CHOICE BASED CREDIT SYSTEM

(CBCS)

Guru Jambheshwar University of Science and Technology, Hisar

Revised Scheme and Syllabi
for

Undergraduate Course:

B. SC. PHYSICAL SCIENCES

(PHYSICS/GEOGRAPHY, CHEMISTRY/ ELECTRONICS/ COMPUTER SCIENCE/ COMPUTER APPLICATIONS, MATHEMATICS)

Under
The Faculty of Physical Sciences and Technology

w.e.f. Academic Session 2018-19

The Revised/consolidated scheme and syllabi of First Year of B.Sc. (Physical Sciences: Physics/Geography, Chemistry/Electronics/Computer Science/Computer Applications, Mathematics) as approved by the competent authority is as under:

Semester-I

Paper Code	Course opted	Nomenclature	Credits	Hr/ week	Marks		
					Ext.	Int.	Total
CXL- 101	Language Skills Compulsory Course-I	English-I	2	2	80	20	100
CPL- 102	Core Course-I (Physics)	Mechanics-I	2	2	80	20	100
CPL- 103	Core Course-II (Physics)	Electricity and Magnetism-I	2	2	80	20	100
CGL- 102	Core Course-I (Geography)	Physical Geography-I	2	2	80	20	100
CGL- 103	Core Course-II (Geography)	Physical Geography-II	2	2	80	20	100
CCL- 104	Core Course-I (Chemistry)	Inorganic Chemistry-I(Atomic structure and Bonding)	2	2	80	20	100
CCL- 105	Core Course-II (Chemistry)	Organic Chemistry-I(General Organic Chemistry and Aliphatic Hydrocarbons)	2	2	80	20	100
CEL- 104	Core Course-I (Electronics))	Network Analysis and Electronic Devices	2	2	80	20	100
CEL- 105	Core Course-II (Electronics))	Analog Electronics	2	2	80	20	100
CCsL- 104	Core Course-I (Computer Science)	Fundamentals of Computer	2	2	80	20	100
CCsL- 105	Core Course-II (Computer Science)	Programming in 'C'	2	2	80	20	100
CCaL- 104	Core Course- I (Computer Applications)	Computer Fundamentals and Operating System	2	2	80	20	100
CCaL- 105	Core Course- II (Computer Applications)	Office Automation Tools	2	2	80	20	100
CML- 106	Core Course-I (Mathematics)	Algebra	4	4	80	20	100
CML- 107	Core Course-I (Mathematics)	Calculus	4	4	80	20	100
CYL- 111	Awareness Program Compulsory Course	Environmental Studies	2	2	80	20	100
CPP- 108*	Practical-I (Physics)	Physics Lab-I	2	4	50	-	50
CGP- 108*	Practical-I (Geography)	Geography Lab-I	2	4	50	-	50
CCP- 109*	Practical-I (Chemistry)	Chemistry Lab-I	2	4	50	-	50
CEP- 109*	Practical-I (Electronics)	Electronics Lab-I (Network Analysis and Analog	2	4	50	-	50

		Electronics)					
CCsP- 109*	Practical-I (Computer Science)	Computer Lab-I (Based on Fundamentals of Computer & Programming in 'C')	2	4	50	-	50
CCaP- 109*	Practical- I (Computer Applications)	Computer Lab-I	2	4	50	-	50
CMP- 110*	Practical-I (Mathematics)	Mathematics Lab-I	1.5	3	50	-	50

- The practical examination to be conducted annually with Second semester examination.

Semester-II

Paper Code	Course opted	Nomenclature	Credits	Hr/ week	Marks		
					Ext.	Int.	Total
CXL- 201	Language Skills Compulsory Course-II	English-II	2	2	80	20	100
CPL- 202	Core Course-III (Physics)	Mechanics-II	2	2	80	20	100
CPL- 203	Core Course-IV (Physics)	Electricity, Magnetism and EMT-II	2	2	80	20	100
CGL- 202	Core Course-III (Geography)	Human Geography-I	2	2	80	20	100
CGL- 203	Core Course-IV (Geography)	Human Geography-II	2	2	80	20	100
CCL- 204	Core Course-III (Chemistry)	Physical Chemistry- I (Chemical Energetics and Equilibria)	2	2	80	20	100
CCL- 205	Core Course-IV (Chemistry)	Organic Chemistry- II (Functional Group Organic Chemistry)	2	2	80	20	100
CEL- 204	Core Course-III (Electronics)	Linear and Digital Integrated circuits	2	2	80	20	100
CEL- 205	Core Course-IV (Electronics))	Digital Electronics	2	2	80	20	100
CCsL- 204	Core Course-III (Computer Science)	Data Structure using 'C'	2	2	80	20	100
CCsL- 205	Core Course-IV (Computer Science)	Computer Organisation	2	2	80	20	100
CCaL- 204	Core Course- III (Computer Applications)	Information Technology	2	2	80	20	100
CCaL- 205	Core Course- IV (Computer Applications)	Programming in 'C'	2	2	80	20	100
CML- 206	Core Course-III (Mathematics)	Vector Calculus and Geometry	4	4	80	20	100
CML- 207	Core Course-IV (Mathematics)	Ordinary Differential Equations and Laplace Transformations	4	4	80	20	100
CPP- 208	Practical-II	Physics Lab-II	2	4	50	-	50

	(Physics)						
CGP- 208	Practical-II (Geography)	Geography Lab-II	2	4	50	-	50
CPP-209	Practical-II (Chemistry)	Chemistry Lab-II	2	4	50	-	50
CEP-209	Practical-II (Electronics)	Linear Integrated circuits and Digital Electronics Lab	2	4	50	-	50
CCsP-209	Practical-II (Computer Science)	Computer Lab-II (Based on Data Structure using 'C')	2	4	50	-	50
CCaP-209	Practical-II (Computer Applications)	Computer Lab- II	2	4	50	-	50
CMP-210	Practical-II (Mathematics)	Mathematics Lab-II	1.5	3	50	-	50

Note:

(1) The subject combinations under B.Sc. (Physical Sciences)are :

- **(i) B.Sc. (Physical Sciences: Physics, Chemistry, Mathematics)**
- **(ii) B.Sc. (Physical Sciences: Geography, Computer Science, Mathematics)**
- **(iii) B.Sc. (Physical Sciences: Physics, Electronics, Mathematics)**
- **(iv) B.Sc. (Physical Sciences: Physics, Computer Science, Mathematics)**
- **(v) B.Sc. (Physical Sciences: Physics, Computer Applications, Mathematics)**

(2) The scheme and syllabus of Mathematics papers is also implemented to BA (with Mathematics) Courses. However, the marking scheme in case of BA courses (Mathematics Subject) will be same as decided by the concerned Board of Studies/Faculty of Humanities and Social Sciences.

(3) ***For the students of B.Sc. Geography, the core papers of Physics is to be replaced by Core papers of the Geography; for Computer Science, the core papers of Chemistry is to be replaced by Core papers of the Computer Sciences; for Electronics the core papers of Chemistry is to be replaced by Core papers of the Electronics and similarly for Computer Applications, the core papers of Chemistry is to be replaced by Core papers of the Computer Applications as decided by the respective Board of studies/Faculty of Engineering and Technology.***

(4) Definition of Credit:
1 credit=1 Hr. Lecture (L) per week
1 credit= 2 Hrs. Practical (P) per week
2 Hrs. = 3 periods of approx. 40/45 minutes

(5) Practical examinations (both odd and even semester's practicals of 50 marks each) to be held annually with even semesters. The marks of Odd semester practicals may be reflected in the DMC of Even semester with code and nomenclature, to be shown separately for each semester.

(6) The distribution of internal assessment marks of 20 is based on the marks obtained by the student in one Minor test of 12 marks to be conducted preferably in the month of November for Odd Semester and in the month of 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. There will be maximum 4 marks for attendance (1 mark for attendance of 71-75%, 2 marks for attendance of 76-80%, 3 marks for attendance of 81-85% and 4 marks for attendance above 85%.). The remaining 4 marks are for Extracurricular activities including assignments.

(7) 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.

SEMESTER I & II

B. SC. PHYSICAL SCIENCES

LANGUAGE SKILLS COMPULSARY COURSE

(ENGLISH)

CXL-101
LANGUAGE SKILLS COMPULSARY COURSE-I
ENGLISH-I
(Credits: 02, 30 Hrs (2Hrs /week))

External Marks: 80
Internal Assessment: 20
Time Allowed: 3 Hours

Paper setter is required to set five questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of ten short answer type questions each of 2 marks. The remaining four questions is to be set uniformly having two questions from each part/unit of 15 marks each. The student is required to attempt five questions in all.

PART-A: The Following text is prescribed for intensive study:
Following poems from *The Chronicles of Time* edited by Asha Kadyan (Oxford University Press)

1. William Shakespeare "Let Me Not to the Marriage of True Minds"
2. John Donne "Death Be Not Proud"
3. John Milton "On His Blindness"
4. Henry Vaughan "The Retreat"
5. John Dryden "Shadwell"
6. Alexander Pope "Know Then Thyself"
7. William Blake "The Little Black Boy"
8. William Wordsworth "Three Years She Grew in Sun and Shower"
9. Percy B. Shelley "England in 1819"
10. Alfred, Lord Tennyson "Crossing the Bar"

PART-B: English Grammar and Composition

1. Translation from Hindi to English
   (Comprehension based on unseen passage for foreign/non- Hindi speaking candidates)
2. Paragraph Writing
3. Common Phrasal Verbs, Prepositions & Common Errors in English

SCHEME OF QUESTION PAPER

Note: The question paper will carry a maximum of 80 marks. The paper will have five questions as per details given below.

Q. 1. There will be ten short answer type questions (one mark each) based on the text book. (2x10 = 20 marks)

Q.2. (a) The candidates will be asked to explain with reference to the context an extract from the text book. There will be internal choice. (7.5 marks)

(b) The candidates will be asked to answer comprehension questions based on an extract from the text book. There will be internal choice. (7.5 marks)

Q.3. There will be one essay type question based on the text book with internal choice. (15 marks)

Q.4. (a) Translation of a passage of about 10 sentences from Hindi to English (Non-Hindi speaking/foreign candidates will attempt a question of comprehension with internal choice based on an unseen passage in lieu of this question). (7.5 marks)

(b) Paragraph (Candidates will be required to write about 150 words on any one out of the five given topics). (7.5 marks)

Q.5. There will be one question with parts on the following items: common phrasal verbs, prepositions, common errors in English. (15 marks)

CXL-201
LANGUAGE SKILLS COMPULSARY COURSE-II
ENGLISH-II
(Credits: 02, 30 Hrs (2Hrs /week))

External Marks: 80
Internal Assessment: 20
Time Allowed: 3 Hours

Paper setter is required to set five questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of ten short answer type questions each of 2 marks. The remaining four questions is to be set uniformly having two questions from each part/unit of 15 marks each. The student is required to attempt five questions in all.

PART-A: The following text is prescribed for intensive study:
1. Following essays from *Ideas Aglow* edited by Dinesh Kumar and V. B. Abrol (Publication Bureau, Kurukshetra University, Kurukshetra)

1. C.E.M. Joad 'Our Civilization'
2. Jayant V. Narlikar 'It's Question Time'
3. N. Ram 'An Interview with Christiaan Barnard'
4. B.R. Ambedkar 'Untouchability and the Caste System'
5. Huck Gutman 'Inhumanisation of War'
6. Amartya Sen 'Seven Types of Gender Inequality'

PART-B: English Grammar and Composition

1. Translation from English to Hindi
(Comprehension based on unseen passage for foreign/non- Hindi speaking candidates)
2. Précis
3. Official Correspondence: Letter Writing

SCHEME OF QUESTION PAPER

Note: The question paper will carry a maximum of 80 marks. The paper will have five questions as per details given below.

Q. 1. There will be ten short answer type questions (one mark each) based on the text book. (2x10 = 10 marks)

Q.2. (a) The candidates will be asked to explain with reference to the context an extract from the text book. There will be internal choice. (7.5 marks)

(b) The candidates will be asked to answer comprehension questions based on an extract from the text book. There will be internal choice. (7.5 marks)

There will be one essay type question based on the text book with internal choice. (15 marks)

Q.4. (a) Translation of a passage of about 10 sentences from English to Hindi (Non-Hindi speaking/foreign candidates will attempt a question of comprehension with internal choice based on an unseen passage in lieu of this question). (7.5 marks)

(b) Précis: The candidates will be required to summarize a given passage in Contemporary English of about 250 words to one-third of its length and also give it a suitable heading. (7.5 marks)

The candidates will be asked to write an official letter. There will be internal choice. (15 marks)

SEMESTER I & II

B. SC. PHYSICAL SCIENCES

(PHYSICS)

CPL-102
Core Course-I
MECHANICS-I
(Credits – 02, 30 Hrs (2 Hrs/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 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, The paper will include at least 20% of total marks as numerical problems.

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 equations, motion of different objects, global positioning system, planetary motion etc.

UNIT-I

Vectors: Scalar and vector fields, 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) (Any mathematical physics book)

UNIT-II

Time derivative of vectors with examples (*1.10, Ref. 1*), Concepts of cartesian, polar and spherical coordinates, Motion in plane Polar Coordinates, velocity and acceleration in polar coordinates (*1.11, Ref. 1*), Dynamics Using Polar Coordinates (*2.10, Ref. 1*)

Momentum and Energy: Momentum, Conservation of momentum, Centre of mass, Centre of mass coordinates with examples (*4.1 to 4.5Ref. 1*), Motion of rockets (*4.8, Ref. 1*), Work and energy, Conservation of energy (*5.1 to 5.3, Ref. 1*)

UNIT-III

Dynamics of a system of particles: Elastic and inelastic collisions between particles (*6.5.2, Ref. 1*), Centre of Mass and Laboratory frames (*6.5.4, Ref. 1*)

Rotational Motion: Angular velocity and angular momentum (*7.2, Ref. 1*), Moment of inertia and parallel and perpendicular axis theorem (*7.3, Ref. 1*), Moment of inertia of (a) thin uniform wire (b) Thin rectangular sheet (c) Rectangular slab (d) ring (e) disc (f) spherical shell (g) solid sphere (h) hollow sphere, Torque (*7.4, Ref. 1*), Conservation of angular momentum (*7.5, Ref. 1*), Angular momentum as vector (*8.2, Ref. 1*), Coriolis forces and its effect on motion (*9.5 along with examples, Ref. 1*)

UNIT-IV

Central force: Basics properties of central forces, Two body problem equivalent to one body problem and concept of reduced mass, Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant) (*10.2, 10.3 Ref. 1*), Kepler's Laws (*10.1 along with example 7.6 of Ref. 1)*

Elasticity: Hooke's law - Stress-strain diagram - Elastic moduli, Poisson's Ratio, Relation between four elastic constants (*Ref. 4*), Bending moments, Bending of cantilever and centrally loaded beams (*Ref. 4*)

Reference Books:

1. An introduction to Mechanics (2^{nd} Ed.), D. Kleppner and R.J. Kolenkow, Cambridge Univ. Press
2. University Physics, FW Sears, MW Zemansky and HD Young13/e, 1986. Addison-Wesley
3. Mechanics Berkeley Physics course,v.1: Charles Kittel, et. Al. 2007, Tata McGraw-Hill.
4. Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000.
5. Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.
6. Classical Mechanics, J.C Uppadhayaya, Himalaya Publishing House

CPL-103
Core Course –II
ELECTRICITY AND MAGNETISM-I
(Credits – 02, 30 Hrs (2 Hrs/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 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. The paper will include at least 20% of total marks as numerical problems.

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: Electrostatic Field (*2.1, Ref.1*), Electric flux, Gauss's theorem of electrostatics, Applications of Gauss theorem (*2.2, Ref.1*), Divergence and curl of electrostatic field (*2.2, Ref.1*) and their physical significance, Electric potential, Electric potential as line integral of electric field (*2.3, Ref.1*), Calculation of electric field from potential, Energy stored in electrostatic field per unit volume (*2.4 of ref.1*)

UNIT-II

Application of Electrostatics: Laplace and Poisson's equations for the electrostatic field (*2.3.3, 3.1: Ref.1*), Multi-pole expansion of potential due to arbitrary charge distribution (*3.4:Ref.1*), Dielectric medium, Polarization (*4.1:Ref.1*), Bound charges in a polarized dielectric and their physical interpretation (*4.2:Ref.1*), Electric displacement (*4.3.1:Ref.1*), Gauss's theorem in dielectrics (*4.3.1:Ref.1*), Parallel plate capacitor completely filled with dielectric, Susceptibility, Permittivity and dielectric constants (*4.4.1:Ref.1*)

UNIT-III

Magnetism: Lorentz force law, Magnetic forces (*5.1:Ref.1*), Magnetostatics: Biot-Savart's law & its applications (1) straight conductor (2) circular coil (3) solenoid carrying current (*5.2:Ref.1*), Divergence and curl of magnetic field (*5.3.1:Ref.1*), Ampere's circuital law and it's applications for simple current configurations (*5.3.3:Ref.1*), Magnetic vector potential (*5.4.1:Ref.1*).

UNIT-IV

Magnetization: The field of a magnetized object, bound currents, physical interpretation of bound currents (*6.2:Ref.1*), Ampere's law for magnetized objects, The Auxiliary field (H) (*6.3:Ref.1*), Magnetic properties of materials (*6.1:Ref.1*), Permeability, Magnetic susceptibility (*6.4:Ref.1*), diamagnetism, para-magnetism and ferromagnetism(*6.1, 6.4.2:Ref.1*), B-H Curve (*6.4.2:Ref.1*), Currie point (*6.4.2:Ref.1*)

Reference Books:

1. Introduction to Electrodynamics, 3rd Ed., 1998, D.J. Griffiths, Benjamin Cummings.
2. ElectricityandMagnetism,EdwardM.Purcell,1986,McGraw-HillEducation.
3. Electricity and Magnetism, J.H. Fewkes& J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
4. University Physics, Ronald Lane Reese, 2003, ThomsonBrooks/Cole.

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

Max. Marks: 50

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. E.C.E of Hydrogen using an Votameter
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 electric vibrator.
10. Low resistance by Carey Foster's bridge with calibration.

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.

CPL-202
Core Course-III
MECHANICS-II
(Credits – 02, 30 Hrs (2 Hrs/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 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, *The paper will include at least 20% of total marks as numerical problems.*

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 (*Ref.1*).

UNIT-II

Oscillations: Simple harmonic motion, Simple pendulum (*11.2, Ref.2*), Compound Pendulum, Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages, Damped oscillations (11.3, *11.2, Ref.2*), Forced oscillations (11.2, *11.4, Ref.2*).

UNIT-III

Theory of Relativity: Inertial and non-inertial frame of references, Galilean transformation (velocity, acceleration) and its inadequacy (sec. 1.2 and 1.3 of Resnick), Michelson-Morley Experiment and its outcome (sec. 1.5 of Resnick), Postulates of Special Theory of Relativity (sec. 1.9 of Resnick), Lorentz Transformations (sec. 2.2 of Resnick), Length contraction, Time dilation (sec.2.3 of Resnick).

UNIT-IV

Application of Relativity: Relativistic transformation of velocity (*2.6, Ref.3*), frequency and wave number (*2.7, Ref.3*), Variation of mass with velocity (*3.2, 3.3 Ref.3),* Massless Particles, Mass-energy Equivalence (*3.6, Ref.3*), Relativistic Doppler effect (*2.7, Ref.3*), Relativistic Kinematics(*3.5, Ref.3*), Transformation of Energy and Momentum (*3.7, Ref.3*), Four Vectors (*3.7, Ref.3*)

Reference Books:

1. Classical Mechanics, 3rd Edition, Pearson
2. An introduction to Mechanics, D. Kleppner and R.J. Kolenkow, 1973, McGraw-Hill.
3. Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.
4. Mechanics Berkeley Physics course,v.1: Charles Kittel, et. Al. 2007, Tata McGraw-Hill.
5. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
6. Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000.

CPL-203

Core Course-IV

ELECTRICITY, MAGNETISM & ELECTROMAGNETIC THEORY-II

((Credits – 02, 30 Hrs (2 Hrs/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 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, The paper will include at least 20% of total marks as numerical problems.

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 isotropicdielectricmedium.

UNIT-I

Electromagnetic Induction: Motional EMF (*7.1.2, 7.1.3:Ref.1*), Faraday's laws of electromagnetic induction (*7.2:Ref.1*), Self and mutual inductance (L and M respectively) (*7.2.3:Ref.1*, Energy stored in magnetic field (*7.2.4:Ref.1*).

AC Circuit Analysis: AC circuit analysis using complex variables, AC circuits with (a) R and C (b) R and L (c) R, L and C, Series and parallel resonance circuits, Quality factors and its importance

UNIT-II

Maxwell`sequations: Maxwell's fixing of Ampere's law, Displacement current, Maxwell's equations in vacuum, Maxwell's equations in matter (*7.3:Ref.1*), The continuity equation (*8.1.1:Ref.1*), Poynting Theorem and Poynting vector (*8.1.2:Ref.1*), Momentum and angular momentum in electromagnetic field (qualitative only) (*8.2.3,8.2.4:Ref.1*), Energy density in electromagnetic field (*8.1.2:Ref.1*).

UNIT-III

The wave equation, Sinusoidal waves (*9.1.1, 9.1.2, 9.1.4:Ref.1*), 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 (9.2*:Ref.1*), Propagation in linear media (*9.3.1:Ref.1*), Reflection and transmission at Normal and Oblique incidence (*9.3.2,9.3.3:Ref.1*), Brewster's angle (*9.3.3:Ref.1*)

UNIT-IV

Scalar and vector potential for electromagnetic fields (*10.1.1:Ref.1*), Gauge Transformation (*10.1.2:Ref.1*), Coulomb Gauge, Lorentz Gauge (*10.1.3:Ref.1*), Electric and magnetic dipole radiation (no derivation needed, discussion of results only) (*11.1.1 and results and assumptions used to derive the results in section 11.1.2, 11.1.3:Ref.1*), Magnetism as relativistic phenomenon (*12.3.1:Ref.1or:Ref.2)*, Transformation of electric and magnetic fields between two inertial frames (*12.3.2:Ref.1or :Ref.2*).

Reference Books:

1. Introduction to Electrodynamics, 3rd Ed., 1998, D.J. Griffiths, Benjamin Cummings.
2. ElectricityandMagnetism,EdwardM.Purcell,1986,McGraw-HillEducation..
3. Electricity and Magnetism, J.H. Fewkes& J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
4. University Physics, Ronald Lane Reese, 2003, ThomsonBrooks/Cole.

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

Marks: 50

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. Calibration of a thermocouple by Potentiometer.

Section: B

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

SEMESTER I & II

B. SC. PHYSICAL SCIENCES

(GEOGRAPHY)

CGL- 102
Core Course-I
PHYSICAL GEOGRAPHY-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 are 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.

Unit-I

Physical Geography: Definition, Nature & Scope.
Origin of the Earth: Tidal and Big Bang Theory

Unit-II

Internal Structure of Earth
(Based on Seismic Evidences)
The Rocks: Classification of Rocks and associated features

Unit-III

Endogenetic and Exogenetic processes
Plate Tectonics: Meaning & Types of Plates, Motion & Associated features

Unit-IV

Agents of Denudation: Wind, River and underground water
Cycle of Erosion: Davis and Penck

CGL- 103

Core Course-II

PHYSICAL GEOGRAPHY-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 are 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.

Unit-I

Atmosphere: Composition and Structure
Insolation and Temperature
Global Air Circulation Pattern: Permanent, Periodic and Local winds

Unit-II

Monsoon and Theories of it's origin
Fronts and Cyclones (Temperate and Tropical)

Unit-III

Hydrological Cycle
Ocean Floor Relief Features

Unit-Iv

Ocean Water temperature and Salinity
Ocean water Circulation: Tides and Currents

Reading List

1. Conserva H. T., 2004: Illustrated Dictionary of Physical Geography, Author House, USA.
2. Gabler R. E., Petersen J. F. and Trapasso, L. M., 2007: Essentials of Physical Geography (8th Edition), Thompson, Brooks/Cole, USA.
3. Garrett N., 2000: Advanced Geography, Oxford University Press.
4. Goudie, A., 1984: The Nature of the Environment: An Advanced Physical Geography, Basil Blackwell Publishers, Oxford.
5. Hamblin, W. K., 1995: Earth's Dynamic System, Prentice Hall, N.J.
6. Husain M., 2002: Fundamentals of Physical Geography, Rawat Publications, Jaipur.
7. Monkhouse, F. J. 2009: Principles of Physical Geography, Platinum Publishers, Kolkata.
8. Strahler A. N. and Strahler A. H., 2008: Modern Physical Geography, John Wiley & Sons, New York.

CGP- 108

Practical -I; Geography Lab--I

(Credits: 02, 60 Hours (4hrs. per week))

Max. Marks: 50

Time: 4 Hours

Note:-Distribution of Marks is as under:
Exercise – 60

Record File- 20
Viva-voce-20

1. 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 exercises/experiments prescribed in the syllabus. After the completion of a practical the teacher concerned will check the note book and

– 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.

2. 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 practical's will be entered. This record will be signed by the concerned teacher.

3. The laboratory Record register will be presented to the external practical examiners for Lab.Record marks. These external examiners may verify the record randomly.

Exercises:

1.	Methods of representing relief.	1
2.	Representation of Topographical features by contours. Slopes (Concave, convex and undulating) Valleys (V Shaped, U shaped and Gorge) Ridges (Volcanic hill, Plateau and Escarpment)	3
3.	Drawing of Profiles (a) Cross Profiles: Serial, superimposed, projected and composite profiles. (b) Longitudinal profiles	5
4.	Interpretation of Topographical and weather maps	2
5.	Chain & Tape Survey	2

Suggested Readings:

1. F.J. Monkhouse and H.R. Wilkinson (1972) Maps and Diagrams, Mothuen and Co. Ltd.,London.
2. L.R. Singh and Raghuvander Singh (1973), Map Work and Practical Geography, Central Book Depot, Allahabad.
3. R.I. Singh and P.K. Dutt (1968), Elements of Practical Geography, Students Friends, Allahabad
4. Singh Gopal (2004) 4th edition, Map Work and Practical Geography, Vikas Publication House, New Delhi.

CGL- 202
Core Course-III
HUMAN GEOGRAPHY-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 are 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.

Unit-I

Definition, Nature & Scope of Human Geography
Major Branches of Human Geography

Unit-II

Concepts of Human Geography- Environmental Determinism, Possibilism, Neo-Determinism
Contemporary Relevance of Human Geography

Unit-III

Evolution of Man : Classification and Characteristics of Human races, Griffith Taylor's Classification
Human Adaption to Environment – Gujjars-Bakarwals and Bushman

Unit-IV

Cultural Regions of the World
Major Religion & Languages of the World and their Distribution

CGL- 203
Core Course-IV
HUMAN GEOGRAPHY-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 are 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.

Unit-I

World Population Distribution
World Population Composition (Age, Sex and Literacy)

Unit-II

World Population Density and Growth
Demographic Transition Theory

Unit-III

Classification of rural and urban settlements
Trends and Patterns of World Urbanisation

Unit-IV

Theories of Morphological Structure of Urban Centres, Burgess, Homer Hyot, Harris-Ullman.

Reading List

1. Chandna, R.C. (2010) Population Geography, Kalyani Publisher.
2. Daniel, P.A. and Hopkinson, M.F. (1989) The Geography of Settlement, Oliver & Boyd, London.
3. Johnston R; Gregory D, Pratt G. et al. (2008) The Dictionary of Human Geography, Blackwell Publication.
4. Jordan-Bychkov et al. (2006) The Human Mosaic: A Thematic Introduction to Cultural Geography. W. H. Freeman and Company, New York.
5. Kaushik, S.D. (2010) Manav Bhugol, Rastogi Publication, Meerut.
6. Maurya, S.D. (2012) Manav Bhugol, Sharda Pustak Bhawan. Allahabad.
7. Ghosh, S. (2015) Introduction to settlement geography. Orient Black Swan Private Ltd., Kolkata
8. Hussain, Majid (2012) Manav Bhugol. Rawat Publications, Jaipur

CGP- 208

Practical -II; Geography Lab--II

(Credits: 02, 60 Hours (4hrs. per week))

Max. Marks: 50

Time: 4 Hours

Note:-Distribution of Marks is as under:

Exercise – 60

Record File- 20

Viva-voce-20

1. *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 exercises/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.

