molecular weight of compounds using these properties.

Credits: -	Elective-
Max.Marks: 50	Min.PassingMarks-17
Total No.of Lectures=60	

Unit	**Topics**	**No. of Lectures**
I	**I. Introductory Quantum mechanics:** Black-body radiation, Planck's radiation law, photoelectric effect, heat capacity of solids, Bohr's model of hydrogen atom (no derivation) and its defects, Compton effect. De Brogile hypothesis, Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiitonian operator **II.Spectroscopy:** Introduction: electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom. **III.Physical properties and molecular structure:** Optical activity, polarization (clausius-Mossotti equation) orientation of dipoles in an electric field, dipole moment, induced dipole moment, measurement of dipole moment-temperature method and refractivity method,dipole moment and structure of molecules, magnetic properties,paramagnetism, diamagnetism and ferromagnetic. Magnetic suscepitibility, its measurements and its importance.	**6** **4** **4**

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II	**IV Elementary Quantum mechanics:** Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box. Schrödinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions. Molecular orbital theory, basic ideas-criteria for forming. M.O from A.O, construction of M.O's by LCAO,H2+ ion, calculation of energy levels from 'wave functions, physical picture of bonding: and antibonding wave functions, concept of σ, σ *, π, π* orbitals and their characteristics. Hybrid orbitals-sp, sp2, sp3 , calculation of coefficients of A.O's used in these hybrid orbitals. Introduction to valence bond model of H2, comparison of M. O. and V. B. models.	**12**
III	**V.Rotational Spectrum** Diatomic molecules, Energy levels of a rigid rotator (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell- Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect. **Vibrational spectrum** Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of an harmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups. Raman Spectrum : concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selction rules. Electronic spectrum: Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and franck codon principle. Qualitative description of σ,π, and η M.O.their energy levels and the respective transition.	**4** **4** **4** **4**

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IV	**VI Photochemistry:** Interactionn of radiation with matter, difference between thermal and photochemical processes, laws of photochemistry: Grothus-Draper law, Stark-Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phpsphorescence, non-radiative processes(internal conversion, intersystem crossing) quantumyield,photosensitized reactions-energy transfer processes(simple examples)Kinetics of photo chemical reaction **Solutions, Dilute Solutions and Colligative Properties** Ideal and non-ideaf solutions, method of expressing concentration of solutions, activity and activity coefficient. Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis, law of osmotic pressure and its measurement, determination of molecular weight form osmotic pressure. Elevation of boiling point and depression in freezing point. Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point.Experimental methods for determining various colligative properties. Abnormal molar mass, Vant hoff factor, colligative properties of degree of dissociation and association of solutes.	**6** **12**

Suggested readings: Atkins, P.W.& paula,J.de atkins physical chemistry Ed.Oxford universitypress13.

Ball,D.W.physical chemistryThomson press, india

Castellan ,G.W. Physical chemistry4th Ed.Narosa(2004)

Text book of Chemistry by R.L. Madan.

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Department of Chemistry

Programme: M.Sc	Year:1	**Semester:I**
Name of Faculty: Dr. Sangeeta Bhatia	Paper-2	**Subject:Chemistry**
CourseCode: H-1008	**CourseTitle:Organic Chemistry I**	

CourseoutcomesChemistry is the central science and impacts on all facets of our lives. An understanding of chemistry is necessary to all other sciences from astronomy to zoology. All of the materials used by engineers and technologists are made by chemical reactions and we all experience chemical reactions continuously, whetier it be breathing or baking a cake, driving a car or listening to a battery driven minidisk player. Chemistry is concerned with all aspects of molecules, their physical and chemical properties, their composition and structure, their synthesis and use in the 21st century. Chemistry is fundamental. To understand why an autumn leaf turns red, or why a diamondis hard, or why soap gets us clean, requires an understanding of chemistry. To design a synthetic fiber, a life-saving drug, or a space capsule requires knowledge of chemistry. The behavior of atoms, molecules, and ions determines the sort of world we have to live in, our shapes and sizes, and even how we feel on a given day. Chemists are very much involved in tackling the problems faced by our modern society. On a given day, a chemist may be studying the mechanism of the recombination of DNA, measuring the amount of insecticide in drinking water, comparing the protein content of meats. developing a new antibiotic, or analyzing a moon rock. So chemistry is worth studying. just because it is such a good antidote for ignorance

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Credits:	
Max.Marks: 50+50	Min.PassingMarks-15
TotalNo.ofLectures=60	

Unit	**Topics**	**No. ofLectures**
I	**Nature of bonding in Organic Molecules** Delocalized chemical bonding, Conjugation, hpyerconjucation, bonding in fullerenes,tautomerism. Aromaticity in in benzenoid and non-benzenoidcompounds,alternant and non-alternant hydrocarbons.Huckel's rule, energy level of n-molccularorbitals.annulenes,antiaromaticity. W-aromaticity, homo-aromaticity. PMO approach .Bonds weakerthancovalent-addition compounds, crown ethercomplexes andcryptands , inclusion compounds,cyclodextrins,catenanes and rotaxanes.	**10**

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II	**Stereochemistry** Conformational analysi of cycloalkanes, decalins, effect of conformation on reactivity,.confomation of sugars,steric strain due tounavoidable crowding. Elements of symmetry. chirality. molecules with more than one chiral center, threo and erythro isomers, methodsof resolution, optical purity. enantiotopic and diastereotopic atoms, groups and faces. Stereospecific and stereoselcctive synthesis. Asymmetric synthesis. Optical activityin the absence of chiral carbon (biphenyls, allenes and spiranes), chirality due to helical shape. Stereochemistry of thecompoundscontainingnitrogen, sulphur and phosphorus.	15
III	**Reaction Mechanism: Structure and Reactivity** Types of mechanisms, types of reactions, thermodynamic and kinetic requirements.kinetic and thermodynamic control, Hanmmond 's postulate, Curtin-Hammett principle.Potential energy diagrams, transition states and intermediates, methods of determiningmechanisms, isotope effects.Hard and soft acids and bases. Generation, structure.stabilityandreactivityofcarbocations,carbanions, freeradicals, carbenes andnitrenes.Effectof structureonreactivity – resonanceand field effects,stericeffect,quantitativetreatment. TheHammettequationandlinearfreeenergyrelationship, substituent andreaction constants. Taft equation.	**15**
IV	**Aliphatic Nucleophilic Substitution** The SN2, SNI. mixed SNI & SN2 and SET mechanisms. The rieighbouring group mechan ism, neighbouring group participation by t and o bonds, anchimeric assistance. Classical and nonclassicalcarbocations, Phenonium ions, nonbornyl system, Common carbocation rearrangements. Application of NMR spectroscopy in the detection' ofcarbocations. The SNi mechanism. Nucleophilic substitution at an allylic, aliphatic trigonal and aVinylic carbon. Reactivity effects of substrate structure, attacking nueleophile, leaving group and reaction medium. Phase transfer catalysis and ultrasound, ambidentnucleophile, regioselectivity	**15**

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V	**Aliphatic Electrophillic Substitution** bimolecular mechanisms- SE2 and SEI. The SEl mechanism, electrophilic substitutiondccompanied by double bond shifts. Effect ofsubstrates, leaving group and the solvent polarity on the reactivity.	**05**

SuggestedReadings: ***Organic Chemistry (Second Edition) by Clayden, Nick Greeves, and Stuart Warren***

Modern Methods of Organic Synthesis by W. Carruthers and I. Coldham (Third edition)

Stereochemistry of Organic Compounds by D. Naspuri

Organic Chemistry by I. L. Finar

March's Advanced Organic Chemistry

Advanced Organic Chemistry by Dr. Jagdambasingh and L.D.S yadav

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SuggestedContinuousEvaluationMethods: tests, assignments, presentations

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Department of Chemistry

Programme: M.Sc	Year:1	**Semester: I**
Name of Faculty: Dr. RenuChoudhary	Paper-3	**Subject:Chemistry**
CourseCode: H-1009	**CourseTitle: Physical Chemistry I**	

CourseoutcomesChemistry is the central science and impacts on all facets of our lives. An understanding of chemistry is necessary to all other sciences from astronomy to zoology. All of the materials used by engineers and technologists are made by chemical reactions and we all experience chemical reactions continuously, whetier it be breathing or baking a cake, driving a car or listening to a battery driven minidisk player. Chemistry is concerned with all aspects of molecules, their physical and chemical properties, their composition and structure, their synthesis and use in the 21st century. Chemistry is fundamental. To understand why an autumn leaf turns red, or why a diamondis hard, or why soap gets us clean, requires an understanding of chemistry. To design a synthetic fiber, a life-saving drug, or a space capsule requires knowledge of chemistry. The behavior of atoms, molecules, and ions determines the sort of world we have to live in, our shapes and sizes, and even how we feel on a given day. Chemists are very much involved in tackling the problems faced by our modern society. On a given day, a chemist may be studying the mechanism of the recombination of DNA, measuring the amount of insecticide in drinking water, comparing the protein content of meats. developing a new antibiotic, or analyzing a moon rock. So chemistry is worth studying. just because it is such a good antidote for ignorance

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Credits:	
Max.Marks: 50+50	Min.PassingMarks-15
TotalNo.ofLectures=60	

Unit	Topics	No. ofLectures
I	**I. Quantum Chemistry** **1. Introduction to Exact Quantum Mechanical Results** The Schrodinger equation and the postulates of quantum mechanics. Discussion of solutions of the Schrodinge cquation to some model systems viz.. particle in a box, the harmonic oscillator, the rigid rotor, the hydrogen atom. **2. Approximate Methods The variation theorem**. lincar variation principle. Perturbation theory (first order and nondegenerate). Applications of variation method perturbation theory to the Helium atom.	30

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	3. Angular Momentum Ordinary angular momentum, generalized angular momentum, eigen functions for angular momentum, eigen values of angular mömentum, operator using ladder operators, addition of an gular momenta, spin, anti symmetry and Pauli's exclusion principle. 4**. Electronic Structure of Atoms** Electronic configuration, Russell-Saunders terms and coupling schemes, Slater-Condon parameters, term separation energies of the pn configuration, term separation energies for the dn configurations, magnetic effect spin-orbit coupling and Zeeman splitting, introduction to the methods of self -consistet field, the virial theorem. **5. Molecular Orbital Theory** Huckel theory of conjugated systems, bond order and charge density calculations. Applications to ethylene, butadiene. cyclopropenyl radical cyclobutadiene etc. Introduction to extended Huckel theory.	
II	**II .Thermodynamics** **1. Classical Thermodynamies** Brief resume of concepts of laws of thermodynamics free energy, chemical potential and entropies. Partial molar properties: partial molar free energy, partial molar volume and partial molar heat content and their significances Determinations of these quantities. Concept of fugacity and determination of fugacity **2. Statistical Thermodynamics** Concept of distribution. thermodynamic probability and most probable distribution. Ensemble averaging, postulates ofensemble averaging	30

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	Canonical, grand canonical and microcanonical ensembles, corresponding distribution laws (using Lagrange's method of undetermined multipliers). Partition functions - translational. rotational, vibrational and electronic partition functions, calculation of thermodynamic properties in terms of partition functions Applications of partition functions. | Vectors and Matrix Algebra Heat capacity behaviour of solids - chemical equilibria and equilibrium constant in terms of partition functions, Fermi-Dirac statistics, distribution law and applications to metal. Bose-Einstein statistics - distribution law and application to helium. **3. Non Equilibrium Thermodynamics** Thermodynamic criteria for non-equilibrium states, entropy production and entropy flow, entropy balance equations for diferent irreversible processes (e.g.. heat flow, chemical reaction etc.) transformations of the generalized fluxes and forces, non equilibrium stationary states, phenomenological equations, microscopic reversibility.	

SuggestedReadings:
Principles of Physical Chemistry Puri, Sharma ,Pathnia
"A Textbook of Physical Chemistry, Computational Aspects in Physical Chemistry" by Kapoor
"Physical Chemistry" by Atkins
"Physical Chemistry" by G W Castellan
"Applied Physical Chemistry" by Colin Heald

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/https://nptel.ac.in/courses/104/103/104103121/https://nptel.ac.in/courses/104/102/104102016/https://nptel.ac.in/courses/104/106/1041061

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Programme: M.Sc	Year:1	**Semester:I**
Name of Faculty: Dr. ShireenSaleem	Paper-4	**Subject:Chemistry**
CourseCode: H-1010	**CourseTitle: Mathematics For Chemists**	

Courseoutcomes -. think critically and analyze mathematical problems. Seminar sessions will be organized to discuss the learning objectives and to progress at regular intervals and to provide support in topics in understanding other subjects like physical chemistry. Students will bring their own case studies to the seminars for discussion .The seminars will also provide opportunities for students to reflect on individual jo. and to discuss the wide range of careers available and use this to expand their persor development plans.

