



RAFFLES UNIVERSITY, NEEMRANA, ALWAR (RAJASTHAN)

Japanese Zone, National Highway-8, Neemrana-307105

Tel.: +91-9214205555 www.rafflesuniversity.edu.in

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. (Six –Semester Course)



RAFFLES

UNIVERSITY

DEPARTMENT OF PHYSICS

SCHOOL OF BASIC AND APPLIED SCIENCES

RAFFLES UNIVERSITY, NEEMRANA, ALWAR (RAJASTHAN)

SCHOOL OF BASIC AND APPLIED SCIENCES

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Physics

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. I Year (I Semester)

Lectures	: 3 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Subject	: Mechanics	Paper Code	: PHY-101

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Background of Vector calculus: Concepts of gradient, Divergence and curl ; Line, Surface and Volume Integrals, Frame of Reference, Galilean transformation, Galilean Invariance, Inertial and Non Inertial frames, Pseudo forces, Rotating reference frame, Centrifugal force, Coriolis force, motion under central force, Kepler's law, Conservative and Non-conservative force.

UNIT-II

Ideal fluids, Equation of continuity, Streamline flow, Rotational and irrotational flows, Euler's equation, Bernoulli's Theorem, Viscous fluids, Poiseuille's equation, Viscosity by rotating cylinder method. Elasticity Hooke's law and elastic constant of isotropic solid.

UNIT-III

Strain and Stress in an isotropic homogeneous medium, Elastic moduli and relations between them, Torsion of cylinders, Bending of beams, Internal energy of a strained body, surface tension and surface energy.

UNIT-IV

Inference of Michelson-Morley Experiment, Postulates of special relativity, Lorentz transformations, Length contraction, Time dilation, Simultaneity in relativity theory, Addition of velocities, Relativistic dynamics, Variation of mass with velocity, Mass-Energy relation.

Books Recommended:

1. Berkely Physics Course. Vol. 1. Mechanics by E.M.Purcell
2. Concepts of Modern Physics by Arthur Beiser
3. Properties of Matter by D.S. Mathur.

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Physics
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. I Year (I Semester)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Subject	: Thermodynamics	Paper Code	: PHY-103

***Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.*

UNIT-I

First Law of Thermodynamics and Internal Energy, Joule's Law, Applications of First Law, Carnot Cycle, Carnot Engine and Refrigerator, Reversible and Irreversible Process, Carnot Theorem, Thermodynamically Scale of Temperature

UNIT-II

Entropy, Calculation of Entropy in various processes, Entropy and unavailable energy, Physical Significance of Entropy, Second law of Thermodynamics, Thermodynamic Potentials and Maxwell's Equations, Application of Maxwell's equations, Phase diagram and triple point of a substance, Joule's Thomson effect.

UNIT-III

Maxwell-Boltzmann Law of Distribution of Molecular Velocities, Evaluation of *r.m.s.* velocity, Average and Most Probable Speeds, Mean Free Path, Transport Phenomenon .Degree of freedom, equi-partition of energy and its application for specific heat of gases.

UNIT-IV

Emissive and Absorptive Powers, Black Body Radiation, Kirchoff's Law , Intensity and Energy Density, Pressure and Energy density, Stefan-Boltzmann Law, Distribution of energy in the spectrum of black body radiation, Wein's Distribution Law, Wein's displacement law, Wein's formula, Rayleigh- Jean's law, Plank's law

Books Recommended:

1. Thermodynamics By Enrico Fermi (Courier Dover Publications, 1956)
2. A Treatise on Heat : Including Kinetic Theory of Gases, Thermodynamics and Recent Advances in Statistical Thermodynamics By Meghnad Saha, B. N. Srivastava (Indian Press, 1958)
3. Heat and Thermodynamics: An Intermediate Textbook By Mark Waldo Zemansky, Richard Dittman (McGraw-Hill, 1981)
4. Thermal Physics by Garg, Bansal and Ghosh (Tata McGra-Hill, 1993)

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Physics
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. I Year (I Semester)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Subject	: Wave & Oscillations	Paper Code	: PHY-105

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Simple Harmonic Oscillations. Differential Equation of SHM and its Solution. Amplitude, Frequency, Time Period and Phase. Velocity and Acceleration. Kinetic, Potential and Total Energy and their Time Average Values. Reference Circle. Rotating Vector Representation of SHM.

