CHOICE BASED CREDIT SYSTEM
(CBCS)

Guru Jambheshwar University of Science and Technology, Hisar

Scheme and Syllabi
for

Undergraduate Course:
B. SC. PHYSICAL SCIENCE (PHYSICS,
CHEMISTRY, MATHEMATICS)

Under
The Faculty of Physical Sciences and Technology

w.e.f. Academic Session 2018-19

Scheme of the Programme for B.Sc. (Physical Sciences with Physics, Chemistry, Mathematics) under Choice Based Credit System (w.e.f. 2018-19)

B.Sc. (Physical Sciences with Physics, Chemistry, and Mathematics) Program has three types of Courses: Foundation courses (72Credits), Discipline based/interdisciplinary Elective Courses (36 Credits) and skill Enhancement Courses (6Credits). Apart from these, there are language skill courses in English (2Credits), Hindi or Sanskrit (2Credits) and one awareness program on Environmental Studies (2Credits). Each course has been uniformly distributed for about 30 hours.

A student can choose one MOOC'S course (2 Credits) that is an added advantage for learning the subject of his/her own choice in place of Discipline Specific or Skill Enhancement Course. He can also earn 2 Credit Course through Extra Curricular Activities NCC/NSS/Swatch Bharat Abhiyan or some Internship program on production of valid certificate from the concerned authority. A student needs to complete a total of 120 Credits in order to pass the degree securing minimum of 35% marks in aggregate.

The internal assessment is based on the marks obtained by the student in best of two Minor tests of 20 marks each and will be conducted during the semester in the month of September and November for Odd Semester and in the month of February and April for Even Semester. A student is required to pass the individual paper with 35% marks overall including internal assessment based on minor test. He may not be given any additional chance for minor test. However, the student also needs to pass the external examination individually with 35% marks.

The Batches of 20 or more can be opted for various courses as per requirement for all practical purposes by the college/institution. The evaluation of Practical may be distributed as 20 marks for lab record, 50 marks for performance during the examination and 30 marks for Viva Voce examination.

Credit Distribution for B.Sc. programme under Choice Based Credit System (CBCS)

	Core Courses	Language skills	Awareness program	Discipline Specific courses(DSC)	Skill Enhancement Courses(SEC)	Total Credits
Theory	48	4	2	24	6	84
Practical	24	-	-	12	-	36

Total Credits required to pass the course -120

Note: MOOC Course can be availed by the candidate either under DSC *OR* SEC.

Semester wise Distribution of Credits

	First year Credit		Second year Credit		Third year Credit		Total Credits
	1st Sem	2nd Sem	3rd Sem	4th Sem	5th Sem	6th Sem	
Language skills	2	-	2	-	-	-	4
Awareness program	-	2		-	-	-	2
Core Courses	18	18	18	18	-	-	72
Discipline Specific courses(DSC)	-	-	-	-	18	18	36
Skill Enhancement Courses(SEC)	-	-		2	2	2	6
Total	20	20	20	20	20	20	120

Semester-I

Paper Code	Course opted	Nomenclature	Credits	Hr/ week	Marks		
					Ext.	Int.	Total
CXL 101	Language Skills Compulsory Course-I	English	2	2	80	20	100
CPL- 102	Core Course-I	Mechanics-I	2	2	80	20	100
CPL- 103	Core Course-II	Electricity, Magnetism and EMT-I	2	2	80	20	100
CCL- 104	Core Course-III	Inorganic Chemistry-I	2	2	80	20	100
CCL- 105	Core Course-IV	Organic Chemistry-I	2	2	80	20	100
CML- 106	Core Course-V	Mathematics-I:Algebra	2	3	80	20	100
CML- 107	Core Course-VI	Mathematics-II: Calculus	2	3	80	20	100
CPP- 108	Practical-I	Physics Lab-I	2	4	100	-	100
CCP- 109	Practical-II	Chemistry Lab-I	2	4	100	-	100
CMP- 110	Practical-III	Mathematics Lab-I	2	4	100	-	100
		Total	**20**	**28**	**860**	140	1000

Semester-II

Paper Code	Course opted	Nomenclature	Credits	Hr/ week	Marks		
					Ext.	Int.	Total
CXL- 201	Awareness Program Compulsory Course	Environmental Science	2	2	80	20	100
CPL- 202	Core Course-VII	Mechanics-II	2	2	80	20	100
CPL- 203	Core Course-VIII	Electricity, Magnetism and EMT-II	2	2	80	20	100
CCL- 204	Core Course -IX	Physical Chemistry-I	2	2	80	20	100
CCL- 205	Core Course -X	Organic Chemistry II	2	2	80	20	100
CML- 206	Core Course -XI	Mathematics –III: Vector Calculus and Geometry	2	3	80	20	100
CML- 207	Core Course -XII	Mathematics –IV: Ordinary Differential Equations	2	3	80	20	100
CPP- 208	Practical-IV	Physics Lab-II	2	4	100	-	100
CCP- 209	Practical-V	Chemistry Lab-II	2	4	100	-	100
CMP- 210	Practical-VI	Mathematics Lab-II	2	4	100	-	100
		Total	**20**	**28**	**860**	140	1000

Semester-III

Paper Code	Course opted	Nomenclature	Credits	Hr/ week	Marks		
					Ext.	Int.	Total
CXL- 301 OR CXL- 302	Language Skills Compulsory Course-II	Hindi OR Sanskrit	**2**	**2**	80	20	100
CPL- 303	Core Course-XIII	Thermal Physics and Statistical Mechanics-I	**2**	**2**	80	20	100
CPL- 304	Core Course -XIV	Optics and Waves-I	**2**	**2**	80	20	100
CCL- 305	Core Course -XV	Physical Chemistry-II	**2**	**2**	80	20	100
CCL- 306	Core Course -XVI	Organic Chemistry III	**2**	**2**	80	20	100
CML- 307	Core Course -XVII	Mathematics- V	2	3	80	20	100
CML- 308	Core Course -XVIII	Mathematics- VI	2	3	80	20	100
CPP-309	Practical -VII	Physics Lab -III	2	4	100	-	100
CCP -310	Practical-VIII	Chemistry Lab-III	2	4	100	-	100
CMP -311	Practical -IX	Mathematics Lab-III	2	4	100	-	100
		Total	**20**	**28**	**860**	140	1000