2. *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 practical's will be entered. This record will be signed by the concerned teacher.*
3. *The laboratory Record register will be presented to the external practical examiners for Lab.Record marks. These external examiners may verify the record randomly.*

1.	Map Scales.	Exercises
i)	Method of Expressing a Scale	4
ii)	Conversion of Statement of Scale into R.F. and Vice-versa.	
iii)	Plain Scale (Km and mile)	
iv)	Comparative Scale	
v)	Diagonal Scale	
2.	Measurement of Distances and Areas on Maps	1
3.	Enlargement and Reduction of Maps	2
4.	Qualitative Map : Choroschematic and Chorocromatic	2
	Quantitative Map: Dot Method and Choropleth	2
5.	Plain Table Survey	2

1. F.J. Monkhouse and H.R. Wilkinson (1972) Maps and Diagrams, Mothuen and Co. Ltd., London
2. L.R. Singh and Raghuvander Singh (1973), Map Work and Practical Geography, Central Book Depot, Allahabad.
3. R.I. Singh and P.K. Dutt (1968), Elements of Practical Geography, Students Friends, Allahabad.
4. Singh Gopal (2004) 4th edition, Map Work and Practical Geography, Viksa Publication House.

SEMESTER I&II

B. SC. PHYSICAL SCIENCES

(CHEMISTRY)

CCL- 104
Core Course-I
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-II
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

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

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.

UNIT-IV

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.

CCP- 109

Practical -I; Chemistry Lab--I

ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY & ALIPHATIC HYDROCARBONS

(Credits: 02, 60 Hours (4hrs. per week))

Marks: 50

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.

CCL 204
Core Course-III
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 G and G^{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-IV
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^{o}, 2^{o} and 3^{o} 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*, 7^{th} 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.

CCP 209

Practical -II

Chemistry Lab--II

CHEMICAL ENERGETICS, EQUILIBRIA & FUNCTIONAL ORGANIC CHEMISTRY

(Credits: 02; 60 Hrs (4Hrs /week)

Marks: 50

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 *H*. **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).

SEMESTER I & II

B. SC. PHYSICAL SCIENCES

(ELECTRONICS)

CEL- 104
Core Course-I
NETWORK ANALYSIS AND ELECTRONIC DEVICES
(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 **(8 Hours)**

Circuit Analysis:

Concept of Voltage and Current Sources. Kirchhoff's Current Law, Kirchhoff's Voltage Law. Mesh Analysis. Node Analysis.

UNIT-II **(8 Hours)**

Networks:

Star and Delta networks, Star-Delta Conversion. Principal of Duality. Superposition Theorem. Thevenin Theorem. Norton's Theorem.

UNIT-III **(8 Hours)**

Networks:

Reciprocity Theorem. Maximum Power Transfer Theorem. Two Port Networks: h, y and z parameters and their conversion.

UNIT-IV **(6 Hours)**

Unipolar Devices:

JFET. Construction, working and I-V characteristics (output and transfer), Pinchoff voltage. UJT, basic construction, working, equivalent circuit and I-V characteristics.

Reference Books:

- Electric Circuits, S. A. Nasar, Schaum's outline series, Tata McGraw Hill (2004)
- Electrical Circuits, M. Nahvi & J. Edminister, Schaum's Outline Series, Tata McGraw-Hill (2005)
- Electrical Circuits, K.A. Smith and R.E. Alley, 2014, Cambridge University Press
- Network, Lines and Fields, J.D.Ryder, Prentice Hall of India.
- Electrical Circuit Analysis, Mahadevan and Chitra, PHI Learning
- Network Analysis, G.K. Mithal, Khanna Publication
- Basic Electronics and Linear Circuits, N.N Bhargava, D C Kulshreshtha
- Electronic Devices and Circuits, David A. Bell, 5th Edition 2015, Oxford University Press.
- Electronic Circuits: Discrete and Integrated, D.L. Schilling and C. Belove, Tata McGraw Hill
- Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6th Edn.,Oxford University Press.
- J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill (2001)
- J. J. Cathey, 2000 Solved Problems in Electronics, Schaum's outline Series, Tata McGraw Hill (1991)

CEL- 105
Core Course-II
ANALOG ELECTRONICS
(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 (8 Hours)

Junction Diode:

PN junction diode (Ideal and practical)-constructions, Formation of Depletion Layer, Diode Equation and I-V characteristics.Idea of static and dynamic resistance, dc load line analysis, Quiescent (Q) point. Zener diode, Reverse saturation current, Zener and avalanche breakdown. Qualitative idea of Schottky diode.

Junction Diode Applications:

Rectifiers- Half wave rectifier, Full wave rectifiers (center tapped and bridge), circuit diagrams, working and waveforms, ripple factor and efficiency. Filter-Shunt capacitor filter, its role in power supply, output waveform, and working. Regulation- Line and load regulation, Zener diode as voltage regulator, and explanation for load and line regulation.

UNIT-II (8 Hours)

Bipolar Junction Transistor:

Review of the characteristics of transistor in CE and CB configurations, Regions of operation (active, cut off and saturation), Current gains α and β. Relations between α and β. dc load line and Q point. Transistor biasing and Stabilization circuits- Fixed Bias and Voltage Divider Bias. Thermal runaway, stability and stability factor S.

UNIT-III **(7 Hours)**

Amplifiers:

Transistor as a two port network, h-parameter equivalent circuit. Small signal analysis of single stage CE amplifier. Input and Output impedance, Current and Voltage gains. Class A, B and C Amplifiers.

Cascaded Amplifiers:

Two stage RC Coupled Amplifier and its Frequency Response.

UNIT-IV **(7 Hours)**

Feedback in Amplifiers:

Concept of feedback, negative and positive feedback, advantages of negative feedback

Sinusoidal Oscillators:

Barkhausen criterion for sustained oscillations. Phase shift and Colpitt's oscillator. Determination of Frequency and Condition of oscillation.

Reference Books:

- Electronic Devices and Circuits, David A. Bell, 5th Edition 2015, Oxford University Press.
- Basic Electronics and Linear Circuits, N.N Bhargava, D C Kulshreshtha
- Electronic Circuits: Discrete and Integrated, D.L. Schilling and C. Belove, Tata McGraw Hill
- Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6th Edn.,Oxford University Press.
- J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill (2001)
- J. J. Cathey, 2000 Solved Problems in Electronics, Schaum's outline Series, Tata McGraw Hill (1991)

CEP- 109
Practical -I; NETWORK ANALYSIS AND ANALOG ELECTRONICS LAB (Credits: 02, 60 Hours (4hrs. per week))

Marks: 50

Time: 4 Hours

AT LEAST 12 EXPERIMENTS FROM THE FOLLOWING BESIDES #1

6. To familiarize with basic electronic components (R, C, L, diodes, transistors), digital Multimeter, Function Generator and Oscilloscope.
7. Measurement of Amplitude, Frequency & Phase difference using Oscilloscope.
8. Verification of (a) Thevenin's theorem and (b) Norton's theorem.
9. Verification of (a) Superposition Theorem and (b) Reciprocity Theorem.
10. Verification of the Maximum Power Transfer Theorem.
11. Study of the I-V Characteristics of (a) p-n junction Diode, and (b) Zener diode.
12. Study of (a) Half wave rectifier and (b) Full wave rectifier (FWR).
13. Study the effect of (a) C- filter and (b) Zener regulator on the output of FWR.
14. Study of the I-V Characteristics of UJT and design relaxation oscillator..
15. Study of the output and transfer I-V characteristics of common source JFET.
16. Study of Fixed Bias and Voltage divider bias configuration for CE transistor.
17. Design of a Single Stage CE amplifier of given gain.
18. Study of the RC Phase Shift Oscillator.
19. Study the Colpitt`s oscillator.

Reference Books:

- Networks, Lines and Fields, J.D.Ryder, Prentice Hall of India.
- J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill (2001)
- Electrical Circuits, M. Nahvi and J. Edminister, Schaum's Outline Series, Tata McGraw-Hill (2005)
- Allen Mottershead, Electronic Devices & Circuits, Goodyear Publishing Corp oration.

CEL 204
Core Course-III
LINEAR AND DIGITAL INTEGRATED CIRCUITS
(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

Operational Amplifiers (Black box approach): **(8 Hours)**

Power supplies for ICs, Interpretation of data sheets, Characteristics of an Ideal and Practical Operational Amplifier (IC 741), Ideal voltage transfer curve, Open and closed loop configuration, Frequency Response. CMRR. Slew Rate and concept of Virtual Ground.

UNIT-II

Applications of Op-Amps: **(8 Hours)**

(1) Inverting and non-inverting amplifiers, (2) Summing and Difference Amplifier (3) Differentiator, (4) Integrator (5) Voltage to current converter

UNIT-III

Applications of Op-Amps: **(8 Hours)**

(6) Active low pass and high pass Butterworth filter (1st and 2nd order) (7) Wein bridge oscillator (8) Square wave generator(9) Comparator and Zero-crossing detector (10) clippers and clampers

UNIT-IV

D-A and A-D Conversion: **(6 Hours)**

4 bit binary weighted and R-2R D-A converters, circuit and working. Accuracy and Resolution. A-D conversion characteristics, successive approximation ADC. (Mention of relevant ICs for all).

Reference Books:

- OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall
- Operational Amplifiers and Linear ICs, David A. Bell, 3rd Edition, 2011, Oxford University Press.
- Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed., 2011,Tata McGraw
- Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.

CEL 205
Core Course-IV
DIGITAL ELECTRONICS
(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 **(8 Hours)**

Number System and Codes:

Decimal, Binary, Octal and Hexadecimal number systems, base conversions.

Representation of signed and unsigned numbers, BCD code. Binary, octal and hexadecimal arithmetic; addition, subtraction by 2's complement method, multiplication. **Logic Gates and Boolean algebra**:

Truth Tables of OR, AND, NOT, NOR, NAND,XOR, XNOR, Universal Gates, Basic postulates and fundamental theorems of Boolean algebra.

UNIT-II **(8 Hours)**

Combinational Logic Analysis and Design:

Standard representation of logic functions(SOP and POS), Minimization Techniques (Karnaugh map minimization up to 4 variables for SOP). **Arithmetic Circuits**:

Binary Addition. Half and Full Adder. Half and Full Subtractor, 4-bit binary Adder/ Subtractor.

Data processing circuits:

Multiplexers, De-multiplexers, Decoders, Encoders.

.

UNIT-III (8 Hours)

Clock and Timer (IC 555):

Introduction, Block diagram of IC 555, Astable and Monostable multivibrator circuits

Sequential Circuits:

SR, D, and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops. Preset and Clear operations. Race-around conditions in JK Flip-Flop. Master-slave JK Flip-Flop.

UNIT-IV (6 Hours)

Shift registers:

Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits).

Counters (4 bits):

Ring Counter. Asynchronous counters, Decade Counter. Synchronous Counter.

Reference Books:

- Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed., 2011,Tata McGraw
- Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.
- Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
- Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer, 2001, PHI Learning.
- Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994)
- R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw-Hill (1994)

CEP 209

Practical -II; LINEAR INTEGRATED CIRCUITS AND DIGITAL ELECTRONICS LAB

(Credits: 02; 60 Hrs (4Hrs /week)

Marks: 50

Time: 4 Hours

At least 04 experiments each from section A, B and C

Section-A: Op-Amp. Circuits (Hardware)

1. To design an inverting amplifier using Op-amp (741,351)for dc voltage of given gain
2. (a) To design inverting amplifier using Op-amp (741,351) & study its frequency response

   (b) To design non-inverting amplifier using Op-amp (741,351) & study frequency response
3. (a) To add two dc voltages using Op-amp in inverting and non-inverting mode

   (b) To study the zero-crossing detector and comparator.
4. To design a precision Differential amplifier of given I/O specification using Op-amp.
5. To investigate the use of an op-amp as an Integrator.
6. To investigate the use of an op-amp as a Differentiator.
7. To design a Wien bridge oscillator for given frequency using an op-amp.
8. To design a circuit to simulate the solution of simultaneous equation and 1st/2ndorder differential equation.
9. Design a Butterworth Low Pass active Filter (1st order) & study Frequency Response
10. Design a Butterworth High Pass active Filter (1st order) & study Frequency Response
11. Design a digital to analog converter (DAC) of given specifications.

Section-B: Digital circuits (Hardware)

1. (a) To design a combinational logic system for a specified Truth Table.

   (b) To convert Boolean expression into logic circuit & design it using logic gate ICs.

   (c) To minimize a given logic circuit.

2. Half Adder and Full Adder.

3. Half Subtractor and Full Subtractor.

4. 4 bit binary adder and adder-subtractor using Full adder IC.

5. To design a seven segment decoder.

6. To design an Astable Multivibrator of given specification using IC 555 Timer.

7. To design a Monostable Multivibrator of given specification using IC 555 Timer.

8. To build Flip-Flop (RS, Clocked RS, D-type and JK) circuits using NAND gates.

9. To build JK Master-slave flip-flop using Flip-Flop ICs

10. To build a Counter using D-type/JK Flip-Flop ICs and study timing diagram.

11. To make a Shift Register (serial-in and serial-out) using D-type/JK Flip-Flop ICs.

Section-C: SPICE/MULTISIM simulations for electronic circuits and devices

1. To verify the Thevenin and Norton Theorems.
2. Design and analyze the series and parallel LCR circuits
3. Design the inverting and non-inverting amplifier using an Op-Amp of given gain
4. Design and Verification of op-amp as integrator and differentiator
5. Design the 1storder active low pass and high pass filters of given cutoff frequency
6. Design a Wein`s Bridge oscillator of given frequency.
7. Design clocked SR and JK Flip-Flop`s using NAND Gates
8. Design 4-bit asynchronous counter using Flip-Flop ICs
9. Design the CE amplifier of a given gain and its frequency response.

Reference Books :

- Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed., 2011,Tata McGraw
- OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edn., 2000, Prentice Hall
- R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw-Hill (1994)
- Digital Electronics, S.K. Mandal, 2010, 1st edition, McGraw Hill

SEMESTER I & II

B. SC. PHYSICAL SCIENCES

(COMPUTER SCIENCE)

CCsL- 104
Core Course-I
COMPUTER FUNDAMENTALS
(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 are 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.

UNIT I

Computer Fundamentals:

Introduction to Computers: Characteristics and Limitations of Computers, Evolution of Computers, Classification of Computers. Computer Languages. Computer Programs, Structured Programming Concepts

Basic Computer Organization:

Units of a computer, CPU, ALU, Memory Hierarchy, Registers, I/O devices. Mother Board, **UNIT II**

Word Processing:

Introduction to MS-Word, Creating & Editing: Formatting Document, Page, Table; Bookmark, Mail Merge, Macros.

Spread Sheets:

Introduction to MS-Excel, Creating & Editing Worksheet, Formatting data, Formulas and Functions, Creating Charts, Pivot Tables.

Power Point Presentations:

Creating, Manipulating & Enhancing Slides, Organizational Charts, Animations & Sounds, Inserting Animated Pictures.

UNIT III

Operating Systems:

Introduction to Operating System: Functions of Operating System, Services; Properties: Batch Processing, Multitasking, Multiprogramming, Interactivity, Distributed environment, Spooling;

Types of Operating System:

Single user and Multiuser, Batch OS, Multiprogramming OS, Multitasking OS, Real-Time OS, Time-Sharing OS, Distributed OS, Network OS.

UNIT IV

Internet Basics:

History of Internet, Web Browsers, Web Servers, Hypertext Transfer Protocol, Internet Protocols Addressing, Internet Connection Types, How Internet Works, ISPs, Search Engines, Emails and Its Working, Internet Security, Uses of Internet, Computer Networks and their advantages, Types of Computer Network, Network Topologies, Basics of Transmission Media. Cloud Computing Basics: Overview, Applications, Intranets and the Cloud. Benefits, Limitations and Security Concerns.

Text/ Reference Books

1. Satish Jain, Kratika, M. Geetha, "MS Office", BPB Publications, 2010.
2. ITL Education Solutio, "Introduction to Computer Science", Pearson Education, 2nd Edition 2012.
3. P. K. Sinha, "Computer Fundamentals", 6th edition, 2003.
4. Tony Feldman,"Introduction to Digital Media", Routledge; 1 edition, 1996.
5. Bartee, Thomas C, "Digital Computer Fundamentals", McGraw-Hill Inc., 6th Edition, 1984.

CCsL 105
Core Course-II
Programming in 'C'
(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 are 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.

UNIT – 1

Introduction to C Programming:

History of C, Character Set, Identifiers and Keywords,

Constants, Types of C Constants, Rules for Constructing Integer, Real and character Constants, Variables, Data Types, rules for constructing variables. Input/output: Unformatted & formatted I/O function, Input functions: scanf(), getch(), getche(), getchar(), gets(); output functions: printf(), putch(), putchar(), puts().

Operators and Expressions:

Arithmetic, relational, logical, bitwise, unary, assignment, conditional operators and special operators, Type Conversion in Assignments, Hierarchy of Operations, Structure of a C program.

UNIT – II

Decision Control Structure:

Decision making Decision making with IF statement, IF-ELSE statement, Nested IF statement, ELSE-IF ladder.

Loop Control Structure:

While and do-while, for loop and Nested for loop,

Case Control Structure:

Decision using switch; goto, break and continue statements.

Functions:

Library functions and user defined functions, Global and Local variables, Function Declaration, Calling and definition of function, Methods of parameter passing to functions, recursion, Storage Classes in C.

UNIT – III

Arrays:

Introduction, Array declaration, Accessing values in an array, Initializing values in an array, Single and Two Dimensional Arrays, Initializing a 2-Dimensional Array, Passing array elements to a function: Call by value and call by reference, Arrays of characters, Insertion and deletion operations, Searching the elements in an array, Using matrices in arrays, Passing an Entire Array to a Function.

Pointers:

Pointer declaration, Address operator "&", Indirection operator "*", Pointer and arrays, Pointers and 2-Dimensional Arrays, Pointer to an Array, Passing 2-D array to a Function, Array of Pointers.

Dynamic Memory Allocation:

malloc(), calloc(), realloc(), free() functions.

UNIT – IV

String Manipulation in C:

Declaring and Initializing string variables, Reading and writing strings, String Handling functions (strlen(), strcpy(), strcmp(), strcat(), strrev()).

Structures and Unions:

Declaration of structures, Structure Initialization, Accessing structure members, Arrays of structure, Nested structures, Structure with pointers, Union.

Files in C:

Introduction, Opening and Closing files, Basic I/O operation on files.

Text/ Reference Books:

1. Yashvant Kanetkar, "Let Us C", 15th Edition, BPB Publications, 2016.
2. Salaria, R.S. : Test Your Skills in C, Salaria Publications, New Delhi.
3. E. Balaguruswami : Programming with C Language, Tata McGraw Hill, New Delhi.
4. Byron S. Gottfried : Programming in C, McGraw Hills Publishers, New York.
5. M.T. Somashekara : Programming in C, Prentice Hall of India.

CCsP- 109
Practical –I: Computer Lab--I
Based on Computer Fundamentals
(Credits: 02, 60 Hours (4hrs. per week))

Marks: 50
Time: 4 Hours

List of Experiments:

Section- A

1. Create an admission form in MS-Word. You need to use Text-Boxes, Shapes, Colors, formatting options, table and horizontal lines.
2. Send a birthday invitation to your 100 friends using Mail-Merge.
3. Study and use various functions like Sum, Average, Maximum, and Minimum in MS-Excel.
4. Fill 50 students' records in MS-Excel sheet1. The fields must be Roll No., Name, Father Name, Course Joined, Marks obtained in three subjects. Create a marks-sheet in sheet2.
5. Create 10 slides in MS-PowerPoint related to internet advantages and disadvantages in daily life. Add animations to these all slides.

Section-B

1. Program to convert a given decimal number into its binary equivalent using bitwise operators.
2. Program to accept a positive integer and find the sum of the digits in it.
3. Find The Roots of Quadratic Equation using if else statement.
4. Program to generate prime numbers.
5. Program to multiply two matrices.
6. Program to find GCD and LCM using non-recursive function.
7. Program to generate terms of Fibonacci series using recursive function.
8. Program to read a string and check whether it is a palindrome or not (using library functions).
9. Program to create a file called emp.txt and store information about a person, in terms of his name, age and salary.
10. Program to add two complex numbers using structure to store a complex number.

Note: In addition to the above experiments, the teacher may add more programs on the behalf of the theory syllabus.

CCsL- 204
Core Course-III
Data Structure Using 'C'
(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 are 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.

UNIT – 1

Data Structure Basics:

Introduction to Complexity, Introduction to Data Structures, Classification of data structure, Abstract data type; Data Structure Operations, Applications of Data Structure.

Arrays:

Definition of array, Single and Multi-dimensional Arrays, Representation of single and 2-dimentional arrays and their address calculation, basic operations on single dimensional arrays, Algorithm for insertion and deletion operations; Sparse Matrices and its representation.

Stacks:

Definition of stack, Operations on stack, Algorithms for push and pop operations using array. Stack Applications: Prefix, Infix and Postfix expressions, Conversion of Infix expressions to Postfix expression using stack; Recursion.

UNIT – II

Queues:

Introduction to Queue. Operations on Queues, Circular queue, Algorithm for insertion and deletion in simple queue and circular queue using array. De-queue, Priority Queues.

Linked Lists:

Introduction, Array vs Linked list; Singly, Doubly and Circular linked Lists and representation of linked lists in memory. Implementation of Stack and simple Queue as single Linked List.

UNIT -III

Trees:

Introduction to Tree as a data structure, Basic Terminology; Binary Trees, Traversal of binary trees: In-order, Pre-order & post-order. Binary tree non recursive traversal algorithms. Binary Search Tree, (Creation, and Traversals of Binary Search Trees)

Graphs:

Introduction, Memory Representation, Graph Traversal (DFS and BFS)

UNIT - IV

Searching:

Binary and Linear Search

Sorting:

Bubble sort, Insertion sort, Selection sort, Merge Sort, Quick sort. Comparison of various Searching and Sorting algorithms.

Text/ Reference Books:

1. Ellis Horowitz & Sartaj Sahni, "Fundamentals of Data structures in C",2nd Edition, Silicon Press, 2007.
2. R. B. Patel, "Expert Data Structures with C", 3rd Edition, Khanna Book Publishing, 2014.
3. A. M. Tenenbaum, Langsam, "Data Structures using 'C'," Pearson Education, 2009.
4. Lipschuitz L. Seymour, 2001 : Data Structure, Schaum Outline Series, TMH, New Delhi.
5. Salaria, R. S. : Data Structures & Algorithm Using C, Khanna Book Publishing Co. (P.) Ltd., New Delhi.
6. Salaria, R. S., Test Your Skills in Data Structures, Khanna Book Publishing Co. (P.) Ltd., New Delhi.
7. Sofat Sanjeev, Data Structure with C and C++, Khanna Book Publishing Co. Patel, R.B., Expert Data Structure in C, Khanna Book Publishing Co.

CCsL- 205
Core Course-IV
COMPUTER ORGANISATION
(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 are 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.

UNIT – I

Data Representation:

Number Systems: Decimal, Binary, Octal, Hexadecimal, Conversion from one number system to other; Binary arithmetic operations, Representation of Negative Numbers: 1's complement and 2's complement; fixed and floating point representation, character representation (BCD, EBCDIC and ASCII Code), BCD number system; Weighted Codes, Self Complementing Code, Excess-3 code, Gray and Cyclic code.

UNIT – II

Boolean Algebra:

Introduction**,** Definition, Postulates of Boolean Algebra, Fundamental Theorems of Boolean Algebra; Duality Principle, Demorgan's Theorems, Boolean Expressions and Truth Tables, Standard SOP and POS forms, Canaonical representation of Boolean expressions, Simplification of Boolean Expressions using theorems of Boolean algebra, Minimization Techniques for Boolean Expressions using Karnaugh Map.

Logic Gates:

AND, OR, NOT, NOR, NAND & XOR Gates and their Truth tables.

UNIT – III

Combinational Circuits:

Half Adder & Full Adder, Half Subtractor & Full Subtractor, Adder & Subtractor, decoders, multiplexors. Realization of Boolean expressions using decoders and multiplexor.

Sequential Circuits:

Flip-Flops, Types- RS, T, D, JK and Master-Salve JK flip flop, Triggering of Flip Flops; Flip Flop conversions, Shift Registers, Synchronous and Asynchronous Counters.

UNIT – IV

Basic Computer Organization and Design:

Register Organization, Bus system, instruction set, timing and control, instruction cycle, memory reference, input-output and interrupt.

Programming the Basic Computer:

Instruction formats, addressing modes, instruction codes.

Input-output Organization:

Peripheral devices, I/O interface, Modes of data transfer,

Direct Memory Access.

Text/ Reference Books:

1. William H.Gothman, "Digital Electronics-An Introduction to Theory and Practice" 2nd Edition, Prentice Hall of India Pvt. Ltd., 2009.
2. Mano, M. Morris,"Digital Logic and Computer Design", Prentice Hall of India Pvt.Ltd., 2000.
3. W.Stallings,"Computer Organization & Architecture", Pearson Education, 7th Edition, New Delhi, 2006.
4. N. Carter,"Computer Architecture", Schaums Outline Series, Tata McGraw Hill, New Delhi, 2006.

CCsP - 209

Practical –II: Computer Lab--II

Based on Data Structure using 'C' language and Database Management System
(Credits: 02, 60 Hrs (4Hrs /week))

Marks: 50
Time: 4 Hours

List of Experiments:

1. Program to convert a given infix expression to postfix.
2. Program to insert/delete an element in/from an array at a given location.
3. Program to implement Stack using structure
4. Program to implement Single Queue using structure
5. Program to insert, delete and display the linked list (Beginning, End and given position)
6. Program to generate BST and traverse recursively (infix).
7. Program to generate BST and traverse recursively (prefix).
8. Program to generate BST and traverse recursively (postfix).
9. Program for Binary Search.
10. Program for sorting an array using any sorting technique

Note: In addition to the above experiments, the teacher may add more programs on the behalf of the theory syllabus.

SEMESTER I & II

B. SC. PHYSICAL SCIENCE

(COMPUTER APPLICATIONS)

CCaL-104
Core Course-I
COMPUTER FUNDAMENTALS AND OPERATING SYSTEM
(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. I 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 are 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. I is compulsory.

UNIT - I

Introduction: Characteristics, evolution and generations of computers, Basic Computer Organization: Input and Output Unit, Primary and Secondary storage, CPU: ALU, Control Unit, Classification of computers, Number Systems: Binary, Hexadecimal, Octal, Decimal numbers, Floating-point Numbers, Computer codes: BCD and EBCDIC codes, ASCII, Unicode.

UNIT - II

Input/Output & Storage Units-: Keyboard, Mouse, Trackball, Joystick, Digitizing tablet, Scanners, Digital Camera, MICR, OCR, OMR, Bar-code Reader, Voice Recognition, Light pen, Touch Screen, Monitors – characteristics and types of monitor -Digital, Analog, Size, Resolution, Refresh Rate, Interlaced / Non Interlaced, Printers& types – Daisy wheel, Dot Matrix, Inkjet, Laser, Line Printer, Plotter, Sound Card and Speakers

UNIT – III

Memories: Memory speed, access time, wait states, Types of memory, Dynamic and Static RAM, memory chip making, Cache memory, shadow RAM, ROM chips, Reading memory error messages, adding RAM, CPU Registers Storage fundamentals - Secondary Data Storage and Retrieval methods - Sequential, Direct and Index Sequential, Various Storage Devices Magnetic Tape, Magnetic Disks, Cartridge Tape, Hard Disk Drives, Floppy Disks, CD/DVD flash drives Video Disk , Blue Ray Disc

UNIT - IV

Windows OS: Operating system definition and evolution, Types of Operating Systems, Functions of operating systems, Popular Operating Systems, Features of Windows OS, Windows history;Files & Folders operations. Desktop, Recycle Bin, My Computer, My Documents, Windows Explorer, Configuring System Devices: Control Panel, Accessories in Windows.

TEXT BOOKS

1. PC Hardware Complete Reference - Craig Zacker & John Rourke, Tata McGraw Hill

2. Inside the PC - Peter Norton, BPB.

3. Foundation of Computing, Sinha P., Sinha P., BPB Publication

REFERENCES BOOKS

1. The Indispensable PC Hardware Book - Messmer, Pearson Education

2. Troubleshooting and Repairing Your PC - Corey Candler, Wiley

3. Upgrading and repairing PC’s - Scott Mueller, Pearson Educati

CCaL 105
Core Course-II
Office Automation Tools
(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 are 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.