UNIT –II

Free Oscillations of Systems with One Degree of Freedom :- (1) Mass-Spring system, (2) Simple Pendulum, (3) Torsional Pendulum, (4) Oscillations in a U-Tube, (5) Compound pendulum: Centres of Percussion and Oscillation, and (6) Bar Pendulum.

UNIT –III

System with Two Degrees of Freedom : Coupled Oscillators. Normal Coordinates and Normal Modes. Energy Relation and Energy Transfer. Normal Modes of N Coupled Oscillators.

UNIT –IV

Plane and Spherical Waves. Longitudinal and Transverse Waves. Plane Progressive (Travelling) Waves. Wave Equation. Particle and Wave Velocities. Differential Equation. Pressure of a Longitudinal Wave. Energy Transport. Intensity of Wave. Water Waves : Ripple and Gravity Waves.

Books Recommended:

1. Vibrations and Waves by A. P. French.(CBS Pub. & Dist., 1987)
2. The Physics of Waves and Oscillations by N.K. Bajaj (Tata McGraw-Hill, 1988)
3. Fundamentals of Waves & Oscillations By K. Uno Ingard (Cambridge University Press, 1988)
4. An Introduction to Mechanics by Daniel Kleppner, Robert J. Kolenkow (McGraw-Hill, 1973)
5. Waves: BERKELEY PHYSICS COURSE (SIE) by Franks Crawford (Tata McGrawHill, 2007).

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Physics

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. I Year (I Semester)

Schedule per week Practical : 4 Hrs

Examination Time : 4 Hrs

Maximum Marks: 50(20+30)

Subject : Physics Lab-I

Paper Code : PHY-107

Special Note:- Minimum six experiments from given list of experiment are required to complete. The students are required to calculate the error involved in a particular experiment.

- I. Each student has to perform a minimum number of experiments prescribed in the syllabus.
- II. 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.
- III. 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.
- IV. The lab. Record register will be presented to external practical examiners for Lab. Record marks. These external examiners will verify the record randomly.

List of Experiments

Note: Students are required to perform minimum five experiments from given list.

1. To determine the height of terrestrial object using sextant.
2. Determination of Stefan's Constant.
3. To study the variation of semiconductor resistance with temperature and hence to Determine the Band Gap of semiconductor in the form of reverse biased P-N junction.
4. Moment of Inertia of a fly-wheel.
5. 'g' by Bar pendulum.
6. M.I. of an irregular body using a torsion pendulum.

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Physics
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. I Year (II Semester)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Subject	: Mathematical Physics	Paper Code	: PHY-102

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Transformation properties of vectors; scalar and vector products; Differentiation and integration of vectors; Concept of tensors; Line integral, volume integral and surface integral involving vector fields; Gradient, divergence and curl of a vector field; Gauss's divergence theorem, Stokes' theorem, Green's theorem - application to simple problems.

UNIT-II

Orthogonal curvilinear coordinates; concept of a metric, spherical and cylindrical coordinates and their unit vectors. Hermitian, orthogonal and unitary matrices, inverse of a matrix, similarity transformations, Eigenvalue problems and diagonalization of matrices

UNIT-III

Infinite sequences and series - convergence and divergence, conditional and absolute convergence, ratio test for convergence. Complex-valued functions - analytic functions defined in terms of Taylor series expansion. Functions of several real variables - partial differentiation.

UNIT-IV

Solution of second order linear differential equation with constant coefficients and variable coefficients by Frobenius' method; Solution of Legendre and Hermite equations about $x = 0$; Legendre and Hermite polynomials - orthonormality properties.

Books Recommended:

1. Matrices and Tensors in Physics by A.W.Joshi.(New Age Int.Pub., 1995).
2. Linear Algebra Theory and Applications by Ward Cheney and David Kincaid (Jones & Bartlett)
3. Vector Spaces and Matrices in Physics by M. C. Jain (Alpha Science International Ltd, 2007).
4. Partial Differential Equations for Scientists and Engineers By Stanley J. Farlow (Dover Publishers, 1993).

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Physics

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Subject	: Semiconductor Devices	Paper Code	: PHY-104

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Energy bands in solids, Intrinsic and extrinsic semiconductors, p-n junction diode and their characteristics, Zener and Avalanche breakdown, Zener diode, Light emitting diodes (LED), Photodiode, Solar Cell, P-n junction, half wave and full wave rectifiers, Zener diode as a voltage regulator. Logic gates and its combination.