Semester-IV

Paper Code	Course opted	Nomenclature	Credits	Hr/ week	Marks		
					Ext.	Int.	Total
CSE-401(i) *OR* CSE-401(ii) *OR* CSE-401(iii) *OR* CSE-401(iv)	Skill Enhancement Course (SEC) -I	Electrical Circuits and Network Skills *OR* Physics Workshop Skills *OR* Computational Physics Skill *OR* Basic Instrumentation Skill	**2**	**3***	80	20	100
CPL- 402	Core Course-XIX	Thermal Physics and Statistical Mechanics-II	**2**	**2**	80	20	100
CPL- 403	Core Course-XX	Waves and Optics-II	**2**	**2**	80	20	100
CCL- 404	Core Course -XXI	Inorganic Chemistry-II	**2**	**2**	80	20	100
CCL- 405	Core Course -XXII	Physical Chemistry-III	**2**	**2**	80	20	100
CML- 406	Core Course -XXIII	Mathematics-VII	**2**	**3**	80	20	100
CML- 407	Core Course -XXIV	Mathematics-VIII	**2**	**3**	80	20	100
CPP- 408	Practical-X	Physics Lab -IV	2	4	100	-	100
CCP- 409	Practical-XI	Chemistry Lab-IV	2	4	100	-	100
CMP- 410	Practical-XII	Mathematics Lab-IV	2	4	100	-	100
		Total	**20**	**29**	**860**	140	1000

*No. of hours include theory + Practical/Demonstration/Project

Semester-V

Paper Code	Course opted	Nomenclature	Credits	Hr/ week	Marks		
					Ext.	Int.	Total
CSE-501(i) OR CSE- 501(ii) OR CSE-501(iii) OR CSE- 501(iv)	Skill Enhancement Course (SEC) -II	CHEM-SEC-1 OR CHEM-SEC-2 OR CHEM-SEC-3 OR CHEM-SEC-4	**2**	**3***	80	20	100
CDS- 502(i) OR CDS- 502(ii) OR CDS- 502(iii) OR CDS- 502(iv)	Discipline Specific Course –I	Digital ,Analog and Instrumentation-I OR Elements of Modern Physics-I OR Mathematical Physics-I OR Quantum Mechanics-I	2	2	80	20	100
CDS- 503(i) OR CDS- 503(ii) OR CDS- 503(iii) OR CDS- 503(iv)	Discipline Specific Course –II	Digital ,Analog and Instrumentation-II OR Elements of Modern Physics-II OR Mathematical Physics-II OR Quantum Mechanics-II	2	2	80	20	100
CDS- 504(i) OR CDS-504(ii) OR CDS- 504(iii) OR CDS- 504(iv)	Discipline Specific Course –III	CHEM-CDS-1 OR CHEM-CDS-2 OR CHEM-CDS-3 OR CHEM-CDS-4	2	2	80	20	100
CDS- 505(i) OR CDS- 505(ii) OR CDS- 505(iii) OR CDS- 505(iv)	Discipline Specific Course –IV	CHEM-CDS-1 OR CHEM-CDS-2 OR CHEM-CDS-3 OR CHEM-CDS-4	2	2	80	20	100

CDS- 506(i) OR CDS- 506(ii) OR CDS- 506(iii) OR CDS- 506(iv)	Discipline Specific Course –V	MATH-CDS-1 OR MATH-CDS-2 OR MATH-CDS-3 OR MATH-CDS-4	2	2	80	20	100
CDS- 507(i) OR CDS- 507(ii) OR CDS- 507(iii) OR CDS- 507(iv)	Discipline Specific Course –VI	MATH-CDS-1 OR MATH-CDS-2 OR MATH-CDS-3 OR MATH-CDS-4	3	3	80	20	100
CPP- 508	Practical-XIII	Physics Lab -V	2	4	100	-	100
CCP- 509	Practical-XIV	Chemistry Lab -V	2	4	100	-	100
CMP- 510	Practical-XV	Maths Lab -V	2	4	100	-	100
		Total	**21**	**28**	**860**	140	1000

*No. of hours include theory + Practical/Demonstration/Project

Semester-VI

Paper Code	Course opted	Nomenclature	Credits	Hr/ week	Marks		
					Ext.	Int.	Total
CSE-601(i) OR CSE- 601(ii) OR CSE--601(iii) OR CSE- 601(iv)	Skill Enhancement Course (SEC) - III	MATH-SEC-1 OR MATH-SEC-2 OR MATH-SEC-3 OR MATH-SEC-4	**3**	**3**	80	20	100
CDS- 602(i) OR CDS- 602(ii) OR CDS- 602(iii) OR CDS- 602(iv)	Discipline Specific Course –VII	Solid State Physics-I OR Nuclear and Particle Physics-I OR Embedded Systems : Introduction to Micro Controllers -I OR Medical Physics -I	2	2	80	20	100
CDS- 603(i) OR CDS- 603(ii) OR CDS- 603(iii) OR CDS- 603(iv)	Discipline Specific Course –VIII	Solid State Physics-II OR Nuclear and Particle Physics-II OR Embedded Systems : Introduction to Micro Controllers -II	2	2	80	20	100

		OR Medical Physics -II					
CDS- 604(i) OR CDS- 604(ii) OR CDS- 604(iii) OR CDS-604(iv)	Discipline Specific Course –IX	CHEM-CDS-5 Or CHEM-CDS-6 Or CHEM-CDS-7 Or CHEM-CDS-8	2	2	80	20	100
CDS- 605(i) OR CDS- 605(ii) OR CDS- 605(iii) OR CDS- 605(iv)	Discipline Specific Course –X	CHEM-CDS-5 OR CHEM-CDS-6 OR CHEM-CDS-7 OR CHEM-CDS-8	2	2	80	20	100
CDS- 606(i) OR CDS- 606(ii) OR CDS- 606(iii) OR CDS -606(iv)	Discipline Specific Course –XI	MATH-CDS-5 OR MATH-CDS-6 OR MATH-CDS-7 OR MATH-CDS-8	2	2	80	20	100
CDS- 607(i) OR CDS- 607(ii) OR CDS- 607(iii) OR CDS- 607(iv)	Discipline Specific Course –XII	MATH-CDS-5 OR MATH-CDS-6 OR MATH-CDS-7 OR MATH-CDS-8	2	2	80	20	100
CPP- 608	Practical-XVI	Physics Lab -V	2	4	100	-	100
CCP- 609	Practical-XVII	Chemistry Lab -V	2	4	100	-	100
CMP- 610	Practical-XVIII	Maths Lab -V	2	4	100	-	100
		Total	**21**	**27**	**560**	140	700

Note :The nomenclature of some of the courses DSCs and SECs of the third semester onwards is yet to be decided.