UNIT – I

MS PowerPoint: Introduction & area of use; Creating a New Presentation; Working with Presentation; Using Wizards; Slides & its different views; Inserting, Deleting and Copying of Slides; Working with Notes, Handouts, Columns & Lists; Adding Graphics, Sounds and Movies to a Slide;Working with PowerPoint Objects; Designing & Presentation of a Slide Show; Printing Presentations, Notes, Handouts with print options. Animations and Sounds, Inserting Animated Pictures or Accessing through Object, Inserting Recorded Sound Effect or In-Built Sound Effect. Outlook Express: Features and uses, Configuring and using Outlook Express for accessing e-mails in office.

UNIT-II

MS Word: Introduction area of use, Menus & Commands; Toolbars & Buttons; Shortcut Menus, Wizards & Templates; Creating a New Document; Different Page Views and layouts; Applying various Text Enhancements; Working with – Styles, Text Attributes; Paragraph and Page Formatting; Text Editing using various features ; Bullets, Numbering, Auto formatting, Printing. Spell Check, Thesaurus, Find & Replace; Headers & Footers ; Inserting – Page Numbers, Pictures, Files, Autotexts, Symbols etc.; Working with Columns, Tabs & Indents; Creation & Working with Tables; Margins & Space management in Document; Adding References and Graphics; Mail Merge, Envelops & Mailing Labels. Importing and exporting to and from various formats.

UNIT – III

Excel: Creating & Saving work book. Structure of Worksheet, entering & editing data, Copying & Moving data, Finding & Replacing data. Filling Data. Sorting data. Formatting Data – Number Style Format, Border & Color, Rotating Texts, Conditional Formatting. Arranging Multiple Workbooks or Windows, Hiding & Unhiding – workbooks, worksheets, rows & columns. Inserting Columns & Rows. Adjusting widths & Heights of Columns & Rows. Copying, moving, inserting, deleting & renaming worksheets in workbooks. Defining, Inserting & deleting Cell or Range Names.

UNIT – IV

Formulas & Functions: Mathematical operators. Creating, changing & copying formulas. Absolute referencing. Functions – Log, Sum, Average, Count, If, Max, Sum If. Date & Time, Database, Text, Maths & Statistical functions. Charts in Excel: Types of charts, Inserting & Modifying charts. File & Print Operations. Linking Worksheets & Workbooks. Creating lists, Using Filters & Subtotals. Recording, running and editing Macros. Data Validation. What-if analysis using Goal seek and scenarios.

TEXT BOOKS

1. Microsoft Office – Complete Reference – BPB Publication

2. Learn Microsoft Office – Russell A. Stultz – BPB Publication

REFERENCES BOOKS

1. Courter, G Marquis. Microsoft Office 2000: Professional Edition. BPB.

2. Koers, D . Microsoft Office XP Fast and Easy. PHI.

3. Nelson, S L and Kelly, J . Office XP: The Complete Reference. Tata McGraw-Hill.

CCaP-109
Practical-I: Computer Lab--1
(Credits: 02, 60 Hours (4hrs. per week))

Marks: 50
Time: 4 Hours

List of Experiments:
Section-A

1. Create an admission form in MS-Word. You need to use Text-Boxes, Shapes, Colors, formatting options, table and horizontal lines.

2. Send a birthday invitation to your 100 friends using Mail-Merge.

3. Study and use various functions like Sum, Average, Maximum, and Minimum in MSExcel.

4. Fill 50 students' records in MS-Excel sheetl. The fields must be Roll No., Name, Father Name, Course Joined, Marks obtained in three subjects. Create a marks-sheet in sheet2.

5. Create 10 slides in MS-PowerPoint related to internet advantages and disadvantages in daily life. Add animations to these all slides.

   Note: In addition to the above experiments, the teacher may add more programs on the behalf of the theory syllabus.

CCaL-204
Core Course-I
INFORMATION TECHNOLOGY
(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 are 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.

UNIT – I

Information Technology Basics, Role of IT. PC evolution, PC classifications, Introduction to Microprocessors.

Inside the PC system unit: PC system unit layout; Motherboard, Memory, Expansion slots and Adapter cards, SMPS, Display unit, Keyboard, Rear side connectors, System Buses, Local Buses

Communication with peripherals: Serial ports, Parallel port, Game Port, USB Port, Fire-Wire Port, HDMI Port, Upgrading PC for Multimedia.

UNIT – II

Information Tools for management control: Decision Support System, Executive Information System, Geographical Information System, On-Line Analytical processing, Data Warehousing, Data Mining, Web advertising, Presentations, Electronic Catalogues

Computer Security: Introduction, Malicious Programs, Digital Signature, Firewall, User Identification and Authentication.

UNIT – III

Emerging Trends in IT: E-Commerce, Electronic Data Interchange(EDI), Mobile Communication, Bluetooth, Global Positioning System(GPS), Smart Cards Multimedia: Definition and building blocks, Hardware, Software and Applications, Multimedia presentation devices, Virtual Reality Digital Sound data: MIDI, Data Compression.

UNIT – IV

Data communications and Computer Networks: Basic Components, Transmission media, Switching, Multiplexing, Modulation, Network Technologies, network types, Communication Protocols, Wireless networks, The Internet: History, Basic services, WWW, browsers, Service

providers, Internet naming and addressing - Electronic mail, Remote login, File Transfer, Search Engine, Getting connected to the Internet.

TEXT BOOKS

1. Sinha P., Sinha P., “Foundations of Computing”, BPB Publication

2. Brain, K. Williams et. al., Using Information Technology, TMH.

REFERENCE BOOKS

1. Turban, Rainer, Potter, Introduction to Information Technology, second edition, Wiley Publications.

2. Dennis P. Curtin, et. al., Information Technology - The Breaking View, TMH.

3. Rajaraman V., “Computer Fundamentals”

CCaL-205
Core Course-IV
PROGRAMMING IN 'C'
(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 are 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.

UNIT-I

Planning the Computer Program: Concept of problem solving, Problem definition, Program design, Debugging, Types of errors in programming, Documentation.

Techniques of Problem Solving: Flowcharting, algorithms, pseudo code, decision table, Structured programming concepts, Programming methodologies viz. top-down and bottom-up programming.

Searching, Sorting, and Merging: Linear & Binary Searching, Bubble, Selection, and Insertion Sorting, Merging.

UNIT-II

Structure of a C Program, C character set, identifiers and keywords, Data types, Constants and Variables, Assignment statement, Symbolic constant. Input/output: Unformatted & formatted I/O function.

Operators & Expression: Arithmetic, relational, logical, bitwise, unary, assignment, conditional operators and special operators. Arithmetic expressions, evaluation of arithmetic expression, type casting and conversion, operator hierarchy & associativity.

UNIT-III

Control statement in C: Branching - Decision making with IF statement, IF-ELSE statement, Nested IF statement, ELSE-IF ladder, switches statement, go to statement. Looping: For, while, and do-while loop, jumps in loops, break, continue statement.

UNIT-IV

Functions: Definition, prototype, passing parameters, recursion. Storage classes in C: auto, extern, register and static storage class, their scope, storage, & lifetime.

Arrays: Definition, types, initialization, processing an array

TEXT BOOKS

1. Sinha, P.K. & Sinha, Priti, Computer Fundamentals, BPB

2. Balagurusamy, E., Programming in ANSI C, Tata McGraw-Hill

REFERENCE BOOKS

1. Dromey, R.G., How to Solve it By Computer, PHI

2. Gottfried, Byron S., Programming with C, Tata McGraw Hill

3. Norton, Peter, Introduction to Computer, McGraw-Hill

4. Leon, Alexis & Leon, Mathews, Introduction to Computers, Leon Tech World

5. Rajaraman, V., Fundamentals of Computers, PHI

CCaP-209 Practical-II: Computer Lab--11
(Credits: 02, 60 Hrs (4Hrs /week))

Marks: 50
Time: 4 Hours

List of Experiments:

1. Program to convert a given decimal number into its binary equivalent using bitwise operators.
2. Program to accept a positive integer and find the sum of the digits in it.
3. Find The Roots of Quadratic Equation using if else statement.
4. Program to generate prime numbers.
5. Program to multiply two matrices.
6. Program to find GCD and LCM using non-recursive function.
7. Program to generate terms of Fibonacci series using recursive function.
8. Program to read a string and check whether it is a palindrome or not (using library functions).

Note: In addition to the above experiments, the teacher may add more programs on the behalf of the theory syllabus.

SEMESTER I & II

B. SC. PHYSICAL SCIENCES

(MATHEMATICS)

CML 106
Core Course-I
ALGEBRA
(Credits: 04; 60 Hrs (4Hrs /week)))

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

The examiner is requested to set nine questions in all, selecting two questions from each Unit. Question no. 1 is compulsory and is based on entire syllabus consisting of eight to ten short answer type questions each of 2 marks. Candidates are 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 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 n^{th} 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 -II
CALCULUS
(Credits: 04; 60 Hrs (4Hrs /week)))

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

The examiner is requested to set nine questions in all, selecting two questions from each Unit. Question no. 1 is compulsory and is based on entire syllabus consisting of eight to ten short answer type questions each of 2 marks. Candidates are 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 ofLimit, continuity and derivability of functions, series expansion indeterminate forms, tracing of curves with the help of asymptotes and singular points..

Unit-I

Limit, continuity (– 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.

CMP 110
PRACTICAL-I
Mathematics Lab– I
(Credits: 1.5; 45 Hrs (3Hrs /week)))

Marks for Major Test (External): 50
Time: 3 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 andexpressions, Input / outputs functions. Decisions control structure: Decision statements, Logical and conditional statements, Implementation of Loops-for, while, do while; Switch Statement & Case control structures.

Part B:

Following Program should be done as Practical:-

1. Program to interchange the value of two variables.
2. Program to calculate compound interest.
3. Program for testing a leap year.
4. Program to find greatest of three numbers.
5. Program to calculate Gross salary of an employee.
6. Program to prepare electricity Bill.
7. Program to find roots of a quadratic equation.
8. Program to provide output of a given function.
9. Program to display table of an input number
10. Program to find reverse of a number
11. Program to generate Fibonacci series.
12. Program to check whether number is prime or not.
13. Program to generate first n prime numbers.
14. Program to check a number is Armstrong or not.
15. Program to convert a number to its binary equivalent.

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.

CML 206
Core Course – III
VECTOR CALCULUS AND GEOMETRY
(Credits: 04; 60 Hrs (4Hrs /week)))

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

The examiner is requested to set nine questions in all, selecting two questions from each Unit. Question no. 1 is compulsory and is based on entire syllabus consisting of eight to ten short answer type questions each of 2 marks. Candidates are 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 Calculus and Geometry deals with 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. Laplacian 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 .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 – IV

ORDINARY DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS

(Credits: 04; 60 Hrs (4Hrs /week)))

Marks for Major Test (External): 80

Marks for Internal Exam: 20

Time: 3 Hours

The examiner is requested to set nine questions in all, selecting two questions from each Unit. Question no. 1 is compulsory and is based on entire syllabus consisting of eight to ten short answer type questions each of 2 marks. Candidates are 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 and Laplace Transforms deals with some important concepts: Exact differential equations, Orthogonal trajectories, Linear differential equations with variable & constant coefficients and solution of ordinary differential equations using Laplace Transforms.	The student will be able to understand basic properties of differential equations, Orthogonal trajectories, Linear differential equations. Apart from this the students will be 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. Solution of Simultaneous Differential Equations and Total Differential Equations. Student will also be able to understand basic properties of Laplace and Inverse Laplace Transforms and solution of ordinary differential equations using Laplace Transform

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.

CMP 210

PRACTIAL-II : Mathematics Lab – II

(Credits: 1.5; 45 Hrs (3Hrs /week)))

Marks for Major Test (External): 50

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:-

16. Program to add two matrices.
17. Program to multiply two matrices.
18. Program to find the inverse of a matrix.
19. Program to find transpose of a matrix.
20. Program to find the sum of a series.
21. Program to sort an entire array using bubble short.
22. Program to find trace of 3X3 Matrix.
23. Program to find largest of three numbers using function.
24. Program to find factorial of a number using recursion.
25. Program to generate n Fibonacci terms using recursion.
26. Program to count number of vowels and consonants in a given sentence.
27. 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 I & II

B. SC. PHYSICAL SCIENCES

AWARENESS PROGRAM COMPULSARY COURSE

(ENVIRONMENTAL STUDIES)

CYL-201
Awareness Program Compulsory Course
ENVIRONMENTAL STUDIES
(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

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.

CHOICE BASED CREDIT SYSTEM

(CBCS)

Guru Jambheshwar University of Science and Technology, Hisar

Scheme and Syllabi
for
(Third & Fourth Semesters)

Undergraduate Course:

B. SC. PHYSICAL SCIENCES

(PHYSICS/GEOGRAPHY, CHEMISTRY/ ELECTRONICS/ COMPUTER SCIENCE/ COMPUTER APPLICATIONS, MATHEMATICS)

Under
The Faculty of Physical Sciences and Technology

w.e.f. Academic Session 2018-19

SEMESTER III & IV

B. SC. PHYSICAL SCIENCES

LANGUAGE SKILLS COMPULSARY COURSE

(HINDI COMPULSORY)

CXL-301(i)
Language Skills Compulsory Course-III
CXL-401(i)
Language Skills Compulsory Course-IV

FOR SYLLABUS OF HINDI SUBJECT, SEE SEPARATE FILE ON WEBSITE

SEMESTER III & IV

B. SC. PHYSICAL SCIENCES

LANGUAGE SKILLS COMPULSARY COURSE

(SANSKRIT COMPULSORY)

CXL-301(ii)
Language Skills Compulsory Course-III
CXL-401(ii)
Language Skills Compulsory Course-IV

FOR SYLLABUS OF SUNSKRIT SUBJECT, SEE SEPARATE FILE ON WEBSITE

SEMESTER III & IV

B. SC. PHYSICAL SCIENCES

(PHYSICS)

CPL-302
Core Course-V
Heat and Thermodynamics
(Credits – 02, 30 Hrs (2 Hrs/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 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, The paper will include at least 20% of total marks as numerical problems.

Course Objective	Course Outcome
The course on Thermal physics deals with some important laws of thermodynamics, concepts of heart, work, temperature and entropy. Behavior of real gases as thermodynamical systems will be of interest.	The student will be able to understand basic concepts of thermodynamical systems.

Unit- I

Zeroth and First Law of Thermodynamics: Extensive and intensive thermodynamic variables, Thermodynamic equilibrium, Zeroth law and Concept of Temperature, Work and heat, State functions, First law of thermodynamics, Internal energy, Applications of first law, General relation between Cp and C_v, Work done during isothermal and adiabatic Processes .

Second Law of Thermodynamics: Reversible and Irreversible process with examples, Conversion of Work into Heat and Heat into Work, Heat Engines, Carnot's Cycle, Carnot engine & efficiency, Refrigerator & coefficient of performance, 2nd Law of Thermodynamics: Kelvin-Planck and Clausius Statements and their Equivalence, Carnot's Theorem

UNIT-II

Entropy and Third law of Thermodynamics: Concept of entropy, Clausius theorem, Clausius Inequality,Second Law of Thermodynamics in terms of Entropy, Entropy of a Perfect Gas and Universe, Entropy Changes in Reversible and Irreversible Processes, Principle of Increase of Entropy, Third Law of Thermodynamics, T-S Diagrams, Phase Change, Classification of Phase Changes.

UNIT-III

Thermodynamic Potentials :- Extensive and Intensive Thermodynamic Variables, Internal Energy, Enthalpy, Gibbs, Helmholtz function and Their Definitions, Properties and Applications.

Maxwell's Thermodynamic Relations: - Derivations of Maxwell's Relations. Applications of Maxwell's Relations: (1) ClausiusClapeyron equation, (2) Values of CP – CV, (3) Energy equations (4) Change of temperature during adiabatic process.

UNIT-IV

Real gases: - Behaviour of Real Gases, Deviations from the Ideal Gas Equation. The Virial Equation, Critical Constants. Continuity of Liquid and Gaseous State. Vapour and Gas, Boyle Temperature, Van der Waal's Equation of State for Real Gases. Values of Critical Constants. Law of Corresponding States. Comparison with Experimental Curves, p-V Diagrams, Joule's Experiment, Free Adiabatic Expansion of a Perfect Gas.

Reference Books:

- Thermal Physics by Garg, Bansal and Ghosh (Tata McGra-Hill, 1993)
- Concepts in Thermal Physics, S. J. Blundell and K. M. Blundel, Oxford University Press
- Heat and Thermodynamics: An Intermediate Textbook By Mark Waldo Zemansky, Richard Dittman (McGraw-Hill, 1981

CPL-303
Core Course –VI
Semiconductor Devices

(Credits – 02, 30 Hrs (2 Hrs/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 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. The paper will include at least 20% of total marks as numerical problems.

Course Objective	Course Outcome
The course on Semiconductor Devices deals with basic semiconductor properties, band formation, intrinsic and extrinsic semiconductors and formation of junction. After discussing the transistor physics, applications of diodes and transistors in various devices are given.	The student will be able to understand the semiconductor junctions, transistors and various devices based on these basic semiconductor elements.

UNIT-I

Semiconductor Diodes and applications: p and n type semiconductors. Barrier Formation in PN Junction Diode, Drift and Diffusion Currents, Current flow mechanism in Forward and Reverse biased PN Junction Diodes mentioning the roles of drift and diffusion currents, V-I characteristics of PN Junction Diode, Static and Dynamic Resistance, Applications of PN Junction Diode as Half-wave rectifier, Full-wave Rectifier (both center-tapped and bridge FWR),Calculation of ripple factor and rectification efficiency, Zener Diode, Applications of Zener Diode as DC voltage Regulator, Principle and structure of (1) LEDs (2) Photodiode (3) Solar Cell.

UNIT-II

Semiconductor Transistors: Bipolar Junction transistors: n-p-n and p-n-p Transistors, Biasing of transistors in Active, Cutoff, and Saturation Modes, Circuit configurations of CB ,CE and CC transistors, characteristics of transistors in CB,CE and CC, Current gains α and β. Relations between α and β, Current gain and power gain, DC Load line and Q- point

UNIT-III

Amplifiers and Their Biasing: Voltage Divider Bias Circuit for CE Amplifier, bias stabilization, Class-A, B&C amplifiers, RC coupled amplifiers and its frequency response, Feedback in amplifiers, positive and negative feedback in amplifiers, Advantages of negative feedback in amplifiers,

Sinusoidal Oscillators: Barkhausen's Criterion for Self-sustained oscillations, Circuit and working of Hartley oscillator, Circuit and working of Colpit's oscillator, Uses of oscillator.

UNIT-IV

Operational Amplifiers (Black Box approach): Qualitative idea of differential amplifier, CMRR, Characteristics of an Ideal and Practical Op-Amp (IC 741), Open-loop& Closed-loop Gain. concept of Virtual ground, Applications of Op-Amps as Inverting Amplifier, Non-inverting Amplifier, Differentiator, Integrator.

Reference Books:

- Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mcgraw Hill.
- Electronic devices and circuits, S. Salivahanan and N. Suresh Kumar, 2012, Tata McGraw Hill.
- Microelectronic Circuits, M.H. Rashid, 2nd Edn., 2011, Cengage Learning.
- Modern Electronic Instrumentation & Measurement Tech., Helfrick & Cooper, 1990, PHI Learning
- Digital Principles & Applications, A.P. Malvino, D.P. Leach &Saha, 7th Ed.,2011, Tata McGraw Hill
- Fundamentals of Digital Circuits, A. Anand Kumar, 2nd Edition, 2009, PHI Learning Pvt. Ltd.
- OP-AMP and Linear Digital Circuits, R. A. Gayakwad, 2000, PHI Learning Pvt. Ltd.

CPP- 308

Practical -III; Physics Lab--III

Credits: 02, total 60 Hours (4hrs. per week)

Max. Marks: 100

Time: 3 Hours

Note:-

1. Do any Seven experiments.
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 the external practical examiners for Lab.Record marks. These external examiners may verify the record randomly.

List of Experiments

1. To measure the (a) area of a window (b) height of an inaccessible object by Sextent.
2. Refractive index and dispersive power of a prism material by spectrometer.
3. To draw a graph between wave length and minimum deviation for various lines from a Mercury discharge source.
4. Determination of wave length of Na light and the number of lines per centimeter using a diffraction grating.
5. To draw common base and common emitter characteristics of a transistor and calculate transistor characteristics parameters.
6. To study the ripple factor in a d.c. power supply.
7. Study of Hartley oscillator (calibration of gang condenser).
8. To measure (a) Voltage, and (b) Frequency of a periodic waveform using a CRO
9. To verify and design AND, OR, NOT and XOR gates using NAND gates

Extended list of experiments that may be added in above list (Experiments based on Computer programming in FORTRAN language.)

1. To print out all natural (even/odd) numbers between given limits using computer.
2. To find maximum, minimum and range of a given set of numbers using computer.
3. To evaluate sum of finite series.
4. Find the roots of a quadratic equation.

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.

CXL-401

Semester IV

CPL-402
Core Course-VII
Statistical Mechanics
(Credits – 02, 30 Hrs (2 Hrs/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 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, *The paper will include at least 20% of total marks as numerical problems.*

Course Objective	Course Outcome
The course on statistical mechanics deals with statistical description of macro system, density of states, concept of ensemble, partition function and kinetic theory of gases. The Maxwell-Boltzmann Distributions, Fermi-Dirac Distribution and Bose-Einstein distributions and their applications are given.	The student will be able to understand some basic notion of statistical mechanics including interpretation of second law of thermodynamics. Concept of negative temperature. Gibbs paradox.

UNIT-I

Statistical Basis of Thermodynamics: - Statistical Basis, Probability and Frequency, Permutations and Combinations, Distribution of n distinguishable and indistinguishable particles in two boxes, Macrostate and Microstate, Thermodynamic Probability, Fluctuations and their Dependence on n : (narrowing of probability distribution with increasing n), Constraints on a System, Static and dynamics system, most probable state, Concept of cell in a compartment, Concept of Ensembles and type of Ensembles (Qualitative Idea only)

Universal Law in Statistics: - Fundamental Postulates of Statistical Mechanics, Density of Quantum states of energy of a particle, Entropy and thermodynamics Probability, Statistical Interpretation of 2nd law of thermodynamics, Partition function and Relation with Thermodynamics Quantities

UNIT-II

Kinetic Theory of Gases: - Maxwell-Boltzmann Law of Distribution of Particle speed in an Ideal Gas and its Experimental Verification, Mean, RMS and Most Probable Speeds.

Molecular Collisions: - Mean Free Path. Collision Probability, Estimates of Mean Free Path, Transport Phenomenon in Ideal Gases: (1) Viscosity, (2) Thermal Conductivity (3) Diffusion. Brownian Motion and its Significance.

Equipartition Law: Degrees of Freedom, Law of Equipartition of Energy (No proof required) and its application to the specific heat of monoatomic and diatomic gases and its limitations.

UNIT-III

Classical Statistics: - Phase space and Application to One Dimension Harmonic Oscillator and Free particle, Division of phase space into cells, Basic approach in three statistics, Maxwell-Boltzmann Distribution Law, Thermodynamic Functions of Finite Number of Energy Levels, Negative Temperature, Thermodynamic Functions of an Ideal Gas, Classical Entropy Expression, Gibbs Paradox.

UNIT-IV

Bose-Einstein Statistics: - B.E. distribution law, Thermodynamic functions of a Completely Degenerate Bose Gas, Bose-Einstein condensation, properties of liquid He (qualitative description), Radiation as photon gas, Bose's derivation of Planck's law.

Fermi-Dirac Statistics: - Fermi-Dirac Distribution Law, Thermodynamic functions of an ideal Completely Degenerate, Fermi Gas, Fermi Energy, Electron gas in a Metal, Specific Heat of Metals, Comparison of three statistics M-B, B-E and F-D.

Suggested Books:

- Concepts in Thermal Physics, S. J. Blundell and K. M. Blundel, Oxford University Press
- Statistical Physics, Berkeley Physics Course Volume 5 by F Reif (Tata McGraw-Hill Company Ltd, 2008)
- Statistical and Thermal Physics: an introduction by S. Lokanathan and R.S. Gambhir. (P.H.I., 1991).
- Statistical Mechanics by R. K. Patharia. (Oxford: Butterworth, 1996).

CPL-403
Core Course-VIII
Waves and Optics
((Credits – 02, 30 Hrs (2 Hrs/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 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, The paper will include at least 20% of total marks as numerical problems.

Course Objective	Course Outcome
The course on Waves and Optics deals with the wave equation, Interference, diffraction and polarization.	The student will be able to understand concepts of transverse and longitudinal waves, Young have double slit experiment. Concept of refractive index, Zone plate, various types of diffraction. Basic idea of the light propagation through optical fibers.

UNIT 1

Wave Motion: Wave Equation, Solution of wave equation, Particle and Wave Velocities, Intensity of Wave, Superposition Principle, Group velocity, Phase velocity

Transverse Waves: The string as a force oscillator, Velocity of Transverse Vibrations of Stretched Strings, Reflections and transmission of waves on a string at a boundary, Transverse waves on a string, Travelling and standing waves on a string, Normal Modes of a string, Reflections and transmission of Energy.

Longitudinal Waves: Velocity of Longitudinal Waves in a Fluid in a Pipe, Newton's Formula for Velocity of Sound, Laplace's Correction (qualitative), Reflections and transmission of sound waves at a boundary, Energy distribution in sound waves.

UNIT II

Interference: Division of amplitude and division of wave front, Young's Double Slit experiment, Lloyd's Mirror and Fresnel's Biprism, Phase change on reflection: Stokes' treatment, Interference in Thin Films: parallel and wedge-shaped films, Newton's Rings: measurement of wavelength and refractive index.

UNIT III

Diffraction: Fresnel Diffraction: Fresnel's Assumptions, Fresnel's Half-Period Zones for Plane Wave, Rectilinear Propagation of Light, Theory of a Zone Plate and its application, Multiple Foci of a Zone Plate, Qualitative description for Fresnel diffraction pattern of a straight edge, a slit and a wire.

Fraunhofer diffraction: Single slit, Double slit multiple slits and 'n' multiple slits, Diffraction grating and it's resolving power, Rayleigh Criteria of the limit of resolution and Resolving Power of a telescope.

UNIT IV

Polarization: Plane polarized light – production and analysis, Circular and elliptical polarization, Optical activity, Specific Rotation

Fibre Optics: Optical Fibres - Construction and working, Critical angle of propagation, Modes of propagation, Acceptance angle, Attenuation. Advantages and applications of Optical Fibre

Reference Books

- Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
- Fundamentals of Optics, F.A. Jenkins and H.E. White, 1981, McGraw-Hill
- Principles of Optics, Max Born and Emil Wolf, 7thEdn., 1999, Pergamon Press.
- Optics, Ajoy Ghatak, 2008, Tata McGraw Hill
- The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
- The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.
- Fundamental of Optics, A. Kumar, H.R. Gulati and D.R. Khanna, 2011, R. Chand Publications

CPP- 408

Practical -IV; Physics Lab--IV

Credits: 02, total 60 Hours (4hrs. per week)

Max. Marks: 100

Time: 3 Hours

Note:-

1. Do any Seven experiments.
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 the external practical examiners for Lab.Record marks. These external examiners may verify the record randomly.

List of Experiments

1. Wave length by Newton's Rings
2. Resolving power of a telescope.
3. Comparison of Illuminating Powers by a Photometer.
4. To find the equivalent focal length of a lens system by nodal slide assembly
5. Study of series and parallel resonance circuits.
6. Electronic Voltmeter measurement of peak, average & R.M.S. value of signal.
7. Study of voltage doubler and trippler circuits.
8. To determine value of Boltzmann constant using V-I characteristic of PN diode.
9. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify λ2 – T Law.

Extended list of experiments that may be added in above list (Experiments based on Computer programming in FORTRAN language.)

1. To find integration of a definite integral by trapezoidal rule.
2. To find the area of a triangle, sphere and cylinder.
3. Given values for a, b, c and d and a set of values for the variable x evaluate the function defined by. f(x) = ax2 + bx + c if x < d f(x) = 0 if x = d f(x) = ax2 + bx - c if x> d For each value of x and print the value of x and f(x). Write a program for an arbitrary number of x values.

References:

1 Worsnop 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.

CPS-409

Skill Enhancement Course-I (Physics)

Electrical Circuits and Network Skills

((Credits – 02, 30 Hrs (2 Hrs/week))

Marks for Major test (External): 50

Time: 2 Hours

Note:-

1. *There are two UNITs and the paper is a mix of theory and practical/demonstration/project to understand the concepts of use of components and design of small circuits.*
2. *The students are required to design the circuits using bread boards and elementary electronic components.*
3. *Each student has to perform/ evolve a small project/device.*
   The teacher concerned will see the performance and conduct the Theory/Viva – voce of each student to find out how much concepts related to the theoretical and experimental part of the project, he/ she has understood. According to his/her performance marks will be recorded, in internal.