UNIT -II

Junction transistors, Working of NPN and PNP transistors, Three configurations of transistor (C-B, C-E, C-C modes), Constants of a transistor, Relation between alpha and beta, Common base, Common emitter and common collector characteristics of transistor, Advantages and disadvantages of C-E configuration, Emitter follower.

UNIT -III

Transistor amplifier, Methods a of transistor biasing and stabilization, D.C. load line, Common base and Common emitter biasing, Common base and common emitter amplifiers, Classification of amplifiers, Feedback in amplifiers, Positive and negative feedback. Advantages of negative feedback,.

UNIT -IV

Oscillators, Principle of oscillation, classification of oscillators, Condition for self sustained oscillation: Barkhausen criterion for oscillation, Tuned collector common emitter oscillator, Hartley oscillator, RC oscillator, Phase shift and Wein-Bridge oscillator, Advantage of of RC oscillator over LC oscillator.

Books Recommended:

1. Integrated Electronics – J. Millman and C. C. Halkias (Mc Graw Hill).
2. Electronic Fundamentals and Applications – D. Chattopadhyay and P. C. Rakshit.
3. Digital Logic and Computer Design – M. Moris Mano, (PHI (Pvt.) Ltd.).
4. Microprocessor Architecture, Programming and Application – R. A. Gaonkar (Wiley EasternLtd.).
5. Introduction to Microprocessor – Software, Hardware Programming – Laventhal (PHI Ltd.).
6. Electronics – R.K. Kar



RAFFLES UNIVERSITY, NEEMRANA, ALWAR (RAJASTHAN)

Japanese Zone, National Highway-8, Neemrana-307105

Tel.: +91-9214205555 www.rafflesuniversity.edu.in

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Physics

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. I Year (II Semester)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Subject	: Laser & Fiber Optics	Paper Code	: PHY-106

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Laser: Principle of Laser action, Population Inversion, Einstein's A and B coefficients, feedback of energy in a resonator, Threshold condition of laser formation. 3 level and 4 level laser systems.

UNIT –II

Characteristics of laser radiation. He-Ne , Nd-YAG Laser, Ruby Laser, Semiconductor Lasers and Dye lasers. Application of Laser. Significance of non-linear polarization of lasers: Second harmonic generation using non-linear optical methods.

UNIT -III

Principle of holography (basic principle), isotope separation. Precision measurements (frequency and distance). Optical fiber, core and cladding, total internal reflection, optical fiber as waveguide, step index and graded index fiber.

UNIT -IV

communication through optical fibers, energy loss, band width and channel capacity for a typical system, attenuation and dispersion, splicing and couplers, Fiber optic sensors.

Books Recommended:

1. Laser Principles and Applications – A. K. Ghatak and K. Tyagrajan (Tata – Mc Graw Hill).
2. Optics and Atomic Physics – B. P. Khandelwal (Sibal Agarwala).
3. Optical Electronic – A. K. Ghatak and K. Tyagrajan.
4. Introduction to Fibre Optics - R. A. Shotwell (EEE, Prentice Hall).



RAFFLES UNIVERSITY, NEEMRANA, ALWAR (RAJASTHAN)

Japanese Zone, National Highway-8, Neemrana-307105

Tel.: +91-9214205555 www.rafflesuniversity.edu.in

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Physics

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. I Year (II Semester)

Practical per Week : 4 Hrs

Examination Time : 4 Hrs

Subject : Physics Lab-II

Maximum Marks: 50(20+30)

Paper Code : PHY-108

Note: Students are required to perform minimum five experiments from given list.

- (1) To study and plot V-I characteristics of PN junction diode.
- (2) To Study and plot V-I characteristics Zener Diode.
- (3) To draw common emitter characteristics of a transistor and calculate transistor characteristics parameters.
- (4) To draw common base characteristics of a transistor and calculate transistor characteristics parameters.
- (5) To plot the waveform of the half wave rectifier and find the ripple factor for H.W.R.
- (6) To plot the waveform of the full wave bridge rectifier and analyze its output.
- (7) To study verify the truth table of all the logic gate.
- (8) To study Cathode Ray Oscilloscope (CRO).

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Physics

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. II Year (III Semester)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Subject	: Electrostatics	Paper Code	: PHY-201

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Coulomb's law of electrostatics, intensity and potential; Gauss' theorem – its application; Poisson and Laplace's equations; deduction from Gauss's theorem; Uniqueness theorem. Superposition theorem (statement only). Application of Laplace's equation to simple cases of symmetric spherical charge distribution.