Credits:	Qualifying Paper
Max.Marks: 25+25	Min.PassingMarks-7.5
TotalNo.ofLectures=30	

Unit	Topics	No. ofLectures
I	**A-vectors** Vectors, dot, cross and triple products ete. The gradient, divergence and curl, Vector calculus, Gauss theory, divergence theorem etc. **B-Matrix Algebra** Addiion and multiplicęţion; inverse, adjoint and transpose of matrices. special matrices (Symmetric, gkew-symmetric, Hermitian, skew-Hermitian, unit, diagonal, unitary etc,) and their properties Matrix equation homogeneous known homogeneous linear equation and condition for the solution linear dependence and independence introduction to vector space Matrix eigenvalues and eigenvectors diagonalization determinants example from huckle theory introduction to tensors polarizability and magnetic suscipitability as examples	10
II	**Differential Calculus** functions continuity and differentiability rules for differentiation application of differential calculus including Maxima and minima (examples related to maximally populated rotational energy levels Bohr's radius and most profitable velocity from Maxwell's distribution etc) exact an inexact differential with their application to thermodynamics properties. integral calculus basic rule for integration integration by parts partial function and	10

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	substitution reduction formula application of integral calculus function of several variable partial differentiation coordinate transformation(example cartesian of spherical polar) curve sketching	
III	**elementary differential equation** variable separable and exact first order differential equations homogeneous exactly linear equation application to chemical kinetics secular equilibrium quantum chemistry etc solution of differential equations by the power series method Fourier series solution of harmony consolator and legendre equation etc. spherical harmonics second order differential equations and their solutions	**07**
IV	. **permutation and probability** permutation and combination, probability and probability theorems, probability curves, average, root mean square and most probable errors, example from the kinetic theory of gas etc, curve fitting (including least square feet etc.)vacuum band with the general poly nominal fit	**03**

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SuggestedReadings: Mathematics for Chemist Bhupender Singh A Pragati Edition

Note:ForthepromotionofHindilanguage,coursebookspublishedinHindimaybeprescribedbytheUniversity

Suggested online links:http://heecontent.upsdc.gov.in/Home.aspxhttps://nptel.ac.in/courses/104/105/104105124/https://nptel.ac.in/courses/103/106/105106204/https://nptel.ac.in/courses/104/105/104105034/https://nptel.ac.in/courses/104/103/104103121/https://nptel.ac.in/courses/104/102/104102016/https://nptel.ac.in/courses/104/106/104106106/https://nptel.ac.in/courses/104/105/104105120/

SuggestedContinuousEvaluationMethods: tests, assignments, presentations

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Department of Chemistry

Programme: M.Sc	Year:1	**Semester:I**
Name of Faculty: Miss. Mehrukiffat Paper-4 **Subject:Chemistry**		
CourseCode: H-1011	**CourseTitle: Biology for Chemists**	

Courseoutcomes

think critically and analyze Biological problems. Seminar sessions will be organized to discuss the learning objectives and to progress at regular intervals and to provide support in topics in understanding other subjects like Bio chemistry. Students will bring their own case studies to the seminars for discussion .The seminars will also provide opportunities for students to reflect on individual jo. and to discuss the wide range of careers available and use this to expand their persor development plans.

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Credits:	Qualifying Paper
Max.Marks: 25+25	Min.PassingMarks-7.5
TotalNo.ofLectures=30	

Unit	Topics	No. ofLectures
I	**cell structure and function** Structure of prokaryotic and eukaryotic cells, intercellular organelles and their functions, comparison of plant and animal cells. Overview of metabolic processes catabolism and anabolism. ATP the biological energy currency.	**08**
II	**Carbohydrates** Confirmation of monosaccharides, structure and functions of important derivatives of monosaccharides like glycosides, deoxysugars,myoinositol amino sugar,N-acetylmuramic acid, sailoc acid, disaccharides and polysaccharides structure polysaccharides cellulose and chitin. Stories polysaccharides starch and glycogen structure and biological functions of glucosaminoglycanes or mucopolysaccharides carbohydrates of glycoproteins and glycolipids role of sugar in biological recognition ascorbic acid. God but I did metabolic Krebs cycle glycolysis. Glycogenesis and glycogenolysis gluconeogenesis, pantos phosphate pathway.	06

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III	**Lipids** Fatty acids, essential fatty acids, structure and function of dry acyl glycos glycerol, glycerol phospholipids, sphinogolipids cholesterol, buy lessons, protostoglandins. Lipoproteins composition and functions, role in antherosclerosis. Properties of lipid aggregates micelles,bilayers,liposomas and their possible biological functions. Biological membranes, Fluid mosaic model of membrane structure. pidmetabolism-ß-oxidation of fatty acids,	**06**
IV	**Amino-acids, Peptides and Proteins** Chemical and enzynmatic hydrolysis of proteins to peptides. Sccondary structure of proteins, forces responsible for holding of secondary structures. a-helix. Pseets, Super secondary structure, triplec helix structure of collagen. Tertiary strucuure of protein- folding and domain structure. Quaternary structurc. Amino acid metabolism-degradation and biosynthesis of amino-acids, sequence determination: chemical/enzymatic/mass spectral, racemiation/detection.	**06**
V	**Nucleic Acids** Purine and pyrimidine bases of nucleic acids. & their syntheiss base pairing Via H. bonding. Structure of ribonucleic acids (RNA) and deoxyribonuclcic acids (DNA, double helix model ofDNA and forces responsible for holding it. Chemical and enzymatic hydrolysis ofnucleic acids, The chemical basis for heredity, an overview of replication of DNA transcriptiop translation and genetic code. Chemical synthesis of mono and trinucleoside.	**04**

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SuggestedReadings:
Biology for Chemist P.K Agarwal A Pragati Edition

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/https://nptel.ac.in/courses/104/103/104103121/https://nptel.ac.in/courses/104/102/104102016/https://nptel.ac.in/courses/104/106/104106106/https://nptel.ac.in/courses/104/105/104105120/

SuggestedContinuousEvaluationMethods: tests, assignments, presentations

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Department of Chemistry

Programme: M.Sc	Year:1	**Semester:I**
Name of Faculty: Dr. ShitalPanday	Paper-1**Subject:Chemistry**	
CourseCode: H-1007	**CourseTitle: Inorganic Chemistry-I**	

Courseoutcomes: After having passed the course, teaching is one of the best options both in schools and colleges levels; for this at the college level, they must have passed the NET exam.
They can also go for jobs in research and development in the industry.
In the public sector, one can find opportunities in Oil India, Geological Survey of India, Meteorological Survey of India, and Department of Oceanography, etc.
Other areas where they can get jobs are management, production, packaging, quality control, marketing and sales in industries such as pharmaceuticals, foods, dyes, cosmetics, polymer, Chemical, etc

Credits:	
Max.Marks: 50+50	Min.PassingMarks- 15
TotalNo.ofLectures= 60	

Unit	Topics	No. ofLectures
I	**. Stereochemistry and Bonding in Main Group Compounds** VSEPR, Walsh diagrams (tri atomic molecules).d pi-Ppi bonds, Bent rule and energetic of hybridization, some simple reactions of covalently bonded molecules.	**12**
II	**Metal-Ligand Equilibria in Solution** Stepwise and overall formation constants and their interaction, trends in stepwise constants. factors affecting the stability of metal complexes with reference to the nature of metal ion and Ligand. chelate effect and its thermodynamic origin determination of binary formation constants by pH-metry and spectrophotometry	**08**
III	**Reaction Mechanism of Transition Metal Complexes**Energy profile of a reaction, reactivity of metal complexes, inert and labile complexeskinetic application of valence bond and crystal field theories. Kinetics of Substitution Reactions- acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, direct and indirect evidences in favour of conjugate mechanism Anationreactions. reactions without Metal-Ligand bond cleavage. Substitution reactions in square planer complexes, the trans effect, mechanism of the substitution reaction.**Redox reactions (electron transfer reactions)** Mechanism of one electron transferreaction (such as Henry taube's classical reaction of (NH3)3Co3+- Cr2+ , inner sphere type reaction), outer sphere type reaction ,cross reactions and Marcus Hush theory (No mathematical treatment).	**24**

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IV	**Metal-Ligand Bonding.** Adjusted CFT Limitations of crystal field theory, Octahedral, tetrahedral and square planar complexes	**16**

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SuggestedReadings:

"Inorganic Chemistry" by Shriver and Atkins

"Advanced Inorganic Chemistry" by Cotton and Wilkinson
"Fundamental Concepts of Inorganic Chemistry, Vol.2" by Asim K Das
"Advanced Inorganic Chemistry – Vol. 2" by PrakashSatya
"Advanced Inorganic Chemistry-Vol.-II" by Gurdeep Raj
. "Fundamental Concepts of Inorganic Chemistry, Vol.3" by Asim K Das

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SuggestedContinuousEvaluationMethods: tests, assignments, presentations

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Department of Chemistry

Programme: M.Sc	Year:1	**Semester:I**
Name of Faculty: Miss. Kahekhasha	Paper-4	**Subject:Chemistry**
CourseCode: H-1012	**CourseTitle: Computer For Chemists**	
Courseoutcomes This is a theory-cum-Laboratory course with more emphasis on laboratory work.		
Credits:		
Max.Marks: 50+50	Min.PassingMarks-15	
TotalNo.ofLectures=60		

Unit	Topics	No. ofLectures
I	**. Introduction to Computers and Computing** Basic structure and functioning of computers with a PC as an illustrative example. Memory. I/0 devices. Secondary storage. Computer languages. Operating systems with DOS as an example. Introduction to UNIX and Windows. Data Processing principles of programming. Algorithms and flow-charts.	**08**
II	**Computer Programming in FORTRAN/C/BASIC** The language feature are listed here with reference to FORTRAN. The instructor may choose another language such as BASIC or C and the feature may be replaced appropriately. Elements of the computer language. Constants and variables. Operations and symbols. Expression. Arithmetic assignment statement input and output. Format statement. Termination statements. Branching statements such as IF or GO TO statement.	12

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	LOGICAL variables, Double Precision variables. Subscripted variables and DIMENSIONS. DO statements. FUNCTION and SUBROUTINE. COMMON and DATA statements. Decision control structure. case4contròl structure, functions, introduction to arrays. programmes based on above. .	
III	**. Programming in Chemistry** Development of small computer course involving simple formula in chemistry such as Vander Waal's equation. pH titration, kinetics, radioactive decay. Evaluation of latice energv and ionic radii from experimental data. Lincar simultaneous equations to solve secular equation with in the Huckel theory. Elementary structural features such as bond lengths. bond angels, dihedral angels etc. of molecule extracted from a dattabase such as Cambridge database.	**15**
IV	**. Use of Computer Programmes** Execution of linear regression, X-V plot, Numerical integration and differentiation as well as differential equation solution programmes. Monte -Carlo and Molecular dynamics. Introduction to MS Ofice (MS Word, MS Excel, MS PowerPoint), Lab sessions based on MS Office package, Introduction to lInternet Explorer.	**25**

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SuggestedReadings:
Computer For Chemists by AnsulBansal,S.KPundir

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Suggested online links:http://heecontent.upsdc.gov.in/Home.aspxhttps://nptel.ac.in/courses/104/105/104105124/https://nptel.ac.in/courses/103/106/105106204/https://nptel.ac.in/courses/104/105/104105034/https://nptel.ac.in/courses/104/103/104103121/https://nptel.ac.in/courses/104/102/104102016/https://nptel.ac.in/courses/104/106/104106106/https://nptel.ac.in/courses/104/105/104105120/

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Department of Chemistry

Programme: M.Sc	Year:1	**Semester:II**
Name of Faculty: Dr. ShitalPanday	Paper-1**Subject:Chemistry**	
CourseCode: H-2007	**CourseTitle: Inorganic Chemistry-II**	

Courseoutcomes: After having passed the course, teaching is one of the best options both in schools and colleges levels; for this at the college level, they must have passed the NET exam.
They can also go for jobs in research and development in the industry.
In the public sector, one can find opportunities in Oil India, Geological Survey of India, Meteorological Survey of India, and Department of Oceanography, etc.
Other areas where they can get jobs are management, production, packaging, quality control, marketing and sales in industries such as pharmaceuticals, foods, dyes, cosmetics, polymer, Chemical, etc

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Credits:	
Max.Marks: 50+50	Min.PassingMarks-15
TotalNo.ofLectures= 60	

Unit	Topics	No. ofLectures
I	**Electronic Spectra and Magnetic Properties of Transition Metal Complexes** Spectroscopic ground states, correlation, Orgel and Tanabe-Sugano diagrams fortranşition metal complexes (d1-d9 states), calculațions of Dq, B and B parameters, charge transfer spectra)spectroscopic method ofassignment of absolute configurationin optically active metal chelates and their stereochemical information, anomalous magnetic moments, magnetic exchange coupling and spin crossover	22