Semester I

CXL-101
Language Skills compulsory Course-I: ENGLISH
(Credits: 02)

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Note: Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

UNIT – I

Syntax
Sentence structures, Verb patterns and their usage

UNIT-II

Phonetics
Basic Concepts – Vowels, Consonants, Phonemes, Syllables; Articulation of Speech Sounds – Place and Manner of Articulation; Transcription of words and simple sentences, using International Phonetic Alphabet.

UNIT-III

Comprehension
Listening and Reading comprehension – Note taking, Reviewing, Summarising, Interpreting, Paraphrasing and Précis Writing.

UNIT-IV

Composition
Descriptive, Explanatory, Analytical and Argumentative Writing - description of simple objects like instruments, appliances, places, persons, principles; description and explanation of processes and operations; analysis and arguments in the form of debate and group discussion.

Reference books:

1. Roy A. & Sharma P.L. English for Students of Science, Orient Longman.
2. Spoken English for India by R.K. Bansal and J.B. Harrison, Orient Longman.
3.Tickoo M.L. & Subramanian A.E. Intermediate Grammar, Usage and Composition, Orient Longman.
4. Pink M.A. & Thomas S.E. English Grammar, Composition and Correspondence, S. Chand and Sons Pvt.Ltd.,Delhi.
5. Thomson & Martinet A Practical English Grammar, OUP, Delhi.
6. Hornby A.S Guide to Patterns and Usage in English, OUP, Delhi.
7. Balasubramanian T. A Textbook of English Phonetics for Indian Students, MacMillan, Chennai.
8. O‟Connor J.D. Better English Pronunciation, Cambridge Univ. Press, London.
9. McCarthy English Vocabulary in Use, Foundation Books (Cambridge University Press), Delhi.

CPL- 102

Core Course-I; PHYSICS: MECHANICS-I
(Credits: 02, 30 Hrs (2Hrs /week))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

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Course Objective	Course Outcome
The course on mechanics deals with Some important mathematical physics concepts, Laws of Motion, rotational motion, Gravitation, and Elasticity.	The student will be able to understand basic mathematical physics equation, motion of different objects, global positioning system, planetary motion etc.

UNIT-I
Vectors: Vector algebra, Scalar and vector products, Derivatives of a vector with respect to a parameter, Gradient of a scalar field and its geometrical interpretation, Divergence and curl of a vector field, Laplacian operator, Vector identities, Line, surface and volume integrals of Vector fields, Flux of a vector field, Gauss's divergence theorem, Stokes Theorem and their applications (no rigorous proofs)

UNIT-II
Ordinary Differential Equations: First Order Differential Equations and Integrating Factor, 1st order homogeneous differential equations, 2nd order homogeneous differential equations with constant coefficients, Particular Integral

Laws of Motion: Frames of reference, Newton's Laws of motion and their applications

UNIT-III
Momentum and Energy: Conservation of momentum, Work and energy, Conservation of energy, Motion of rockets.
Dynamics of a system of particles: Elastic and inelastic collisions between particles, Centre of Mass and Laboratory frames
Rotational Motion: Angular velocity and angular momentum, Torque, Conservation of angular momentum, Angular momentum as vector, Coriolis forces and its effect on motion
UNIT-IV
Gravitation: Newton's Law of Gravitation, Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant), Kepler's Laws, Satellite in circular orbit and applications, Geosynchronous orbits, Weightlessness, Basic idea of global positioning system (GPS).
Elasticity: Hooke's law - Stress-strain diagram - Elastic moduli-Relation between elastic constants - Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants -

Reference Books:
- University Physics, FW Sears, MW Zemansky and HD Young13/e, 1986. Addison-Wesley
- Mechanics Berkeley Physics course,v.1: Charles Kittel, et. Al. 2007, Tata McGraw- Hill.
- Physics – Resnick, Halliday & Walker 9/e, 2010, Wiley
- Engineering Mechanics, Basudeb Bhattacharya, 2nd edn., 2015, Oxford University Press
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
- An introduction to Mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
- Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000.
- Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.
- Classical mechanics, J.C Uppadhayaya

CPL- 103
Core Course-I; PHYSICS: ELECTRICITY AND MAGNETISM-I
(Credits: 02;30 Hrs (2Hrs /week)))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

Course Objective	Course Outcome
The course on Electricity and Magnetism deals with Coulomb's law, Electric field, potential formulation of electrostatic, Capacitors, Magnetism and magnetic materials along with the applications of these concepts	The student will be able to understand Gauss-divergence theorem, Stokes theorem in dielectrics, electrical and magnetic properties of materials

UNIT_I

Electrostatics: Coulomb's law, Electrostatic Field, Electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem (1) Electric field due to point charge, infinite line of charge (2) due to uniformly charged spherical shell and solid sphere, (3) due to plane charged sheet (4) due to charged conductor, Divergence and curl of electrostatic field, Electric potential as line integral of electric field, Potential due to (1) a point charge (2) electrical dipole (3) uniformly charged spherical shell (4) solid sphere, Calculation of electric field from potential.

UNIT-II

Application of Electrostatics: Capacitance of (1) an isolated spherical conductor (2) Parallel plate (3) spherical and cylindrical condenser, Energy per unit volume in electrostatic field, Laplace and Poisson's equations for the electrostatic field, Multipole expansion of potential due to arbitrary charge distribution, Dielectric medium, Polarization, Bound charges in a polarized dielectric and their physical interpretation, Electric displacement, Gauss's theorem in dielectrics, Parallel plate capacitor completely filled with dielectric, Susceptibility, Permittivity and dielectric constant

UNIT-III

Magnetism: Lorentz force law, magnetic forces, Magnetostatics: Biot-Savart's law & its applications (1) straight conductor (2) circular coil (3) solenoid carrying current, Divergence and curl of magnetic field, Magnetic vector potential, Ampere's circuital law and it's applications for simple current configurations, Magnetic vector potential.