Course Objective	Course Outcome
The aim of this course is to enable the students to design and trouble shoots the electrical circuits, networks and applications through hands-on mode.	The student will be able to design the electrical and electronic circuits. This will enable the student to evolve small projects.

UNIT -I

Basic Electrical Components: Electronic components. Passive components. Resistors and their types. Color coding of resistors. Troubles in resistors. Capacitors and their types. Troubles in capacitors. Inductors and their types. Troubles in inductors. Internal resistance and impedance.Types of Electrical switches. “Single-pole Single-throw” (SPST) switch. “Single-pole Double-throw” (SPDT) switch. “Double-pole Double-throw” (DPDT) switch. Application of SPST , SPDT and DPDT switches.

Electrical Protection and Electrical Wiring: Relays. Fuses and disconnect switches. Circuit breakers. Overload devices. Ground-fault protection. Grounding and isolating. Construction and working of MCB & MCCB and their uses. Different types of conductors and cables. Basics of wiring - Star and delta connection. Voltage drop and losses across cables and conductors.. Insulation. Solid and stranded cable. Preparationofextensionboard.

UNIT-II

Electrical Energy Sources and Measurements: Real (practical) and ideal voltage source. Real (practical)current source. Conversion of voltage source into current source or vice-versa Maximum power transfer theorem. Thevenin theorem and norton’s theorem. Familiarization with multimeter. Voltmeter and ammeter. AC source -single phase and three phase alternating current sources. Measurement of energy consumption in AC circuits.

Digital Circuits: Difference between Analog and Digital Circuits, Binary Numbers, Decimal to Binary and Binary to Decimal Conversion, AND, OR and NOT Gates, Realization of AND, OR and NOT Gates using Diodes, resistances and Transistor, NAND and NOR Gates as Universal Gates, Realization of AND, OR and NOT Gates using NAND Gates only and NOR Gates only, XOR gates, XNOR Gates,De Morgan's Theorems, Boolean Laws.

Reference Books:

- A text book in Electrical Technology- B L Theraja – S Chand & Co.
- A text book of Electrical Technology - A K Theraja.

SEMESTER III & IV

B. SC. PHYSICAL SCIENCES

(GEOGRAPHY)

CGL - 302

Core Course – V

GEOGRAPHY OF INDIA

Credits: 02 Hrs (2 Hrs / 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 two marks. The remaining eight questions are to be set uniformly having two questions from each unit. The students is required to attempt five questions in all selecting one question from each unit and Question No. 1 is compulsory.

Unit-1

1. India: Location, Relief Structure and Drainage Systems.
2. Climate: Seasons of India, Theory of Indian Monsoon.
3. Classification and Distribution of Indian soils and Natural Vegetation.

Unit-II

4. Population: Distribution, Density, Growth, Composition and Migration.
5. Human Settlements: Classification of Urban and Rural Settlements.

Unit-III

6. Land use, Green Revolution and Problems of Indian Agriculture.
7. Regional Variation in Cropping Pattern: Rice, Wheat, Sugarcane, and Cotton.

Unit-IV

8. Energy and mineral resources: coal, petroleum, and Hydroelectricity, iron-ore and mica.
9. Industries – iron and steel and cotton textile and industrial regions.
10. Modes of transport and communication.

Reading List

1. Hussain M., 1992: G*eography of India*, Tata McGraw Hill Education.
2. Mamoria C. B., 1980: *Economic and Commercial* G*eography of India*, Shiva Lal Agarwala.
3. Miller F. P., Vandome A. F. and McBrewster J., 2009: *Geography of India: Indo- Gangetic Plain, Thar Desert, Major Rivers of India, Climate of India, Geology of India*, Alphascript Publishing.
4. Nag P. and Sengupta S., 1992: G*eography of India*, Concept Publishing.
5. Pichamuthu C. S., 1967: *Physical Geography of India*, National Book Trust.
6. Sharma T. C. and Coutinho O., 1997: *Economic and Commercial* G*eography of India*, Vikas Publishing.
7. Singh Gopal, 1976: *A* G*eography of India*, Atma Ram.
8. Spate O. H. K. and Learmonth A. T. A., 1967: *India and Pakistan: A General and Regional Geography*, Methuen.
9. Rana, Tejbir Singh, 2015, Diversity of India , R.K. Books, Delhi.

CGL - 303

Core Course – VI

REGIONAL PLANNING WITH SPECIAL REFERENCE TO HARYANA

Credits: 02 Hrs (2 Hrs / 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 two marks. The remaining eight questions are to be set uniformly having two questions from each unit. The students is required to attempt five questions in all selecting one question from each unit and Question No. 1 is compulsory.

Unit-1

1. Concept, Need and Types of regional planning.
2. Characteristics and Delineation of regional planning.
3. Regionalization of India for planning: Agro – ecological zones.

Unit-II

4. Models for Regional Planning: Growth Pole Theory, Core Periphery Model and Growth Foci Concept in Indian Context.
5. Success Story and failures of Regional Plans: Damodar Valley Corporation (DVC), Integrated Tribal Development programme (ITDP).

Unit-III

6. Physical and economic diversities in Haryana:

i). Relief, Climate, Drainage, Groundwater, Soils and Natural Vegetation.
ii). Cropping Pattern in Haryana.
iii). Industrial regions and means of transportation.

Unit-IV

7. Distribution, density and growth of population in Haryana.
8. Educational development, health facilities and gender issues (sex ratio) in Haryana.

Reading List

1. Blij H. J. De, 1971: *Geography: Regions and Concepts*, John Wiley and Sons.
2. Claval P.l, 1998: *An Introduction to Regional Geography*, Blackwell Publishers, Oxford and Massachusetts.
3. Friedmann J. and Alonso W. (1975): *Regional Policy - Readings in Theory and Applications*, MIT Press, Massachusetts.
4. Gore C. G., 1984: *Regions in Question: Space, Development Theory and Regional Policy*, Methuen, London.
5. Gore C. G., Köhler G., Reich U-P. and Ziesemer T., 1996: *Questioning Development; Essays on the Theory, Policies and Practice of Development Intervention*, Metropolis- Verlag, Marburg.
6. Haynes J., 2008: *Development Studies*, Polity Short Introduction Series.
7. Johnson E. A. J., 1970: *The Organization of Space in Developing Countries*, MIT Press, Massachusetts.
8. Peet R., 1999: *Theories of Development*, The Guilford Press, New York.
9. UNDP 2001-04: *Human Development Report,* Oxford University Press.
10. World Bank 2001-05: *World Development Report,* Oxford University Press, New

CGP – 308*

Practical – III; Geography Lab – III

(Credits: 02, 60 Hours (4 hrs. per week)

Maximum Marks:100

Time: 4 Hours

Note: Distribution of Marks is as under;

Exercise - 60

Record File - 20

Viva – voce - 20

1. 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 exercises/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.

2. 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 practical's will be entered. This record will be signed by the concerned teacher.
3. The laboratory Record register will be presented to the external practical examiners for Lab. Record marks. These external examiners may verify the record randomly.

Projection

1. Introduction to Map Projection: Meaning, Classification and importance; Characteristics of latitudes and longitudes lines.
2. Cylindrical projections: Characteristics, applications and drawing; (3 exercises)
   (i) Simple cylindrical projection
   (ii) Cylindrical equal area projection.
   (iii) True shape or orthomorphic or Mercator's Projection.

3. Conical Projections: Characteristics, applications and drawing. (5 exercises)
   (i) Simple conical projections with one standard parallel
   (ii) Simple conical projection with two standard parallel

(iii) Bonne's Projection

(iv) Polyconic Projection.

(v) International Map Projection.

4. Zenithal Projections: Characteristics, applications and drawing. (5 exercises)

(i) Polar Zenithal Equidistant Projection.

(ii) Polar Zenithal Equal Area Projection

(iii) Polar Zenithal Gnomonic Projection

(iv) Polar Zenithal Stereographic Projection.

(v) Polar Zenithal Orthographic Projection

5. Characteristics, applications and drawings. (2 exercises)

(i) Sinusoidal

(ii) Mollweide Projections.

6. Prismatic Compass Survey. (2 exercises)

Suggested Readings:-

1. Goyal K.K.1981.. Practical Geography, Manthan Publication, Rohtak.

2. Gregory S. 1963. Statistical Methods and the Geography, Longman, London.

3. Khan, A.A. 1996. Text Book of Practical Geography, Concept, New Delhi,.

4. Lawarence, GRP1968. Cartographic Methods, Methuen, London,.

5. Monkhouse, F.J. and Wilkinson, H.R1994. Maps and Diagrams, Methuen, London,

6. Pal. S.K. 1998: Statistics for Geoscientist- Techniques and Applications, Concept Publication, New Delhi,.

7. Sarkar, A.K 1997: Practical Geography-A Systematic Approach, Orient Longman, Calcutta,.

8. Singh, R.L. 1972. Elements of Practical Geography, Kalyani Pub., New Delhi

9. Steers, J.B. Map Projections; University of London Press, London.

CGL - 402

Core Course – VII

ENVIRONMENTAL GEOGRAPHY

Credits: 02 Hrs (2 Hrs / 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 two marks. The remaining eight questions are to be set uniformly having two questions from each unit. The students is required to attempt five questions in all selecting one question from each unit and Question No. 1 is compulsory.

Unit-I

1. Environmental Geography: Definition, Concepts and Scope.
2. Approaches to the study of environmental geography.

Unit- II

3. Ecosystem: Concept, Structure and functions.
4. Flow of energy; food chain and food web; trophic level.

Unit- III

5. Biomes and Habitat: Tropical rainforest biome, Grassland biomes and Desert biome.
6. Environmental Problems and Management: Climate change and Global warming.

Unit – IV

7. Environmental Programmes and Policies – Developed countries and Developing countries.
8. Global Environmental concerns: Stockholm conference, Earth summit and Kyoto protocol and after.

Reading List

1. Casper J.K. (2010) Changing Ecosystems: Effects of Global Warming. Infobase Pub. New York.
2. Hudson, T. (2011) Living with Earth: An Introduction to Environmental Geology, PHI Learning Private Limited, New Delhi.
3. Miller, G.T. (2007) Living in the Environment: Principles, Connections, and Solutions, Brooks/ Cole Cengage Learning, Belmont.
4. Singh, R.B. (1993) Environmental Geography, Heritage Publishers, New Delhi.
5. UNEP (2007) Global Environment Outlook: GEO4: Environment For Development, United Nations Environment Programme. University Press, Cambridge.
6. Wright R. T. and Boorse, D. F. (2010) Toward a Sustainable Future, PHI Learning Pvt Ltd, New Delhi.
7. Singh, R.B. and Hietala, R. (Eds.) (2014) Livelihood security in Northwestern Himalaya: Case studies from changing socio-economic environments in Himachal Pradesh, India. Advances in Geographical and Environmental Studies, Springer
8. Singh, Savindra 2001. *Paryavaran Bhugol*, Prayag Pustak Bhawan, Allahabad. (in Hindi)

CGL - 403

Core Course – VIII

GEOGRAPHY OF DISASTER

Credits: 02 Hrs (2 Hrs / 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 two marks. The remaining eight questions are to be set uniformly having two questions from each unit. The students is required to attempt five questions in all selecting one question from each unit and Question No. 1 is compulsory.

Unit - I

1. Hazards, Risk, Vulnerability and Disasters: Definition and Concepts.
2. Tectonic disasters: Earthquakes, Tsunamis and Volcanic eruption in India.

Unit – II

3. Hydrological disasters: Occurrence and impact of floods and droughts in India.
4. Climatic disasters: Tropical cyclones, Heavy Precipitation Events-Cloud Burst, Heat and cold waves.

Unit - III

5. Human induced disasters: Forest Fire, Road Accidents, Agricultural residual burning.
6. Mitigation and Preparedness for disasters, NDMA and NIDM: Indigenous Knowledge and Community – based disaster management. Do's and Don'ts During disaster.

Unit – IV

7. Post disaster Rehabilitation: Policies and Programmes.
8. Major Disaster in India: Bhopal Gas Tragedy, Bhuj Eartquake, Kashmir flood.

Reading List

1. Government of India. (1997) Vulnerability Atlas of India. New Delhi, Building Materials & Technology Promotion Council, Ministry of Urban Development, Government of India.

2. Kapur, A. (2010) Vulnerable India: A Geographical Study of Disasters, Sage Publication, New Delhi.

3. Modh, S. (2010) Managing Natural Disaster: Hydrological, Marine and Geological Disasters, Macmillan, Delhi.

4. Singh, R.B. (2005) Risk Assessment and Vulnerability Analysis, IGNOU, New Delhi. Chapter 1, 2 and 3

5. Singh, R. B. (ed.), (2006) Natural Hazards and Disaster Management: Vulnerability and Mitigation, Rawat Publications, New Delhi.

6. Sinha, A. (2001). Disaster Management: Lessons Drawn and Strategies for Future, New United Press, New Delhi.

7. Stoltman, J.P. et al. (2004) International Perspectives on Natural Disasters, Kluwer Academic Publications. Dordrecht.

8. Singh Jagbir (2007) "Disaster Management Future Challenges and Oppurtunities", 2007. Publisher- I.K. International Pvt. Ltd. S-25, Green Park Extension, Uphaar Cinema Market, New Delhi, India (www.ikbooks.com).

CGP – 408*

Practical – IV; Geography Lab – IV
(Credits: 02, 60 Hours (4 hrs. per week)

Maximum Marks: 100
Time: 4 Hours

Note: Distribution of Marks is as under;
Exercise - 60
Record File - 20
Viva – voce - 20

1. 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 exercises/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.
2. 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 practical's will be entered. This record will be signed by the concerned teacher.
3. The laboratory Record register will be presented to the external practical examiners for Lab. Record marks. These external examiners may verify the record randomly.

Remote Sensing and GPS based Project Report

1. Remote Sensing: Definition, Development, Platforms and Types.
2. Aerial Photography: Principles, Types and Geometry.
3. Satellite Remote Sensing: Principles, EMR Interaction with Atmosphere and Earth surface; Satellites (Land sat & IRS) and Sensors.
4. Interpretation and Application of Remote Sensing: Land use / Land Cover
5. Global Positioning System (GPS): Principles and Uses.

Practical Record: A Project file consisting of following exercises;

1. Demarcation of Principal Point, Conjugate Principal point and Flight line on Aerial Photographs – 3 Exercises.
2. Determination of Scale of Aerial Photographs – 3 Exercises.
3. Interpretation of Single Vertical Photographs – 1 Exercise.
4. Use of Stereoscope and Identification of Features – 1 Exercise.
5. Identification of Features (Different Topography) on IRSID, LISS III imagery (Mark copy of FCC) -3

Suggested Readings:-

1. John R. Jensen, Remote Sensing of the Environment; An Earth Resource Perspective, Pearson Education, (India Edition) New Delhi, 2009.
2. Lillesand and R.W. Kiefer, Remote Sensing and Image Interpretation, John Wiley and Sons, 1994.

SEMESTER III&IV

B. SC. PHYSICAL SCIENCES

(CHEMISTRY)

Semester III

CCL-304
CORE COURSE-V
PHYSICAL CHEMISTRY-II:
(SOLUTIONS, PHASE EQUILIBRIUM, CONDUCTANCE & ELECTROCHEMISTRY)
Credits: 02; 30 Hrs (2Hrs /week)

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

Note: *The examiner is requested to set nine questions in all, selecting two questions from each UNIT and one compulsory question (Question No.1 based on entire syllabus will consist of eight short answer type questions each of two marks). The candidate is required to attempt five questions in all selecting one from each UNIT and the compulsory Question No.1.*

UNIT-I

Solutions

Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions. Vapour pressure-composition and temperature composition curves of ideal and non-ideal solutions. Distillation of solutions.Azeotropes.Colligative properties of solutions.Thermodynamic derivations of relation between amount of solute and elevation in boiling point and depression in freezing point.

Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids. Immiscibility of liquids- Principle of steam distillation.

(8 Hours)

UNIT-II

Phase Equilibrium

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

(7 Hours)

UNIT-III

Conductance

Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes.Kohlrausch law of independent migration of ions.

Transference number, ionic mobility. Applications of conductance measurements: determination of degree of ionization of weak electrolyte, solubility and solubility products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt. Conductometric titrations (only acid-base).Concept of pH and pK_a, buffer solution, buffer action, Handerson Hazel Blac equation.

(7 Hours)

UNIT-IV

Electrochemistry

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

Calculation of equilibrium constant from EMF data. Concentration cells with transference and without transference. Liquid junction potential and salt bridge.pH determination using hydrogen electrode and quinhydrone electrode.
Potentiometric titrations -qualitative treatment (acid-base and oxidation-reduction only).

(8 Hours)

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-305
CORE COURSE-VI
ORGANIC CHEMISTRY-III*:*
(FUNCTIONAL GROUP ORGANIC CHEMISTRY-II)
Credits: 02; 30 Hrs (2Hrs /week)

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

Note: *The examiner is requested to set nine questions in all, selecting two questions from each UNIT and one compulsory question (Question No.1 based on entire syllabus will consist of eight short answer type questions each of two marks). The candidate is required to attempt five questions in all selecting one from each UNIT and the compulsory Question No.1.*

UNIT-I

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

Carboxylic acids and their derivatives

Carboxylic acids (aliphatic and aromatic)

Preparation: Acidic and Alkaline hydrolysis of esters.

Reactions: Hell-Vohlard-Zelinsky Reaction.

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

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

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

(7 Hours)

UNIT-II

Amines and Diazonium Salts

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

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

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

Diazonium salts: *Preparation:* from aromatic amines. *Reactions:* conversion to benzene, phenol, dyes.

(8 Hours)

UNIT-III

Amino Acids, Peptides and Proteins:

Preparation of Amino Acids: Strecker synthesis using Gabriel's phthalimide synthesis. Zwitterion, Isoelectric point and Electrophoresis.

Reactions of Amino acids: ester of –COOH group, acetylation of $–NH_2$ group, complexation with Cu^{2+} ions, ninhydrin test.

Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins.

Determination of Primary structure of Peptides by degradation Edmann degradation (N-terminal) and C–terminal (thiohydantoin and with carboxypeptidase enzyme).Synthesis of simple peptides (upto dipeptides) by N-protection (t-butyloxycarbonyl and phthaloyl) & C-activating groups and Merrifield solid-phase synthesis.

(8 Hours)

UNIT-IV

Carbohydrates:

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

(7 Hours)

Reference Books:

- Morrison, R. T. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Finar, I. L. *Organic Chemistry* (*Volume 1*), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Finar, I. L. *Organic Chemistry* (*Volume 2)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Nelson, D. L. & Cox, M. M. *Lehninger's Principles of Bioch*emistry *7th Ed.,* W. H. Freeman.
- Berg, J.M., Tymoczko, J.L. &Stryer, L. *Biochemistry*, W.H. Freeman, 2002. Kotz, J.C., Treichel, P.M. & Townsend, J.R. *General Chemistry*, Cengage Learning India Pvt. Ltd.: New Delhi (2009).
- Petrucci, R.H. *General Chemistry*, 5th Ed., Macmillan Publishing Co.: New York (1985).

CCP-309
PRACTICAL-III
CHEMISTRY LAB-III:
(SOLUTIONS, PHASE EQUILIBRIUM, CONDUCTANCE, ELECTROCHEMISTRY & FUNCTIONAL GROUP ORGANIC CHEMISTRY)
Credits: 02; 60 Hrs (4Hrs /week)

Marks (External): 100
Time: 6Hrs

Section A: Physical Chemistry

Solutions: Determination of molecular weight of non volatile solute by Rast Method.

Phase equilibria: i.Construction of the phase diagram of a binary system (simple eutectic) using cooling curves.

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

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

Conductance: i.Determination of cell constant

ii.Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.

iii.Perform the following conductometric titrations:

a. Strong acid vs. strong base

b. Weak acid vs. strong base

Potentiometry: Perform the following potentiometric titrations:

i. Strong acid vs. strong base

ii. Weak acid vs. strong base

iii. Potassium dichromate vs. Mohr's salt

Section B: Organic Chemistry

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

II. 1.Separation of amino acids by paper/thin layer chromatography.

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

3. Titration curve of glycine

4. Action of salivary amylase on starch

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

6. Differentiation between a reducing and a nonreducing sugar.

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).
- Ahluwalia, V.K. &Aggarwal, R. *Comprehensive Practical Organic Chemistry*, Universities Press.

Semester IV

CCL-404
CORE COURSE-VII
INORGANIC CHEMISTRY-II:
TRANSITION METALS & COORDINATION CHEMISTRY
Credits: 02; 30 Hrs (2Hrs /week)

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

Note: The examiner is requested to set nine questions in all, selecting two questions from each UNIT and one compulsory question (Question No.1 based on entire syllabus will consist of eight short answer type questions each of two marks). The candidate is required to attempt five questions in all selecting one from each UNIT and the compulsory Question No.1.

UNIT-I

Transition Elements (3d series)

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

(8 Hours)

UNIT-II

Lanthanoids and actinoids

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

(7 Hours)

UNIT-III

Coordination Chemistry

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

(7 Hours)

UNIT-IV

Crystal Field Theory

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

(8 Hours)

Reference Books:

- Cotton, F.A. & Wilkinson, G. *Basic Inorganic Chemistry,* Wiley.
- Shriver, D.F. & Atkins, P.W. *Inorganic Chemistry*, Oxford University Press.
- Wulfsberg, G. *Inorganic Chemistry,* Viva Books Pvt. Ltd.
- Rodgers, G.E. *Inorganic & Solid State Chemistry,* Cengage Learning India Ltd., 2008.

CCL-405
CORE COURSE-VIII
PHYSICAL CHEMISTRY-III:
STATES OF MATTER & CHEMICAL KINETICS
Credits: 02; 30 Hrs (2Hrs /week)

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

Note: The examiner is requested to set nine questions in all, selecting two questions from each UNIT and one compulsory question (Question No.1 based on entire syllabus will consist of eight short answer type questions each of two marks). The candidate is required to attempt five questions in all selecting one from each UNIT and the compulsory Question No.1.

UNIT-I

Kinetic Theory of Gases

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

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

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

Temperature dependence of these distributions.Most probable, average and root mean square velocities (no derivation). Collision cross section, collision number, collision frequency, collision diameter and mean free path of molecules.

(8 Hours)

UNIT-II

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

(7 Hours)

UNIT-III

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

(7 Hours)

UNIT-IV

Chemical Kinetics: The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates.Order and molecularity of a reaction.Derivation of integrated rate

equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants).Half–life of a reaction.General methods for determination of order of a reaction.Concept of activation energy and its calculation from Arrhenius equation.
Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).

(8 Hours)

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).

CCP-409
PRACTICAL-IV
CHEMISTRY LAB IV:
(TRANSITION METAL & COORDINATION CHEMISTRY, STATES OF MATTER & CHEMICAL KINETICS)
Credits: 02; 60 Hrs (4 Hrs /week)

Marks (External): 100
Time: 6Hrs

Section A: Inorganic Chemistry

Semi-micro qualitative analysis (using H_2S or other methods) of mixtures - not more than four ionic species (two anions and two cations, excluding insoluble and interfering salts) out of the following:
Cations : NH_4^+, Pb^{2+}, Bi^{3+}, Cu^{2+}, Cd^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, K^+
Anions : CO_3^{2-} , S^{2-}, SO_3^{2-}, $S_2O_3^{2-}$, NO_2^-, CH_3COO^-, Cl^-, Br^-, I^-, NO_3^-, SO_4^{2-}, PO_4^{3-}, BO_3^{3-}, $C_2O_4^{2-}$,
(Spot tests should be carried out wherever feasible)

1. Estimate the amount of nickel present in a given solution as bis(dimethylglyoximato)nickel (II) in a given solution gravimetrically.
2. Estimation of (i) Mg^{2+} or (ii) Zn^{2+} by complexometric titrations using EDTA.
3. Estimation of total hardness of a given sample of water by complexometric titration.

Section B: Physical Chemistry

I. Surface tension measurement (use of organic solvents excluded).
a. Determination of the surface tension of a liquid or a dilute solution using a stalagmometer.
b. Study of the variation of surface tension of a detergent solution with concentration.
II. Viscosity measurement (use of organic solvents excluded).
a. Determination of the viscosity of a liquid or dilute solution using an Ostwald's viscometer.
b. Study of the variation of viscosity of an aqueous solution with concentration of solute.
III. Chemical Kinetics
Study the kinetics of the following reactions by integrated rate method:
a. Acid hydrolysis of methyl acetate with hydrochloric acid.
b. Saponification of ethyl acetate.
c. Compare the strengths of HCl and H_2SO_4 by studying kinetics of hydrolysis of methyl acetate

Reference Books:

- Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
- Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.
- Khosla, B. D.; Garg, V. C. &Gulati, A. *Senior Practical Physical Chemistry,* R. Chand & Co.: New Delhi (2011).

SEMESTER III & IV

B. SC. PHYSICAL SCIENCES

(ELECTRONICS)

Semester III

CEL 304
Core Course V (Electronics)
Communication Electronics - 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.

UNIT-I (8 Hours)

Electronic communication:
Introduction to communication – means and modes. Need for modulation. Block diagram of an electronic communication system. Brief idea of frequency allocation for radio communication system in India (TRAI). Electromagnetic communication spectrum, band designations and usage. Channels and base-band signals. Concept of Noise, signal-to-noise (S/N) ratio.

UNIT-II (8 Hours)

Analog Modulation:
Amplitude Modulation, modulation index and frequency spectrum. Generation of AM (Emitter Modulation), Amplitude Demodulation (diode detector), Concept of Single side band generation and detection.

UNIT-III (7 Hours)

Analog Modulation:
Frequency Modulation (FM) and Phase Modulation (PM), modulation index and frequency spectrum, equivalence between FM and PM, Generation of FM using VCO, FM detector (slope detector), Qualitative idea of Super heterodyne receiver.

UNIT-IV (7 Hours)

Analog Pulse Modulation:

Channel capacity, Sampling theorem, Basic Principles- PAM, PWM, PPM modulation and detection technique for PAM only, Multiplexing.

Reference Books:

- Modern Digital and Analog Communication Systems, B.P. Lathi, 4th Edition, 2011,Oxford University Press.
- Electronic Communications, D. Roddy and J. Coolen, Pearson Education India.
- Advanced Electronics Communication Systems- Tomasi, 6th edition, Prentice Hall.
- Principles of Electronic communication systems – Frenzel, 3rd edition, McGraw Hill
- Communication Systems, S. Haykin, 2006, Wiley India
- Electronic Communication system, Blake, Cengage, 5th edition.
- Wireless communications, Andrea Goldsmith, 2015, Cambridge University Press

CEL 305
Core Course VI (Electronics)
Microprocessor
(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 **(8 Hours)**

Microcomputer Organization:
Input/Output Devices. Data storage (idea of RAM and ROM). Computer memory. Memory organization & addressing. Memory Interfacing. Memory Map.

UNIT-II **(6 Hours)**

8085 Microprocessor Architecture:

Main features of 8085. Block diagram. Pin-out diagram of 8085. Data and address buses. Registers. ALU. Stack memory. Program counter. Hardware and software interrupts.

UNIT-III **(8 Hours)**

8085 Programming :

Instruction classification, Instructions set (Data transfer including stacks. Arithmetic, logical, branch, and control instructions). Subroutines, delay loops. Timing & Control circuitry. Timing states. Instruction cycle, Timing diagram of MOV and MVI.

UNIT-IV **(7 Hours)**

Introduction to embedded system:
Embedded systems and general purpose computer systems. Architecture of embedded system. Classifications, applications and purpose of embedded systems.

Reference Books:

- Microprocessor Architecture Programming & applications with 8085, 2002, R.S.Goankar, Prentice Hall.
- Microprocessor and Microcontrollers, N. Senthil Kumar, 2010, Oxford University Press
- Advanced Microprocessors and Interfacing : Badri Ram; TMH
- Introduction to embedded system, K.V. Shibu, 1st edition, 2009, McGraw Hill
- Embedded Systems: Architecture, Programming & Design, Raj Kamal, 2008, Tata McGraw Hill
- The 8051 Microcontroller and Embedded Systems Using Assembly and C, M.A. Mazidi, J.G. Mazidi, and R.D. McKinlay, 2nd Ed., 2007, Pearson Education India.