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II	**Metal - pi Complexes** Metal carbonyls, structure and bonding, vibrational spectra of metal carbonyls forbonding and structural elucidation, important reactions of metal carbonyls: preparation bonding. Structure and important reactions of transition metal nitrosyl, dinitrogenandioxygencómplexes; tertiary phosphine as Ligand	18
III	**Metal Clusters** Higher boranes, carboranes, metalloboranes and metallocarboranes. Metal carbonyand halide clusters, compounds with netal-metal multiple bonds,	**12**
IV	**Nuclear Chemistry** Radioactive decay &cquilibrium. Nuclear Reactions, Q-ValuccrosS-Sections, typesorreactions, Chemical etteets of nuclear transformations Fission &Pusion, FiSsionproduç,& fission yields. Radioactive techniques, tracer techniques	**8**

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SuggestedReadings:

"Inorganic Chemistry" by Shriver and Atkins

"Advanced Inorganic Chemistry" by Cotton and Wilkinson
"Fundamental Concepts of Inorganic Chemistry, Vol.2" by Asim K Das
"Advanced Inorganic Chemistry – Vol. 2" by PrakashSatya
"Advanced Inorganic Chemistry-Vol.-II" by Gurdeep Raj
. "Fundamental Concepts of Inorganic Chemistry, Vol.3" by Asim K Das

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Suggested online links:http://heecontent.upsdc.gov.in/Home.aspxhttps://nptel.ac.in/courses/104/105/104105124/https://nptel.ac.in/courses/103/106/105106204/https://nptel.ac.in/courses/104/105/104105034/https://nptel.ac.in/courses/104/103/104103121/https://nptel.ac.in/courses/104/102/104102016/https://nptel.ac.in/courses/104/106/104106106/https://nptel.ac.in/courses/104/105/104105120/

SuggestedContinuousEvaluationMethods: tests, assignments, presentations

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Department of Chemistry

Programme: M.Sc	Year:1	**Semester:II**
Name of Faculty: Dr. Sangeeta Bhatia	Paper-2	**Subject:Chemistry**
CourseCode: H-2008	**CourseTitle:Organic Chemistry II**	

CourseoutcomesChemistry is the central science and impacts on all facets of our lives. An understanding of chemistry is necessary to all other sciences from astronomy to zoology. All of the materials used by engineers and technologists are made by chemical reactions and we all experience chemical reactions continuously, whetier it be breathing or baking a cake, driving a car or listening to a battery driven minidisk player. Chemistry is concerned with all aspects of molecules, their physical and chemical properties, their composition and structure, their synthesis and use in the 21st century. Chemistry is fundamental. To understand why an autumn leaf turns red, or why a diamondis hard, or why soap gets us clean, requires an understanding of chemistry. To design a synthetic fiber, a life-saving drug, or a space capsule requires knowledge of chemistry. The behavior of atoms, molecules, and ions determines the sort of world we have to live in, our shapes and sizes, and even how we feel on a given day. Chemists are very much involved in tackling the problems faced by our modern society. On a given day, a chemist may be studying the mechanism of the recombination of DNA, measuring the amount of insecticide in drinking water, comparing the protein content of meats. developing a new antibiotic, or analyzing a moon rock. So chemistry is worth studying. just because it is such a good antidote for ignorance

.

Credits:	
Max.Marks: 50+50	Min.PassingMarks-15
TotalNo.ofLectures=60	

Unit	Topics	No. ofLectures
I	**Aromatic Electrophilic Substitution** The arenium ion mechanism. orientation and reactivity, energy profile diagrams. Theortho/para ratio. ipso attack, orientation in other ring systems. Quantitative treatmexof reactivity in substrates and electrophilés. Diazonium coupling, Vilsmeirreaction,Gattermann-Koch reaction	**06**
II	**Aromatic Nucleophilic Substitution**The SNAr, SN 1, benzyne and SRN l mechanisms. Reactivity - effect of substratestructure., leaving group and attacking nucleophile. The von Richter. Sommelet-Hauserand Smiles rearrangements.	05

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III	**Free Radical Reactions** Types of free radical reactions, free radical substitution mechaníism, mechanism at anaromatic substrate, neighbouring group assistance. Reactivity for aliphatic and aromaticsubstrates at abridgchcad. Reactivity in the attacking radicals. The effect of solventson reactivity. Allylic halogenations (NBS), oxidation of aldehydes to carboxylic acid.autooxidation, coupling ofalkynes and arylationofaromatic compounds by diazoniumsalts. Sandmeyer reaction. Free radical rearrangement. Hunsdiecker reaction	**08**
IV	**. Addition to Carbon-Carbon Multiple Bonds** Mechanistic and stercochemical aspects of addition reactions involving electrophiles.nucleophiles and free radicals, regio- and chemoselectivity, orientation and rcactivityAddition to cyclopropane ring. Hydrogenation of double and triple bonds. Hydrogenationof aromatic rings. Hydroboration. Michael reaction. Sharpless asymmetric epoxidation.	**06**
V	**Addition to Carbon-Hetero Multiple Bonds** Mechanism of metal hydride reduction of saturated and unsaturated carbonvlcompounds, acids, esters and nitriles. Addition of Grignard reagents, organozinc andorganolithium reagents to carbonyl and unsaturated carbonyl compounds. Wittig reaction.Mechanism of condensation reactions involving enolates -Aldol. Knoevenagel. Claisen.Mannich, Benzoin, Perkin and Stobbereactions.Hydrolysis of esters and amides.ammonolysis of esters	**12**
VI	**Elimination Reactions** The E2. El and El CB mechanisms and their spectrum. Orientation ofthe double Reactivity - effects of substrate structures, attacking hase, the leaving group and themedium. Mechanism and orientation in pyrolyticelimiħation.	**05**
VII	**Pericyclic Reactions** Molecutar orbital symmetry, Frontier orbitals of ethylene, 1,3- butadiene, 1,3.5-hexatriene and allyl system. Classification of pericyclic reactions. WoodwardHoffimann correlation diagrams. FMO and PMO approach. Electrocyclic reactions -conrotatory and disrotatory motions, 4n, 4nt2 and allyl systems. Cycloaddditionsantarafacial and suprafacial additions, 4n and 4n+2 systems, 2+2 addition of ketenes.1,3 dipolar cycloadditions and cheleotropicreactions.Sigmatropic rearrangements - suprafacial and antarafacial shifts of H, Sigmatropicshifts involving carbon moieties. 3,3- and 5,5- Sigmatropic rearrangements. Claisen,	**18**

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	Cope, Sommelet Hauser Rearrangement, Ene reaction	

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SuggestedReadings: ***Organic Chemistry (Second Edition) by Clayden, Nick Greeves, and Stuart Warren***

Modern Methods of Organic Synthesis by W. Carruthers and I. Coldham (Third edition)

Stereochemistry of Organic Compounds by D. Naspuri

Organic Chemistry by I. L. Finar

March's Advanced Organic Chemistry

Advanced Organic Chemistry by Dr. Jagdambasingh and L.D.S yadav

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SuggestedContinuousEvaluationMethods: tests, assignments, presentations

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Department of Chemistry

Programme: M.Sc	Year:1	**Semester:II**
Name of Faculty: Dr. RenuChoudhary	Paper-3	**Subject:Chemistry**
CourseCode: H-2009	**CourseTitle: Physical Chemistry II**	

CourseoutcomesChemistry is the central science and impacts on all facets of our lives. An understanding of chemistry is necessary to all other sciences from astronomy to zoology. All of the materials used by engineers and technologists are made by chemical reactions and we all experience chemical reactions continuously, whetier it be breathing or baking a cake, driving a car or listening to a battery driven minidisk player. Chemistry is concerned with all aspects of molecules, their physical and chemical properties, their composition and structure, their synthesis and use in the 21st century. Chemistry is fundamental. To understand why an autumn leaf turns red, or why a diamondis hard, or why soap gets us clean, requires an understanding of chemistry. To design a synthetic fiber, a life-saving drug, or a space capsule requires knowledge of chemistry. The behavior of atoms, molecules, and ions determines the sort of world we have to live in, our shapes and sizes, and even how we feel on a given day. Chemists are very much involved in tackling the problems faced by our modern society. On a given day, a chemist may be studying the mechanism of the recombination of DNA, measuring the amount of insecticide in drinking water, comparing the protein content of meats. developing a new antibiotic, or analyzing a moon rock. So chemistry is worth studying. just because it is such a good antidote for ignorance

.

Credits:	
Max.Marks: 50+50	Min.PassingMarks- 15
TotalNo.ofLectures= 60	

Unit	Topics	No. ofLectures
I	**Chemical Dynamics** Methods of determining rate laws. collision theory of reaction rates, steric factor.activated complex theory, Arrhenius cquation and the activated complex theory; ionic reactions, kinetic salt effects, steady state kinetics, kinctic and thermodynamic controlof reactions, treatment of unimolocilar reactions. Dynamic chain (hydrogen-bromine reaction, pyrolysis ofacctaldehyde, decompositionofethanc). photochemical (hydrogen-bromine and hydrogen-chlorinc reactions) and oscillatory'reactions (Belousov -Zhabotinskỷ reaction), homogencous catalysis, kineticsof enzyme, reactions, general features of fast reactions, study of fast	**20**

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	reactions by flow method: relaxation method, flash photolysis and the nuclear magnetic resonance method.Dynamics ofmolecular motions, probing the transition state, dynamics of unimolecular reactions (Lindemann Hinshelwood and Rice-Ramsperger - Kassel-Marcus [RRKM)theories of unimolecular reactions).	
II	**Surface Chemistry** **A. Adsorption** Surface tension, capillary action, pressure difference across curvedsurface (Laplace equation). vapour pressure of droplets (Kelvin equation), Gibbs adsorption isotherm, estimation of surface area (BET equátion), Elementary treatmentof BET cquation, catalytic activity at surfaces. **B. Micelles** Surface active agents, classification of surface active agents, micellization.hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMCof surfactants, counter ion binding to micelles, thermodynamics of micellization,solubilization, miero emulsion, reverse micelles. **C. Macromolecules** Polymer - definition, types of polymers, kinetics of radicalpolymerization, mechanism of polymerization.-Molecular mass, number and mass average molecular mass, molecular mass determination(Elementary treatment of Osmometry, Viscometry, Sedimentation and Light scatteringmethods), chain configuratiomof macromolecules, calculation of average dimensions ofvarious chain structures. .	**20**

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III	**Electrochemistry** Electrochemistry of solutions. Debye-Huckel - Onsager treatment and its extension.Ion solvent interactions. Debye-Huckel-Jerum mode. Thermodynamics of electrified interface equations. Derivátion of electro-capillarity, Lippmann equations (surfaceexcess), methods of determination. Structure of electrified interfaces, Guoy -Chapman. Stern.Over potentials, exchange current density, derivation of Butler -Volmer equation, Tafeplot. Quantum aspects of charge transfer at electrodes-solution interfaces, quantization ofcharge transfer, tunneling. Semiconductor interfaces - theory of double laver al Semiconductor. electrolyte solution interfaces, structure of houble layer interfaces.Electrocatalysis - influence of various parameters: Hydrogen electrode. Bioclectrochemistry, Polarography theory, IIkovic equation, half wave potential anditssignifjcance.Introduction to corrosion, homogenous theory, forms of corrosion, corrosion monitoring and prevention methods.	**20**

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SuggestedReadings:

Principles of Physical Chemistry Puri, Sharma ,Pathnia

"A Textbook of Physical Chemistry, Computational Aspects in Physical Chemistry" by Kapoor

"Physical Chemistry" by Atkins

"Physical Chemistry" by G W Castellan

"Applied Physical Chemistry" by Colin Heald

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SuggestedContinuousEvaluationMethods: tests, assignments, presentations

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Department of Chemistry

Programme: M.Sc	Year:2	**Semester:III**
Name of Faculty: Dr. RenuChoudhary	Paper-2	**Subject:Chemistry**
CourseCode: H-3008	**CourseTitle: Spectroscopy**	

CourseoutcomesChemistry is the central science and impacts on all facets of our lives. An understanding of chemistry is necessary to all other sciences from astronomy to zoology. All of the materials used by engineers and technologists are made by chemical reactions and we all experience chemical reactions continuously, whetier it be breathing or baking a cake, driving a car or listening to a battery driven minidisk player. Chemistry is concerned with all aspects of molecules, their physical and chemical properties, their composition and structure, their synthesis and use in the 21st century. Chemistry is fundamental. To understand why an autumn leaf turns red, or why a diamondis hard, or why soap gets us clean, requires an understanding of chemistry. To design a synthetic fiber, a life-saving drug, or a space capsule requires knowledge of chemistry. The behavior of atoms, molecules, and ions determines the sort of world we have to live in, our shapes and sizes, and even how we feel on a given day. Chemists are very much involved in tackling the problems faced by our modern society. On a given day, a chemist may be studying the mechanism of the recombination of DNA, measuring the amount of insecticide in drinking water, comparing the protein content of meats. developing a new antibiotic, or analyzing a moon rock. So chemistry is worth studying. just because it is such a good antidote for ignorance

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Credits:	Compulsory Paper
Max.Marks: 50+50	Min.PassingMarks-15
TotalNo.ofLectures=60	

Unit	Topics	No. ofLectures
I	**Ultraviolet Visible Spectroscopy** Various electronic transitions (185-800 nm), Beer-Lambert law, effect of solvent on electronic transitions, ultraviolet bands for carbonyl compounds, unsaturated carbonyl compounds, dienes, conjugated polyenes. Fieser-Woodward rules for conjugated dienes and carbonyl compounds ultraviolet spectra of aromatic and heterocyclic compounds Steric effect in biphenyls.	