UNIT-IV

Magnetization: The field of a magnetized object, bound currents, physical interpretation of bound currents, Ampere's law for magnetized objects, The

susceptibility, diamagnetism, paramagnetism and ferromagnetism, B-H Curve, Currie point

Reference Books:

- Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education..
- Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
- Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
- D.J. Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.

CCL- 104
Core Course-III; INORGANIC CHEMISTRY--I
ATOMIC STRUCTURE AND BONDING
(Credits: 02;30 Hrs (2Hrs /week)))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

UNIT-I

Atomic Structure-I   **(8 Hours)**

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

What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and ψ^2, Schrödinger equation for hydrogen atom. Radial and angular parts of the hydogenic wavefunctions (atomic orbitals) and their variations for 1*s*, 2*s*, 2*p*, 3*s*, 3*p* and 3*d* orbitals (Only graphical representation).

UNIT-II

Atomic Structure-II   **(7 Hours)**

Radial and angular nodes and their significance. Radial distribution functions and the concept of the most probable distance with special reference to 1*s* and 2*s* atomic orbitals. Significance of quantum numbers, orbital angular momentum and quantum numbers m_l and m_s. Shapes of *s*, *p* and *d* atomic orbitals, nodal planes. Discovery of spin, spin quantum number (*s*) and magnetic spin quantum number (m_s).

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

UNIT-III

Chemical Bonding   **(8 Hours)**

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

Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis

of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.

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

UNIT-IV

Molecular Structure   **(7 Hours)**

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

Reference Books:

- Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
- Cotton, F.A., Wilkinson, G. & Gaus, P.L. *Basic Inorganic Chemistry*, 3rd ed., Wiley.
- Douglas, B.E., McDaniel, D.H. & Alexander, J.J. *Concepts and Models in Inorganic Chemistry*, John Wiley & Sons.
- Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. *Inorganic Chemistry: Principles of Structure and Reactivity*, Pearson Education India, 2006.

CCL- 105
Core Course-IV; ORGANIC CHEMISTRY--I
GENERAL ORGANIC CHEMISTRY & ALIPHATIC HYDROCARBONS
(Credits: 02, 30 Hrs (2Hrs /week)))

Marks for Major Test (External): 80

Marks for Internal Exam: 20

Time: 3 Hours

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UNIT-I

Fundamentals of Organic Chemistry   **(7 Hours)**

Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis.

Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals.

Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. Aromaticity: Benzenoids and Hückel's rule.

UNIT-II

Stereochemistry   **(8 Hours)**

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

UNIT-III

Aliphatic Hydrocarbons-I   **(8 Hours)**

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

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

Alkenes: (Upto 5 Carbons) *Preparation:* Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). *Reactions:* cis-
addition (alk. KMnO4) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidation.

Aliphatic Hydrocarbons-II   **(7 Hours)**

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

Alkynes: (Upto 5 Carbons) *Preparation:* Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides.

Reactions: formation of metal acetylides, addition of bromine and alkaline $KMnO_4$, ozonolysis and oxidation with hot alk. $KMnO_4$.

Reference Books:

- Graham Solomon, T.W., Fryhle, C.B. & Dnyder, S.A. *Organic Chemistry,* John Wiley & Sons (2014).
- McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
- Sykes, P. *A Guidebook to Mechanism in Organic Chemistry,* Orient Longman, New Delhi (1988).
- Eliel, E.L. *Stereochemistry of Carbon Compounds*, Tata McGraw Hill education, 2000.
- Finar, I.L. *Organic Chemistry* (Vol. I & II), E.L.B.S.
- Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010.
- Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry,* S. Chand, 2010.

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

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Course Objective	Course Outcome
The course on Algebra deals with advance topics on matrices viz. rank, eigen values and homogeneous and non homogeneous systems, solution of cubic and bi-quadratic equations and DeMoivre's theorem.	The student will be able to find the rank, eigen values of matrices and solve the homogeneous and non homogeneous systems, solution of cubic and bi-quadratic equations.

Unit-I
Matrices, Symmetric, Skew-Symmetric, Hermitian and Skew-Hermitianmatrics. Rank of a matrix. Linear dependence and independence of rows and columns of matrices.Row Equivalent matrices and column equivalent Matrices, Reduction to a Row and Column Mtrices, Normal form of a Matrix, Row rank and column rank of a matrix. Eigen values, eigen vectors and the characteristic equations of a matrix.

Unit-II
Minimal polynomial of a matrix.Cayley Hamilton theorem.Applications of matrices to a system of linear(both homogeneous and non-homogenous) equations. Theorems of consistency of a system of linear equations.Unitary and Orthogonal Matrices, Bilinear Form and Quadratic Form.

Unit-III
Discarte' Rule of Signs, Relations between the roots and coefficients of general polynomial equation in one variable. Solutions of polynomial equations having conditions on roots.Common roots and multiple roots. Transformation of equations into equations with roots multiplied by a given number, Equation with Reciprocal Roots, Roots Diminished by a given number.

Unit-IV
Solutions of cubic equations by Cardan's method, Discarte' Method and Ferarri Method.Biquadratic equations and their solutions.DeMoivre's theorem. Its applications in solutions of polynomials equations, Finding the nth root of a number.

Books Recommended:
1. H.S. Hall and S.R. Knight : Higher Algebra, H.M. Publications 1994.
2. Shanti Narayan : A Text Books of Matrices.
3. ChandrikaPrasad : Text Book on Algebra and Theory of Equations.
Pothishala Private Ltd., Allahabad.

CML- 107
Core Course-V; Mathematics--II
Calculus
(Credits: 02, 45 Hrs (3Hrs /week))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

Course Objective	Course Outcome
The course on differential Calculus deals with some important concepts of limit, continuity, differentiability of functions and tracing of curves.	The student will be able to understand basic properties of Limit, continuity and derivability of functions, series expansion indeterminate forms, tracing of curves with the help of asymptotes and singular points..

Unit-I

Limit, continuity ($\varepsilon - \delta$ definition), Types of Discontinuties and differentiability of functions.Successive differentiation of functions in imlicit, explicit and parametric form.Lebnitz theorem.Some general theorems on differentiable functions and expansions. Taylor's theorem with Langrange's form and Cauchy' form of remainder after 'n' terms.Maclaurinform and Infinite Series.

Unit-II

Asymptotes parallel to coordinate axis and Oblique Assymptotes in Cartesian and Polar form.Singular points.Points of inflexion. Multiple points. Cusps,nodes & conjugate points.Tracing of curves in Cartesian, parametric and polar co-ordinates, particularly, Asteroid, Cycloid and Cardoid.