CEP 309
Practical III (Electronics)
Communication Electronics LAB
(Credits: 02; 60 Hrs (4Hrs /week)

Marks: 100
Time: 4 Hours

At least 8 experiments are to be performed including at least 6 experiments from following:

1. To design an Amplitude Modulator using Transistor.
2. To study envelope detector for demodulation of AM signal
3. To study FM Generator and Detector circuit
4. To study AM Transmitter and Receiver
5. To study FM Transmitter and Receiver
6. To study Time Division Multiplexing (TDM)
7. To study Pulse Amplitude Modulation (PAM)
8. To study Pulse Width Modulation (PWM)
9. To study Pulse Position Modulation (PPM)
10. To study Pulse Code Modulation (PCM)

Semester IV

CEL 404
Core Course-VII (Electronics)
Communication Electronics - 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.

UNIT-I (8 Hours)

Digital Pulse Modulation:
Need for digital transmission, Pulse Code Modulation, Digital Carrier Modulation Techniques, Sampling, Quantization and Encoding. Concept of Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), and Binary Phase Shift Keying (BPSK).

UNIT-II (8 Hours)

Introduction to Communication and Navigation systems:
Satellite Communication– Introduction, need, Geosynchronous satellite orbits, geostationary satellite, advantages of geostationary satellites. Satellite visibility, transponders (C - Band), path loss, ground station, simplified block diagram of earth station. Uplink and downlink. GPS navigation system (qualitative idea only)

UNIT-III (7 Hours)

Mobile Telephony System:
Basic concept of mobile communication, frequency bands used in mobile communication, concept of cell sectoring and cell splitting, SIM number, IMEI number, need for data encryption

UNIT-IV (7 Hours)

Mobile Telephony System:
Architecture (block diagram) of mobile communication network, idea of GSM, CDMA, TDMA and FDMA technologies, simplified block diagram of mobile phone handset, 2G, 3G and 4G concepts (qualitative only).

Reference Books:

- Modern Digital and Analog Communication Systems, B.P. Lathi, 4th Edition, 2011,Oxford University Press.
- Electronic Communications, D. Roddy and J. Coolen, Pearson Education India.
- Advanced Electronics Communication Systems- Tomasi, 6th edition, Prentice Hall.
- Principles of Electronic communication systems – Frenzel, 3rd edition, McGraw Hill
- Communication Systems, S. Haykin, 2006, Wiley India
- Electronic Communication system, Blake, Cengage, 5th edition.
- Wireless communications, Andrea Goldsmith, 2015, Cambridge University Press

CEL 405
Core Course-VIII (Electronics)
Microcontroller
(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 (8 Hours)

8051 microcontroller:
Introduction and block diagram of 8051 microcontroller, architecture of 8051, overview of 8051 family, 8051 assembly language programming, Program Counter and ROM memory map, Data types and directives, Flag bits and Program Status Word (PSW) register, Jump, loop and call instructions.

UNIT-II (7 Hours)

8051 I/O port programming:
Introduction of I/O port programming, pin out diagram of 8051 microcontroller, I/O port pins description & their functions, I/O port programming in 8051 (using assembly language), I/O programming: Bit manipulation.

UNIT-III (8 Hours)

8051 Programming:
8051 addressing modes and accessing memory locations using various addressing modes, assembly language instructions using each addressing mode, arithmetic and logic instructions

UNIT-IV (7 Hours)

8051 Programming:
8051 programming in C: for time delay & I/O operations and manipulation, for arithmetic and logic operations, for ASCII and BCD conversions.

Reference Books:

- The 8051 Microcontroller and Embedded Systems Using Assembly and C, M.A. Mazidi, J.G. Mazidi, and R.D. McKinlay, 2nd Ed., 2007, Pearson Education India.
- Microprocessor and Microcontrollers, N. Senthil Kumar, 2010, Oxford University Press
- 8051 microcontrollers, Satish Shah, 2010, Oxford University Press.
- Introduction to embedded system, K.V. Shibu, 1st edition, 2009, McGraw Hill
- Embedded Systems: Architecture, Programming & Design, Raj Kamal, 2008, Tata McGraw Hill
- Embedded Systems: Design & applications, S.F. Barrett, 2008, Pearson Education India
- Embedded Microcomputer systems: Real time interfacing, J.W. Valvano 2011, Cengage Learning

CEP 409

Practical -IV (Electronics)

Microprocessor and Microcontroller Lab

(Credits: 02; 60 Hrs (4Hrs /week)

Marks: 100

Time: 4 Hours

At least 8 experiments are to be performed including at least 6 experiments from following:

Section-A: Programs using 8085 Microprocessor

1. Addition and subtraction of numbers using direct addressing mode
2. Addition and subtraction of numbers using indirect addressing mode
3. Multiplication by repeated addition.
4. Division by repeated subtraction.
5. Handling of 16-bit Numbers.
6. Use of CALL and RETURN Instruction.
7. Block data handling.
8. Other programs (e.g. Parity Check, using interrupts, etc.).

Section-B: Experiments using 8051 microcontroller:

1. To find that the given numbers is prime or not.
2. To find the factorial of a number.
3. Write a program to make the two numbers equal by increasing the smallest number and decreasing the largest number.
4. Use one of the four ports of 8051 for O/P interfaced to eight LED's. Simulate binary counter (8 bit) on LED's .
5. Program to glow the first four LEDs then next four using TIMER application.
6. Program to rotate the contents of the accumulator first right and then left.
7. Program to run a countdown from 9-0 in the seven segment LED display.
8. To interface seven segment LED display with 8051 microcontroller and display 'HELP' in the seven segment LED display.
9. To toggle '1234' as '1324' in the seven segment LED display.
10. Interface stepper motor with 8051 and write a program to move the motor through a given angle in clock wise or counter clockwise direction.
11. Application of embedded systems: Temperature measurement & display on LCD

SEMESTER III & IV

B. SC. PHYSICAL SCIENCES

(MATHEMATICS)

CML 306: Advanced Calculus

Marks (Theory): 80 **Marks(Total) : 100**
Marks (Internal Assessment) : 20 **Time : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

Continuity, Sequential Continuity, properties of continuous functions, Uniform continuity, chain rule of differentiability. Mean value theorems; Rolle's Theorem and Lagrange's mean value theorem and their geometrical interpretations. Taylor's Theorem with various forms of remainders, Darboux intermediate value theorem for derivatives, Indeterminate forms.

Section – II

Limit and continuity of real valued functions of two variables. Partial differentiation. Total Differentials; Composite functions & implicit functions. Change of variables. Homogenous functions & Euler's theorem on homogeneous functions. Taylor's theorem for functions of two variables.

Section – III

Differentiability of real valued functions of two variables. Schwarz and Young's theorems. Implicit function theorem. Maxima, Minima and saddle points of two variables. Lagrange's method of multipliers.

Section – IV

Jacobians, Beta and Gama functions, Double and Triple integrals, Dirichlets integrals, change of order of integration in double integrals.

Books Recommended:

1. Gabriel Klaumber, Mathematical analysis, Marcel Dekkar, Inc., New York, 1975
2. R.R. Goldberg , Real Analysis, Oxford & I.B.H. Publishing Co., New Delhi, 1970
3. Gorakh Prasad, Differential Calculus, Pothishala Pvt. Ltd., Allahabad
4. S.C. Malik , Mathematical Analysis, Wiley Eastern Ltd., Allahabad.
5. Shanti Narayan, A Course in Mathemtical Analysis, S.Chand and company, New Delhi
6. Murray, R. Spiegel, Theory and Problems of Advanced Calculus, Schaum Publishing co., New York

CML 307: Numerical Analysis

Marks (Theory): 80 **Marks (Total): 100**
Marks (Internal Assessment): 20 **Time: 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

Finite Difference operators and their relations, difference table, finding the missing terms and effect of error in a difference tabular values, Interpolation with equal intervals: derivations of Newton's forward and Newton's backward interpolation formulae and their applications, Interpolation with unequal intervals: derivations of Newton's divided difference & Lagrange's Interpolation formulae and their applications.

Section – II

Central Difference interpolation formulae: derivations of Gauss's forward and Gauss's backward interpolation formulae, Sterling,Bessel formulae and their applications. Numerical Differentiation: Relation between difference operator and derivative operator, Derivative of a function using interpolation formulae (as studied in Sections – I & II). Numerical Integration: Newton-Cote's Quadrature formula, Trapezoidal rule, Simpson's one- third rule and Simpson's three-eighth rule, Chebychev formula, Gauss Quadrature formula.

Section – III

Solution of Algebraic and Transcendental equations: Bisection method, Regula-Falsi method, Secant method, Newton-Raphson's method, Newton's iterative method for finding pth root of a number. Simultaneous linear algebraic equations: Gauss-elimination method, Gauss-Jordan method, Triangularization method (LU decomposition method). Iterative method, Jacobi's method, Gauss-Seidal's method, Relaxation method.

Section – IV

Eigen Value Problems: Power method, Jacobi's method, Given's method, House-Holder's method. Numerical solution of ordinary differential equations: Single step methods-Picard's method. Taylor's series method, Euler's method, Modified Euler's method, Runge-Kutta Methods. Multiple step methods; Predictor-corrector method, Milne-Simpson's method

Books Recommended:

1. Babu Ram, Numerical Methods: Pearson Publication.
2. R.S. Gupta, Elements of Numerical Analysis, Macmillan's India 2010.

3. M. K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Method, Problems and Solutions, New Age International (P) Ltd., 1996.
4. M. K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Method for Scientific and Engineering Computation, New Age International (P) Ltd., 1999
5. C. E. Froberg, Introduction to Numerical Analysis (2nd Edition).
6. Melvin J. Maaron, Numerical Analysis-A Practical Approach, Macmillan Publishing Co., Inc., New York
7. R.Y. Rubnistein, Simulation and the Monte Carlo Methods, John Wiley, 1981

CMP 310: Mathematics Lab-III

Marks (Total): 100
Time: 3 Hrs

Write down and execute the following programs using C-Programming Language

1. To interpolate the data using Newton's forward interpolation formula
2. To interpolate the data using Newton's backward interpolation formula
3. To interpolate the data using Gauss's forward interpolation formula
4. To interpolate the data using Gauss's backward interpolation formula
5. To interpolate the data using Lagrange's interpolation formula
6. To find the roots of algebraic and transcendental equations using Bisection method.
7. To find the roots of algebraic and transcendental equations using Regula-Falsi method.
8. To find the roots of algebraic and transcendental equations using Secant method.
9. To find the roots of algebraic and transcendental equations using Newton-Raphson's method.
10. To solve the system of linear equations using Gauss -elimination method.
11. To solve the system of linear equations using Gauss -Seidal iteration method.
12. To solve the system of linear equation using Gauss –jordan method.
13. To find the largest eigen value of a matrix by Power -method.
14. To integrate numerically using Trapezoidal rule.
15. To integrate numerically using Simpson's one- third rule.
16. To integrate numerically using Simpson's three-eighth rule.
17. To find numerical solution of ordinary differential equations by Euler's method/ Modified Euler's method.
18. To find numerical solution of ordinary differential equations by Runge -Kutta method.

BOOKS SUGGESTED:

1. Applied Numerical Analysis by Curtis F. Gerald and Patrick G. Wheatley – Pearson Education Ltd.
2. Numerical Methods: E. Balagurusamy, T.M.H.

CML 406: Partial Differential Equations & Special Functions

Marks (Theory): 80 **Marks(Total) : 100**
Marks (Internal Assessment) : 20 **Time : 3Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

Partial differential equations: Formation, order and degree, Linear and Non-Linear Partial differential equations of the first order: Complete solution, singular solution, General solution, Solution of Lagrange's linear equations, Charpit's general method of solution. Compatible systems of first order equations, Jacobi's method.

Section – II

Linear partial differential equations of second and higher orders, Linear and non-linear homogeneous and non-homogeneous equations with constant coefficients, Partial differential equation with variable coefficients reducible to equations with constant coefficients, their complimentary functions and particular integrals, Equations reducible to linear equations with constant coefficients. Method of separation of variables: Solution of Laplace's equation, Wave equation (one and two dimensions), Diffusion (Heat) equation (one and two dimension) in Cartesian Co-ordinate system.

Section – III

Classification of linear partial differential equations of second order, hyperbolic, parabolic and elliptic types, Reduction of second order linear partial differential equations to Canonical (Normal) forms and their solutions, Solution of linear hyperbolic equations, Monge's method for partial differential equations of second order, Cauchy's problem for second order partial differential equations, Characteristic equations and characteristic curves of second order partial differential equation.

Section – IV

Series solution of differential equations – Power series method. Bessel equation and its solution: Bessel functions and their properties-Convergence, recurrence, Relations and generating functions, Orthogonality of Bessel functions. Legendre differential equation and its solution: Legendre function and its properties-Recurrence Relations and generating functions. Orthogonality of Legendre polynomial. Rodrigues' Formula for Legendre Polynomial.

Books Recommended:

1. D.A. Murray, Introductory Course on Differential Equations, Orient Longman, (India), 1967
2. Erwin Kreyszing, Advanced Engineering Mathematics, John Wiley & Sons, Inc., New York, 1999
3. A.R. Forsyth, A Treatise on Differential Equations, Macmillan and Co. Ltd.

4. Ian N. Sneddon, Elements of Partial Differential Equations, McGraw Hill Book Company, 1988
5. Frank Ayres, Theory and Problems of Differential Equations, McGraw Hill Book Company, 1972
6. J.N. Sharma and Kehar Singh, Partial Differential Equations
7. W.W. Bell, Special Functions for Scientists and Engineers.

CML-407 Mechanics-I

Theory: 80 **Marks (Total): 100**
Marks (Internal Assessment): 20 **Time: 3 Hrs**

Note:Attempt five questions in all. The question paper will consist of four sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. Each of the four sections **(I-IV)** will contain two questions and the students are required to attempt one question from each section. All questions carry equal marks.

Section -I

Forces in two dimension (co-planner), triangle law and polygon law of forces, Lami's theorem, resultant of concurrent and coplanar forces, conditions of equilibrium of concurrent forces. Parallel forces: like parallel and unequal unlike parallel forces, resultant and centre of parallel forces; Moments and Couples.

Section -II

Forces in three dimensions, Poinsot'scentral axis, conditions for the reduction of a general system of forces in space to a single force, equations of central axis, Wrenches: Definition and basic laws, resultant wrench of two wrenches, locus of the central axis of two wrenches; Null lines and null planes.

Section –III

Velocity and acceleration along a plane curve, component of velocity and acceleration in radial, transverse, tangential and normal directions, Relative velocity and acceleration.Simple harmonic motion (SHM).

Section- IV

Newton's laws of motion, Central Orbits, differential equations of Central Orbits in polar form and in pedal form, areal velocity, elliptic, hyperbolic and parabolic orbit, velocity in a circle, apse and apsidal distances: definition and laws, velocity from infinity, Kepler's laws of planetary motion, equivalence of Kepler's laws of planetary motion and Newton's law of gravitation, motion under the inverse square law.

Books Recommended:

1. S.L. Loney : Statics, Macmillan Company, London.
2. R.S. Verma: A Text Book on Statics, Pothishala Pvt. Ltd., Allahabad.
3. S.L. Loney, An Elementary Treatise on the Dynamics of a Particle and a Rigid Bodies, Cambridge University Press, 1956
4. F. Chorlton, Dynamics, CBS Publishers, New Delhi.
5. A.S. Ramsey, Dynamics Part-1&2, CBS Publisher & Distributors.

SEMESTER V & VI

B. SC. PHYSICAL SCIENCES

(PHYSICS)

CPL-501
Discipline Specific Course-I
Elements of Modern Physics
(Credits – 02, 30 Hrs (2 Hrs/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 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, The paper will include at least 20% of total marks as numerical problems.

Course Objective	Course Outcome
The course on Elements of Modern Physics deals with Bohr Model, Fundamentals of Wave Mechanics, Heisenberg uncertainty principle, Schrodinger Equation and LASER.	The student will be able to understand Photo-electric effect and Compton scattering, calculation of energy levels for Hydrogen like atoms, Principle and working of LASER systems.

UNIT-I

Introduction to Quantisation: Properties of Thermal Radiation, Spectral Distribution of Blackbody Radiation, Kirchhoff's Law, Stefan-Boltzmann Law and Wien's Distribution and Displacement law, Rayleigh-Jean's Law, Ultraviolet Catastrophe, Planck's Quantum Postulates, Planck's Law of Blackbody Radiation: Experimental Verification.

Photo-electric effect and Compton scattering; Pair production and annihilation, Bremsstrahlung effect, Cherenkov radiation, Production of X-rays.

UNIT-II

Bohr Model: Drawbacks of Rutherford model, Bohr atomic model; Bohr's quantization rule and atomic stability; Calculation of energy levels for hydrogen like atoms and their spectra, Effect of nuclear mass on spectra, Correspondence principle.

Fundamentals of Wave Mechanics: De Broglie wavelength and matter waves; Wave-particle duality; Frank-Hertz, Davison and Germer experiment, phase velocity, group velocity and their relations.

UNIT-III

Heisenberg Uncertainty Principle; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle, Properties of wave-function, Physical Interpretation of wave-function.

Schrodinger Equation: Momentum and Energy operators, Stationary states, Physical interpretation of a wave function, probabilities and normalization, Schrodinger Equation, Particle in1-dimention infinite potential well.

UNIT – IV

LASER: Absorption and emission of radiation (qualitative only); Basic features of LASER, Population inversion; Resonance cavity; laser pumping; threshold condition for laser emission; Einstein's Co-efficient, 3 level and 4 level system, Basic principle and working of He-Ne LASER and Ruby LASER, Applications of LASER.

Reference Books:

- Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill.
- Modern Physics, John R. Taylor, Chris D. Zafiratos, Michael A. Dubson,2009, PHI Learning.
- Quantum Physics, Berkeley Physics Course Vol.4. E.H. Wichman, 2008, Tata McGraw-Hill Co.
- Modern Physics, R.A. Serway, C.J. Moses, and C.A. Moyer, 2005, Cengage Learning.

CPL-502

Discipline Specific Course-II
Nuclear Physics
(Credits – 02, 30 Hrs (2 Hrs/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 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, The paper will include at least 20% of total marks as numerical problems.

Course Objective	Course Outcome
The course on Nuclear Physics deals with Basic Properties of Nuclei Radioactivity, Nuclear Models and nuclear forces, Radiation Interaction, Nuclear Reactions, Nuclear Radiation Detector and Nuclear Reactors.	The student will be able to understand Nuclear composition and nuclear properties, Nuclear models, Nuclear detectors and reactors.

UNIT-1

Basic Properties of Nuclei: Nuclear composition (p-e and p-n hypotheses), Nuclear properties; Nuclear mass, size, spin, parity, magnetic dipole moment, quadruple moment (shape concept) and binding energy, nuclear binding energy curve.

Radioactivity: Law of Radioactive Decay, Half-life, Radioactive Series, α-decay: Range of α-particles, Geiger-Nuttal law and α-particle Spectra, β-decay, Energy Spectra and Neutrino Hypothesis, γ-decay : Origin of γ-rays.

UNIT-II

Nuclear Models and Nuclear Forces: Similarity between nuclear matter and liquid drop, Liquid Drop Model, Semi-classical Mass formula, Limitations of liquid drop model, Magic number, Experimental signature of shell structure in nuclei, Nuclear Shell Model (qualitative only) and its application, Meson Theory of Nuclear Forces.

UNIT -III

Radiation Interaction: Interaction of heavy charged particles (proton, Alpha particles etc.); Energy loss of heavy charged particle (Discussion of Bethe formula), Range of alpha particles. Interaction of light charged particle (Beta-particle), Interaction of Gamma Ray; Passage of Gamma radiations through matter (Photoelectric, Compton and pair production effect), Absorption of Gamma rays (Mass attenuation coefficient),

Nuclear Reactions: Types of nuclear reactions, Concept of reaction cross-section, Concept of Compound and Direct Reactions.

UNIT- IV

Nuclear Radiation Detectors: Gas filled counters; Ionization chamber, proportional counter, G.M. Counter (detailed study), Basic principle of scintillation counter and semiconductor detectors.

Nuclear Reactors: General aspects of reactor design, Nuclear fission reactor (Principle, construction, working and use) **Particle Accelerators:** Particle Accelerator facilities in India, Linear Accelerator, Cyclotron, Synchrotron

References:

- Concepts of Modern Physics by Arthur Beiser (McGraw-Hill Book Company, 1987)
- Nuclear Physics, S. B. Patel, New Age publication
- Introduction to the physics of nuclei and particles by R.A. Dunlap.(Singapore: Thomson Asia, 2004).
- Nuclear physics by Irving Kaplan. (Oxford & IBH, 1962).
- Introductory nuclear physics by Kenneth S. Krane.(John Wiley & Sons, 1988).

CPP- 508

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

Max marks: 100
Examination Time: 3 Hours

Note:

1. *Each student should perform any seven experiments.*
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:-*
   i. *Each student has to perform a minimum number of experiments prescribed in the syllabus.*
   ii. *After completion of experiment, the teacher will check the note book and conduct Viva – voce of each student to find out how much theoretical and experimental concept the student has understood. Lab. record will be maintained by giving marks on his practical note-book.*
4. *To compute total marks for lab. performance, a separate register will be maintained. Each student will be assigned separate page on this register. Marks obtained by the student in different experiements will be entered. This record will be signed by the concerned teacher.*
5. *The laboratory 'record register' will be presented to each external examiner for Lab. Record marks. External examiners may verify the record randomly.*

List of Experiments

1. Determine e/m by Thomson's method
2. Study the frequency response of C B transistor amplifier
3. To determine Hall coefficient of a semiconductor sample.
4. Measurement of energy band gap of Ge/Si by four probe method
5. (a) Draw the plateau using G M counter (b) Determine the mass attenuation coefficient by G M counter
6. Determine the wavelength of Na by Fresnel Byprism
7. Diameter of a Lycopodium powder using corona rings
8. Study double slit interference by He-Ne laser
9. Determine the diameter of a thin wire using (He-Ne Laser) diffraction method

Extended list of experiments that may be added in above list (Experiments based on Computer programming in FORTRAN language.)

1. Compute the product of two matrices of different dimension using DO loop
2. Numerical integration by Simpson 1/3 rule
3. Fitting of a straight line using Least-Square method

References:

1 Worsnop 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.

CPL- 601
Discipline Specific Course-III
Solid State Physics
(Credits – 02, 30 Hrs (2 Hrs/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 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, The paper will include at least 20% of total marks as numerical problems.

Course Objective	Course Outcome
The course on Solid State Physics deals with some important concepts of crystal structure, lattice vibrations, band theory, magnetic properties of matter and superconductivity.	The student will be able to understand the concept of crystal planes and Miller indices, Phonon, Curie law, Applications of Superconductivity.

UNIT-I

Crystal Structure I: Crystalline and glassy forms, liquid crystals, crystal structure, periodicity, lattice and basis, crystal translational vectors and axes. Unit cell and Primitive Cell, Winger Seitz primitive Cell, symmetry operations for a two dimensional crystal, Bravais lattices in two and three dimensions. Crystal planes and Miller indices, Inter-planer spacing, Crystal structures of Zinc Sulphide, Silicon, Sodium Chloride and Diamond.

UNIT- II

Crystal Structure II: X-ray diffraction, Bragg's Law and experimental X-ray diffraction methods. K-space and reciprocal lattice and its physical significance, reciprocal lattice vectors, reciprocal lattice to a simple cubic lattice, b.c.c. and f.c.c.

Lattice vibrations: Phonon concept, Vibration of monoatomic and diatomic lattice, Acoustical and optical modes, Dispersion relation for phonons, Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids, Debye T^3 law.

UNIT- III

Band Theory: Free electron gas models, Nearly free electron model, Bloch function, Kronig Penny model, Velocity and Effective mass of electron, Distinction between metals, semiconductors and insulators, Hall Effect

Magnetic Properties of Matter: Dia-, Para-, Ferromagnetic Materials, Classical Langevin Theory of dia - and Paramagnetic Domains, Curie's law.

UNIT- IV

Super Conductivity: Historical introduction, Survey of superconductivity, Super conducting systems, High T_c Super conductors, Isotopic Effect, Critical Magnetic Field, Meissner Effect, London Theory and Penetration Depth, Classification of Superconductors (type I and Type II), BCS Theory of Superconductivity, Flux quantization, Josephson Effect (AC and DC), Practical Applications of superconductivity and their limitations.

Reference Books:

- Solid State Physics, M.A. Wahab, Narosa Publication
- Solid state physics, S.O. Pillai, New Age Publication
- Introduction to Solid State Physics, Charles Kittel, 8th Edition, 2004, Wiley India Pvt. Ltd.
- Elements of Solid State Physics, J.P. Srivastava, 4th Edition, 2015, Prentice-Hall of India

CPL-602
Discipline Specific Course-IV
Quantum Mechanics
(Credits – 02, 30 Hrs (2 Hrs/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 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, The paper will include at least 20% of total marks as numerical problems.

Course Objective	Course Outcome
The course on Quantum Mechanics deals with applications of Schrodinger equation, spectroscopic terms and Rotational and vibrational spectra of diatomic molecules	The student will be able to understand basic concepts of Quantum Mechanics, one dimentional Harmonic Oscillator problem,Coupling Schemes, Rotational and vibrational spectra of diatomic molecules.

UNIT -1

Basics of Quantum Mechanics: Wave function and its physical significance, Properties of wave-function, Orthogonality and Normalization of wave function**,** Time dependent Schrodinger wave equation, Time Independent Schrodinger Equation, Momentum and Energy operators; Hermitian Operators- Eigenvalue and Eigen functions, Commutator relations of various operators, Stationary states; Probabilities and normalization, Probability current densities and its relation to wavefunction, Expectation Values of Dynamical quantities, Particle in 1-dimention Infinite Square Well (Energy levels and general Wavefunction)

UNIT-2

Application of Schrodinger Wave Equation: Solution of Schrodinger Equation for the Finite Potential Well, 1-Dimention Harmonic Oscillator problem - Algebraic and Analytical solutions, Free particle and concept of group velocity, Tunneling through finite potential barrier - Examples of alpha decay and tunnel diodes (qualitative only), Generalized uncertainty principles for Position-Momentum and Energ

UNIT-3

Larmor's precession, Spectroscopic terms and their notation, Selection rule, Orbital magnetic dipole moment (Bohr magneton), Coupling scheme; LS or Russel-Saunders Coupling scheme and JJ coupling scheme, Pauli principal, Hyperfine structure of spectral lines and its origin, isotopic effect, Atom in external magnetic field; Normal Zeeman effect

UNIT-4

Rotational spectra of diatomic molecules as rigid rotator, energy levels, Rotational spectra of diatomic molecules as non-rigid rotator, Intensity of rotational lines, Vibrational spectra, Vibrational-Rotational, Raman and electronic spectra of molecules: Vibrational energy of diatomic molecules, Molecules as Harmonic Oscillator

Reference:

- Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill
- Quantum Mechanics, D.J. Griffith, Pearson Ltd.
- Quantum Mechanics, V. K. Jain
- Quantum Physics, Berkeley Physics Course Vol.4. E.H. Wichman, 2008, Tata McGraw-Hill Co.

CPP- 608

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

Max. Marks: 100
Examination Time: 3 Hours

Note:

1. *Each student should perform any seven experiments.*
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:-*
   iii. *Each student has to perform a minimum number of experiments prescribed in the syllabus.*
   iv. *After completion of experiment, the teacher will check the note book and conduct Viva – voce of each student to find out how much theoretical and experimental concept the student has understood. Lab. record will be maintained by giving marks on his practical note-book.*
4. *To compute total marks for lab. performance, a separate register will be maintained. Each student will be assigned separate page on this register. Marks obtained by the student in different experiements will be entered. This record will be signed by the concerned teacher.*
5. *The laboratory 'record register' will be presented to each external examiner for Lab. Record marks. External examiners may verify the record randomly.*

List of Experiments

1. Study the frequency response of C E transistor amplifier
2. Study the B H curve using oscilloscope
3. Experiments based on application of OPAMP
4. Determine the velocity of ultrasonic in the Kerosene oil
5. Photo electric effect:
   I. Photo current *vs* Intensity.
   II. Energy of photo electron *vs* frequency of light photon.
6. Determine the resolving power of a prism
7. Thickness of a thin paper using interference fringes in an air wedge
8. Determine the resolving power of a transmission grating

Extended list of experiments that may be added in above list (Experiments based on Computer programming in FORTRAN language.)

1. Using array variable, find out the average and standard deviation
2. Compute the sum of a finite series up to correct three decimal place
3. With the help of a program arrange the marks in ascending of descending order

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.