UNIT –II

Multipole expansion of scalar potential – monopole, dipole and quadrupole terms; potential and field due to a dipole; work done in deflecting a dipole; dipole-dipole interaction(for both electric and magnetic dipoles); force on dipole in a non- homogeneous field.

UNIT -III

Polarisation, electric displacement vector (D); Gauss's theorem in dielectric media; boundary conditions; electrostatic field energy; computation of capacitance in simple cases (parallel plates); spherical and cylindrical capacitors containing dielectrics – uniform and non uniform.

UNIT –IV

Solution of field problems in case of a point charge near a grounded conducting infinite plane. Boundary value problem : in uniform external field for (i) conducting spherical shell and (ii) dielectric sphere.

Books Recommended:

1. Introduction to Electrodynamics by A.Z.Capri & P.V.Panat.(New Delhi: Narosa Pub.House, 2002).
2. Electromagnetics by Joseph A.Edminister 2nd ed.(New Delhi: Tata Mc Graw Hill, 2006).
3. Fundamentals of electromagnetics by M.A.W.Miah.(Tata Mc Graw Hill,1992)
4. Applied electromagnetism By Liang Chi Shen, Jin Au Kong (PWS Pub. Co., 1995)
5. David J. Griffiths, Introduction to Electrodynamics, 3rd edition, (Benjamin Cummings 1998).

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Physics
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. II Year (III Semester)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Subject	: Magnetism	Paper Code	: PHY-203

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Lorentz force and concept of magnetic induction; force on linear current element; Biot- Savart's law. $\vec{\nabla} \cdot \vec{B} = 0$; magnetic vector potential; calculation of vector potential and magnetic induction in simple cases – straight wire, magnetic field due to small current loop.

UNIT –II

magnetic dipole; field due to a dipole; magnetic shell; Ampere's theorem; Ampere's circuital law illustration (straight wire); force between long parallel current carrying conductors Magnetic mono pole and dipole; comparison between static electric and magnetic fields.

UNIT -III

Free current and bound current; surface and volume density of current distribution; magnetization; non uniform magnetization of matter ; Ampere's law in terms of free current density and introduction of H.

UNIT –IV

line integral of H in terms of free current; boundary conditions for B and H; permanently magnetized body; magnetic scalar potential; application of Laplace's equation to the problem of a magnetic sphere in uniform magnetic field; hysteresis and energy loss in ferromagnetic material; magnetic circuit; energy stored in magnetic field.

Books Recommended:

1. Fundamentals of electromagnetics by M.A.W.Miah.(Tata Mc Graw Hill,1992)
2. Applied electromagnetism By Liang Chi Shen, Jin Au Kong (PWS Pub. Co., 1995)
3. David J. Griffiths, Introduction to Electrodynamics, 3rd edition, (Benjamin Cummings 1998).
4. J. D. Jackson, Classical Electrodynamics, 3rd edition, (Wiley, New York 1998)
5. M. Lifshitz and L. D. Landau, Classical Theory of Fields (Course of Theoretical Physics), 2nd Edition, (Pergamon Pr; 1981).

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Physics
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. II Year (III Semester)

Lectures	: 2 Hrs	
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)
Subject	: Elective paper	Paper Code : PHY-205(A)

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

OPTICS – I

UNIT-I

Light as electromagnetic waves wave normals and rays : short wavelength limit and ray (geometrical) optics. Fermat principle, application to reflection and refraction at curved surfaces. Dispersive power of optical systems, dispersive power of prism.

UNIT –II

Chromatic aberration – methods of reduction, achromatic lens combination. Optical instruments Field of view, entrance and exit pupil microscope, eyepieces- Ramsden and Huygen. Huygen's principle; deduction of law of reflection and refraction.

UNIT -III

Fresnel's biprism, interference in thin film; fringes of equal inclination and equal thickness; Newton's ring. Michelson's interferometer, application in fine structure study. Multiple beam interference – reflected and transmitted pattern. Fabry-Perot interferometer and application to fine structure study.

UNIT –IV

Fresnel and Fraunhofer class, Fresnel's half period zones; explanation of rectilinear propagation of light; zone plate. Fraunhofer diffraction due to a single slit, double slit and circular aperture (qualitative). Plane diffraction grating (transmission). Rayleigh criterion of resolution; resolving power of prism, telescope, microscope and transmission grating.