Curvature (radius of curvature for Cartesian curve, parametric curves, polar curves, pedal curves)..

Unit-III

Reduction formulae. Rectification, length of cuves in Cartesian, parametric and polar curves particularly Asteroid, Cycloid and Cardoid., intrinsic equations of curve.

Unit-IV

Quardrature (area)Sectorial area. Area bounded by closed curves in Cartesian, parametric form and polar form. Volumes and surfaces of solids of revolution about x-axis and about any line.

Books Recommended

1. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002.
2. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2007.
3. George B. Thomas, Jr., Ross L. Finney : Calculus and Analytic Geometry, Pearson Education (Singapore); 2001.
4. T.M. Apostal : Calculus, vol. 1, John Wiley and Sons (Asia) : 2002.
5. A.I. Kostrikin: Introduction to Algebra, Springer Verlag, 1984.
6. Differential and Integral Calculus : Shanti Narayan.
7. . Murray R. Spiegel : Theory and Problems of Advanced Calculus. Schaun's Outline series. Schaum Publishing Co., New York.
8. N. Piskunov : Differential and integral Calculus. Peace Publishers, Moscow.
9. GorakhPrasad : Differential Calculus. Pothishasla Pvt. Ltd., Allahabad.

CPP- 108
Practical -I; Physics Lab--I
(Credits: 02, 60 Hours (4hrs. per week))

Max. Marks: 100

Time: 4 Hours

Note:-
1. Do any *four* experiments from each Section.
2. The students are required to calculate the error involved in a particular experiment.
3. For giving marks under Lab. Record each college will maintain practical assessment record by using the following procedure:-
   Each student has to perform a minimum number of experiments prescribed in the syllabus.
   After the completion of a practical the teacher concerned will check the note book and conduct the Viva – voce of each student to find out how much concepts related to the theoretical and experimental part of the experiment he/ she has understood. According to his/her performance marks will be recorded on their practical note-book. These marks will constitute the lab. Record.
4. To compute the final marks for lab. Record, a separate register will be maintained. Each student will be assigned separate page on this register. On this page the marks obtained by the student in different practicals will be entered. This record will be signed by the concerned teacher.
5. The laboratory Record register will be presented to eth external practical examiners fro Lab.Record marks. These external examiners may verify the record randomly.

Section: A

1. Moment of Inertia of a fly-wheel.
2. M.I. of an irregular body using a torsion pendulum.
3. Surface tension by Jeager's Method.
4. Young's Modulus by bending of beam.
5. Modulus of rigidity by Maxell's needle.

Section: B

6. Low resistance by Carey Foster's bridge with calibration
7. Determination of Impedance of an A.C. circuit and its verification.
8. Frequency of A.C. mains by Sonometer using an electromagnet.
9. Frequency of A. C. mains by Sonometer using an electromagnet

References:

1 Worshnop and Flint, Advanced Practical Physics

2 Nelkon M and Ogborn, Advanced Level Practical Physics, Heinemann Education Bookd Ltd, New Delhi

3 Srivastava S S and Gupta M K, Experiments in Electronics, Atma Ran & Sons, Delhi 4 Gupta S L and Kumar V, Practical Physics, Pragati Prakashan, Meerut.

CCP- 109
Practical -II; Chemistry Lab--I
ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY & ALIPHATIC HYDROCARBONS
(Credits: 02, 60 Hours (4hrs. per week))

Marks: 100

Time: 4 Hours

Section A: Inorganic Chemistry - Volumetric Analysis

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.

2. Estimation of oxalic acid by titrating it with $KMnO_4$.

3. Estimation of water of crystallization in Mohr's salt by titrating with $KMnO_4$.

4. Estimation of Fe (II) ions by titrating it with $K_2Cr_2O_7$ using internal indicator.

5. Estimation of Cu (II) ions iodometrically using $Na_2S_2O_3$.

Section B: Organic Chemistry

1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements)

2. Separation of mixtures by Chromatography: Measure the R_f value in each case (combination of two compounds to be given)

(a) Identify and separate the components of a given mixture of two amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography

(b) Identify and separate the sugars present in the given mixture by paper chromatography.

Reference Books:
- Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
- Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.
- Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., *Textbook of Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996.
- Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry* Orient-Longman, 1960.

CMP- 110

Practical -III; Mathematics Lab--I
(Credits: 02, 60 Hours (4hrs. per week))

Max. Marks(External) :100

Time: 6 Hours

Course Objective	Course Outcome
The course on Practical deals with some important concepts of Programming in C.	The student will be able to solve and calculate the mathematical problems through programming.

Part A: Introduction to Programming in C

Data types, Operators and expressions, Input / outputs functions.

Decisions control structure: Decision statements, Logical and conditional statements,Implementation of Loops-for, while, do while; Switch Statement & Case control structures. Introduction to arrays.

Part B:

Programmes based on simple arithmetic, Algebra and Differential calculus

Books Recommended:
1. B.W. Kernighan and D.M. Ritchie : The C Programming Language, 2nd Edition
2. V. Rajaraman : Programming in C, Prentice Hall of India, 1994
3. Byron S. Gottfried : Theory and Problems of Programming with C, Tata McGraw-Hill Publishing Co. Ltd., 1998
4. M.K. Jain, S.R.K.Lyengar, R.K. Jain : Numerical Method, Problems and Solutions, New Age International (P) Ltd., 1996
5. M.K. Jain, S.R.K. Lyengar, R.K. Jain : Numerical Method for Scientific and Engineering Computation, New Age International (P) Ltd., 1999
6. Computer Oriented Numerical Methods, Prentice Hall of India Pvt. Ltd.
7. Programming in ANSI C, E. Balagurusamy, Tata McGraw-Hill Publishing Co.Ltd.

Semester II

CXL-201
Awareness Program Compulsory Course: ENVIRONMENTAL SCIENCE
(Credits: 02; 30 Hrs (2Hrs /week))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Note: Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

UNIT – I
The Multidisciplinary nature of environmental studies Definition, scope and importance, Need for public awareness. Natural resources: Renewable and non-renewable resources Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation b) Water resources: Use and over-utilization of surface and ground water, floods and drought. c) Mineral resources: Use and exploitation, environmental effects of extrading. d) Food resources: World food problems, changes caused by agriculture, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. e) Energy Resources: Growing energy needs, renewable and non renewable energy sources use of alternative energy sources. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification

Unit-II
Ecosystems Concept of an ecosystem, Structure and function of an ecosystem, Procedures, consumers and decomposers, Energy flow in the ecosystem, Ecological succession & Food chains, food webs and ecological pyramids. Biodiversity and its conservation: Introduction – Definition: genetic, species and ecosystem diversity, Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, National and local levels, India as a megadiversity nation.