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II	**Infrared Spectroscopy Instrumentation and sample handling**. Characteristic vibrational frequencies of alkanes, alkynes, aromatic compounds, alcohols, ethers, phenols and amines, Detailed study of Vibrational frequencies of carbonyl compounds (Ketones, aldehydes, esters, amides, acids, anhydrides, lactones, lactams and conjugated carbonyl compounds), Effect of hydrogen bonding and solvent effect on vibrational frequencies. Symmetry and shapes of AB, A2, AB2, AB3, AB4, AB5, and AB6, mode of bonding of ambidentate ligand, ethylenediamine and diketonato complexes, application of resonance .	
III	**Optical Rotatory Dispersion (ORD) and Circular Dichroism (CD)** Definition, deduction of absolute configuration, octant rule for ketones.	
IV	**Nuclear Magnetic Resonance Spectroscopy** General introduction and definition, chemical shift, spin-spin interaction, shielding mechanism, mechanism, of measurement chemical shift values and correlation for protons bonded to carbon (aliphatic, olefinic, aldehydic and aromatic) and other nuclei (alcohols, phenols, enols, carboxylic acids, amines, amides &mercapto), Intensity of NMR regnals, chemical exchange, effect of deuteration, complex spin-spin interaction between two, three, four and five nuclei (first order spectra) virtual coupling, stereochemistry hindered rotation, karlus curve variation of coupling constant with dihedral angle. Simplification of complex spectra, nuclear magnetic double resonance, contact shift reagents, solvent effects. Fourier transforms technique, Nuclear Overhauser Effect (NOE) Resonance of other nuclei-F, P. Some applications including biochemical systems.	
V	**Carbon-13 NMR Spectroscopy** General Considerations, chemical shift (aliphatic, olefinic, alkyne, aromatic, heteroaromatic and carbonyl carbon), coupling constants, Introduction to 2 D NMR. Head of the Chemistry Deptt. R.G. (P.G.) College, Meerut.	

VI	**Electron Spin Resonance Spectroscopy** Hyperfine coupling, spin polarization for atoms and transition metal ions, spin-orbit coupling and significance of g-tensors, application to transition metal complexes (having one unpaired electron) including biological systems and to inorganic free radicals such as pH4, F2- and (BH3).	
VII	**Mossbauer spectrocopy** Basic principles, spectral parameters and spectrum display. Application of the technique to the studies of (1) bonding and structures of Fe2+ and Fe3+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds –nature of M-L bond, coordination number, structure and (3) detection of oxidation state and in equivalent MB atoms.	

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SuggestedReadings:

1- Inorganic Electronic Spectroscopy, A.P.B. Lever, Elsevier.

2- Physical Methods for Chemistry, R.S. Drago, Saunders Company.

3- Structural Methods in Inorganic chemistry, E.A.V. Ebsworth, D.W.H.

Rankin and S. Cradock.ELBS.

4- Infrared and Raman Spectra : Inorganic and Coordination compounds,

K. Nakamoto. Wiley.

5- Progress in Inorganic Chemistry vol., 8. ed, F.A. cotton, vol., 15, ed.

S.J. Lippard, wiley.

6- Transition Metal Chemistry ed, R.L. Carlin vol. 3 Dekker.

7- Inorganic Electronic Spectroscopy, A.P.B. Lever, Elsevier.

8- NMR, NOR, EPR and Mossbauer spectroscopy in Inorganic

Chemistry, R.V. Parish, Ellis.

9- Horwood. Practical NMR Spectroscopy, M.L. Martin, J.J. Delpeugh

and G.J. NBrtin. Heyden.

10- Introduction to NMR Spectroscopy, R.J. Abraham, J. Fisher and P.

Loftus.Wiley.

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SuggestedContinuousEvaluationMethods: tests, assignments, presentations

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Department of Chemistry

Programme: M.Sc	Year:2	**Semester:III**
Name of Faculty: Dr. Sangeeta Bhatia	Paper-1**Subject:Chemistry**	
CourseCode: H-3007	**CourseTitle: Photo Chemistry**	

CourseoutcomesChemistry is the central science and impacts on all facets of our lives. An understanding of chemistry is necessary to all other sciences from astronomy to zoology. All of the materials used by engineers and technologists are made by chemical reactions and we all experience chemical reactions continuously, whetier it be breathing or baking a cake, driving a car or listening to a battery driven minidisk player. Chemistry is concerned with all aspects of molecules, their physical and chemical properties, their composition and structure, their synthesis and use in the 21st century. Chemistry is fundamental. To understand why an autumn leaf turns red, or why a diamondis hard, or why soap gets us clean, requires an understanding of chemistry. To design a synthetic fiber, a life-saving drug, or a space capsule requires knowledge of chemistry. The behavior of atoms, molecules, and ions determines the sort of world we have to live in, our shapes and sizes, and even how we feel on a given day. Chemists are very much involved in tackling the problems faced by our modern society. On a given day, a chemist may be studying the mechanism of the recombination of DNA, measuring the amount of insecticide in drinking water, comparing the protein content of meats. developing a new antibiotic, or analyzing a moon rock. So chemistry is worth studying. just because it is such a good antidote for ignorance

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Credits:	
Max.Marks: 50+50	Min.PassingMarks- 15
TotalNo.ofLectures= 60	

Unit	Topics	No. ofLectures
I	**Basic of Photochemistry** Absorption, excitation, photochemical laws, quantum yield, electronically excited states-life times-measurements of the times. Flash photolysis, stopped Flow techniques, Energy dissipation by radiative and non-radiative processes, absorption spectra, Franck-Condon principle, photochemical stages-primary and secondary processes.	
II	**Photochemical Reactions** Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molectule, quantum, yield, transfer of excitation energy, actinometry	

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III	**Properties of Excited States** Structure, dipole moment, acid-base strengths, reactivity. Photochemical kinetics-calculation of rates of radiative processes. Bimolecular deactivation-quenching.	
IV	**Determination of Reaction Mechanism** Classification, rate constants and life times of reactive energy states-determination of rate constants of reactions. Effect of light intensity on the rate of photochemical reactions. Types of photochemical-photo-dissociation, gas-phase photolysis.	
V	**Photochemistry of Alkenes** Intromolecular reactions of the olefinic bond-geometrical isomerism, cyclisat ion reactions, rearrangement of 1,4 and 1,5-dienes,	
VI	**- Photochemistry of Carbonyl compounds** Intramolecular reactions of carbonyl compounds-saturated, cyclic and acyclic, , - unsaturated and , unsaturated compounds, Cyclohexadienones. Intermolecular …….buchi Reaction	
VII	- **Photochemistry of Aromatic Compounds** Isomerisations, additions and substitutions	
VIII	**Miscellaneous Photochemical Reactions** Photo-Fries reactions of anilides. Photo Fries rearrangement. Barton reaction. Singlet molecular oxygen reactions. Photochemical formation of smog.	

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	Photo degradation of polymers, Photochemistry of vision.	

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SuggestedReadings: fundamental of Photo chemistry by K.K. Rohtagi – Mukherjee
Essentials of Molecular Photo chemistrt by A .Gilbert &Baggott
Molecular Photochemistry N.J.Turro ,W.A Benjamin
Introductory Photochemistry by A. Cox & T. Camp

Photochemistry And Pericyclic Reactions

Book by Jagdamba Singh

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Department of Chemistry

Programme: M.Sc	Year:2	**Semester:III**
Name of Faculty: Dr. ShitalPanday	Paper-1**Subject:Chemistry**	
CourseCode: H-3009	**CourseTitle: Analytical Chemistry (compulsory for all branches)**	

CourseoutcomesChemistry is the central science and impacts on all facets of our lives. An understandingof chemistry is necessary to all other sciences from astronomy to zoology. All of thematerials used by engineers and technologists are made by chemical reactions and weall experience chemical reactions continuously, whetier it be breathing or baking acake, driving a car or listening to a battery driven minidisk player. Chemistry is concernedwith all aspects of molecules, their physical and chemical properties, their compositionand structure, their synthesis and use in the 21st century.Chemistry is fundamental. To understand why an autumn leaf turns red, or why adiamondis hard, or why soap gets us clean, requires an understanding of chemistry. Todesign a synthetic fiber, a life-saving drug, or a space capsule requires knowledge ofchemistry. The behavior of atoms, molecules, and ions determines the sort of world wehave to live in, our shapes and sizes, and even how we feel on a given day. Chemists arevery much involved in tackling the problems faced by our modern society. On a givenday, a chemist may be studying the mechanism of the recombination of DNA, measuringthe amount of insecticide in drinking water, comparing the protein content of meats.developing a new antibiotic, or analyzing a moon rock. So chemistry is worth studying.just because it is such a good antidote for ignorance

Credits:	
Max.Marks: 50+50	Min.PassingMarks-15
TotalNo.ofLectures= 60	

Unit	Topics	No. ofLectures
I	**Introduction** Classification of analytical methods-classical and instrumental, types of instrumental analysis, selecting an analytical method.	
II	**Errors and Evaluation** : Definition of terms of mean and median, precision-standard deviation, relative standard deviation, accuracy, absolute error. Types of error in experimental data-determination (systematic), intermediate (random) and gross. Sources of errors and the effect upon the analytical results methods for reporting analytical data. Statistical evaluation of data indeterminate errors. The use of statistics	

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III	**Radiochemical methods :** Elementary working, Principles of Geiger Muller, lionization, proportional and -ray counters. Neutron radiation sources, radio tracer techniques. Nautron Activation Analysis (NAA) : Principle, Techniques and applications in preparation of some commonly used radioactive isotopes. Use of radioactive isotopes in analytical and physiochemical problems, Isotopic Dilution Analysis (IDA), substoichiometric IDA, advantages and limitations of IDA and comparison of IDA with NAA. Principle of Radiometric Titrations, Types, Experimental techniques and its applications	
IV	**Thermal methods of Analysis :** Introduction of different thermal methods, Thermogravimetry- TGA & DTA, static thermogravimetry, quasithermogravimetry and dynamic thermogravimetry, Instrumental and balances, X-Y recorder,thermogram, factors affecting thermograms. Application of thermogravimetry. Differential Scanning Calorimetry (DSC) : Introduction, instrumentation, DSC-curves, factors affecting DSC curves and applications. Thermometric Titrations : Introduction, Instrumentation, apparatus, theory and applications.	
V	**Chromatographic Techniques** : Adsorption and Partition Chromatography, Paper Chromatography, Thin Layer chromatography lon exchange and Gas chromatography, HPLC, Size Exclusion Chromatography, their principles, techniques and important applications	
VI	Electroanalytical Techniques : A- Voltametry : General introduction, Principle, Instrumentation, types of Voltammetry Paleography (Principle & Instrumentation), Cyclic Voltammetry, Pulse Methods. Stripping Technique : Anodic and Cathodic Stripping Voltametry and their applications in the trace determination of metal ions and biologically important compounds.	

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	B. Ion Selective Electrodes : Electrical Properties of membrane, Glass electrode with special reference to H+ , Na+, K+ions, operation of solid membrane electrode, operation of liquid membrane electrode, coated type ion electode. Applications of ion selective electrode in determination of some toxic metal and some anions (F-, CI-Br, I-, and NO3).	