Books Recommended:

1. Optics and Atomic Physics – B. P. Khandelwal (Sibal Agarwala).
2. Optical Electronic – A. K. Ghatak and K. Tyagrajan.
3. Introduction to Fibre Optics - R. A. Shotwell (EEE, Prentice Hall).

OR

Paper Code : PHY-205(B)

Material Sciences

UNIT-I

Atomic structure and bonding in materials. Crystal structure of materials, crystal systems, unit cells and space lattices, determination of structures of simple crystals by x-ray diffraction, miller indices of planes and directions, packing geometry in metallic, ionic and covalent solids. Concept of amorphous, single and polycrystalline structures and their effect on properties of materials. Crystal growth techniques. Imperfections in crystalline solids and their role in influencing various properties.

UNIT –II

Imperfections in crystalline solids and their role in influencing various properties. Smart materials, exhibiting ferroelectric, piezoelectric, optoelectric, semiconducting behavior, lasers and optical fibers, photoconductivity and superconductivity, nanomaterials.

UNIT -III

Stress-strain diagrams of metallic, ceramic and polymeric materials, modulus of elasticity, yield strength, tensile strength, toughness, elongation, plastic deformation, viscoelasticity, hardness, impact strength, creep, fatigue, ductile and brittle fracture.

UNIT –IV

Reflection, refraction, absorption and transmission of electromagnetic radiation in solids. Origin of magnetism in metallic and ceramic materials, paramagnetism, diamagnetism, antiferromagnetism, ferromagnetism, ferrimagnetism, magnetic hysteresis.

Books Recommended:

1. Material Science by V.Raghwan
2. Material science by Dierk Raabe
3. Material Science by Kelester

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Physics
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. II Year (III Semester)

Schedule per Week Practical	: 4 Hrs	
Examination Time	: 4 Hrs	Maximum Marks: 50(20+30)
Subject	: Physics Lab-III	Paper Code : PHY-207

List of Experiments

Note: Students are required to perform minimum five experiments from given list.

1. To determine Earth's magnetic field using tangent Galvanometer.
2. Viscosity of water by its flow through a uniform capillary tube.
3. Verify the Faraday Law using magnetic induction.
4. Conversion of galvanometer into ammeter.
5. Conversion of galvanometer into voltmeter.
6. Calibration of a thermocouple by Potentiometer.
7. To determine specific resistance of a metallic wire using potentiometer.

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Physics
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. II Year (IV Semester)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Subject	: Statistical Mechanics	Paper Code	: PHY-202

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Statistical Mechanics: microstates and macrostates-classical description in terms of phase space and quantum description in terms of wave functions. Idea of ensemble. Hypothesis of equal a priori probability for microstates of an isolated system in equilibrium.

UNIT –II

Micro-canonical ensemble, Canonical and Grand canonical ensemble. Partition function of a system in thermal equilibrium with heat bath. Law of equipartition of energy, its limit of validity and application.

UNIT -III

Quantum Statistics: Gibbs' Paradox, Identical particle and symmetry requirement. Derivation of FD and BE statistics as the most probable distributions (micro- canonical ensemble). Classical limit of quantum statistics.

UNIT –IV

Bose Einstein (BE) distribution law: Derivation, Application of BE statistics to derive Planck's law. Rayleigh Jean's and Wien's law as limiting cases of Planck's law. Phonons and lattice, specific heat of solids: Einstein and Debye's theory, Bose- Einstein condensation.

Books Recommended:

1. Statistical Physics, F. Mandle (ELBS).
2. Fundamentals of Statistical and Thermal Physics, F. Reif, (Mc Graw Hill).
3. Statistical Mechanics by R. K. Patharia.(Oxford: Butterworth, 1996).
4. Statistical Mechanics by K. Huang (Wiley, 1987.)
5. Statistical Mechanics by Eyring Eyring Eyring

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Physics
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. II Year (IV Semester)

Lectures	: 2 Hrs	
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)
Subject	: Quantum Mechanics-I	Paper Code : PHY-204

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Basic Quantum Mechanics: de Broglie hypothesis, Compton effect, Davision-Germer experiment, Heisenberg uncertainty principle. Concept of wave function as describing the dynamical state of a single particle. Group velocity and phase velocities. Classical velocity of a particle and group velocity of the wave representing the particle. Principle of superposition.