Unit-III
Environmental Pollution Definition, Causes, effects and control measures of: - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution & Nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes.

Unit-IV
Social Issues and the Environment From Unsustainable to sustainable development, urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people- its problems and concerns. Environmental ethics: Issues and possible solutions, Climate change, global warming, acid rain, 7 ozone layer depletion, nuclear accidents and holocaust, Wasteland reclamation, Consumerism and waste products, environment Protection Act, Air (Prevention and Control of Pollution) Act, Water(Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environment legislation & Public awareness.

Reference books:
1. De A. K. Environmental Chemistry, Wiley Eastern Ltd, 1999.
2. Bharucha E. Text book of Environmental studies, University press, Hydrabad 2005.
3. Cunningham W P., Cooper T H. Gorhani E. Hepworth M T, Environmental Enclopedia, Jaico publication House, Mumbai, 2001.
4. Miller T G. Environmental Science Wadsworth publishing corp, 2000.

CPL- 202
Core Course-VII; PHYSICS: MECHANICS-II
(Credits: 02; 30 Hrs (2Hrs /week)))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Note:Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

Course Objective	Course Outcome
The course on mechanics deals with Lagrengian formulation of mechanics, Oscillatory motion and damping and special theory relativity	The student will be able to understand some advanced notion of mechanics, SHM and relativistic addition of velocities.

UNIT-I
Constrained motion, Degree of freedom and Generalized coordinates, Generalized displacement, velocity, acceleration, momentum, force and potential, Hamilton's variational principle, Lagrange's equation of motion from Hamilton's principle, Application of Lagrange's equation for simple problems of mechanics

UNIT-II
Oscillations: Simple harmonic motion, Simple pendulum, Compound Pendulum, Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages, Damped oscillations, Forced oscillations.

UNIT-III
Special Theory of Relativity: Michelson-Morley Experiment and its outcome, Galilean transformation (velocity, acceleration) and its inadequacy, Postulates of Special Theory of Relativity, Lorentz Transformations.

UNIT-IV
Application of Relativity: Lorentz contraction, Time dilation, Relativistic transformation of velocity, frequency and wave number, Relativistic addition of velocities, Variation of mass with velocity, Massless Particles, Mass-energy Equivalence, Relativistic Doppler effect, Relativistic Kinematics, Transformation of Energy and Momentum, Four Vectors

Reference Books:
- University Physics, FW Sears, MW Zemansky and HD Young13/e, 1986. Addison-Wesley
- Mechanics Berkeley Physics course,v.1: Charles Kittel, et. Al. 2007, Tata McGraw- Hill.
- Physics – Resnick, Halliday & Walker 9/e, 2010, Wiley
- Engineering Mechanics, Basudeb Bhattacharya, 2nd edn., 2015, Oxford University Press
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
- An introduction to Mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
- Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000.
- Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.

CPL 203

Core Course-VIII; PHYSICS: ELECTRICITY, MAGNETISM & ELECTROMAGNETIC THEORY-II
(Credits: 02; 30 Hrs (2Hrs /week)))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

Course Objective	Course Outcome
The course on Electricity and Magnetism deals with the Electromagnetic induction, Maxwell's Equations, Electromagnetic wave propagation, Poynting's Vector and electromagnetic field transformation	The student will be able to understand electromagnetic induction and it's applications, Maxwell's equations and generation of electromagnetic fields, wave propagation through vacuum and isotropic dielectric medium.

UNIT-I
Electromagnetic Induction: Motional EMF, Faraday's laws of electromagnetic induction, Lenz's law, Self and mutual inductance (L and M respectively), Self induction of a single coil, Mutual induction of two coils, Transformers, Energy stored in magnetic field, The continuity equation.

UNIT-II
Maxwell`s equations: Maxwell's fixing of Ampere's law, Displacement current, Maxwell's equations in vacuum, Maxwell's equations in matter, Poynting Theorem and Poynting vector, Momentum and angular momentum in electromagnetic field (no derivation needed), Energy density in electromagnetic field.

UNIT-III
The wave equation, Sinusoidal waves, Wave equations for **E** and **B** fields, Electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, Energy and momentum in EM waves, Propagation in linear media, Reflection and transmission at Normal and Oblique incidence, Brewster's angle

UNIT-IV
Scalar and vector potential for electromagnetic fields, Gauge Transformation,

Coulomb Gauge, Lorentz Gauge, Electric and magnetic dipole radiation (no derivation needed, discussion of results only), Magnetism as relativistic phenomenon, Transformation of electric and magnetic fields between two inertial frames.

Reference Books:

- Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education..
- Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
- Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
- D.J. Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.

Core Course-IX; PHYSICAL CHEMISTRY--I
CHEMICAL ENERGETICS AND EQUILIBRIA
(Credits: 02; 30 Hrs (2Hrs /week)))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

UNIT-I

Chemical Energetics   **(8 Hours)**

Review of thermodynamics and the Laws of Thermodynamics.

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

UNIT-II

Chemical Equilibrium   **(8 Hours)**

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

UNIT-III

Ionic Equilibria-I   **(7 Hours)**

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect.

UNIT-IV

Ionic Equilibria-II   **(7 Hours)**

Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.

Reference Books:

- Barrow, G.M. *Physical Chemistry* Tata McGraw-Hill (2007).
- Castellan, G.W. *Physical Chemistry* 4th Ed. Narosa (2004).
- Kotz, J.C., Treichel, P.M. & Townsend, J.R. *General Chemistry* Cengage Learning India Pvt. Ltd., New Delhi (2009).
- Mahan, B.H. *University Chemistry* 3rd Ed. Narosa (1998).
- Petrucci, R.H. *General Chemistry* 5th Ed. Macmillan Publishing Co.: New York (1985).

CCL 205
Core Course-X; ORGANIC CHEMISTRY--II
FUNCTIONAL GROUP ORGANIC CHEMISTRY
(Credits: 02; 30 Hrs (2Hrs /week)))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

UNIT-I

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure for all UNITS I-IV.