SEMESTER V & VI

B. SC. PHYSICAL SCIENCES

(GEOGRAPHY)

YET TO BE FINALISED

SEMESTER V&VI

B. SC. PHYSICAL SCIENCES

(CHEMISTRY)

Semester V

CCL-503(i)
Discipline Specific Course-I(i)
POLYMER CHEMISTRY-I
Credits: 02; 30 Hrs (2Hrs /week)

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

Note: ***The examiner is requested to set nine questions in all, selecting two questions from each UNIT and one compulsory question (Question No.1 based on entire syllabus will consist of eight short answer type questions each of two marks). The candidate is required to attempt five questions in all selecting one from each UNIT and the compulsory Question No.1.***

UNIT-I

Introduction and history of polymeric materials:
Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, Texture of polymers.
Nature and structure of polymers-Structure Property relationships.

(7 Hours)

UNIT-II

Functionality and its importance:
Criteria for synthetic polymer formation, classification of polymerization processes, Relationships between functionality, extent of reaction and degree of polymerization.Bi-functional systems, Poly-functional systems.
Properties of Polymers (Physical, thermal, flow & mechanical properties).

(8 Hours)

UNIT-III

Brief introduction to preparation, structure, properties and application of the following polymers: polyolefins, polystyrene and styrene copolymers, poly(vinyl chloride) and related polymers, poly(vinyl acetate) and related polymers, acrylic polymers, fluoro polymers, polyamides and related polymers.

(8 Hours)

UNIT-IV

Polycarbonates,Phenol formaldehyde resins (Bakelite, Novalac), polyurethanes, silicone polymers, polydienes, Conducting Polymers, [polyacetylene, polyaniline, poly(p-phenylene sulphide polypyrrole, polythiophene)].

(7 Hours)

Reference Books:

- Seymour, R.B.&Carraher, C.E. *Polymer Chemistry: An Introduction,* Marcel Dekker, Inc. New York, 1981.
- Odian, G. *Principles of Polymerization*, 4th Ed. Wiley, 2004.
- Billmeyer, F.W. *Textbook of Polymer Science*, 2nd Ed. Wiley Interscience, 1971.
- Ghosh, P. *Polymer Science & Technology*, Tata McGraw-Hill Education, 1991.
- Lenz, R.W. *Organic Chemistry of Synthetic High Polymers.* Interscience Publishers, New York, 1967.

CCL-504(i)
Discipline Specific Course-I(i)
POLYMER CHEMISTRY-II
Credits: 02; 30 Hrs (2Hrs /week)

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

Note: The examiner is requested to set nine questions in all, selecting two questions from each UNIT and one compulsory question (Question No.1 based on entire syllabus will consist of eight short answer type questions each of two marks). The candidate is required to attempt five questions in all selecting one from each UNIT and the compulsory Question No.1.

UNIT-I

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

(8 Hours)

UNIT-II

Crystallization and crystallinity: Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point.
Glass transition temperature (Tg) and determination of Tg, Free volume theory, WLF equation, Factors affecting glass transition temperature (Tg).

(7 Hours)

UNIT-III

Determination of molecular weight of polymers (M_n, M_w, etc) by end group analysis, viscometry, light scattering and osmotic pressure methods.Molecular weight distribution and its significance.Polydispersity index.

(7 Hours)

UNIT-IV

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

(8 Hours)

Reference Books:

- Seymour, R.B.&Carraher, C.E. *Polymer Chemistry: An Introduction,* Marcel Dekker, Inc. New York, 1981.
- Odian, G. *Principles of Polymerization*, 4th Ed. Wiley, 2004.
- Billmeyer, F.W. *Textbook of Polymer Science*, 2nd Ed. Wiley Interscience, 1971.
- Ghosh, P. *Polymer Science & Technology*, Tata McGraw-Hill Education, 1991.
- Lenz, R.W. *Organic Chemistry of Synthetic High Polymers.* Interscience Publishers, New York, 1967.

CCP-509(i)
PRACTICAL-V(i)
CHEMISTRY DSC LAB V(i)
POLYMER CHEMISTRY
Credits: 02; 60Hrs (4 Hrs /week)

Marks (External): 100
Time: 6Hrs

I. Polymer synthesis

1. Free radical solution polymerization of styrene (St) / Methyl Methacrylate (MMA) / Methyl Acrylate (MA) / Acrylic acid (AA).
   a. Purification of monomer
   b. Polymerization using benzoyl peroxide (BPO) / 2,2'-azo-bisisobutylonitrile (AIBN)
2. Preparation of nylon 66/6
3. Interfacial polymerization, preparation of polyester from isophthaloyl chloride (IPC) and phenolphthalein
   a. Preparation of IPC
   b. Purification of IPC
   c. Interfacial polymerization
4. Redox polymerization of acrylamide
5. Precipitation polymerization of acrylonitrile
6. Preparation of urea-formaldehyde resin
7. Preparation of novalac resin/resold resin
8. Microscale emulsion polymerization of poly(methylacrylate).

II. Polymer characterization

1. Determination of molecular weight by viscometry:
   a. Polyacrylamide-aq. $NaNO_2$ solution
   b. (Poly vinyl proplylidine (PVP) in water
2. Determination of the viscosity-average molecular weight of poly(vinyl alcohol) (PVOH) and the fraction of "head-to-head" monomer linkages in the polymer.
3. Determination of molecular weight by end group analysis: Polyethylene glycol (PEG) (OH group).

III. Polymer analysis

1. Estimation of the amount of HCHO in the given solution by sodium sulphite method
2. Instrumental Techniques
3. Preparation of polyacrylamide and its electrophoresis

*at least 7 experiments to be carried out.

Reference Books:

- M.P. Stevens, *Polymer Chemistry: An Introduction*, 3rd Ed., Oxford University Press, 1999.
- H.R. Allcock, F.W. Lampe & J.E. Mark, *Contemporary Polymer Chemistry*, 3rd ed. Prentice-Hall (2003)
- F.W. Billmeyer, *Textbook of Polymer Science*, 3rded.Wiley-Interscience (1984)
- J.R. Fried, *Polymer Science and Technology*, 2nded.Prentice-Hall (2003)
- P. Munk& T.M. Aminabhavi, *Introduction to Macromolecular Science*, 2nded.John Wiley & Sons (2002)
- L. H. Sperling, *Introduction to Physical Polymer Science*, 4thed.John Wiley & Sons (2005)
- M.P. Stevens, *Polymer Chemistry: An Introduction*3rded.Oxford University Press (2005).
- Seymour**/** Carraher's Polymer Chemistry, 9th ed.by Charles E. Carraher, Jr. (2013).

CCL-503(ii)
Discipline Specific Course-I(ii)
Chemistry of Main Group Elements, Theories of Acids and Bases-I
Credits: 02; 30 Hrs (2Hrs /week)

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

Note: ***The examiner is requested to set nine questions in all, selecting two questions from each UNIT and one compulsory question (Question No.1 based on entire syllabus will consist of eight short answer type questions each of two marks). The candidate is required to attempt five questions in all selecting one from each UNIT and the compulsory Question No.1.***

UNIT-I

Acids and Bases: Bronsted–Lowry concept, conjugate acids and bases, relative strengths of acids and bases, effects of substituent and solvent, differentiating and levelling solvents. Lewis acid-base concept, classification of Lewis acids and bases, Lux-Flood concept and solvent system concept.Hard and soft acids and bases (HSAB concept), applications of HSAB process.

(7 Hours)

UNIT-II

General Principles of Metallurgy: Chief modes of occurrence of metals based on standard electrode potentials, Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agents.
Hydrometallurgy with reference to cyanide process for gold and silver. Methods of purification of metals (Al, Pb, Ti, Fe, Cu, Ni, Zn, Au): electrolytic refining, zone refining, van Arkel-de Boer process, Parting Process, Mond's process and Kroll Process.

(8 Hours)

UNIT-III

***s*- and *p*-Block Elements**
Periodicity in *s*- and *p*-block elements with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electron gain enthalpy, electronegativity (Pauling scale).
General characteristics of *s*-block metals like density, melting and boiling points, flame colour and reducing nature.
Oxidation states of *s*- and *p*-block elements, inert-pair effect, diagonal relationships and anomalous behaviour of first member of each group. Allotropy in C, P and S.

(7 Hours)

UNIT-IV

Complex forming tendency of *s* block elements and a preliminary idea of crown ethers and cryptates, structures of basic beryllium acetate, salicylaldehyde/ acetylacetonato complexes of Group 1 metals.
Solutions of alkali metals in liquid ammonia and their properties.
Common features, such as ease of formation, solubility and stability of oxides, peroxides, superoxides, sulphates and carbonates of *s*-block metals.

(8 Hours)

Recommended texts:

- 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.
- Greenwood, N.N. &Earnshaw. *Chemistry of the Elements*, ButterworthHeinemann. 1997.
- Rodger, G.E. *Inorganic and Solid State Chemistry*, Cengage Learning India Edition, 2002.
- Miessler, G. L. & Donald, A. Tarr. *Inorganic Chemistry* 4thEd.,Pearson, 2010.

Atkin, P. *Shriver & Atkins' Inorganic Chemistry* 5th Ed. Oxford University Press (2010).

CCL-504(ii)
Discipline Specific Course-II(ii)
Chemistry of Main Group Elements-II
Credits: 02; 30 Hrs (2Hrs /week)

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

Note: *The examiner is requested to set nine questions in all, selecting two questions from each UNIT and one compulsory question (Question No.1 based on entire syllabus will consist of eight short answer type questions each of two marks). The candidate is required to attempt five questions in all selecting one from each UNIT and the compulsory Question No.1.*

UNIT-I

Structure, bonding and properties (acidic/ basic nature, oxidizing/ reducing nature and hydrolysis of the following compounds and their applications in industrial and environmental chemistry wherever applicable:
Diborane and concept of multicentre bonding, hydrides of Groups 13 (EH_3), 14, 15, 16 and 17.
Oxides of N and P, Oxoacids of P, S and Cl.

(8 Hours)

UNIT-II

Halides and oxohalides of P and S (PCl_3, PCl_5, $SOCl_2$ and SO_2Cl_2) Interhalogen compounds.
A brief idea of pseudohalides

(7 Hours)

UNIT-III

Noble gases: Rationalization of inertness of noble gases, clathrates, preparation and properties of XeF_2, XeF_4 and XeF_6 ,bonding in these compounds using VBT and shapes of noble gas compounds using VSEPR Theory

(7 Hours)

UNIT-IV

Inorganic Polymers: Types of inorganic polymers and comparison with organic polymers, structural features, classification and important applications of silicates. Synthesis, structural features and applications of silicones.Borazines and cyclophosphazenes – preparation, properties and reactions. Bonding in $(NPCl_2)_3$.

(8 Hours)

Recommended texts:

- 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.
- Greenwood, N.N. &Earnshaw. *Chemistry of the Elements*, ButterworthHeinemann. 1997.
- Rodger, G.E. *Inorganic and Solid State Chemistry*, Cengage Learning India Edition, 2002.
- Miessler, G. L. & Donald, A. Tarr. *Inorganic Chemistry* 4thEd.,Pearson, 2010.
- Atkin, P. *Shriver & Atkins' Inorganic Chemistry* 5th Ed. Oxford University Press (2010).

CCP-509(ii)
PRACTICAL-V(ii)
CHEMISTRY DSC LAB V
Chemistry of Main Group Elements, Theories of Acids and Bases
Credits: 02; 60 Hrs (4 Hrs /week)

Marks (External): 100
Time: 6Hrs

1. Iodometric estimation of potassium dichromate and copper sulphate
2. Iodimetric estimation of antimony in tartaremetic
3. Estimation of amount of available chlorine in bleaching powder and household bleaches
4. Estimation of iodine in iodized salts.
5. Iodimetric estimation of ascorbic acid in fruit juices.
6. Estimation of dissolved oxygen in water samples.
7. Gravimetric estimation of sulphate as barium sulphate.
8. Gravimetric estimation of aluminium as oximato complex
9. Preparation of the following: potash alum, chrome alum, tetraamminecopper(II) sulphate monohydrate, potassium trioxalatoferrate(III) (any two, including one double salt and one complex).

Recommended Texts:

- Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
- Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.

CCS-505(i)
Skill Enhancement Course-I
PESTICIDE CHEMISTRY (Theory)
Credits: 02; 30 Hrs (2Hrs /week)

Total Marks: 100

Marks (External): 50

Examination Time: 2Hrs

Note: The examiner is requested to set five questions in all, selecting two questions from each UNIT and one compulsory question (Question No.1 based on entire syllabus will consist of ten short answer type questions each of two marks). The candidate is required to attempt three questions in all selecting one from each UNIT and the compulsory Question No.1.

UNIT-I

General introduction to pesticides (natural and synthetic), benefits and adverse effects, changing concepts of pesticides.

UNIT-II

Structure activity relationship, synthesis and uses of representative pesticides in the following classes: Organochlorines (DDT, Gammexene, Aldrin, Dialdrin); Organophosphates (Malathion, Parathion); Carbamates (Carbofuran and carbaryl); Quinones (Chloranil), Anilides (Alachlor and Butachlor).

Marks (Internal): 50

Skill Enhancement Course-I
PESTICIDE CHEMISTRY (Practicals)

1. To calculate acidity/alkalinity in given sample of pesticide formulations as per BIS specifications.
2. Preparation of simple organophosphates, phosphonates and thiophosphates

Reference Book

- Cremlyn, R. *Pesticides. Preparation and Modes of Action*, John Wiley & Sons, New York, 1978.

CCS-505(ii)
Skill Enhancement Course-III
FUEL CHEMISTRY (Theory)
Credits: 02; 30 Hrs (2Hrs /week)

Total Marks: 100

Marks (External): 50

Time: 2 Hrs

Note: The examiner is requested to set five questions in all, selecting two questions from each UNIT and one compulsory question (Question No.1 based on entire syllabus will consist of ten short answer type questions each of two marks). The candidate is required to attempt three questions in all selecting one from each UNIT and the compulsory Question No.1.

UNIT-I

Review of energy sources (renewable and non-renewable). Classification of fuels and their calorific value.

Coal: Uses of coal (fuel and nonfuel) in various industries, its composition, carbonization of coal. Coal gas, producer gas and water gas—composition and uses. Fractionation of coal tar, uses of coal tar bases chemicals, requisites of a good metallurgical coke, Coal gasification (Hydro gasification and Catalytic gasification), Coal liquefaction and Solvent Refining.

Petroleum and Petrochemical Industry: Composition of crude petroleum, Refining and different types of petroleum products and their applications.

UNIT-II

Fractional Distillation (Principle and process), Cracking (Thermal and catalytic cracking), Reforming Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels. Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and its derivatives Xylene.

Lubricants: Classification of lubricants, lubricating oils (conducting and nonconducting) Solid and semisolid lubricants, synthetic lubricants.
Properties of lubricants (viscosity index, cloud point, pore point) and their determination.

Marks (Internal): 50

Skill Enhancement Course-III
FUEL CHEMISTRY (Practicals)

Properties of lubricants (viscosity index, cloud point, pore point) and their determination.

Reference Books:

- Stocchi, E. *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK (1990).
- Jain, P.C. & Jain, M. *Engineering Chemistry*DhanpatRai& Sons, Delhi.
- Sharma, B.K. & Gaur, H. *Industrial Chemistry,* Goel Publishing House, Meerut (1996).

Semester VI
CCL-603(i)
Discipline Specific Course-III(i)
ORGANOMETALLICS AND BIOINORGANIC CHEMISTRY
Credits: 02; 30 Hrs (2Hrs /week)

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

Note: The examiner is requested to set nine questions in all, selecting two questions from each UNIT and one compulsory question (Question No.1 based on entire syllabus will consist of eight short answer type questions each of two marks). The candidate is required to attempt five questions in all selecting one from each UNIT and the compulsory Question No.1.

UNIT-I

Chemistry of 3d metals

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

(8 Hours)

UNIT-II

Organometallic Compounds

Definition and Classification with appropriate examples based on nature of metalcarbon bond (ionic, s, p and multicentre bonds). Structures of methyl lithium, Zeiss salt and ferrocene. EAN rule as applied to carbonyls.

(7 Hours)

UNIT-III

Preparation, structure, bonding and properties of mononuclear and polynuclear carbonyls of 3d metals.p-acceptor behaviour of carbon monoxide. Synergic effects (VB approach)-(MO diagram of CO can be referred to for synergic effect to IR frequencies).

(7 Hours)

UNIT-IV

Bio-Inorganic Chemistry

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

(8 Hours)

Reference Books:

- James E. Huheey, Ellen Keiter& Richard Keiter: *Inorganic Chemistry: Principles of Structure and Reactivity,* Pearson Publication.
- G.L. Miessler& Donald A. Tarr: *Inorganic Chemistry,* Pearson Publication.
- J.D. Lee: *A New Concise Inorganic Chemistry,* E.L.B.S.
- F.A. Cotton & G. Wilkinson: *Basic Inorganic Chemistry*, John Wiley & Sons.

CCL-604(i)
Discipline Specific Course-IV(i)
POLYNUCLEAR HYDROCARBONS AND UV, IR SPECTROSCOPY
Credits: 02; 30 Hrs (2Hrs /week)

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

Note: The examiner is requested to set nine questions in all, selecting two questions from each UNIT and one compulsory question (Question No.1 based on entire syllabus will consist of eight short answer type questions each of two marks). The candidate is required to attempt five questions in all selecting one from each UNIT and the compulsory Question No.1.

UNIT-I

Polynuclear and heteronuclear aromatic compounds:
Properties of the following compounds with reference to electrophilic and nucleophilic substitution: Naphthalene, Anthracene, Furan, Pyrrole, Thiophene, and Pyridine.

(8 Hours)

UNIT-II

Active methylene compounds:
Preparation: Claisen ester condensation. Keto-enoltautomerism.
Reactions: Synthetic uses of ethyl acetoacetate (preparation of non-hetero molecules having upto 6 carbon).

(7 Hours)

UNIT-III

Application of Spectroscopy to Simple Organic Molecules
Application of visible, ultraviolet and infrared spectroscopy in organic molecules. Electromagnetic radiations, electronic transitions, λ_{max}&ε_{max}, chromophore, auxochrome, bathochromic and hypsochromic shifts. Application of electronic spectroscopy and Woodward rules for calculating λ_{max} of conjugated dienes and α,β-unsaturated compounds.

(7 Hours)

UNIT-IV

Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions).

(8 Hours)

Reference Books:

- I.L. Finar: *Organic Chemistry* (Vol. I & II), E.L.B.S.
- John R. Dyer: *Applications of Absorption Spectroscopy of Organic Compounds,* Prentice Hall.
- R.M. Silverstein, G.C. Bassler& T.C. Morrill*: Spectroscopic Identification of Organic Compounds*, John Wiley & Sons.
- R.T. Morrison & R.N. Boyd: *Organic Chemistry,* Prentice Hall.
- Peter Sykes: *A Guide Book to Mechanism* in *Organic Chemistry,* Orient Longman.
- ArunBahl and B. S. Bahl: *Advanced Organic Chemistry,* S. Chand.

CCP-609(i)
PRACTICAL-VI(i)
CHEMISTRY DSC LAB VI
Organometallics, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy
Credits: 02; 60 Hrs (4Hrs /week)

Marks (External): 100
Time: 6Hrs

Section A: Inorganic Chemistry

1. Separation of mixtures by chromatography: Measure the R_f value in each case. (Combination of two ions to be given)
a. Paper chromatographic separation of Fe^{3+}, $A1^{3+}$ and Cr^{3+} or
b. Paper chromatographic separation of Ni^{2+}, Co^{2+}, Mn^{2+} and Zn^{2+}
2. Preparation of any two of the following complexes and measurement of their conductivity:
a. tetraamminecarbonatocobalt (III) nitrate
b. tetraamminecopper (II) sulphate
c. potassium trioxalatoferrate (III) trihydrate

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

Section B: Organic Chemistry

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

Reference Books:

- A.I. Vogel: Qualitative Inorganic Analysis, Prentice Hall, 7th Edn.
- A.I. Vogel: Quantitative Chemical Analysis, Prentice Hall, 6th Edn.
- 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.

CCL-603(ii)
Discipline Specific Course-III(ii)
QUANTUM CHEMISTRY
Credits: 02; 30 Hrs (2Hrs /week)

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

Note: The examiner is requested to set nine questions in all, selecting two questions from each UNIT and one compulsory question (Question No.1 based on entire syllabus will consist of eight short answer type questions each of two marks). The candidate is required to attempt five questions in all selecting one from each UNIT and the compulsory Question No.1.

UNIT-I

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

(8 Hours)

UNIT-II

Qualitative treatment of simple harmonic oscillator model of vibrational motion: Setting up of Schrödinger equation and discussion of solution and wave functions. Vibrational energy of diatomic molecules and zero-point energy.
Angular momentum: Commutation rules, quantization of square of total angular momentum and z-component.
Rigid rotator model of rotation of diatomic molecule.Schrödinger equation.

(7 Hours)

UNIT-III

Qualitative treatment of hydrogen atom and hydrogen-like ions: setting up of Schrödinger equation in spherical polar coordinates, radial part, quantization of energy (only final energy expression). Average and most probable distances of electron from nucleus.
Setting up of Schrödinger equation for many-electron atoms (He, Li). Need for approximation methods. Statement of variation theorem and application to simple systems (particle-in-a-box, harmonic oscillator, hydrogen atom).

(7 Hours)

UNIT-IV

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

(8 Hours)

Reference Books:

- Chandra, A. K. *Introductory Quantum Chemistry* Tata McGraw-Hill (2001).
- House, J. E. *Fundamentals of Quantum Chemistry* 2nd Ed. Elsevier: USA (2004).
- Lowe, J. P. & Peterson, K. *Quantum Chemistry*, Academic Press (2005).

CCL-604(ii)
Discipline Specific Course-IV(ii)
SPECTROSCOPY & PHOTOCHEMISTRY
Credits: 02; 30 Hrs (2Hrs /week)

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

Note: The examiner is requested to set nine questions in all, selecting two questions from each UNIT and one compulsory question (Question No.1 based on entire syllabus will consist of eight short answer type questions each of two marks). The candidate is required to attempt five questions in all selecting one from each UNIT and the compulsory Question No.1.

UNIT-I

Molecular Spectroscopy:

Interaction of electromagnetic radiation with molecules and various types of spectra; Born-Oppenheimer approximation.

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

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

(8 Hours)

UNIT-II

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

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

(7 Hours)

UNIT-III

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

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

(8 Hours)

UNIT-IV

Photochemistry

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

(7 Hours)

Reference Books:

- Banwell, C. N. &McCash, E. M. *Fundamentals of Molecular Spectroscopy* 4th Ed. Tata McGraw-Hill: New Delhi (2006).
- Kakkar, R. *Atomic & Molecular Spectroscopy*: *Concepts & Applications*, Cambridge University Press (2015).

CCP-609(ii)
Practical-VI(ii)
CHEMISTRY DSE LAB 6B: QUANTUM CHEMISTRY, SPECTROSCOPY & PHOTOCHEMISTRY
Credits: 02; 60 Hrs (4Hrs /week)

Marks (External): 100
Time: 6Hrs

UV/Visible spectroscopy

1. Study the 200-500 nm absorbance spectra of $KMnO_4$ and $K_2Cr_2O_7$ (in 0.1 M H_2SO_4) and determine the λ_{max} values. Calculate the energies of the two transitions in different units (J molecule^{-1}, kJ mol^{-1}, cm^{-1}, eV).
2. Study the pH-dependence of the UV-Vis spectrum (200-500 nm) of $K_2Cr_2O_7$.
3. Record the 200-350 nm UV spectra of the given compounds (acetone, acetaldehyde, 2-propanol, acetic acid) in water. Comment on the effect of structure on the UV spectra of organic compounds.

Colorimetry

1. Verify Lambert-Beer's law and determine the concentration of $CuSO_4$ / $KMnO_4$ / $K_2Cr_2O_7$ in a solution of unknown concentration
2. Determine the concentrations of $KMnO_4$ and $K_2Cr_2O_7$ in a mixture.
3. Study the kinetics of iodination of propanone in acidic medium.
4. Determine the amount of iron present in a sample using 1,10-phenathroline.
5. Determine the dissociation constant of an indicator (phenolphthalein).
6. Analyse the given vibration-rotation spectrum of HCl(g)

Reference Books

- Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.
- Khosla, B. D.; Garg, V. C. &Gulati, A., *Senior Practical Physical Chemistry,* R. Chand & Co.: New Delhi (2011).
- Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. *Experiments in Physical Chemistry8th Ed.;* McGraw-Hill: New York (2003).
- Halpern, A. M. &McBane, G. C. *Experimental Physical Chemistry3rd Ed.;* W.H. Freeman & Co.: New York (2003).

SEMESTER V & VI

B. SC. PHYSICAL SCIENCES

(ELECTRONICS)

Semester V
CEL 503 (i)
Discipline Specific Course I (Electronics)
Electronic Instrumentation - 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.

UNIT-I (8 Hours)

Measurements:
Accuracy and precision. Significant figures. Error and uncertainty analysis. Shielding and grounding. Electromagnetic Interference.

Basic Measurement Instruments:
DC measurement-ammeter, voltmeter, ohm meter, AC measurement, Digital voltmeter systems (integrating and non-integrating). Digital Multimeter - Block diagram principle of measurement of I, V, C. Accuracy and resolution of measurement.

UNIT-II (7 Hours)

Basic Measurement Instruments:
Measurement of Impedance (A.C. bridges), Measurement of Self Inductance (Anderson's bridge), Measurement of Capacitance (De Sauty's bridge), Measurement of frequency (Wien's bridge).

UNIT-III (7 Hours)

Oscilloscope:
Block Diagram, CRT, Vertical Deflection, Horizontal Deflection. Screens for CRT, Oscilloscope probes, measurement of voltage, frequency and phase by Oscilloscope. Digital Storage Oscilloscopes. LCD display for instruments.

Signal Generators:
Function generator, Pulse Generator, (Qualitative only).

UNIT-IV (8 Hours)

Power supply:
Block Diagram of a Power Supply, Qualitative idea of C and L Filters. IC Regulators (78XX and 79XX), Line and load regulation, Short circuit protection. Idea of switched mode power supply (SMPS) and uninterrupted power supply (UPS).

Reference Books:

- David A. Bell, Electronic Devices and Circuits, Oxford University Press (2015).
- W.D. Cooper and A. D. Helfrick, Electronic Instrumentation and Measurement Techniques, Prentice Hall (2005).
- E.O. Doebelin, Measurement Systems: Application and Design, McGraw Hill Book -fifth Edition (2003).
- A Course in Electrical and Electronic Measurement and instrumentation, A K Sawhney, Dhanpat Rai
- Alan S. Morris, “Measurement and Instrumentation Principles”, Elsevier (Butterworth Heinmann-2008).
- S. Rangan, G. R. Sarma and V. S. Mani, Instrumentation Devices and Systems, Tata Mcgraw Hill (1998).
- Introduction to measurements and instrumentation, 4th Edn., Ghosh, PHI Learning

CEL 503 (ii)
Discipline Specific Course I (Electronics)
Signal and System
(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 (8 Hours)

Introduction to Signal

Classification of Signals, Basic operations**:** Time Shifting, Time Reversal, Time Scaling, Signal representation in terms of singular functions, Correlation of Signals and its Properties, Representation of a Continuous-Time Signal by its Samples: The Sampling Theorem, Reconstruction , Aliasing.

UNIT-II (7 Hours)

System & its Properties

classification of Systems: Linear & Nonlinear ; Static & Dynamic , Causal & Non-causal , Stable & Unstable System, Time variant & Time Invariant Systems with examples,
Linear Time-Invariant Systems: Definition and Properties, Impulse Response, Representation of LTI systems using Differential and Difference equations.

UNIT-III (7 Hours)

Fourier Series:

Introduction to Frequency domain Representation, Fourier Series Representation of Periodic Signals, Convergence of Fourier Series, Properties of Fourier Series

UNIT-IV (8 Hours)

Fourier Transform:

Need for Fourier Transform, Fourier Transform for periodic and Aperiodic signals, Convergence of Fourier Transform, Properties of Fourier Transform, Applications of Fourier Transform.

Reference Books:

- Signals and systems, A. V. Oppenheim, A. S. Willsky, PHI
- Signals and systems, Tarun K. Rawat, Oxford University Press.
- Signals & Systems, Farooq Husain, Umesh Publications.
- Digital Signal Processing, S. Salivahanan, A. Vallavraj, Tata McGraw Hill.
- Principles of Signal Processing and Linear Systems, B.P. Lathi, Oxford University Press.
- Fundamentals of Digital Signal processing using MATLAB, R.J. Schilling and S.L. Harris, 2005, Cengage Learning.
- Fundamentals of signals and systems, P.D. Cha and J.I. Molinder, 2007, Cambridge University Press.
- Digital Signal Processing Principles Algorithm & Applications, J.G. Proakis and D.G. Manolakis, 2007, 4th Edition, Prentice Hall.
- K.A. Navas and R Jayadevan, Lab Primer Through MATLAB, PHI

CEL 503 (iii)
Discipline Specific Course I (Electronics)
Semiconductor Devices Fabrication
(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 (7 Hours)

Introduction of Semiconductor Process Technology: Semiconductor materials, Crystal growth techniques- Czochralski technique, Float Zone Process, Wafer preparation, Clean room.