UNIT –II

Operators in quantum mechanics: Basic postulates of quantum mechanics, Dynamical variables as linear hermitian operators, eigenvalue equation satisfied by them. Momentum energy and angular momentum operators. Results of measurement of variables. Expectation values

UNIT –III

Commutation relations between the operators. Compatible observables and simultaneous measurements. Ehrenfest theorem. Time dependent and time independent Schrödinger equation. Solutions, Eigen states, normalization and ortho-normality of wave function.

UNIT –IV

Simple application of Quantum Mechanics: One dimensional potential well, boundary condition. Penetration of rectangular potential barrier in one dimension: derivation of reflection and transmission coefficients.-explanation of alpha decay.

Books Recommended:

1. Quantum Mechanics – J. L. Powell and B. Crasemonn, (Oxford, Delhi).
2. Quantum Mechanics – F. Schwabl (Narosa).
3. Quantum Mechanics – A. K. Ghatak and S. Lokenathan (Macmillan, Delhi).

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Physics
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. II Year (IV Semester)

Lectures	: 2 Hrs	
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)
Subject	: Elective paper	Paper Code : PHY-206(A)

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

OPTICS – II

UNIT-I

Polarization : Different states of polarization; double refraction (Explanation from Electromagnetic theory), Huygen's construction for uni axial crystals; Polaroid's and their uses. circularly and elliptically polarized light. Fresnel's explanation of optical activity; Bi quartz and half shade polarimeter.

UNIT –II

Production and analysis of plane, circularly and elliptically polarised light by retardation plates and rotatory polarisation Frenel's diffraction, Zone plate, diffraction due to straight edge. Fraunhofer diffraction due to single and double slits, plane transmission grating and its resolving power.

UNIT -III

The principle of holography, Modifications and applications. Observing small object deformations . Holographic optical instruments Pattern recognition Volume holograms.

UNIT –IV

The electric dipole interaction ,Simple laser theory. Three-level systems and atomic interference Lasing without inversion ,Correlated emission laser. Motion of a two-level atom in a quantized light field.

Books Recommended:

1. Fundamentals of Optics By Francis Arthur Jenkins and Harvey Elliott White (McGraw-Hill, 1976)
2. Optics by Ajoy Ghatak (Tata McGraw Hill, 2008)
3. Optics By Eugene Hecht and A R Ganesan (Pearson Education, 2002)
4. Light and Optics: Principles and Practices by Abdul Al-Azzawi (CRC Press, 2007)
5. Contemporary Optics by A. K. Ghatak & K. Thyagarajan.(Plenum Press,1978).

OR

Paper Code : PHY-206(B)

Astrophysics & Cosmology

UNIT-I

Ancient astronomical systems and their utility. Celestial sphere. Calendrical phenomena. Major planets, their orbits and their satellites. Asteroid belt, comets and other objects of the solar system.

UNIT –II

Variety of stellar objects; classification of stars; distance scales. Current survey of galaxies; clusters, voids, quasars Hubble expansion. Mass distribution in galaxies and clusters; Dark Matter. Type II a supernova and Dark Energy.

UNIT –III

Main sequence stars, H-R Diagram. White dwarfs, neutron stars, supernovae, quasars and gamma ray bursters. Equivalence principle and a metric for the spacetime. Black Holes; FRW models; gravitational lensing.

UNIT –IV

Primordial formation of neutral Hydrogen; CMBR. Chandrasekhar limit, Big Bang Nucleosynthesis; Baryon to entropy ratio; Neutrinos and other relics.

Books Recommended:

1. Bradly W. Carrol and Dale A. Ostlie, An introduction to Modern Astrophysics 2nd Ed., Pearson publication
2. P. J. E. Peebles, Principles of Physical Cosmology Princeton Univ. Press (1993)
3. T. Padmanabhan, Cosmology and Astrophysics through Problems Cambridge Univ. Press (1996)
4. T. Padmanabhan, Theoretical Astrophysics, vol I, II and III (Cambridge Univ. Press (1992 - 96)

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Physics
(Syllabus and Scheme of Studies w. e. f. 2015-16 onwards)
B. Sc. II Year (IV Semester)

Practical per Week	: 4 Hrs	
Examination Time	: 4 Hrs	Maximum Marks: 50(20+30)
Subject	: Physics Lab-IV	Paper Code : PHY-208

Note: Students are required to perform minimum five experiments from given list.