Aromatic hydrocarbons (7 Hours)

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

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

UNIT-II

Alkyl and Aryl Halides (8 Hours)

Alkyl Halides (Upto 5 Carbons) Types of Nucleophilic Substitution (S_N1, S_N2 and S_Ni) reactions.

Preparation: from alkenes *and* alcohols.

Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vs substitution.
Aryl Halides *Preparation:* (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions.

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

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

UNIT-III

Alcohols, Phenols and Ethers (Upto 5 Carbons)   **(8 Hours)**

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

Reactions: With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. $KMnO_4$, acidic dichromate, conc. HNO_3). Oppeneauer oxidation *Diols:* (Upto 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement.

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

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

UNIT-IV

Aldehydes and ketones (aliphatic and aromatic)   **(7 Hours)**

(Formaldehye, acetaldehyde, acetone and benzaldehyde)

Preparation: from acid chlorides and from nitriles.

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

Reference Books:

- Graham Solomon, T.W., Fryhle, C.B. & Dnyder, S.A. *Organic Chemistry,* John Wiley & Sons (2014).
- McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
- Sykes, P. *A Guidebook to Mechanism in Organic Chemistry,* Orient Longman, New Delhi (1988).
- Finar, I.L. *Organic Chemistry* (Vol. I & II), E.L.B.S.
- Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010.
- Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry,* S. Chand, 2010.

CML 206
Core Course-XI; Mathematics- III
Vector Calculus and Geometry
(Credits: 02; 45 Hrs (3Hrs /week)))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

Course Objective	Course Outcome
The course on Vector and Geometry deals with advance topics on vectors and geometry viz. directional derivatives, gradient, curl, two and three dimensional geometry.	The student will be able to find directional derivatives, gradient, curl . Laplasian operator, two and three dimensional geometry.

Unit – I

Scalar and vector product of three vectors, product of four vectors. Reciprocal vectors. Vector differentiation Scalar Valued point functions, vector valued point functions, derivative along a curve, directional derivatives. Gradient of a scalar point function, geometrical interpretation of grad Φ. Divergence and curl of vector point function.

Unit – II

Gradient, divergence and curl of sums and product and their related vector identities. Laplacian operator. Orthogonal curvilinear coordinates Conditions for orthogonality fundamental triad of mutually orthogonal unit vectors. Gradient, Divergence, Curl and Laplacian operators in terms of orthogonal curvilinear coordinates, Cylindrical co-ordinates and Spherical co-ordinates.

Unit – III

Vector integration: Indefinite Integral, Definite Integral, Standard results of Integration. Line integral, Surface integral, Volume integral. Gauss Divergence Theorem, Divergence Theorem in Cartesian Co-ordinates, Green Theorem, Stoke's Theorem(Relation between line Integral and Surface Integral). Stoke's Theorem in Cartesian form. Green's Theorem in Plane as special case of Stoke's Theorem, problems based on these theorems.

Unit -IV

Geometry: General equation of second degree. Tracing of conics. Tangent at any point to the conic, chord of contact, pole of line to the conic, director circle of conic. Polar equation of a conic, tangent and normal to the conic. Sphere: Plane section of a sphere. Sphere through a given circle. Intersection of two spheres, Cones. Right circular cone. Cylinder: Right circular cylinder.

Books Recommended:

1. Murrary R. Spiegal : Theory and Problems of Advanced Calculus, Schaum Publishing Company, New York.
2. Murrary R. Spiegal : Vector Analysis, SchaumPublisghing Company, New York.
3. N. Saran and S.N. NIgam. Introduction to Vector Analysis, Pothishala Pvt. Ltd., Allahabad.
4. Shanti Narayna : A Text Book of Vector Calculus. S. Chand & Co., New Delhi.

CML 207
Core Course-XI; Mathematics- IV
Ordinary Differential Equations
(Credits: 02; 45 Hrs (3Hrs /week)))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

Course Objective	Course Outcome
The course on ordinary differential equations deals with some important concepts Exact differential equations, Orthogonal trajectories, Linear differential equations with variable and constant coefficients.	The student will be able to understand basic properties of differential equations, Orthogonal trajectories, Linear differential equations. Apart from this the students will able to solve ODE by Transformation of the equation by changing the dependent variable/ the independent variable. Solution by operators of non-homogeneous linear differential equations. Reduction of order of a differential equation. Method of variations of parameters. Method of undetermined coefficients, solution of simultaneous differential equations and total differential equations.

Unit – I

Geometrical meaning of a differential equation.Exact differential equations, integrating factors. First order higher degree equations solvable for x,y,p Lagrange's equations, Clairaut's equations. Equation reducible to Clairaut's form.Singular solutions.

Unit – II

Orthogonal trajectories: in Cartesian coordinates and Polar coordinates. Self orthogonal family of curves.Linear differential equations with constant coefficients.Homogeneous linear ordinary differential equations. Equations reducible to homogeneous.

Unit – III

Linear differential equations of second order.Reduction to normal form.Transformation of the equation by changing the dependent variable/ the independent variable.Solution by operators of non-homogeneous linear differential equations.Reduction of order of a differential equation.Method of variations of parameters.Ordinary simultaneous differential equations.Solution of simultaneous differential equations.

Unit – IV

Laplace Transforms –Existence theorem for Laplace transforms, Linearity of the Laplace transforms, Shifting theorems, Laplace transforms of derivatives and integrals, Differentiation and integration of Laplace transforms, Convolution theorem, Inverse Laplace transforms, convolution theorem, Inverse Laplace transforms of derivatives,solution of ordinary differential equations using Laplace transform.

Books Recommended :

1. D.A. Murray : Introductory Course in Differential Equations. Orient Longaman (India) . 1967
2. A.R.Forsyth : A Treatise on Differential Equations, Machmillan and Co. Ltd. London
3. E.A. Codington : Introduction to Differential Equations.
4. S.L.Ross: Differential Equations, John Wiley & Sons
5. B.Rai& D.P. Chaudhary : Ordinary Differential Equations; Narosa, Publishing House Pvt. Ltd.
6. M.D. Raisinghania :Ordinary and Partial Differential Equations.
7. Dyke,Phil : An introduction to Laplace Transforms and Fourier Series,Springer Undergraduate Mathematics Series.