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SuggestedReadings: **"Principles of Analytical Chemistry: A Textbook" by Miguel Valcarcel**
"Analytical Chemistry: Principles" by Kennedy J H
"Analytical Chemistry: Principles and Techniques" by Larry G Hargis
"Fundamentals of Analytical Chemistry" by D A Skoog
"Analytical Chemistry" by Sharma B K
"Analytical chemistry" by Gurdeep R Chatwal and MadhuArora
"Analytical Chemistry: Theory and Practice" by R M Verma

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SuggestedContinuousEvaluationMethods: tests, assignments, presentations

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Department of Chemistry

Programme: M.Sc	Year:2	**Semester:III**
Name of Faculty: Dr. Sangeeta Bhatia	Paper-4**Subject:Chemistry**	
CourseCode: H-3011	**CourseTitle: Bio Organic Chemistry**	

CourseoutcomesChemistry is the central science and impacts on all facets of our lives. An understanding of chemistry is necessary to all other sciences from astronomy to zoology. All of the materials used by engineers and technologists are made by chemical reactions and we all experience chemical reactions continuously, whetier it be breathing or baking a cake, driving a car or listening to a battery driven minidisk player. Chemistry is concerned with all aspects of molecules, their physical and chemical properties, their composition and structure, their synthesis and use in the 21st century. Chemistry is fundamental. To understand why an autumn leaf turns red, or why a diamondis hard, or why soap gets us clean, requires an understanding of chemistry. To design a synthetic fiber, a life-saving drug, or a space capsule requires knowledge of chemistry. The behavior of atoms, molecules, and ions determines the sort of world we have to live in, our shapes and sizes, and even how we feel on a given day. Chemists are very much involved in tackling the problems faced by our modern society. On a given day, a chemist may be studying the mechanism of the recombination of DNA, measuring the amount of insecticide in drinking water, comparing the protein content of meats. developing a new antibiotic, or analyzing a moon rock. So chemistry is worth studying. just because it is such a good antidote for ignorance

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Credits:	Elective I
Max.Marks: 50+50	Min.PassingMarks- 15
TotalNo.ofLectures= 60	

Unit	**Topics**	**No. ofLectures**
I	**Introduction:** Chemistry of amino acids proteins and their derivatives; methods of isolation and identification; Primary, secondary, tertiary and quaternary structures of proteins; determination and biochemical applications of the structures proteins; Nomenclature of nucleosides and nucleotides; Effects of acid and alkali on hydrolysis of nucleic acids ; Structure of DNA and RNA ; prokaryotic versus eukaryotic organisms	

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II	**. Enzymes :** Introduction and historical perspective, Chemical and biological catalysis, remarkable properties of enzymes like catalytic power, specificity and regulation. Nomenclature and classification, extraction and purification. Fisher's lock and key and Koshland's induced fit hypothesis, concept and identification of active site by the use of inhibitors, affinity labeling and enzyme modification by site-directed mutagenesis. Enzyme kinetics, Michaelismeten and Lineweaver-Burk Plots, reversible and irreversitble inhibition	
III	**Mechanism of Enzyme Action** Transition-state theory, orientation and steric effect, acid-base catalysis, covalent catalysis, strain or distortion. Examples of some typical enzyme mechanisms for chymotrypsin, rebonuclease, lysozyme andcarboxypeptidase A.	
IV	**. Kinds of Reactions Catalysed by Enzymes** Nucleophilic displacement on a phosphorus atom, multiple displacement reactions and the coupling of ATP cleavage to endergonic processes. Transfer of sulphate, addition and elimination reactions, enolic intermediates, intermediates in isomerization reactions, cleavage and condensation, some isomerization and rearrangement reactions. Enzyme catalyzed carboxylation and decarboxylation	

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V	**Co-Enzyme Chemistry** Co-Factors as derived from vitamins, co-enzymes, prosthetic groups, apoenzymes. Structure and biological functions of co-enzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD+ , NADP+ , FMN, FAD, lipoic acid, vitamin B12 Mechanisms of reactions catalyzed by the above co-factors.	
VI	**. Enzyme Models** Host-guest chemistry, chiral recognition and catalysis, molecular recognition, molecular asymmetry and prochirality. Biomimetic chemistry, crown ethers. Cyptates. Cyclodextrins, cyclodextrin-based enzyme models, calixarenes, ionophores, micelles, synthetic enzyme of synzymes.	
VII	**Biotechnological Applications of Enzymes** Large-scale production and purification of enzymes, techniques and methods of immobilization of enzymes, effect of immobilization on enzyme activity, application of immobilized enzymes, use of enzymes in food and drink industry-brewing and chesse-making, syrups from corn starch, enzymes as targets for drug design. Clinical uses of enzymes, enzyme therapy.enzymes and recombinant DNA technology. Application of enzymes in organic synthesis	

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SuggestedReadings:

Bio organic chemistry a chemical approach to enzyme action ,Hermann drugs and C. Penny,Springer-verlag

Understanding Enzyme ,Trevor Palmer,Prentee Hall

Enzyme Chemistry Impact and application E.d.Collin ,J . Suckling,chapman& Hall

Funtamentals of Enzymology N.C Price & L. Stevens

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SuggestedContinuousEvaluationMethods: tests, assignments, presentations

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Department of Chemistry

Programme: M.Sc	Year:2	**Semester:IV**
Name of Faculty: Dr. ShitalPanday	Paper-1**Subject:Chemistry**	
CourseCode: H-4016	**CourseTitle:Chemistry of Natural Products**	

CourseoutcomesChemistry is the central science and impacts on all facets of our lives. An understanding of chemistry is necessary to all other sciences from astronomy to zoology. All of the materials used by engineers and technologists are made by chemical reactions and we all experience chemical reactions continuously, whetier it be breathing or baking a cake, driving a car or listening to a battery driven minidisk player. Chemistry is concerned with all aspects of molecules, their physical and chemical properties, their composition and structure, their synthesis and use in the 21st century. Chemistry is fundamental. To understand why an autumn leaf turns red, or why a diamondis hard, or why soap gets us clean, requires an understanding of chemistry. To design a synthetic fiber, a life-saving drug, or a space capsule requires knowledge of chemistry. The behavior of atoms, molecules, and ions determines the sort of world we have to live in, our shapes and sizes, and even how we feel on a given day. Chemists are very much involved in tackling the problems faced by our modern society. On a given day, a chemist may be studying the mechanism of the recombination of DNA, measuring the amount of insecticide in drinking water, comparing the protein content of meats. developing a new antibiotic, or analyzing a moon rock. So chemistry is worth studying. just because it is such a good antidote for ignorance

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Credits:	Elective
Max.Marks: 50+50	Min.PassingMarks-15
TotalNo.ofLectures=60	

Unit	Topics	No. ofLectures
I	Terpenoids and Carotenoids : Classification, nomenclature, occurrence, isolation.General methods of structure, determination, isoprene rule, Structure determination.stereochemistry biosynthesis and synthesis of the following representative molecules:Citral, Geraniol, termpencol Menthol, Farnesol, Zingiberen.	
II	Alkaloids: Definition, nomenclature and physiological action, occurrence, isolation.general methods or structure elucidation, degradation, classification based on nitrogenheterocyclic rings, role of alkalords in plants, Structure, stereochemistry, synthesisand biosynthesis of the following: Ephedrine, (+) Coniline, Nicoline, Atropine, Quinineand Morphine.	

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III	**Steroids** : Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and stereochemistry. Isolation, Structure determination and synthesis of Cholestrol. Bileacids. Androsterone, Testosteronc, Estronc, Progestrone, Aldosterone, Biosynthesisof steroids	
IV	**Plant Pigments** : Occurrence, nomenclature and generalmethods ofstructuredetermination, Isolation and synthesis of Apigenin, Luteolin, Quercetin, mytcelin.Ouercetin-3-glucoside, Vitexin, Diadzein, Butein, Aureusin, Cyanidin-7- arabinoside,Cyanidin, Hirsutidin. Biosynthesis of flavonoids: Acetate pathway and ShikimicacidPathway	
V	**Prophyrins :** Structure and synthesis of Haemoglobin and Chlorophyll.	
VI	**Prostaglandins** : Occurrence, biogenesis and physiological effects Synthesis of PGE2, and PGF2a,	

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SuggestedReadings:

"Chemistry of Natural products" by S V Bhat
"The Chemistry of Natural Products" by R H Thomson
"Natural Products: Chemistry And Applications" by Sujata V Bhat and B A Nagasampagi
"Chemistry Of Natural Products" by Krishnaswamy N R
"Chemistry of Natural Products: Amino Acids, Peptides Proteins and Enzymes" by V K Ahluwalia and Lalita S Kumar

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Department of Chemistry

Programme: M.Sc	Year:2	**Semester:IV**

Name of Faculty: Dr.Sangeeta Bhatia –Unit - VI
Dr. RenuChoudhary- Unit – I , III, IV
Dr. ShitalPanday Unit- II , V

Paper-1

Subject**:Chemistry**

CourseCode: H-4007	**CourseTitle: Environmental Chemistry**

CourseoutcomesAfter having passed the course, teaching is one of the best options both in schools and colleges levels; for this at the college level, they must have passed the NET exam.

They can also go for jobs in research and development in the industry.In the public sector, one can find opportunities in Oil India, Geological Survey of India, Meteorological Survey of India, and Department of Oceanography, etc.Other areas where they can get jobs are management, production, packaging, quality control, marketing and sales in industries such as pharmaceuticals, foods, dyes, cosmetics, polymer, Chemical, etc

Credits:	Compulsory Paper
Max.Marks: 50+50	Min.PassingMarks-15
TotalNo.ofLectures=60	

Unit	Topics	No. ofLectures
I	**Environment**Introduction. Composition of atmosphere, vertical termperature. heat budget of the earth atmospheric system, vertical stability atmosphere. Biogeochemical cycles of C. N,P. S and O. Biodistribution of elements	
II	**Hydrosphere** Chemical composition of water bodies-lakes, streams, rivcrs and wet lands ctc. Hydrological cycle.Aquatic pollution - inorganic. organic. pesticide, agricultural, industrial and sewage.detergents, oil spills and oil pollutants. Water quality parameters - dissolved oxygen.biochemical oxygen demand, solids, metals, content of chloride, sulphate. phosphate.nitrate and micro-organ isms. Water quality standards. Analytical methods for measuring BOD, DO, COD, F, Oils. metals (As, Cd. Cr. HgPb. Se etc.), residual chloride and chlorine demand.Purification and treatment of water.	

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III	**Soils** Composition, micro and macro nutrients, Pollution - fertilizers. pesticides. plastics and metals. Waste trçatment.	
IV	**Atmosphere** Chemical compositjonofatmosphere - particles, ions and radicals and their formation Chemical and photochemical reactions in atmosphere, smog formation, oxides ofN. C. S. O and their.effect. polfution by chemicals. petroleum, minerals.chlorofluorohydrocarbons. Green house effect. acid rain, air pollution controls and their chemistry .Analytical methods for measuring air pollutants. Continuous monitoring instruments	
V	**Industrial Pollution** - Cement. sugar, distillery, drug. paper and pulp. thermal power plants, nuclear pewr plants. metallurgy. Polymers, drugs etc. Radionuclide analysis. Disposal of wastes and their imanagement	
VI	**Environmental Toxicology** Chemical solutions to environmeňtal problems, biodégradability, principles of decomposition: better industrial processes. Bhopal gas tragedy, Chernobyl, Three Mile Island, SewalD.andMinamata disasters	

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SuggestedReadings:

Environment Chemistry Anil Km De Arnav Kumar De
Environment Chemistry H.Kaur
Environment Chemistry B.K.Sharma
Environment Chemistry with Green Chemistry Asim .K. Das

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SuggestedContinuousEvaluationMethods: tests, assignments, presentations

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Department of Chemistry

Programme: M.Sc	Year:2	**Semester:IV**
Name of Faculty: Dr. Shital Panday	Paper-1	**Subject:Chemistry**
CourseCode: H-4013	**CourseTitle:Organic Synthesis I**	

CourseoutcomesChemistry is the central science and impacts on all facets of our lives. An understanding of chemistry is necessary to all other sciences from astronomy to zoology. All of the materials used by engineers and technologists are made by chemical reactions and we all experience chemical reactions continuously, whetier it be breathing or baking a cake, driving a car or listening to a battery driven minidisk player. Chemistry is concerned with all aspects of molecules, their physical and chemical properties, their composition and structure, their synthesis and use in the 21st century. Chemistry is fundamental. To understand why an autumn leaf turns red, or why a diamondis hard, or why soap gets us clean, requires an understanding of chemistry. To design a synthetic fiber, a life-saving drug, or a space capsule requires knowledge of chemistry. The behavior of atoms, molecules, and ions determines the sort of world we have to live in, our shapes and sizes, and even how we feel on a given day. Chemists are very much involved in tackling the problems faced by our modern society. On a given day, a chemist may be studying the mechanism of the recombination of DNA, measuring the amount of insecticide in drinking water, comparing the protein content of meats. developing a new antibiotic, or analyzing a moon rock. So chemistry is worth studying. just because it is such a good antidote for ignorance

.

Credits:	Elective
Max.Marks: 50+50	Min.PassingMarks-15
TotalNo.ofLectures=60	

Unit	Topics	No. ofLectures
I	**Organometallic Reagents:** Principle, preparations, properties and applications of the following in organic synthesiswith mechanistic details:Group | & Il metal organic compoundsLi, Mg, Hg, Cd, Zn and Ce CompoundsTransition metalsCu. Pd, Ni, Fe, Co, Rh, Cr and Ti Compounds.Other elementsS, Si, B and I compounds.	
II	**Oxidation:** Introduction. Different oxidative processes.Hydrocarbons- alkenes, aromatic rings, saturated C-H groups (activatėd andunactivated).Alcohols, diols, aldehydes, ketones, ketals and carboxylic acids.Amines, Hydrazines and sulphides.Oxidationtvith ruthenium tetraoxide, iodobenzenediacetate and thallium (Ill) nitrate.	

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III	**Reduction:** Introduction. Different reductive processes.Aiydrocarbons- alkanes, alkenes, alkynes and aromatic rings.Aarbonyl Compounds- aldehydes, ketones, acidş and their derivatives.Epoxides, nitro. nitroso, azo and oxime groups.	
IV	**Rearrangements:** General mechanistic considerations- nature of migration, migratory aptitude, memoryeffects.A detailed study of the following rearrangements: Pinacol-Pinnacolone. Wagner-Meerwin, Demjanov, benzyl-Benzilic acid, Favorskii.Arndt-Eistern synthesis. Neber.Beckmann, Hoffman, Curtius, Schmidt, BaeyerVilliger, Shaprio reaction. Barton,Chichibaben, Hoffiman-Lofler Freytag reaction, Wittig reaction.	
V	**METALLOCENES, NONBENZĒNOID AROMATIC AND POLYCYCLIC** AROMATIC COMPOUNDS:General considerations, synthesis and reactions of Ferrocene, Chrysene, Azülene.	