Oxidation: Thermal oxidation process- Kinetics of growth for thick and thin oxide, Dry and Wet oxidation. Effects of high pressure and impurities, Impurity redistribution during oxidation, Masking property of silicon oxide, Chemical vapour deposition of silicon oxide, Properties of silicon oxide, Step coverage, P-glass flow.

UNIT-II (7 Hours)

Etching: Wet chemical etching- Basic process and few examples of etchants for semiconductors, insulators and conductors, Dry etching using plasma etching technique.

Epitaxy Deposition: Epitaxial growth by vapor phase epitaxy (VPE) and molecular beam epitaxy (MBE). **Diffusion:** Basic diffusion process- Diffusion equation, Diffusion profiles, Extrinsic diffusion concentration dependent diffusivity, Lateral diffusion, Doping through Ion implantation and its comparison with diffusion.

UNIT-III (8 Hours)

Lithographic Processes: Optical lithography, Exposure tools, Masks, Photoresist, Pattern Transfer, Resolution Enhancement Techniques- Electron beam lithography, X-ray lithography and Ion beam lithography, Comparison between various lithographic techniques.

Metallization: Uses of Physical Vapor Deposition and Chemical Vapor Deposition technique for Aluminum and Copper metallization.

UNIT-IV (7 Hours)

Process Integration: Passive components- Integrated circuit resistor, Integrated circuit inductor, Integrated circuit capacitor, MOSFET technology-Basic fabrication process of NMOS, PMOS and CMOS technology.

Characterization: introduction to Various characterization methods for structural, electrical and optical properties, Basic idea of X-ray diffractometer (XRD), Scanning electron microscope, (SEM) Transmission electron microscope(TEM) and UV-VIS-NIR spectrophotometer (Atomic force microscopy).

Reference Books:

- Physics of Semiconductor Devices, S. M. Sze. Wiley-Interscience.
- VLSI Fabrication Principles (Si and GaAs), S.K. Gandhi, John Wiley & Sons, Inc.
- Basic VLSI Design, D A Pucknell, PHI.
- Silicon VLSI Technology, James Plummer, Pearson
- Handbook of Thin Film Technology, Leon I. Maissel and Reinhard Glang.
- Fundamentals of Semiconductor Fabrication, S.M. Device and G. S. May, John-Wiley
- The science and Engineering of Microelectronics Fabrication, Stephen A. Champbell, 2010, Oxford University Press.
- Introduction to Semiconductor materials and Devices, M. S. Tyagi, John Wiley & Sons

CEL 504 (i)
Discipline Specific Course II (Electronics)
Electronic Instrumentation - 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.

UNIT-I **(8 Hours)**

Lock-in-amplifier:
Basic Principles of phase locked loop (PLL), Phase detector (XOR & edge triggered), Voltage Controlled Oscillator (Basics, varactor), lock and capture. Basic idea of PLL IC (565 or 4046). Lock-in-amplifier, Idea of techniques for sum and averaging of signals.

UNIT-II **(7 Hours)**

Virtual Instrumentation:
Introduction, Interfacing techniques (RS 232, GPIB, USB), Idea about Arduino microcontroller and interfacing software like LABVIEW.

UNIT-III **(8 Hours)**

Transducers:
Classification of transducers, Basic requirement/characteristics of transducers, Active and Passive transducers, Resistive (Potentiometer- Theory, temperature compensation & applications) and Capacitive (variable air gap type) transducers

UNIT-IV **(7 Hours)**

Transducers:
Inductive (LVDT) & piezoelectric transducers. Measurement of temperature (RTD, semiconductor IC sensors), Light transducers (photo resistors & photovoltaic cells).

Reference Books:

- David A. Bell, Electronic Devices and Circuits, Oxford University Press (2015).
- W.D. Cooper and A. D. Helfrick, Electronic Instrumentation and Measurement Techniques, Prentice Hall (2005).
- E.O. Doebelin, Measurement Systems: Application and Design, McGraw Hill Book -fifth Edition (2003).
- A Course in Electrical and Electronic Measurement and instrumentation, A K Sawhney, Dhanpat Rai
- Alan S. Morris, “Measurement and Instrumentation Principles”, Elsevier (Butterworth Heinmann-2008).
- S. Rangan, G. R. Sarma and V. S. Mani, Instrumentation Devices and Systems, Tata Mcgraw Hill (1998).
- Introduction to measurements and instrumentation, 4th Edn., Ghosh, PHI Learning

CEL 504 (ii)
Discipline Specific Course II (Electronics)
Programming with Scilab/Matlab
(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 (8 Hours)

Basics:
environment, Basic computer programming, Variables and constants, operators and simple calculations, Formulas and functions, toolboxes.

Matrices and Vectors:
Matrix and linear algebra review, Vectors and matrices,Matrix operations and functions

UNIT-II (7 Hours)

Programming:
script file and function file (m-files), If-else statement, For loop, while loop, 2d Plotting, 3d plotting

UNIT-III (7 Hours)

Statistics programming
Mean and median of a vector, standard deviation and variance of a vector, largest element of a vector, percentiles

UNIT-IV (8 Hours)

image processing: Basic idea of digital images, Basic image processing, image arithmetic, adding noise to images, filtering
Numerical Analysis : Numerical integration, differentiation, ordinary differential equation

Reference Books:

- Hema Ramachandran, Achuthsankar S. Nair, SciLab : A free software to Matlab, S Chand
- Tejas Seth, SciLab : A practical introduction to programming and problem solving
- Rachna Verma, Arvind Verma, Introduction to Scilab
- Rudra Pratap, Getting started with MATLAB, Oxford
- Amos Gilat, MATLAB: An Introduction with applications, Wiley
- Raj Kumar Bansal, Ashok Kumar Goyal, MATLAB and its application in engineering, Pearson

CEL 504 (iii)
Discipline Specific Course II (Electronics);
Antenna Theory
(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 (7 Hours)

Introduction:
Antenna as an element of wireless communication system, Antenna radiation mechanism, Types of Antennas, Fundamentals of EMFT: Maxwell's equations and their applications to antennas.

UNIT-II (8 Hours)

Antenna Parameters:
Antenna parameters: Radiation pattern (polarization patterns, Field and Phase patterns), Field regions around antenna, Radiation intensity, Beamwidth, Gain, Directivity, Polarization, Bandwidth, Efficiency and Antenna temperature.

UNIT-III (8 Hours)

Antenna as a Transmitter/Receiver:
Effective Height and Aperture, Power delivered to antenna, Input impedance. Radiation from an infinitesimal small current element, Radiation from an elementary dipole (Hertzian dipole), Reactive, Induction and Radiation fields, Power density and radiation resistance for small current element and half wave dipole antenna.

UNIT-IV (7 Hours)

Radiating wire Structures :
Monopole, Dipole, Folded dipole, Loop antenna and Biconical broadband Antenna. Basics of Patch Antenna and its design. Examples of Patch antenna like bowtie, sectoral, fractal, etc.

Reference Books:

- Constantine A. Ballanis, Antenna Theory, John Wiley & Sons
- John Kraus, Ronald Marhefka, Antenna and Wave Propagation, McGraw Hill
- Warren Stutzman and Gary Thiele, Antenna Theory and Design, Wiley
- R.L.Yadava Antenna and Wave Propagation, PHI Learning.
- Edward Jordan and Keith Balmain, Electromagnetic Waves and Radiating Systems, Pearson

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Semester V

CEL 505 (i)
Skill Enhancement Course II(Electronics)
Design and Fabrication of Printed Circuit Boards
(Credits: 02; 30 Hrs (2Hrs /week))

Marks for Major Test (External): 50
Marks for Internal Exam: 50
Time: 2 Hours

Paper setter is required to set 5 questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of ten short answer type questions each of 2 marks. The remaining four questions is to be set uniformly having two questions from each unit. The student is required to attempt three questions in all selecting one question from each unit and Question no. 1 is Compulsory.

UNIT-I **(15 Hours)**

PCB Fundamentals:

PCB Advantages, components of PCB, Electronic components, Microprocessors and Microcontrollers, IC's, Surface Mount Devices (SMD), Data sheets, Classification of PCB-single, double, multilayer and flexible boards, Manufacturing of PCB, PCB standards.

Schematic and Layout Design:
Schematic diagram, General, Mechanical and Electrical design considerations, Placing and Mounting of components, Conductor spacing, routing guidelines, heat sinks and package density, Net list, creating components for library, Tracks, Pads, Vias, power plane, grounding.

UNIT-II **(15 Hours)**

Technology OF PCB:
Design automation, Design Rule Checking, Exporting Drill and Gerber Files, Drills, Footprints and Libraries, Adding and Editing Pins, copper clad laminates, materials of copper clad laminates, properties of laminates (electrical and physical), types of laminates, Film master preparation, Image transfer, photo printing, Screen Printing.
Plating techniques etching techniques, Mechanical Machining operations, Lead cutting and Soldering Techniques, Testing and quality controls.

Reference Books:

- R.S Khandpur, Printed Circuit Board: Design, Fabrication, Assembly and Testing, Tata McGraw Hill.
- Walter Bosshart, Printed Circuit Boards: Design and Technology, Tata McGraw Hill.

CEL 505 (ii)
Skill Enhancement Course II(Electronics)
Robotics
(Credits: 02; 30 Hrs (2Hrs /week))

Marks for Major Test (External): 50
Marks for Internal Exam: 50
Time: 2 Hours

Paper setter is required to set 5 questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of ten short answer type questions each of 2 marks. The remaining four questions is to be set uniformly having two questions from each unit. The student is required to attempt three questions in all selecting one question from each unit and Question no. 1 is Compulsory.

UNIT-I (15 Hours)

Robot defining Criteria , basic components of a robot - sensor, actuator, controller, end effector Arduino control Board for robots, installing arduino software on windows, interfacing arduino with computer, installing arduino IDE on android devices.

Sensors:

Analog and digital sensors, active and passive sensors, attributes of sensors, sensor calibration Ultrasonic sensor (modes, accuracy, limitations, calibration), light sensor, Position encoders, Gyroscope and Accelerometer, Temperature and humidity sensor (DHT 11)

UNIT-II (15 Hours)

Actuators:

Motor characteristics (voltage, current, speed, torque, resistance), DC Motors, speed and torque, Gearing and Efficiency, Servo Motors, Stepper motors, Motor Control and its implementations.

Interfacing and other operations of robotics:

programming Arduino for DC motor control, programming Arduino for servo motor, sensor interfacing to arduino.

Reference Books:

- Cameron Hughes, Tracy Hughes, Robot Programming : A guide to controlling autonomous robots, Pearson
- Vinesh Kumar, Make your first robot, Notion press.
- K S Fu, R C Gonzalez, Robotics : control, sensing, vision and intelligence, McGraw Hill
- Ashitava Ghosal, Robotics : fundamental concepts and analysis, Oxford
- Richard Blum, Arduino Programming, Pearson

CEL 505 (iii)
Skill Enhancement Course II(Electronics)
Mobile Application Programming
(Credits: 02; 30 Hrs (2Hrs /week))

Marks for Major Test (External): 50
Marks for Internal Exam: 50
Time: 2 Hours

Paper setter is required to set 5 questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of ten short answer type questions each of 2 marks. The remaining four questions is to be set uniformly having two questions from each unit. The student is required to attempt three questions in all selecting one question from each unit and Question no. 1 is Compulsory.

UNIT-I (15 Hours)

Introduction to Mobile Application Programming :
What is mobile Application Programming, Different Platforms, Architecture and working of Android, iOS and Windows phone 8 operating system, Comparison of Android, iOS and Windows phone 8 functions

Android Development Environment:
What is Android, Advantages and Future of Android, Tools and about Android SDK, Installing Java, Eclipse, and Android, Android Software Development Kit for Eclipse, Android Development Tool: Android Tools for Eclipse, AVDs: Smartphone Emulators, Image Editing

UNIT-II (15 Hours)

Android Software Development Platform:
Understanding Java SE and the Dalvik Virtual Machine, Directory Structure of an Android Project, Common Default Resources Folders, The Values Folder, Leveraging Android XML, Screen Sizes, Launching Your Application: The Android Manifest.xml File, Creating Your First Android Application

Android Framework Overview:
The Foundation of OOP, The APK File, Android Application Components, Android Activities: Defining the User Interface, Android Services: Processing in the Background, Broadcast Receivers: Announcements and Notifications, Content Providers: Data Management, Android Intent Objects: Messaging for Components, Android Manifest XML: Declaring Your Components.

Reference Books:

- Barry Burd, Andriod Application Development, John Wiley & sons
- Joseph Annuzzi, Lauren Darcy, Introduction to Android Application Development, Addison Wesley
- Mathew Gimson, Android Programming

CEP 509 (i)
Practical -V (Electronics)
Electronic Instrumentation Lab
(Credits: 02; 60 Hrs (4Hrs /week)

Marks: 100
Time: 4 Hours

At least 8 experiments are to be performed including at least 6 experiments from following:

1. To analyze analog and digital multi meter for various measurements.
2. To study the front panel controls of storage CRO.
3. To measure resistance by Wheatstone bridge and measurement of bridge sensitivity.
4. To measure Capacitance by De Sauty's bridge
5. To determine the Characteristics of resistance transducer - Strain Gauge (Measurement of Strain using half and full bridge.)
6. To determine the Characteristics of LVDT.
7. To determine the Characteristics of Thermistors and RTD.
8. To measure temperature using Thermocouples.
9. To design regulated power supply of given rating (5 V or 9V).
10. To design and study the Sample and Hold Circuit.
11. To plot the frequency response of a microphone.
12. To measure pressure using Piezo-Electric Pick up.
13. To measure distance using LDR.
14. To study Arduino microcontroller.
15. To study RS 232 interface.

CEP 509 (ii)
Practical -V (Electronics)
Signal and System Lab
(Credits: 02; 60 Hrs (4Hrs /week)

Marks:100
Time: 4 Hours

At least 08 experiments are to be performed including at least 06 experiments from following using numerical computation software SciLab/MatLab

1. To generate continuous and discrete unit step signal.
2. To generate ramp and exponential signal in continuous and discrete domain.
3. To perform addition and subtraction of two signal in continuous and discrete domain.
4. To find and plot even and odd components of a signal.
5. To perform time shifting and time scaling operation on signals.
6. To perform folding and multiplication operation on signals.
7. To generate a random binary signal.
8. To determine and analyze energy of a continuous and discrete signal.
9. To determine and analyze power spectrum of a signal.
10. To determine autocorrelation and cross correlation of discrete data sequences.
11. To obtain and plot convolution of a discrete signal.
12. To obtain pole-zero plot of a given transfer function.
13. To determine and plot Fourier series representation of a given function.
14. To determine and plot Fourier transform of a discrete signal.
15. To write a program for time invariant system.
16. To write a program for linear system.

CEP 509 (iii)
Practical -V (Electronics)
Electronics Skill Lab
(Credits: 02; 60 Hrs (4Hrs /week)

Marks: 100
Time: 4 Hours

At least 08 experiments are to be performed including at least 06 experiments from following:

1. To familiarize about electronic components and their values
2. To study data sheets of diode and transistor.
3. Introduction of circuit schematic and layout tool.
4. To design schematic and layout of full wave rectifier.
5. To design schematic and layout of regulated DC power supply.
6. To design schematic and layout of clipper circuit.
7. Introduction of Design rule check (DRC) and Netlist.
8. Introduction of PCB types and standards.
9. Introduction of image transfer techniques.
10. Introduction of etching techniques.
11. Introduction of Soldering tools, materials and process.
12. To build and test full wave rectifier circuit on PCB.
13. To build and test power supply circuit on PCB.
14. To build and test clipper circuit on PCB.

Semester VI
CEL 603 (i)
Discipline Specific Course III (Electronics)
Digital System Design
(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 (7 Hours)

Introduction to digital design and VERILOG:
Digital logic design flow, Benefits of CAD, Introduction to HDLs, Verilog and its capabilities, Design Methodologies, Modules, Instances, Components of Simulation and Test Bench.Basic Concepts: Data Types, System Tasks and Compiler Directives. Modules and Ports.

UNIT-II (7 Hours)

Combinational circuit design using Verilog:
multiplexers, demultiplexers, decoders, encoders and adder circuits.

UNIT-III (8 Hours)

Sequential circuit design using Verilog:
flip-flop, latch and register. Finite state machines: Mealy and Moore. shift registers and counters.

UNIT-IV (8 Hours)

Programmable logic devices:
Evolution of Programmable logic devices. PAL, PLA, FPGA architectures. Placement and routing. Logic cell structure, Programmable interconnects, Logic blocks and I/O Ports. Clock distribution in FPGA. Timing issues in FPGA design. Boundary scan

Reference Books:

- Samir Palnitkar, Verilog HDL, Pearson Education; Second edition (2003).
- Zainalabedin Navabi, Verilog Digital System Design. TMH; 2nd edition.
- J. Bhaskar, A Verilog HDl Primer, Pearson
- D.J. Laja and S. Sapatnekar, Designing Digital Computer Systems with Verilog, Cambridge University Press, 2015.
- VLSI design, Debaprasad Das, 2nd Edition, 2015, Oxford University Press.
- Lizy Kurien and Charles Roth, Principles of Digital Systems Design and VHDL. Cengage Publishing.
- Ming-Bo Lin, Digital System Designs and Practices: Using Verilog HDL and FPGAs. Wiley India Pvt Ltd.
- Wayne Wolf, FPGA Based System Design. Pearson Education.

CEL 603 (ii)
Discipline Specific Course III (Electronics);
Digital Signal Processing
(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 (8 Hours)

Discrete-Time Fourier Transform:
Fourier Transform representation for Discrete –Time Aperiodic & Periodic Signals, Properties of Discrete –Time Fourier Transform, Basic Fourier Transform Pairs.

UNIT-II (7 Hours)

Z-Transform
Introduction to Z-Transform, Region of Convergence (ROC) for Z-Transform, Z-Transform Properties, Inverse Z-Transform, Analysis of LTI Systems Using Z-Transform, Application of z transform,

UNIT-III (7 Hours)

Discrete Fourier Transform:
Frequency Domain Sampling (Sampling of DTFT), The Discrete Fourier Transform (DFT) and its Inverse, DFT Properties: Periodicity, Linearity, Circular Time Shifting, Circular Frequency Shifting; Linear Convolution Using the DFT

Filter Concepts:
Phase Delay and Group delay, Zero-Phase Filter, Linear-Phase Filter, Advantages and Disadvantages of Digital Filters, Simple FIR Digital Filters, Simple IIR Digital Filters

UNIT-IV (8 Hours)

Finite Impulse Response Digital Filter:
Desirability of Linear-Phase Filters, Frequency Response of Linear-Phase FIR Filters Rectangular Windowing Method

Infinite Impulse Response Digital Filter:
Design of IIR Filters from Analog Filters, IIR Filter Design by Impulse Invariance Method.

Reference Books:

- Digital Signal Processing, Tarun Kumar Rawat, 2015, Oxford University Press, India.
- Digital Signal Processing, S. K. Mitra, McGraw Hill, India.
- Principles of Signal Processing and Linear Systems, B.P. Lathi, 2009, 1st Edition, Oxford University Press.
- Fundamentals of Digital Signal processing using MATLAB, R.J. Schilling and S.L. Harris, 2005, Cengage Learning.
- Fundamentals of signals and systems, P.D. Cha and J.I. Molinder, 2007, Cambridge University Press.

- Digital Signal Processing Principles Algorithm & Applications, J.G. Proakis and D.G. Manolakis, 2007, 4th Edition, Prentice Hall.
- K.A. Navas and R Jayadevan, Lab Primer Through MATLAB, PHI

CEL 603 (iii)
Discipline Specific Course III (Electronics);
Photonic Devices
(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 (8 Hours)

Classification of photonic devices. Interaction of radiation and matter, Radiative transition and optical absorption.

Light Emitting Diodes- Construction, materials and operation. Semiconductor Laser- Condition for amplification, laser cavity, heterostructure and quantum well devices. Charge carrier and photon confinement, line shape function. Threshold current. Laser diode.

UNIT-II (7 Hours)

Photodetectors: Photoconductor. Photodiodes (p-i-n, avalanche) and Photo transistors, quantum efficiency and responsivity. Photomultiplier tube.

UNIT-III (7 Hours)

Solar Cell: Construction, working and characteristics

LCD Displays: Types of liquid crystals, Principle of Liquid Crystal Displays, applications, advantages over LED displays.

UNIT-IV (8 Hours)

Introduction to Fiber Optics: Evolution of fiber optic system- Element of an Optical Fiber Transmission link- Ray Optics-Optical Fiber Modes and Configurations -Mode theory of Circular Wave guides- Overview of Modes-Key Modal concepts- Linearly Polarized Modes - Single Mode Fibers-Graded Index fiber structure.

Reference Books:

- Gerd Keiser, Optical communications essentials, McGraw Hill.
- Djafar K. Mynbaev, Fiber-Optic communications technology, Pearson.
- John M Senior, Optical Fiber Communications, PHI.
- J. Wilson & J.F.B. Hawkes, Optoelectronics: An Introduction, Prentice Hall India (1996).
- S.O. Kasap, Optoelectronics & Photonics, Pearson Education (2009).
- AK Ghatak & K Thyagarajan, Introduction to fiber optics, Cambridge Univ. Press (1998).
- Optoelectronic Devices and Systems, Gupta, 2nd edition, PHI learning.

CEL 604 (i)
Discipline Specific Course IV (Electronics);
VLSI Design
(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 (8 Hours)

CMOS Logic:
Inverter, NAND gate, combinational logic, NOR gate, compound gates, pass transistors and transmission gates, Tristates, Multiplexers, latches and flip flops. VLSI Design flow

UNIT-II (7 Hours)

MOS Transistor Theory:
Introduction, I-V characteristics, C-V characteristics, Non Ideal I-V effects - Velocity saturation, Channel length modulation, Body Effect, Subthreshold conduction. Noise Margin.

UNIT-III (7 Hours)

Circuit characterization and Performance Estimation:
Delay Estimation, RC Delay Models, Delay in multistage logic networks, choosing the best number of stages, static and dynamic power dissipation, Low power design, Interconnect, Design Margin

UNIT-IV (8 Hours)

Circuit Design:
Combinational Circuit Design: Static CMOS, Ratioed Circuits
Sequential Circuit Design: Sequencing static circuits, Conventional CMOS latches and flip-flops.

Reference Books:

- Neil H.E. Weste, David Harris, CMOS VLSI Design : A circuits and systems perspective, Pearson
- Jan M Rabaey, Anantha Chandrakasan & Nikolic, Introduction to Digital Integrated Circuits: A design perspective, Pearson

CEL 604 (ii)
Discipline Specific Course IV (Electronics)
Internet of Things
(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 **(8 Hours)**

Introduction:
Definition and characteristics of IOT, Physical Design of IoT, Logical Design of IoT, Basic steps of IoT Design methodology, IoT enabling technologies, M2M basics, Difference between IoT and M2M. Software defined networking. network function virtualization.

UNIT-II **(7 Hours)**

IoT Physical Devices:
Basic building blocks of an IoT device, Exemplary Devices - Raspberry Pi, Arduino,
Arduino board details, Analog, digital and PWM pins, Arduino IDE software, SPI and I2C communications,

UNIT-III **(7 Hours)**

Interfacing:
Interfacing LED, LCD with Arduino, Programs to interface sensors to Arduino, Interfacing motors.

UNIT-IV **(8 Hours)**

Case Studies:
Smart lighting, Home intrusion detection, smart parking system, Air pollution monitoring, Smart irrigation

Reference Books:

- Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-on approach, Universities press
- K.G.Srinivasa, G.M.Siddesh, Internet of Things, Cengage
- Adrian Mcewen, Hakin Cassimally, Designing the internet of Things, Wiley
- David Hanes, Gonzalo Salagueiro, IoT Fundamentals, CISCO

CEL 604 (iii)
Discipline Specific Course IV (Electronics);
Consumer Electronics
(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 (8 Hours)

Audio and Video Systems

Microphones: Construction, working principles and applications of microphones, their types viz: a) Carbon b) moving coil, c) velocity, d) crystal, e) condenser, e) cordless etc; Loud Speaker: Direct radiating, horn loaded woofer, tweeter, mid range, multi-speaker system, baffles and enclosures; Sound recording on magnetic tape, its principles, block diagram and tape transport mechanism; Digital sound recording on tape and disc CD system: Hi-Fi system, pre-amplifier, amplifier and equalizer system, stereo amplifiers

UNIT-II (7 Hours)

Video Systems:

Different types of screens: LCD, LED, Plasma, CRT, 3d display, Digital cameras (still and video), Basic idea of principles of Black and White and colour TV and their difference, Standards Remote Control, VCD and DVD Players

UNIT-III (7 Hours)

Office and Home Gadgets

Basic block diagram, working of the followings: Desktop computer, Laptop, Micro SD card, Pen drive, Hard disk, Printer (inkjet and laser), Scanner, FAX machine, Photostat and Xerox machines, EPABX, Micro wave ovens, washing machine, RO, UPS/inverters, Air conditioners,Refrigerators

UNIT-IV (8 Hours)

Advance Gadgets:

Basic block diagram and working of the followings: Drones, Bar coding, Automated Teller Machines (ATM), Dish washer, cable TV and DTH, cable TV using internet, Electronic Ignition Systems for automobiles, Home security and CCTV, 3D Printers, LCD projector

Reference Books:

- S.P Bali, Consumer Electronics, Pearson Education
- Philip Hoff, Consumer Electronics for Engineers, Cambridge University Press
- B.Grob, Basic Electronics,Tata Mc Graw Hill
- Thomas E. Kissell, Industrial Electronics: Applications for Programmable Controllers, Instrumentation and Process Control, and Electrical Machines and Motor Controls, Prentice Hall

CEP 609 (i)

Practical -VI (Electronics)

Digital System Design Lab

(Credits: 02; 60 Hrs (4Hrs /week)

Marks: 100

Time: 4 Hours

At least 08 experiments are to be performed including at least 06 experiments from following using Verilog:

1. Write code to realize basic and derived logic gates.
2. To design Half adder, Full Adder using basic and derived gates.
3. To design Half subtractor and Full Subtractor using basic and derived gates.
4. Design and simulation of a 4 bit Adder.
5. Multiplexer (4x1) using logic gates.
6. To design Demultiplexer using logic gates.
7. To design Encoder using logic gates.
8. To design Decoder using logic gates.
9. Design and simulation of Comparator.
10. Design and simulation of Clocked D, JK and T Flip flops (with Reset inputs)
11. Design and simulation 3-bit Ripple counter
12. Design and simulation of ALU
13. To design and study switching circuits (LED blink shift)
14. To design traffic light controller.
15. To interface a keyboard.
16. To interface multiplexed seven segment display.
17. To interface a LCD using FPGA
18. To interface a stepper motor and DC motor.
19. To interface ADC 0804.

CEP 609 (ii)

Practical -VI (Electronics)

Digital Signal Processing Lab

(Credits: 02; 60 Hrs (4Hrs /week)

Marks: 100

Time: 4 Hours

At least 08 experiments are to be performed including at least 06 experiments from following using numerical computation software SciLab/MatLab

1. Write a program to generate and plot the following sequences: (a) Unit sample sequence $\delta(n)$, (b) unit step sequence $u(n)$, (c) ramp sequence $r(n)$, (d) real valued exponential sequence $x(n) = (0.8)^n u(n)$ for $0 \leq n \leq 50$.

2. Write a program to compute the convolution sum of a rectangle signal (or gate function) with itself for N = 5

$$x(n) = rect\left(\frac{n}{2N}\right) = \Pi\left(\frac{n}{2N}\right) = \begin{cases} 1 & -N \leq n \leq N \\ 0 & otherwise \end{cases}$$

3. An LTI system is specified by the difference equation

$$y(n) = 0.8y(n-1) + x(n)$$

(a) Determine $H(e^{jw})$

(b) Calculate and plot the steady state response $y_{ss}(n)$ to

$$x(n) = \cos(0.5\pi n)u(n)$$

4. Given a casual system

$$y(n) = 0.9y(n-1) + x(n)$$

(a) Find $H(z)$ and sketch its pole-zero plot

(b) Plot the frequency response $|H(e^{jw})|$ and $\angle H(e^{jw})$

5. Design a digital filter to eliminate the lower frequency sinusoid of $x(t) = \sin 7t + \sin 200t$. The sampling frequency is $f_s = 500\,Hz$. Plot its pole zero diagram, magnitude response, input and output of the filter.