CPP 208
Practical -IV; Physics Lab--II
(Credits: 02; 60 Hrs (4Hrs /week))

Marks: 100

Time: 3 Hours

Note:-
1. Do any Four experiments from each Section.
2. The students are required to calculate the error involved in a particular experiment.
3. For giving marks under Lab. Record each college will maintain practical assessment record by using the following procedure:-
   Each student has to perform a minimum number of experiments prescribed in the syllabus.
   After the completion of a practical the teacher concerned will check the note book and conduct the Viva – voce of each student to find out how much concepts related to the theoretical and experimental part of the experiment he/ she has understood. According to his/her performance marks will be recorded on their practical note-book. These marks will constitute the lab. Record. To compute the final marks for lab. Record, a separate register will be maintained. Each student will be assigned separate page on this register. On this page the marks obtained by the student in different practicals will be entered. This record will be signed by the concerned teacher.
4. The laboratory Record register will be presented to eth external practical examiners fro Lab.Record marks. These external examiners may verify the record randomly.

Section: A

1. Elastic constant by Scarle's method.
2. Viscosity of water by its flow through a uniform capillary tube.
3. 'g' by Bar pendulum.
4. E.C.E. of hydrogen using an Ammeter.
5. Calibration of a thermocouple by Potentiometer.

Section: B

6. High resistance by substitution method.
7. To draw forward and reverse bias characteristics of a semiconductor diode.
8. Zener Diode voltage regulation characteristics.
9. Verification of inverse square law by photo-cell.
10. To study the characteristics of a solar cell.

References:

1 Worshnop and Flint, Advanced Practical Physics

2 Nelkon M and Ogborn, Advanced Level Practical Physics, Heinemann Education Bookd Ltd, New Delhi

3 Srivastava S S and Gupta M K, Experiments in Electronics, Atma Ran & Sons, Delhi 4 Gupta S L and Kumar V, Practical Physics, Pragati Prakashan, Meerut.

Practical -V; Chemistry Lab--II
CHEMICAL ENERGETICS, EQUILIBRIA & FUNCTIONAL ORGANIC CHEMISTRY
(Credits: 02; 60 Hrs (4Hrs /week)

Marks: 100

Time: 4 Hours

Section A: Physical Chemistry
Thermochemistry
1. Determination of heat capacity of calorimeter for different volumes.
2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
3. Determination of enthalpy of ionization of acetic acid.
4. Determination of integral enthalpy of solution of salts (KNO_3, NH_4Cl).
5. Determination of enthalpy of hydration of copper sulphate.
6. Study of the solubility of benzoic acid in water and determination of ΔH. **Ionic equilibria** pH measurements

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

Measurement of the pH of buffer solutions and comparison of the values with theoretical values.

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

Reference Books

- Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., *Textbook of Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996.
- Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry* Orient-Longman, 1960.
- Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry,* R. Chand & Co.: New Delhi (2011).

CMP 210
PRACTIAL-VI : Mathematics Lab – II
(Credits: 02; 45 Hrs (3Hrs /week)))

Marks for Major Test (External): 100
Time: 3 Hours

Course Objective	Course Outcome
The course on Practical deals with some important concepts of vectors geometry and ODE.	The student will be able to solve and calculate the mathematical problems through programming.

Part A: Introduction to Programming in C
Strings : Character data type, Standard string handling functions, arithmetic operations on characters. Structures: definition, using structures, use of structures in arrays and arrays in structures, Functions.
Part B:
Following Program should be done as Practical:-

1. Program to add two matrices.
2. Program to multiply two matrices.
3. Program to find the inverse of a matrix.
4. Program to find transpose of a matrix.
5. Program to find the sum of a series.
6. Program to sort an entire array using bubble short.
7. Program to find trace of 3X3 Matrix.
8. Program to find largest of three numbers using function.
9. Program to find factorial of a number using recursion.
10. Program to generate n Fibonacci terms using recursion.
11. Program to count number of vowels and consonants in a given sentence.
12. Program to print a salary chart for employee of a company.

Books Recommended:
1. B.W. Kernighan and D.M. Ritchie : The C Programming Language, 2nd Edition
2. V. Rajaraman : Programming in C, Prentice Hall of India, 1994
3. Byron S. Gottfried : Theory and Problems of Programming with C, Tata McGraw-Hill Publishing Co. Ltd., 1998
4. M.K. Jain, S.R.K. Lyengar, R.K. Jain : Numerical Method, Problems and Solutions, New Age International (P) Ltd., 1996
5. M.K. Jain, S.R.K. Lyengar, R.K. Jain : Numerical Method for Scientific and Engineering Computation, New Age International (P) Ltd., 1999
6. Computer Oriented Numerical Methods, Prentice Hall of India Pvt. Ltd.
7. Programming in ANSI C, E. Balagurusamy, Tata McGraw-Hill Publishing Co.Ltd.

Semester III

CXL-301
Language Skills Compulsory Course-II: HINDI
(Credits: 02; 30 Hrs (2Hrs /week)))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Note: Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

CXL-302
Language Skills Compulsory Course-II: SANSKRIT
(Credits: 02; 30 Hrs (2Hrs /week)))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Note: Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

CPL- 303
Core Course-XIII; THERMAL PHYSICS AND STATISTICAL MECHANICS--I
(Credits: 02; 30 Hrs (2Hrs /week)))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

CPL- 304

Core Course-XIV; OPTICS AND WAVES--I
(Credits: 02; 30 Hrs (2Hrs /week)))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

CCL- 305
Core Course-XV; PHYSICAL CHEMISTRY--II
(Credits: 02; 30 Hrs (2Hrs /week)))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

CCL- 306
Core Course-XVI; ORGANIC CHEMISTRY--III
(Credits: 02; 30 Hrs (2Hrs /week)))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

CML 307
Core Course-XVII; MATHEMATICS--V
(Credits: 02; 30 Hrs (2Hrs /week)))

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

CML 308
Core Course-XVIII; MATHEMATICS--VI
FUNCTIONAL GROUP ORGANIC CHEMISTRY
(Credits: 02; 30 Hrs (2Hrs /week))

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

CPP 309
Practical -VII; Physics Lab--III
(Credits: 02;60 Hrs (4Hrs /week))

CCP 310
Practical -VIII; Chemistry Lab--III
(Credits: 0260 Hrs (4Hrs /week))

CMP 311
Practical -IX; Mathematics Lab--III
(Credits: 0260 Hrs (4Hrs /week))

Marks :100