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SuggestedReadings:

Organic Synthesis through Disconnection approach by P . S. Kalsi

Principles of Organic Synthesis" by Richard O C Norman and James MorrissCoxon

"advanced organic chemistry principles, tools and logic of synthesis" by R BalajiRao

"Organic Synthesis : Special Techniques" by V K Ahluwalia

"Modern Methods of Organic Synthesis" by W Carruthers

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Department of Chemistry

Programme: M.Sc	Year:2	**Semester:IV**
Name of Faculty: Dr. Sangeeta Bhatia	Paper-3	**Subject:Chemistry**
CourseCode: H-4015	**CourseTitle: Polymers**	

CourseoutcomesChemistry is the central science and impacts on all facets of our lives. An understanding of chemistry is necessary to all other sciences from astronomy to zoology. All of the materials used by engineers and technologists are made by chemical reactions and we all experience chemical reactions continuously, whetier it be breathing or baking a cake, driving a car or listening to a battery driven minidisk player. Chemistry is concerned with all aspects of molecules, their physical and chemical properties, their composition and structure, their synthesis and use in the 21st century. Chemistry is fundamental. To understand why an autumn leaf turns red, or why a diamondis hard, or why soap gets us clean, requires an understanding of chemistry. To design a synthetic fiber, a life-saving drug, or a space capsule requires knowledge of chemistry. The behavior of atoms, molecules, and ions determines the sort of world we have to live in, our shapes and sizes, and even how we feel on a given day. Chemists are very much involved in tackling the problems faced by our modern society. On a given day, a chemist may be studying the mechanism of the recombination of DNA, measuring the amount of insecticide in drinking water, comparing the protein content of meats. developing a new antibiotic, or analyzing a moon rock. So chemistry is worth studying. just because it is such a good antidote for ignorance

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Credits:	Elective
Max.Marks: 50+50	Min.PassingMarks-15
TotalNo.ofLectures=60	

Unit	**Topics**	**No. of Lecture**
I	**Basics** Importance of polymers. Basic concepts: Monomers, repeat units, degree of polymerization. Linear, branched and nctwork polymers. Classification of polymers. Polymerization: condensation, addition, radicat chain-ionic and co-ordination and copolymerization. Polymerization conditions and polymer rcaction. Polymerization in homogeneous and heterogencous systems	

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II	**Polymer characterization** Polydispersion-average molecular weight concept. Number, Weight and Viscosity average molecular weight. Polydispersity and molecular weight distribution. The practical significance of molccular weight. Measurement of molecular weight. End group, viscosity light scattering, osmotic and ultracentrifugation methods. Analysis and testing of polymers and chemical analysis of polymers, spectroscopic methods, physical testing - tensile strength. fatigue. impact. Tear resistancc. Hardness and abrasion resistance. .	
III	**Structure and Properties** Morphology and order in crystalline polymers-configurations of polymer chains. Crystal structures of polymers. Morphology of crystalline polymers, strain-induced morphology, crystallization and melting. Polymer structure and physical properties-crystalline melting point Tm-melting points of homogeneous series, effect of chain flexibility and other steric factors, entropy and heat of fusion. The glass transition temperature, Tgrelationship between Tm &Tg, effects of molecular weight, diluents. chemical structure, chain topology, branching and cross linking. Property requirements and polymer utilization.	
IV	**Polymer Processing** Plastics, elastomers and fibers. Compounding. Processing techniques: Calendering. die casting, rotational casting, film casting, injection moulding, blow moulding, extrusion moulding, thermoforming, foaming, reinforcing and fiber spinning.	

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V	**Properties of Commercial Polymers** Polyethylene, Polyvinyl chloride. polyamides, polyesters. phenolic resins., epoxy resins and silicon polymers. Functional Polymers- Fire retarding polymers and electrically conducting polymers. Biomedical polymers- contact lens, dental polymers. artificial heart, kidney, skin and blood cells.	

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SuggestedReadings:

"Polymer Science and Technology" by Fried

. "Macromolecules: Synthesis, Order and Advanced Properties (Advances in Polymer Science)" by K A Armitstead and Y Chujo

"Polymer Blends and Alloys: An Overview" by R P Singh

Gowarikervishwanathhan, Sreedher

Fred W. Billmeyer

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Department of Chemistry

Programme: B.Sc	Year:1	**Semester:I**

Name of Faculty:

Dr. Renu Choudhary Unit III ,IV , V ,VII

Dr. Shital Panday Unit I, II, VI ,VIII

Paper-1**Subject:Chemistry**

CourseCode:B020101T	**CourseTitle:**FundamentalsofChemistry	Credits -4

Courseoutcomes:

There is nothing more fundamental to chemistry than the chemical bond. Chemical bonding is the language of logic forchemists. Chemical bonding enables scientists to take the 100-plus elements of the periodic table and combine them inmyriad ways to form chemical compounds and materials. Periodic trends, arising from the arrangement of the periodictable, provide chemists with an invaluable tool to quickly predict an element's properties. These trends exist because ofthe similar atomic structure of the elements within their respective group families or periods, and because of the periodicnature of the elements. Reaction mechanism gives the fundamental knowledge of carrying out an organic reaction in astep-by-step manner. This course will provide a broad foundation in chemistry that stresses scientific reasoning andanalytical problemsolvingwith a molecular perspective.Students will gainanunderstandingof

- Moleculargeometries,physicalandchemicalpropertiesof themolecules.
- Current bonding models for simple inorganic and organic molecules in order to predict structures and importantbondingparameters.
- ThechapterRecapitulationofbasicsoforganicchemistrygivesthemost primaryandutmostimportantknowledgeand concepts oforganic Chemistry.
- This course gives a broader theoretical picture in multiple stagesin an overall chemical reaction. It describesreactiveintermediates,transitionstatesandstatesofall thebondsbrokenandformed.It enablestounderstandthereactants,catalyst, steriochemistryand major andminor productsofanyorganicreaction.
- It describes the types of reactions and the Kinetic and thermodynamic aspects one should know for carrying outanyreaction andthe ways howthereaction mechanismcan bedetermined.

ThechaptersSteriochemistrygivestheclearpictureoftwo-dimensionalandthree-dimensionalstructureofthemolecules,andtheirrole inreaction mechanism.

Credits: 4	Elective
Max.Marks: 25+75	Min.PassingMarks-

TotalNo.ofLectures=60

Unit	**Topics**	**No. ofLectures**

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I	*Introduction to Indian ancientChemistry and contribution of Indian Chemists, in context to theholisticdevelopment of modernscienceandtechnology,shouldbeincludedunderContinues Evaluation(CIE)* **MolecularpolarityandWeakChemicalForces:** Resonance and resonance energy, formal charge, Van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interaction, dipole moment and molecular Structure (Diatomicand polyatomic molecules), Percentage ionic character from dipole moment, polarizing power andpolarizability. Fajan's rules and consequences of polarization. Hydrogen bonding, van der Waalsforces, ion-dipole forces, dipole-dipole interactions, induced dipole interaction. Effects of weakchemical forces, melting and boiling points, solubility, energetics of dissolution process. Latticeenergyand Borrn-Haber cycle,solvationenergy, and solubilityofionic solids.	10
II	**SimpleBondingtheoriesofMolecules** Atomic orbitals, Aufbau principle, multiple bonding (σ and π bond approach) and bond lengths, thevalence bond theory (VBT), Concept of hybridization, hybrid orbitals and molecular geometry,Bent's rule, Valence shell electron pair repulsion theory (VSEPR), shapes of the following simplemoleculesandionscontainginglonepairsandbondpairsofelectrons:H_2O,NH_3,PCl_5,SF_6,SF_4, ClF_3,I_3^-,ClF_2^- andSO_4^{2-} andH_3O^+.Molecularorbitaltheory(MOT).Molecularorbitaldiagrams bondordersofhomonuclearandheteronucleardiatomicmoleculesandions(N_2,O_2,C_2,B_2,F_2,CO,NO,and theirions)	10
III	**Periodicproperties ofAtoms(withreferencetos&p-block)**: Briefdiscussion,factorsaffectingandvariationtrendsoffollowingpropertiesingroupsandperiods. Effectivenuclearcharge,shieldingorscreeningeffect,Slaterrules,Atomicandionicradii,Electronegativity,Pauling's/AllredRochow'sscales,Ionizationenthalpy,Electrongainenthalpy.	05
IV	**Recapitulation of basics of Organic Chemistry:** Hybridization, bond lengths and bond angles,bond energy, localized and delocalized chemical bonding, Van der Waals interactions, inclusioncompounds, Clatherates, Charge transfer complexes, hyperconjugation, Dipole moment; ElectronicDisplacements: Inductive,electromeric,resonancemesomericeffectsandtheirapplications	05
V	**Mechanism of Organic Reactions:** Curved arrow notation, drawing electron movements withallows, half-headed and double-headed arrows, homolytic and heterolytic bond fission, Types ofreagents–electrophilesandnucleophiles, Typesoforganicreactions,Energy considerations.Reactiveintermediates–Carbocations,carbanions,freeradicals,carbenes,arynesandnitrenes(withexamples).Assigningformalchargesonintermediatesandotherionicspecies.Methodsofdeterminationofreactionmechanism(productanalysis,intermediates,isotopeeffects,kineticand stereochemicalstudies).	10

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VI	**Steriochemistry**-Concept of isomerism, Types of isomerism; Optical isomerism – elements ofsymmetry,molecularchirality,enantiomers,stereogeniccenter,opticalactivity,propertiesofena ntiomers, chiral and achiral molecules with two stereogenic centers, disasteromers, threo anderythrodiastereomers,mesocompounds,resolutionofenantionmer,inversion,retentionandrec emization. Relative and absolute configuration, sequence rules, D & L and R & S systems ofnomenclature. Geometric isomerism – determination of configuration of geometric isomers, E & Zsystem of nomenclature, geometric isomerism in oximes and alicyclic compounds. Conformationalisomerism – conformational analysis of ethane and n-butane; conformations of cyclohexane, axialandequatorialbonds,conformationofmonosubstitutedcyclohexanederivatives,Newmanpr ojectionandSawhorseformulae,Fischer NewmanprojectionandSawhorseformulae,Fischerandflyingwedgeformulae,Differencebetwee n configurationandconformation	10
VII	**BasicComputersystem(inbrief)-** HardwareandSoftware;Inputdevices,Storagedevices,Outputdevices,CentralProcessingUnit(C ontrolUnitandArithmeticLogicUnit);Numbersystem(Binary,Octal and Hexadecimal Operating System); Computer Codes (BCD and ASCII)**;** Numeric/Stringconstants and variables. Operating Systems (DOS, WINDOWS, and Linux); Software languages:LowlevelandHighLevellanguages(Machinelanguage,Assemblylanguage;QBASIC, FORTRANandC++);SoftwareProducts(Office,chemsketch,scilab,matlab,hyperchem,etc.),int ernet application.	**05**
VIII	**MathematicalConceptsforChemistry** Logarithmic relations, curve sketching, linear graphs and calculation of slopes, differentiation offunctions like Kx, e^x, X^n , sin x, log x; maxima and minima, partial differentiation and reciprocityrelations, Integration of some useful/relevant functions; permutations and combinations, Factorials,Probability	**05**

SuggestedReadings:

1. Lee,J.D.ConciseInorganicChemistry,PearsonEducation2010
2. Huheey,J.E.,Keiter,E.A.,Keiter,R.L.,Medhi,O.K.InorganicChemistry,PrinciplesofS tructureandReactivity,Pearson Education 2006.
3. Douglas,B.E.andMcDaniel,D.H.,Concepts&ModelsofInorganicChemistry,Oxford,1970
4. Shriver,D.D.&P.Atkins,*InorganicChemistry2ndEd.*, Oxford UniversityPress,1994.
5. Day,M.C.andSelbin,J.TheoreticalInorganicChemistry,ACSPublications1962.
6. SinghJ.,YadavL.D.S.,AdvancedOrganicChemistry,PragatiEdition

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7. Morrison,R.N.&Boyd,R.N. *OrganicChemistry*,DorlingKindersley(India) Pvt.Ltd.(PearsonEducation).
8. Carey,F.A.,Guiliano,R.M.*OrganicChemistry*,Eighthedition,McGrawHillEducation,2012.
9. Loudon,G.M.*OrganicChemistry*,Fourthedition,OxfordUniversityPress,2008.
10. Clayden,J., Greeves, N. &Warren, S.*Organic Chemistry*,2nd edition, Oxford UniversityPress, 2012.
11. GrahamSolomons, T.W.,Fryhle, C. B. *Organic Chemistry*,JohnWiley&Sons,Inc.
12. Sykes,P.*AguidebooktoMechanism inOrganicChemistry*,PearsonEducation,2003
13. Francis**,P.G.**MathematicsforChemists,Springer,1984

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Department of Chemistry

Programme: B.Sc	Year:1	**Semester:II**

Name of Faculty:

Dr. Renu Choudhary Unit II, III, V, VII

Dr. Shital Panday Unit I, IV, VI , VIII

Paper-1 **Subject: Chemistry**

Course Code: B020201T	**CourseTitle: Bio-organic and Medicinal Chemistry**

Courseoutcomes: Biomoleculesareimportantforthefunctioningoflivingorganisms.Thesemoleculesperformortriggerimportantbiochemicalreactionsinlivingorganisms.Whenstudyingbiomolecules,onecanunderstandthephysiologicalfunctionthatregulatesthepropergrowthanddevelopmentofahumanbody.Thiscourseaimstointroducethestudentswithbasicexperimentalunderstandingofcarbohydrates,aminoacids,proteins,nucleicacidsandmedicinalchemistry.Uponcompletionofthiscoursestudentsmaygetjobopportunitiesinfood,beverageand pharmaceuticalindustries.