6. Let $x(n)$ be a 4-point sequence:

$$x(n) = \underset{\uparrow}{\{1,1,1,1\}} = \begin{cases} 1 & 0 \le n \le 3 \\ 0 & otherwise \end{cases}$$

Compute the DTFT $X(e^{jw})$ and plot its magnitude

(a) Compute and plot the 4 point DFT of $x(n)$

(b) Compute and plot the 8 point DFT of $x(n)$ (by appending 4 zeros)

(c) Compute and plot the 16 point DFT of $x(n)$ (by appending 12 zeros)

7. Let $x(n)$ and $h(n)$ be the two 4-point sequences,

$$x(n) = \underset{\uparrow}{\{1,2,2,1\}}$$

$$h(n) = \underset{\uparrow}{\{1,-1,-1,1\}}$$

Write a program to compute their linear convolution using circular convolution.

8. Using a rectangular window, design a FIR low-pass filter with a pass-band gain of unity, cut off frequency of 1000 Hz and working at a sampling frequency of 5 KHz. Take the length of the impulse response as 17.

9. Design an FIR filter to meet the following specifications:
passband edge $F_p = 2\ KHz$
stopband edge $F_s = 5\ KHz$
Passband attenuation $A_p = 2\ dB$
Stopband attenuation $A_s = 42\ dB$
Sampling frequency $F_s = 20\ KHz$

10. The frequency response of a linear phase digital differentiator is given by

$$H_d(e^{jw}) = jwe^{-j\tau w} \qquad |w| \le \pi$$

Using a Hamming window of length M = 21, design a digital FIR differentiator. Plot the amplitude response.

CEP 609 (iii)

Practical -VI (Electronics)

Advance Communication Lab

(Credits: 02; 60 Hrs (4Hrs /week)

Marks: 100

Time: 4 Hours

At least 08 experiments are to be performed including at least 06 experiments from following:

1. To study FSK modulator.
2. To study PSK modulator.
3. To study ASK modulator.
4. To study Time Division Multiplexing of two band limited signals.
5. To study Frequency Division Multiplexing of two band limited signals.
6. To study various line coding techniques
7. To study Pre-emphasis and de-emphasis
8. To study DPSK generation and detection
9. To study QPSK generation and detection
10. To measure Numerical Aperture of a given optical fiber
11. To study Analog and Digital communication link using optical fiber.
12. To study BER in optical transmitter fiber link.
13. To measure losses in a given optical fiber (propagation loss, bending loss)
14. To measure directivity and gain of Standard dipole antenna.
15. To measure directivity and gain of microstrip patch antenna
16. To measure directivity and gain of Yagi antenna

SEMESTER V & VI

B. SC. PHYSICAL SCIENCES

(MATHEMATICS)

CML-506 (i): Groups and Rings

Marks (Theory): 80 **Marks (Total) : 100**
Marks (Internal Assessment) : 20 **Time : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

Definition of a group. Examples of abelian and nonabelian groups. The group Z_n of integers under addition modulo n and the group of $U(n)$ of units under multiplication modulo n. Generator of a group. Cyclic groups. Permutations groups. Alternating groups, Cayley's theorem. Subgroups and Subgroup criteria. Cosets, Left and right cosets, properties of cosets.

Section – II

Index of a sub-group. Coset decomposition, Lagrange's theorem on groups and its consequences, Normal subgroups, Quotient groups, Homomorphisms, isomorphisms, automorphisms on group. Center of a group and class equation of a group and derived group of a group.

Section – III

Introduction to Rings, Subrings, Integral domains and Fields, Characteristics of a ring. Ring homomorphisms, Theorems on Ring homomorphisms. Ideals (Principle, Prime and Maximal) and Quotient rings, Field of quotients of an integral domain.

Section – IV

Euclidean rings, Polynomial rings, Polynomials over the rational field, The Eisenstein's criterion of irreducibility of polynomials over the field of rational numbers. Polynomial rings over commutative rings. Principal ideal domain, Unique factorization domain.

Books Recommended:

1. I.N. Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975
2. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal, Basic Abstract Algebra (2^{nd} edition).
3. VivekSahai and VikasBist, Algebra, Narosa Publishing House.
4. I.S. Luther and I.B.S. Passi, Algebra, Vol.-II, Narosa Publishing House.

CML-506(ii): Sampling Techniques

Marks (Theory): 80 **Marks(Total) : 100**
Marks (Internal Assessment) : 20 **Time : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section-I

Sample Surveys: Concepts of population, sample, sampling unit, parameter, statistic, sample frame and standard error. Principal steps in sample surveys - need for sampling, census versus sample surveys, sampling and non- sampling errors, sources and treatment of non-sampling errors, advantages and limitations of sampling. Sampling Methods: Types of sampling: Subjective, probability and mixed sampling methods. Methods of drawing random samples with and without replacement.

Section-II

Estimates of population mean, total, and proportion, their variances and the estimates of variances in Simple Random Sampling With and Without Replacement. Estimates of population mean, total, and proportion, their variances and the estimates of variances with (i) Stratified Random Sampling with Proportional and Neyman allocation, and (ii) Systematic Sampling when N= nk. Comparison of relative efficiencies. Advantages and disadvantages of SRS, Stratified and Systematic sampling methods.

Section-III

Time series: Time series and its components with illustrations, additive, multiplicative and mixed models. Determination of trend by least squares and moving average methods. Growth curves and their fitting with reference to Modified exponential, Gompertz and Logistic curves. Determination of seasonal indices by Ratio to moving average, ratio to trend and link relative methods.

Section-IV

Demand Analysis: Introduction. Demand and supply, price elasticity of supply and demand. Methods of determining demand and supply curves, Leontief's ,Pigous's methods of determining demand curve from time series data, limitations of these methods Pigou's method from time series data. Pareto law of income distribution curves of concentration. Index Numbers: Concept, construction, uses and limitations of simple and weighted index numbers. Laspeyer's, Paasche's and Fisher's index numbers, criterion of a good index numbers.

Recommended Books:

1. A.M.Goon, M.K.Gupta, B. Dasgupta: Fundamentals of Statistics Vol II World Press Private Ltd.,Calcutta
2. A.M.Goon,M.K.Gupta,B.Dasgupta An outline of Statistical Theory Vol II World Press Private Ltd.,Calcutta.
3. Cochran W.G., Sampling Techniques, Wiley Publishers
4. Daroga Singh and Chowdhary: Theory and Analysis of Sample survey designs. Wiley Eastern.
5. S.P.Gupta : Statistical Methods. Sultan Chand and Sons.
6. Sukhatmeet. al., Sample Theory of Surveys with Applications, Lowa State Uni. Press & IARS
7. V.K. Kapoor and S.C. Gupta: Fundamentals of Applied Statistics. Sultan Chand.

CML-507 (i): Sequence and Series

Marks (Theory): 80 **Marks (Total): 100**
Marks: Internal Assessment (20) **Time: 3 Hours**

Note:Attempt five questions in all. The question paper will consist of four sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. Each of the four sections **(I-IV)** will contain two questions and the students are required to attempt one question from each section. All questions carry equal marks.

SECTION-I

Boundedness of the set of real numbers; least upper bound, greatest lower bound of a set, neighborhoods, interior points, isolated points, limit points, open sets, closed set, interior of a set, closure of a set in real numbers and their properties.

Sequence: Real sequences and their convergence, theorem on limits of sequence, bounded and monotonic sequences, Cauchy's sequence, Cauchy general principle of convergence, subsequences, subsequential limits.

SECTION-II

Infinite series: Convergence and divergence of Infinite Series, Comparison Tests of positive terms Infinite series, Cauchy's general principle of Convergence of series, Convergence and divergence of geometric series, Hyper Harmonic series or p-series. D-Alembert's ratio test, Raabe's test, Logarithmic test, De Morgan and Bertrand's test, Cauchy's nth root test, Gauss Test, Cauchy's integral test, Cauchy's condensation test.

Alternating series: Leibnitz's test, absolute and conditional convergence. Arbitrary series: Abel's lemma, Abel's test, Dirichlet's test.

SECTION-III

Fourier's series: Fourier expansion of piecewise monotonic functions, Properties of Fourier Co-efficients, Dirichlet's conditions, Parseval's identity for Fourier series, Fourier series for even and odd functions, Half range series, Change of Intervals.

SECTION-IV

Riemann integral: Definition and examples. Darboux's Theorem and condition of existence of Riemann's integral. Integrabililty of continuous, monotonic functions and discontinuous functions. Properties of integrable functions. Continuity and differentiability of integrable functions. Primitive. The Fundamental theorem of integral calculus. Mean value theorems of integral calculus.

Books Recommended

1. T.M.Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi,1985.
2. R.R. Goldberg, Methods of Real Analysis, John Wiley and Sons, Inc., New York, 1976.
3. SC Malik and Savita Arora, Mathematical New Age International (P) Limited Published, New Delhi, 2012 (Fourth Edition).
4. D. Somasundaram and B. Choudhary: A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997.
5. R.G. Bartle and D.R. Shernert: Introduction to Real Analysis, Wiley, 2011.
6. Shanti Narayan : A Course of Mathematical Analysis, S. Chand & Co., New Delhi

CML-507(ii): Sample Surveys and Design of Experiments

Marks (Theory): 80 **Marks (Total): 100**

Marks (Internal Assessment): 20 **Time : 3 Hrs**

Note:Attempt five questions in all. The question paper will consist of four sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. Each of the four sections **(I-IV)** will contain two questions and the students are required to attempt one question from each section. **All questions carry equal marks.**

Section-I

Sample Surveys: Concepts of population and sample. Complete enumeration vs. sampling. Need for sampling. Principal and organizational aspects in the conduct of a sample survey. Properties of a good estimator, Sampling and non-sampling errors.

Section-II

SRSWR & SRSWOR, determination of sample size. Stratified random sampling and different allocations. Systematic sampling, comparison of known sampling strategies under linear trend. Ratio and Regression estimators and their comparison with SRSWOR estimator.

Section-III

Indian official Statistics: Present official Statistical system in India relatinig to census of population, agriculture, industrial production, and prices; methods of collection of official Statistics, Their reliability and limitation and the principal publications containing such Statistics. Also the various agencies responsible for the data collection- C.S.O., N.S.S.o., office of the Registrar General, Their historical development, main functions and important publications.

Analysis of variance and covariance: analysis of variance and covariance (with one concomitant variable) in one way and two way classified data with equal number of observations per cell.

Section-IV

Design of experiments: Principles of experimentation, uniformity trails, completely randomized, Randomized block and Latin square designs. Missing plot technique, 2^2 and 2^3 Factorial experiments: construction and analysis.

Regression Analysis: Two variable linear model- estimation, testing and problems of predication. Predication of the estimated regression equation, interval estimation, variance estimation.

Books Recommemded

1. W.G. Cochran, *Sampling Techniques,* John Wiley and Sons, New York, 1997.
2. A.M. Goon, M. K. Gupta and B. Dasgupta, *fundamentals of Statistics* (Vol.II), 8th Ed. World Press, Kolkata, 2005.
3. A.M. Goon, M. K. Gupta and B. Dasgupta, *An Outline of Statistical Theory* (Vol. II), 3rd Ed. World Press, Kolkata, 2005.
4. S.C. Gupta and V.K. Kapoor, *Fundamentals of Applied Statistics,* 4th Ed., Sultan Chand and Sons, 2008.
5. A. M. Kshirsagar, *A Course in Linear Models,* Marcel Dekker, Inc., N.Y., 1983.

CML-508(i): Number Theory & Trigonometry

Marks (Theory): 80 **Marks(Total) : 100**
Marks (Internal Assessment) : 20 **Time : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section-I

Linear Diophantine equation, prime counting function, statement of prime number theorem, Goldbach conjecture, linear congruences, complete set of residues, Chinese remainder theorem, Fermat's little theorem, Wilson's theorem.

Section-II

Number theoretic functions, sum and number of divisors, totally multiplicative functions, the Möbius inversion formula, the greatest integer function, Euler's phi-function, Euler's theorem, reduced set of residues, some properties of Euler's phi-function.

Section-III

Order of an integer modulo n, primitive roots for primes, composite numbers having primitive roots, Euler's criterion, the Legendre symbol and its properties, quadratic reciprocity, quadratic congruences with composite moduli.

Section-IV

Exponential, Logarithmic, Circular functions; sin(nx), cos(nx), tan(nx), $\sin^n x$, $\cos^n x$, $\tan^n x$, hyperbolic and inverse hyperbolic functions - simple problems. Gregory's series, Summation of Trigonometric series, Trigonometric expansions of sine and cosine as infinite products (without proof).

Recommended Books:

1. David M. Burton, Elementary Number Theory (6th Edition), Tata McGraw-Hill Edition, Indian reprint, 2007.
2. Neville Robinns, Beginning Number Theory (2nd Edition), Narosa Publishing House Pvt. Limited, Delhi, 2007.
3. Trigonometry : P. Duraipandian
4. Plane Trigonometry part 2 : S. L. Loney, (Macmillan and Co. London)

CML-508(ii): Integer Programming and Theory of Games

Marks (Theory): 80 **Marks(Total) : 100**
Marks (Internal Assessment) : 20 **Time : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section-I

Scope and applicability. Formulations. Combinatorial optimization. Relaxations. Linear programs with integer solutions. Integer Programming Problem (IPP): Pure and Mixed IPP, Methods for solving IPP: Branch and Bound Method, implicit enumeration,Gomory's Cutting Plane Method.

Section-II

Applications of IPP, 0-1 Programming: applications, enumeration algorithm. Gomory-Chvátal theory. The mixed integer Gomory cut. The problem of convergence and stalling. Disjunctive programming: optimization over unions of polyhedra.

Section-III

Introduction to Game theory, Fundamental theorem of game theory, min-max and max-min principle, Formulation of two person zero sum rectangular games, Solution of rectangular games with saddle, points.

Section-IV

Dominance principle, rectangular games without saddle point- mixed strategy, games, Bayesian Games, Extensive Form Games with Perfect Information. Graphical, algebraic and linear programming solution of m x n games.

Recommended Books:

1. Hamdy A. Taha: Operations Research-An Introduction, Prentice Hall, 9th Edition, -2010.
2. Frederick Hillier and Gerald Lieberman, Introduction to Operations Research. 9th Edition, McGraw-Hill Professional, 2010.
3. P. R. Thei, G. E. Keough: An introduction to Linear Programming and Game Theory. Wiley, New Jersey, 3rd Ed., 2008.
4. S. Chandra, Jayadeva, AparnaMehra: Numerical Optimization with Application, Narosa Publishing House, 2009

CML-605 (i): Linear Algebra

Marks (Theory): 80 **Marks(Total) : 100**
Marks (Internal Assessment) : 20 **Time : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

Vector spaces, subspaces, Sum and Direct sum of subspaces, Linear span, Linearly Independent and dependent subsets of a vector space. Finitely generated vector space, Existence theorem for basis of a finitely generated vactor space, Finite dimensional vector spaces, Invariance of the number of elements of bases sets, Dimensions, Quotient space and its dimension.

Section – II

Homomorphism and isomorphism of vector spaces, Linear transformations and linear forms on vactor spaces, Vactor space of all the linear transformations, Null Space, Range space of a linear transformation, Rank and Nullity Theorem,

Section – III

Algebra of Linear Transformation, Minimal Polynomial of a linear transformation, Singular and non-singular linear transformations, Matrix of a linear Transformation, Change of basis, Eigen values and Eigen vectors of linear transformations.

Section – IV

Inner product spaces, Cauchy-Schwarz inequality, Orthogonal vectors, Orthogonal complements, Orthogonal sets and Basis, Bessel's inequality for finite dimensional vector spaces, Gram-Schmidt, Orthogonalization process, Adjoint of a linear transformation and its properties, Unitary linear transformations.

Books Recommended:

1. I.N. Herstein,: Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975
2. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal, Basic Abstract Algebra (2^{nd} edition).
3. VivekSahai and VikasBist, Algebra, Narosa Publishing House.
4. I.S. Luther and I.B.S. Passi, Algebra, Vol.-II, Narosa Publishing House.

CML 605(ii): Bio-Mathematics

Marks (Theory): 80 **Marks(Total) : 100**
Marks (Internal Assessment) : 20 **Time : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section-I

Population growth, Administration of drugs, Cell division. Modelling Biological Phenomena: Heart beat, Blood Flow, Nerve Impulse transmission, Chemical Reactions, Predator-prey models. Stability and oscillations: Epidemics, the phase plane, Local Stability, Stability, Limit Cycles, Forced oscillations, Computing trajectories.

Section-II

Mathematics of Heart Physiology: The local model, The Threshold effect, The phase plane analysis and the heart beat model, Physiological considerations of the heart beat model, A model of the cardiac pace-maker. Bifurcation and chaos: Bifurcation, Bifurcation of a limit cycle, Discrete bifurcation, Chaos, Stability, The Poincare plane.

Section-III

Mathematics of imaging of the Brain: Modelling of computerized tomography (CT, Magnetic resonance Imaging (MRI), Discrete analogues and Numerical Implementation. Networks in Biological Sciences: Dynamics of Small world networks, scale-free networks, complex networks, cellular automata.

Section-IV

Modelling Molecular Evolution: Matrix models of base substitutions for DNA sequences, The Jukes-Cantor Model, the Kimura Models, Phylogenetic distances. Constructing Phylogenetic trees: Unweighted pair-group method with arithmetic means (UPGMA), Neighbour- Joining Method, Maximum Likelihood approaches.

Recommended Books:

1. Elizabeth S. Allman and John a. Rhodes, Mathematical Models in Biology, Cambridge University Press, 2004.
2. C. Epstein, The Mathematics of Medical Imaging, Prentice Hall, 2003 (copyright Pearson Education, 2005).
3. S. Helgason, The Radon transform, Second Edition, Birkhauser, 1997.
4. D. S. Jones and B. D. Sleeman, Differential Equations and Mathematical Biology, Cahapman& Hall, CRC Press, London, UK, 2003.
5. James Keener and James Sneyd, Mathematical Physiology, Springer Verlag, 1998, Corrected 2nd printing, 2001.

CML-606(i) Mechanics-II

Theory: 80 **Marks (Total): 100**
Marks (Internal Assessment): 20 **Time: 3 Hrs**

Note:Attempt five questions in all. The question paper will consist of four sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. Each of the four sections **(I-IV)** will contain two questions and the students are required to attempt one question from each section. All questions carry equal marks.

Section - I

Analytical conditions of equilibrium of co-planar forces: Equilibrium of three forces, conditions of equilibrium, trigonometric theorem's, conditions of equilibrium of co-planar forces (First, Second and Third form); Friction: Definition of friction and basic laws, problems based on equilibrium of rods and ladders; Centre of gravity: Basic concepts and definitions, centre of gravity of a uniform rod, a thin uniform lamina in the form of a parallelogram, a thin uniform triangular lamina, three uniform rods forming a triangle, a uniform quadrilateral lamina, lamina in the form of a trapezium, centre of gravity of a body by integration.

Section - II

Motion of a particle attached to an elastic string, Hooke's law, motion of horizontal and vertical elastic strings, Definition of work, Power and Energy, work done by a variable force, work done in stretching an elastic string, principle of work and energy, conservative system of forces, principle of conservation of energy, impulse of a constant force and a variable force.

Section - III

Motion of a particle on smooth curves, motion on the outside and inside of a smooth vertical circle, cycloidal motion, motion on a rough curve under gravity.

Section - IV

Projectile motion of a particle in a plane, velocity at any point of the trajectory, directions of projection for a particle, range and time of flight on an inclined plane, directions of projection for a given velocity and a given range; range and time of fight down an inclined plane.

Books Recommended:

1. S.L. Loney: Statics, Macmillan Company, London.
2. R.S. Verma: A Text Book on Statics, Pothishala Pvt. Ltd., Allahabad
3. S.L. Loney, An Elementary Treatise on the Dynamics of a Particle and a Rigid Bodies, Cambridge University Press, 1956.
4. F. Chorlton, Dynamics, CBS Publishers, New Delhi.
5. A.S. Ramsey, Dynamics Part-1&2, CBS Publisher & Distributors.

CML-606(ii): Queuing and Reliability Theory

Marks (Theory): 80 **Marks(Total) : 100**
Marks (Internal Assessment) : 20 **Time : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section-I

General concepts of queueing system and Introduction to stochastic processes, Measures of performance, Arrival and Service processes, Kendall's notation, Single server and multi server models. channels in parallel with limited and unlimited queues --M/M/1/K, M/M/C.

Section-II

Queues with unlimited service, Finite source queues, Applications of Simple Queuing Decision Models, Design and Control Models.

Reliability concepts – Systems of components. Series and parallel systems – Coherent structures and their representation in terms of paths and cuts, Modular decomposition.

Section-III

Reliability of coherent systems – Reliability of Independent components, association of random variables, bounds on systems reliability and improved bounds on system reliability under modular decomposition.

Section-IV

Life Distribution: Survival function – Notion of aging IFR, DFR, DFRA, NBU and NBUE classes, Exponential distributions and its no-ageing property, ageing properties of other common life distribution, closures under formation of coherent structures, convolutions and mixtures of theses cases. Reliability estimation: Estimation of two and three parameter Gamma, Weibull and log normal distributions.

Recommended Books:

1. D. Gross and C. Harris, Fundamentals of Queueing Theory, 3rd Edition, Wiley, 1998. (WSE Edition, 2004).
2. J. Medhi, Stochastic Models in Queueing Theory, 2nd Edition, Academic Press, 2003. (Elsevier India Edition, 2006).
3. John G. Rau, Optimization and Probability in Systems Engineering, V. N. Reinhold Co. 1970.
4. L. Kleinrock, Queueing Systems, Vol. 1: Theory, Wiley, 1975.
5. Marvin Rausand and ArnljotHoyland, System Reliability Theory: Models, Statistical Methods and Applications, 2" Ed. John Wiley and Sons Inc. 2003.
6. U N Bhatt: An Introduction to Queueing Theory: Modeling and Analysis in Applications (Statistics for Industry and Technology), Birkhauser Boston, 2008.

CML-607 (i): Real and Complex Analysis

Marks (Theory): 80 **Marks (Total): 100**
Marks: Internal Assessment (20) **Time : 3 Hours**

Note:Attempt five questions in all. The question paper will consist of four sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. Each of the four sections **(I-IV)** will contain two questions and the students are required to attempt one question from each section. All questions carry equal marks.

SECTION-I

Definition and examples of metric spaces, neighborhoods, limit points, interior points, open and closed sets, closure and interior, boundary points, subspace of a metric space, equivalent metrics, Cauchy sequences, completeness, Cantor's intersection theorem.

SECTION-II

Baire's category theorem, Contraction Principle, continuous functions, uniform continuity, compactness for metric spaces, sequential compactness, Bolzano-Weierstrass Property, total boundedness, finite intersection property, continuity in relation with compactness, connectedness.

SECTION-III

Improper integrals and their convergence, comparison tests, Abel's and Dirichlet's tests, Frullani's integral, Integral as a function of a parameter. Continuity, differentiability and integrability of an integral of a function of a parameter.

SECTION-IV

Topology of complex numbers: Trigonometric, exponential, logarithmic and hyperbolic trigonometric functions. Extended complex plane, Stereographic projection of complex numbers. Continuity and differentiability of complex functions. Analytic functions, Cauchy-Riemann equations, harmonic conjugates, harmonic functions. Construction of analytic functions: direct method and Milne-Thomson method.

Books Recommended

1. T.M.Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi,1985.
2. R.R. Goldberg, Methods of Real Analysis, John Wiley and Sons, Inc., New York, 1976.
3. D. Somasundaram and B. Choudhar: A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997.
4. M.D. Raisinghania, Elements of Real Analysis, S.Chand Publication, 2003.
5. R.G. Bartle and D.R. Shernert: Introduction to Real Analysis, Wiley, 2011.
6. H.A. Priestly, Introduction to Complex Analysis, Clarendon Press, Oxford, 1990.
7. L.V. Ahlfors, Complex Analysis, McGraw-Hill, 1979.

CML-607(ii): Optimization Techniques

Marks (Theory): 80 **Marks (Total): 100**

Marks (Internal Assessment): 20 **Time : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section-I

Dynamic programming: Multistage decision processes, Recursive nature of computations, Forward and Backward recursion, Bellman's principle of optimality, Selective dynamic programming applications involving additive and multiplicative separable returns for objectives as well as constraint functions, Problem of dimensionally.

Goal Programming: Weighted and pre-emptive goal programming, graphical solution.

Section-II

Decision Analysis: Decision making under risk- Decision tree analysis, Posterior (Baye's) probabilities, Decision under uncertainty- criterion of pessimism, criterion of optimism, Laplace criterion, criterion of realism, criterion of regret.

Section-III

General concepts of queueing system, Measures of performance, Arrival and service Processes, Single server and multi server models, channel in parallel with limited and unlimited queues- M/M/1/K, M/M/C. Queues with unlimited service. Finite source queues. Applications of simple queueing decision model's, Design and control models.

Section-IV

Basics of reliability. Classes of life distributions. Series, parallel configuration. Reliability models, Reliability, Mean time before failure and Hazard rate of Exponential and Weibull distributions. Concepts and definitions of preventive maintenance, corrective maintenance and age replacement.

Books Recommended

1. R.B. Cooper, *Introduction to Queueing Theory, 2nd*Ed., North Holland, 1981.
2. D. Gross, C.M. Harris, *Fundamentals of Queueing Theory,* 3rd Ed., John Wiley and Sons Inc. P. Ltd., 2002.
3. U.N. Prabhu, *Foundations of Queueing Theory,* International Series in Operations & Management Science, Kluwer Academic Publishers, 2nd Ed., 2002.
4. John G. Rau, *Optimization and Probability in Systems Engineering,* V.N. Reinhold Co., 1970.
5. Riccardo Manzini, Alberto Regattieri, Hoang Pham, Emilio Ferrai, *Maintenance for Industrial Systems,* Springer-Verlag, London Limited, 2010.
6. P.K. Kapur, R.B. Garg, S. Kumar, *contributions to Hardware and Software Reliability,* World Scientific, Singapore, 1999.

CMS-608(i): Solid Geometry

Marks (Theory): 50 **Marks(Total) : 100**
Marks (Internal Assessment) : 50 **Time : 2 Hrs**

Note: *The examiner is requested to set five questions in all, selecting two questions from each UNIT and one compulsory question (Question No.1 based on entire syllabus will consist of five short answer type questions each of two marks). The candidate is required to attempt three questions in all selecting one from each UNIT and the compulsory Question No.1. All questions carry equal marks.*

UNIT-I

Central Conicoids: Equation of tangent plane. Director sphere. Normal to the conicoids. Polar plane of a point. Enveloping cone of a coincoid. Enveloping cylinder of a coincoid.

UNIT-II

Paraboloids: Circular section, Plane sections of conicoids. Generating lines. Confocal conicoid. Reduction of second degree equations.

Books Recommended:

1. R.J.T. Bill, Elementary Treatise on Coordinary Geometry of Three Dimensions, MacMillan India Ltd. 1994.
2. P.K. Jain and Khalil Ahmad: A Textbook of Analytical Geometry of Three Dimensions, Wiley Eastern Ltd. 1999.

CMS-608(ii)

Skill Enhancement Course

Financial Mathematics

Credits: 02; 30 Hrs (2Hrs /week)

Marks (Theory): 50 **Marks (Total) : 100**
Marks (Internal Assessment) : 50 **Time : 2 Hrs**

Note: *The examiner is requested to set five questions in all, selecting two questions from each UNIT and one compulsory question (Question No.1 based on entire syllabus will consist of five short answer type questions each of two marks). The candidate is required to attempt three questions in all selecting one from each UNIT and the compulsory Question No.1.*

UNIT-I

Basic principles: Comparison, arbitrage and risk aversion, Interest (simple and compound, discrete and continuous), time value of money, inflation, net present value, internal rate of return (calculation by bisection and Newton-Raphson methods), comparison of NPV and IRR.

UNIT-II

Bonds, bond prices and yields, Macaulay and modified duration, term structure of interest rates: spot and forward rates, explanations of term structure, running present value, floating-rate bonds, immunization, convexity, putable and callable bonds.

Recommended Books:

1. David G. Luenberger, Investment Science, Oxford University Press, Delhi, 1998.
2. John C. Hull, Options, Futures and Other Derivatives (6th Edition), PrenticeHall India, Indian reprint, 2006.
3. Sheldon Ross, An Elementary Introduction to Mathematical Finance (2nd Edition), Cambridge University Press, USA, 2003