Credits: 4	Elective
Max.Marks: 25+75	Min. Passing Marks-
Total No.of Lectures=60	

Unit	**Topics**	**No. of Lectures**
I	**Chemistry of Carbohydrates** : Classification of carbohydrates, reducing and non-reducingsugars, General Properties of Glucose and Fructose, their open chain structure. Epimers,mutarotation and anomers. Mechanism of mutarotation Determination of configuration ofGlucose (Fischer's proof). Cyclic structure of glucose. Haworth projections. Cyclic structureoffructose.Interconversionsofsugars(ascendinganddescendingofsugarseries,conversionof aldoses to ketoses). Lobry de Bruyn-van Ekenstein rearrangement; stepping–up (Kiliani-Fischermethod)andstepping–down(Ruff's&Wohl'smethods)ofaldoses;end-group-interchangeofaldosesLinkagebetweenmonosachharides,structureofdisacharrides(sucrose,maltose,lactose)andpolysacharrides(starchandcellulose)excludingtheirstructureelucidation	10

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II	**ChemistryofProteins:**Classification*ofaminoacids,*zwitterionstructureandIsoelectricpoint.Overviewofprimary,secondary,tertiaryandquaternarystructureofproteins.Determinationofprimarystructureofpeptides,determinationofN-terminalaminoacid(byDNFBandEdmanmethod)andC–terminalaminoacid(bythiohydantoinandwithcarboxypeptidase enzyme). Synthesis of simple peptides (upto dipeptides) by N-protection &C-activating groups and Merrifield solid phase synthesis. Protein denaturation/ renaturationMechanismofenzymeaction,factorsaffectingenzymeaction,Coenzymesandcofactorsand theirroleinbiologicalreactions,Specificityofenzymeaction(Includingstereospecifity),	10
III	**Chemistry of Nucleic Acids:**Constituents of Nucleic acids: Adenine, guanine, thymine andCytosine(Structureonly),Nucleosidesandnucleotides **(nomenclature**),Synthesisofnucleicacids,Structureofpolynucleotides;StructureofDNA(Watson-Crickmodel)andRNA(**typesofRNA**),GeneticCode,BiologicalrolesofDNAandRNA:Replication,Transcriptionand Translation	05
IV	**IntroductoryMedicinalChemistry:**Drugdiscovery,designanddevelopment;BasicRetrosynthe ticapproach.Drugaction-receptortheory.Structure–activityrelationshipsofdrugmolecules, binding role of –OH group,-NH_2 group, double bond and aromatic ring, Synthesisoftherepresentativedrugsofthefollowingclasses:analgesicsagents,antipyreticagents,anti-inflammatory agents (Aspirin, paracetamol); antibiotics (Chloramphenicol); antibacterial andantifungalagents(Sulphonamides;Sulphanethoxazol,Sulphacetamide);antiviralagents(Acyclovir),CentralNervousSystemagents(Phenobarbital,Diazepam),Cardiovascular (Glyceryltrinitrate),HIV-AIDSrelateddrugs(AZT-Zidovudine	10
V	**SolidState** Definition of space lattice, unit cell. Laws of crystallography – (i) Law of constancy ofinterfacialangles,(ii)Lawofrationalityofindicesandiii)Symmetryelementsincrystalsandlaw ofsymmetry.X-ray diffractionbycrystals.DerivationofBraggequation.Determination ofcrystalstructureofNaCl,KClandCsCl (Laue'smethod andpowder method).	05
VI	**IntroductiontoPolymer** Monomers, Oligomers, Polymers and their characteristics,Classification of polymers :Naturalsynthetic,linear,crosslinkedandnetwork;plastics,elastomers,fibres,Homopolymers and Co-polymers, Bonding in polymers : Primary and secondary bond forcesin polymers ; cohesive energy, and decomposition of polymers. Determination of Molecularmassofpolymers:NumberAveragemolecularmass(Mn)andWeightaveragemolecular mass(Mw) of polymers and determination by (i) Viscosity (ii) Light Scattering method (iii)	10

	Gelpermeationchromatography(iv)Osmometryand Ultracentrifuging. **SiliconesandPhosphazenes**–Siliconesandphosphazenesasexamplesofinorganic polymers,natureofbondingintriphosphazenes	
VII	**KineticsandMechanismofPolymerization** Polymerization techniques, Mechanism and kinetics of copolymerization,Addition or chain-growthpolymerization,Freeradicalvinylpolymerization,ionicvinylpolymerization,Ziegler-Nattapolymerizationandvinylpolymers,Condensationorstepgrowth-polymerization, Polyesters,polyamides,phenolformaldehyderesins,ureaformaldehyderesins,epoxyresin andpolyurethanes,Naturalandsyntheticrubbers,Elementaryideaoforganicconducting polymers	05
VIII	**SyntheticDyes:**Colourandconstitution(electronicConcept),Classificationofdyes,Chemistryandsynthesisof Methylorange,Congored,Malachitegreen,crystalviolet, phenolphthalein,fluorescein,AlizarinandIndigo	05

SuggestedReadings:

1. Davis,B.G.,Fairbanks,A.J.,*CarbohydrateChemistry*,OxfordChemistryPrimer,OxfordUniversityPress.
2. Finar,I.L.*OrganicChemistry*(*Volume2),*DorlingKindersley(India)Pvt.Ltd.(PearsonEducation).
3. Nelson,D.L.&Cox,M.M. *Lehninger'sPrinciplesofBioch*emistry*7thEd.*,W. H.Freeman.
4. Berg,J.M.,Tymoczko, J.L.&Stryer, L. *Biochemistry 7th Ed.*, W. H. Freeman.
5. Morrison,R.T.&Boyd,R. N.*OrganicChemistry*,DorlingKindersley(India) Pvt.Ltd.(PearsonEducation).
6. Patrick,G.L.IntroductiontoMedicinalChemistry,OxfordUniversityPress,UK,2013.
7. Singh,H.&Kapoor,V.K.MedicinalandPharmaceuticalChemistry,VallabhPrakashan,Pitampura,NewDelhi,2012.
8. Atkins,P.W.&Paula,J.deAtkin'sPhysicalChemistryEd.,OxfordUniversityPress13(2006).
9. Ball,D.W. Physical ChemistryThomson Press,India (2007).
10. Castellan,G.W.PhysicalChemistry4thEd. Narosa(2004).
11. R.B.Seymour&C.E.Carraher:*PolymerChemistry:AnIntroduction,*MarcelDekker,Inc.NewYork,1981.
12. G.Odian: *Principles of Polymerization*, 4thEd.Wiley, 2004.
13. F.W. Billmeyer:*Textbookof Polymer Science*, 2ndEd. WileyInterscience,1971.
14. P.Ghosh:PolymerScience &Technology,Tata McGraw-HillEducation,1991

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Curriculum Delivery and Planning

Department of Mathematics (PCM):-

Programme: B.Sc.	Year: First	**Semester**: First
Name of Faculty: Dr. Preeti Singh		
Course Title: The Differential Calculus and Integral Calculus		**Credits**: 4
Course Code: B030101T		Core Compulsory
Max. Marks: 25+75		Theory

Course Outcome:

- To give foundation knowledge for the students to understand basics of mathematics including applied aspects for developing enhanced quantitative skills and pursuing higher mathematics and research as well.
- By the time students complete the course they will have wide ranging application of the subject and have the knowledge of real valued functions such as sequences and series. They will also be able to know about convergence of sequence and series. Also they have knowledge about curvature, envelope and evolutes and trace curve in polar, Cartesian as well as parametric curves.
- The main object of the course is to equip the students with necessary analytic and technical skills. By applying the principles of integral he learns to solve a variety of practical problems in science and engineering.
- The students is equipped with standard concepts and tools at an intermediate to advance level that will serve him well towards taking more advance level course in mathematics.

Unit	Topics	No. of Lectures: 60
	Part- A **Differential Calculus**	
I	Introduction to Indian ancient Mathematics and Mathematicians should be include under continous Internal Evaluation. Neighborhood of a point bounded above sets, bounded below sets, Bounded sets, Unbounded sets, open sets/ interval, closed sets/ interval, limits points of a set isolated points. Limit, continuity and differentiability of function of single variable, Cauchy's definition uniform continuity , boundedness theorem, intermediate value theorem, extreme value theorem, Darboux's intermediate value theorem for derivatives and chain rule.	**09**
II	Rolle's theorem language and Cauchy Mean value theorems, Taylor's theorem with various forms of remainders, Successive differentiation, Leibniz theorem, Malcanrin's and Taylor's series partial differentiation Euler's theorem on homogenous function.	**07**
III	Tangent and Normal, Asymptotes, curvature, envelopes and evolutes, Tests for concavity and convexity, points of inflexion, Multiple points, parametric representation of curves and tracing of parametric curves, tracing of curves in Cartesian and Polar form.	**07**
IV	Definition of sequence, theorems or limits of sequences, bounded and monotonic sequence, Cauchy's convergence criterion, Cauchy sequence, limit superior and limit inferior of a sequence, subsequence	**07**

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	series of non negative terms, convergence and divergence, comparison test, cauchy's integral test, Ratio tests, root test, Raabe's logarithmic test, De Morgan and Bertrand's tests, alternating series, Leibanitz' s theorem, absolute and conditional convergence.	
	Part- B **Integral Calculus**	
V	Concept of partition of interval, properties of partitions, Rienmann integral, criterion of Riemann Integrability of a function, Integrability of continuous and monotonic functions, fundamental theorem of integral calculus, Mean value theorem of integral calculus, differentiation under the sign of Integration.	**09**
VI	Improper integrals, their classification and convergence, comparison test, μ- test, Abel's test, Dirichle's test, quotation test, Beta and Gamma functions.	**07**
VII	Rectification, volumes and surfaces of solid of revolution, Pappus theorem, multiple integrals, change of order integration ,Dirichlet's theorem, liouville's theorem for multiple integrals.	**07**
VIII	Vector differentiation Gradient, Divergence and curl, Normal on a Surface, directional derivative, vector integration, statements of theorems, of Gauss, Green & Stokes, only without proof, Applications of these theorems for evaluation of double and triple.	**07**

Suggested Readings:

Part-A (Differential Calculus):-

- R.G. Bartle & D.R. Sherbert, Introduction to Real Analysis, John Wily & sons, 1999
- T.M. Apostal , Clculus Vol. I , John Willy & Sons Inc. 1974
- Ajit Kumar and S. Kumarsen, A Basie Course in Real Analysis. CRC Press 2019
- G.B. Thomas and R.L. Finney, Calculus, Pearson Education , 2010

Part- B (Integral Calculus):-

- T.M. Apostal , Clculus Vol. II , John Willy & Sons Publication,1974
- Withold A.J. Kosmala. A Friendly Introduction to Analysis, Single and Multivariable, Pearson, 2003
- Shanty Narayan & P.K. Mittal Integral Calculus S. Chand, 2005
- Erwin Kreyszig Advanced Engineering Mathematics, John Willy & Sons, 20011

Continuous Evaluation Methods: Test and Presentation

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Curriculum Delivery and Lesson Planning

Department of Mathematics (PCM):-

Programme: B.Sc.	Year: First	Semester: Second
Name of Faculty: Dr. Preeti Singh		
Course Title: Matrices and Differential Equations and Goemetry.		Credits: 4
Course Code: B080101T		Core Compulsory
Max. Marks: 25+75		Theory

Course Outcome:

- The subject of the course are designed in such a way that they focus on developing mathematical skills in algebra, calculus and analysis and give in depth knowledge of geometry, calculus, algebra, and other theories.
- The students will be able to find the rank, eigen values of matrices and study the linear homogenous and non- homogenous equations. The course in differential equation intends to develop problem solving skills for solving various types of differential equation and geometrical of differential equation.
- The subjects learn and visualize the fundamental ideas about coordinate geometry and learn to describe some of the surface by using analytical geometry.
- On successfully completion of the course students have gained knowledge about regular geometrical figures and their properties, they have the foundation for higher course in Geometry.

Unit	Topics	No. of Lectures: 90
	Part- A Matrices and differential Equations	
I	Types of matrices, elementary operations on matrices, rank of matrix system of linear homogenous and non- homogenous equations theorems on consistency of a system of linear equations. Echelon form of a matrix, normal form of a matrix, inverse of a matrix by elementary operations.	**12**
II	Eigen values, Eigen vectors and characteristics equation of matrix, Caley- Hamilton theorem and its applications in finding inverse of a matrix, Diagonalization of matrices.	**11**
III	Formation of differential equations, geometrical meaning of a differential equations, Equation of first order and first degree, Equation in which the variable are separable, Homogenous equations, Exact differential equations and equations reducible to the exact form linear differential equation.	**11**
IV	First order higher degree equations solvable for x,y,p, Clairaut's equation and singular solutions, orthogonal trajectories, linear differential equation of order greater than one with constant coefficients, Cauchy- Euler form.	**11**
	Part- B Geometry	
V	General equation of second degree. System of conics, Tracing of Conics, confocal conics, Polar equation of conics and its properties.	**12**
VI	Three dimensional coordinates. Projection and direction cosine, Plane (Cartesian and vector form), Straight line in three dimensions.	**11**
VII	Sphere, Cone, Cylinder.	**11**

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VIII	Central conicoid , Parabolas, plane section of conicoid, Generating lines, Confocal conicoid, Reduction of second degree equations.	**11**

Suggested Readings:

Part-A (Matrices and Differential Equations):-

- Shanti Narayan, A Textbook of Matrices, S Chand, 2010
- Fuzhen zhang, Matrix Theory- Basic Results and Techniques, Springer, 1999
- B Rai. D.P. Chaudhary & H.J. Freeedman, A Course in Differential Equations, Narosa, 2002
- William E Boyce and Richard C Di Prima, Elementary Differential Equations and Boundary Value Problems, John Willy and sons, 2009
- D.A. Murray, Introductory Course in Differential Equation.

Part- B (Geometry):-

- Robbert J T Bell, An Elementary Treatise on Coordinate Geometry of three dimensions. Macmillan India Ltd. 1923
- P.R.Vittal, Analytical Geometry 2D & 3D Pearson, 2013
- S.L. Loney The Elements of Coordinate Geometry McMillan and company, London, 2018

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Curriculum Delivery and Lesson Planning

Department of Physics (PCM)

Programme: B. Sc.	Year: First	Semester: First
Name of Faculty: Dr. Jyotshana Gaur		
Course Title: Mathematical Physics & Newtonian Mechanics		Credits: 4
Course Code: B010101T		Core Compulsory
Max. Marks: 25+75		Theory

Course Outcome:

• Perceive the difference between scalars, vectors, pseudo-scalars and pseudo-vectors.
• The physical interpretation of gradient, divergence and curl.
• Understand the connection and difference between Cartesian, spherical and cylindrical coordinate systems.
• Recognise the meaning of 4-vectors, Kronecker delta and Epsilon (Levi Civita) tensors.
• Study the origin of pseudo forces in rotating frame.
• Study the response of the classical systems to external forces and their elastic deformation.
• Understand the dynamics of planetary motion and the working of Global Positioning System (GPS).
• Understand the different features of Simple Harmonic Motion (SHM) and wave propagation.

Unit	Topics	No. of Lectures: 60
	Part A: Basic Mathematical Physics	
	Contribution of Indian Scientists: Contributions of Aryabhata, Vikram Sarabhai, C V Raman, S N Bose, M N Shaha, Subrahmanyam, Chandrasekhar. Chandrasekhar.	
I	**Vector Algebra:** Coordinate rotation, reflection and inversion for defining scalars, vectors, pseudo-scalars and pseudo-vectors (include physical examples). Component form in 2D and 3D. Geometrical and physical interpretation of addition, subtraction, dot product, wedge product, cross product and triple product of vectors. Position, separation and displacement vectors.	7
II	**Vector Calculus:** Geometrical and physical interpretation of vector differentiation, Gradient, Divergence and Curl and their significance. Vector integration, Line, Surface (flux) and Volume integrals of vector fields. Gradient theorem, Gauss-divergence theorem, Stoke-curl theorem, Green's theorem (statement only). Introduction to Dirac delta function.	8
III	**Coordinate Systems:** 2D & 3D Cartesian, Spherical and Cylindrical coordinate systems, basis vectors, transformation equations. Expressions for displacement vector, arc length, area element, volume element, gradient, divergence and curl in different coordinate	8

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	systems. Components of velocity and acceleration in different coordinate systems.	
IV	**Introduction to Tensors** Principle of invariance of physical laws w.r.t. different coordinate systems as the basis for defining tensors. contravariant, covariant & mixed tensors and their ranks, 4-vectors. Index notation and summation convention. Symmetric and skew-symmetric tensors. Examples of tensors in physics.	7
PART B: Newtonian Mechanics & Wave Motion		
V	**Dynamics of a System of Particles:** Review of historical development of mechanics up to Newton. Background, statement and critical analysis of Newton's axioms of motion. Dynamics of a system of particles, centre of mass motion, and conservation laws & their deductions. Rotating frames of reference.	8
VI	**Dynamics of a Rigid Body:** Angular momentum, Torque, Rotational energy and the inertia tensor. Rotational inertia for simple bodies (ring, disk, rod, solid and hollow sphere, solid and hollow cylinder, rectangular lamina). The combined translational and rotational motion of a rigid body on horizontal and inclined planes. Elasticity, relations between elastic constants, bending of beam and torsion of cylinder.	8
VII	**Motion of Planets & Satellites:** Two particle central force problem, reduced mass, relative and centre of mass motion. Newton's law of gravitation, gravitational field and gravitational potential. Kepler's laws of planetary motion and their deductions. Motions of geo-synchronous & geo-stationary satellites and basic idea of Global Positioning System (GPS).	7
VIII	**Wave Motion:** Differential equation of simple harmonic motion and its solution, use of complex notation, damped and forced oscillations, Quality factor. Composition of simple harmonic motion, Lissajous figures. Differential equation of wave motion. Plane progressive waves in fluid media, reflection of waves and phase change, pressure and energy distribution. Principle of superposition of waves, stationary waves, phase and group velocity.	7

Suggested Readings:

PART A

1. Murray Spiegel, Seymour Lipschutz, Dennis Spellman, "Schaum's Outline Series: Vector Analysis", McGraw Hill, 2017, 2e
2. A.W. Joshi, "Matrices and Tensors in Physics", New Age International Private Limited, 1995, 3e

PART B

3. Charles Kittel, Walter D. Knight, Malvin A. Ruderman, Carl A. Helmholz, Burton J. Moyer, "Mechanics (In SI Units): Berkeley Physics Course Vol 1", McGraw Hill, 2017, 2e
4. H. K. Malik and A.K. Singh "Engineering Physics", McGraw Hill Education (India) Private Limited, 2018, 2e.

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5. D.S. Mathur, P.S. Hemne, “Mechanics”, S. Chand Publishing, 1981, 3e

Books of local authors:

6. Mathematical Physics, B. D. Gupta, S. Chand Publiction
7. Mechanics & Wave Motion, Agrawal, Jain & Sharma, Krishna Prakashan, Meerut
8. यांत्रिकी □□□ □□□□ गति, अग्रवाल, □□□ □ □□□□□, □□□□□□ □□□□□□□, □□□□

Suggestive Digital Platforms / Web Links:

8. MIT Open Learning - Massachusetts Institute of Technology,https://openlearning.mit.edu/
9. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
10. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchConte
11. Swayam Prabha – DTH Channel,https://www.swayamprabha.gov.in/index.php/program/current_he/8

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Curriculum Delivery and Lesson Planning

Department of Physics (PCM)

Programme: B.Sc.	Year: First	Semester: Second
Name of Faculty: Dr. Jyotshana Gaur		
Course Title: Thermal Physics & Semiconductor Devices		Credits: 4
Course Code: B010201T		Core Compulsory
Max. Marks: 25+75		Theory

Course Outcome:

- Recognize the difference between reversible and irreversible processes.
- Understand the physical significance of thermodynamical potentials.
- Comprehend the kinetic model of gases w.r.t. various gas laws.
- Study the implementations and limitations of fundamental radiation laws.
- Utility of AC bridges.
- Recognize the basic components of electronic devices.
- Design simple electronic circuits.
- Understand the applications of various electronic instruments.

Unit	Topics	No. of Lectures: 60
	Part A: Thermodynamics & Kinetic Theory of Gases	
I	**0^{th} & 1^{st} Law of Thermodynamics:** State functions and terminology of thermodynamics. Zeroth law and temperature. First law, internal energy, heat and work done. Work done in various thermodynamical processes. Enthalpy, relation between C_P and C_V. Carnot's engine, efficiency and Carnot's theorem. Efficiency of internal combustion engines (Otto and diesel).	8
II	**2^{nd} & 3^{rd} Law of Thermodynamics:** Different statements of second law, Clausius inequality, entropy and its physical significance. Entropy changes in various thermodynamical processes. Third law of thermodynamics and unattainability of absolute zero. Thermodynamical potentials, Maxwell's relations, conditions for feasibility of a process and equilibrium of a system. Clausius-Clapeyron equation, Joule-Thompson effect.	8
III	**Kinetic Theory of Gases:** Kinetic model and deduction of gas laws. Derivation of Maxwell's law of distribution of velocities and its experimental verification. Degrees of freedom, law of equipartition of energy (no derivation) and its application to specific heat of gases (mono, di and poly atomic)	7
IV	**Theory of Radiation:** Blackbody radiation, spectral distribution, concept of energy density and pressure of radiation. Derivation of Planck's law, deduction of Wien's distribution law, Rayleigh-Jeans law, Stefan-Boltzmann law and Wien's displacement law from Planck's law.	7
	PART B: Circuit Fundamentals & Semiconductor Devices	

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V	**DC & AC Circuits:** Growth and decay of currents in RL circuit. Charging and discharging of capacitor in RC, LC and RCL circuits. Network Analysis - Superposition, Reciprocity, Thevenin's and Norton's theorems. AC Bridges - measurement of inductance (Maxwell's, Owen's and Anderson's bridges) and measurement of capacitance (Schering's, Wein's and de Sauty's bridges).	7
VI	**Semiconductors & Diodes:** P and N type semiconductors, qualitative idea of Fermi level. Formation of depletion layer in PN junction diode, field & potential at the depletion layer. Qualitative idea of current flow mechanism in forward & reverse biased diode. Diode abrication. PN junction diode and its characteristics, static and dynamic resistance. Principle, structure, characteristics and applications of Zener, Light Emitting, and Photo diodes. Half and Full wave rectifiers, calculation of ripple factor, rectification efficiency and voltage regulation. Basic idea about filter circuits and voltage regulated power supply.	8
VII	**Transistors:** Bipolar Junction PNP and NPN transistors. Study of CB, CE & CC configurations w.r.t. active, cutoff & saturation regions; characteristics; current, voltage & power gains; transistor currents & relations between them. Idea of base width modulation, base spreading resistance & transition time. DC Load Line analysis and Q-point stabilization. Voltage divider bias circuit for CE amplifier.	8
VIII	**Electronic Instrumentation:** Multimeter: Principles of measurement of dc voltage, dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance. Cathode Ray Oscilloscope: Block diagram of basic CRO. Construction of CRT, electron gun, electrostatic focusing and acceleration (no mathematical treatment). Front panel controls, special features of dual trace CRO, specifications of a CRO and their significance. Applications of CRO to study the waveform and measurement of voltage, current, frequency & phase difference.	7

Suggested Readings:

1. M.W. Zemansky, R. Dittman, "Heat and Thermodynamics", McGraw Hill, 1997, 7e
2. F.W. Sears, G.L. Salinger, "Thermodynamics, Kinetic theory & Statistical thermodynamics", Narosa Publishing House, 1998
3. Enrico Fermi, "Thermodynamics", Dover Publications, 1956
4. S. Garg, R. Bansal, C. Ghosh, "Thermal Physics", McGraw Hill, 2012, 2e

PART B

5. R.L. Boylestad, L. Nashelsky, "Electronic Devices and Circuit Theory", Prentice-Hall of India Pvt. Ltd.,
2015, 11e
6. A. Sudhakar, S.S. Palli, "Circuits and Networks: Analysis and Synthesis", McGraw Hill, 2015, 5e
7. S.L. Gupta, V. Kumar, "Hand Book of Electronics", Pragati Prakashan, Meerut, 2016, 43e

Books of local authors:

1. Heat and Thermodynamics, Brij Lal Subrahmanyam
2. Refresher Course in Physics, C.L.Arora (for U.P. State Universities), S.Chand Publication
3. Kinetic Theory and Thermodynamics, Agrawal, Jain & Sharma, Krishna Prakashan, Meerut
4. Circuit fundamentals & Basic Electronics, Agrawal, Jain & Sharma, Krishna Prakashan, Meerut

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