1. Verification of Newton's Ring formula and determination of wavelength of sodium light.
2. Determination of Magnifying and Resolving power of a telescope.
3. Refractive Index and Dispersive Power of a Prism using spectrometer.
4. Determine wavelength of light using plane transmission diffraction grating.
5. Determine resolving power of a grating.
6. Specific Rotation of Sugar solution by Laurent's half-Shade Polarimeter.
7. To determine numerical aperture of the optical fiber
8. Wavelength of Sodium light by Fresnel's Biprism.

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Physics
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. III Year (V Semester)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Subject	: Solid State Physics	Paper Code	: PHY-301

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

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

UNIT –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.

UNIT -III

Hall Effect. Magnetism-Dia, Para, Ferro-magnetic properties of materials. Electron spin and magnetic moment. Magnetic susceptibility.

UNIT –IV

Historical introduction, Survey of superconductivity, Super conducting systems, High Tc Super conductors, Isotopic Effect, Critical Magnetic Field, Meissner Effect, London equation. Classification of Superconductors (type I and Type II), BCS Theory of Superconductivity, Flux quantization, Josephson Effect (AC and DC).

Reference Book:

1. C. Kittel, Introduction to Solid State Physics, 7th Ed (1996) John Wiley & Sons, New Delhi.
2. H. Ibach and H. Lüth, Solid State Physics, An Introduction to Theory and Experiment, Springer-Verlag, Berlin, 1991
3. Pillai O S, Solid State Physics, New Age International Publishers (2007) New Delhi

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Physics
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. III Year (V Semester)

Lectures	: 2 Hrs	
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)
Subject	: Advance Electronics	Paper Code : PHY-303

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Field Effect Transistors (FET), JFET structure, JFET operation, static, drain and transfer characteristics, pinch off Common source FET amplifier, small signal low frequency equivalent circuit- voltage gain. MOSFET-enhancement and depletion type, principle of operation, drain and transfer characteristics, idea of CMOS

UNIT –II

Operational Amplifiers: Ideal OP-AMP characteristics, concept of virtual ground, Definition of important terms in connection with OP-AMP: Offset voltage, CMRR, slew rate. Application of OP-AMP: Design of Inverting and non-inverting amplifier, Differential amplifier, Schmitt trigger, Integrator and Differentiator,

UNIT –III

Communication Principles: Modulation - elementary theory of Amplitude Modulation (AM) and Frequency Modulation (FM) modulation index. Detection of AM and FM waves.

UNIT –IV

AND, OR, NOT gates – truth tables, circuits of AND and OR gates using diodes and transistors; circuit of NOT gate using transistor; NAND and NOR as universal gate. Combination of gates for obtaining different Boolean function. de Morgan's theorem Half adder, full adder, digital comparator, decoder, encoder (ROM), multiplexer. Digital to analog and Analog to digital conversions.

Books Recommended:

1. Integrated Electronics – J. Millman and C. C. Halkias (Mc Graw Hill).
2. Electronic Fundamentals and Applications – D. Chattopadhyay and P. C. Rakshit.
3. Digital Logic and Computer Design – M. Moris Mano, (PHI (Pvt.) Ltd.).
4. Microprocessor Architecture, Programming and Application – R. A. Gaonkar (Willey EasternLtd.).

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Physics
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. II Year (IV Semester)

Lectures	: 2 Hrs	
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)
Subject	: Elective paper	Paper Code : PHY-305(A)

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

Classical Mechanics

UNIT-I

System of particles, Constraints, Generalized coordinates, D'Alemberts principle and Lagrange's equation, Velocity dependent potential of electro-magnetic field.

UNIT-II

Hamilton's principle, Lagrange's equation, Lagrangian for simple systems, Cyclic coordinates, symmetries and conservation laws. Legendre transformations and Hamilton's equations of motion

UNIT-III

Hamiltonian for a charge particle in Electro-magnetic field, Cyclic coordinates and conservation laws, Poisson Brackets, Jacobi Identity, Canonical transformation .Hamilton-Jacobi theory,

UNIT-IV

Two body central force problem, reduction to the equivalent one body problem, Differential equation for the orbit and integrable power law potentials, Condition for stable circular orbit, Kepler problems.

Books Recommended:

1. Classical Mechanics: H. Goldstein
2. Classical Mechanics of Particles and Rigid Bodies: K. C. Gupta.
3. Introduction to Classical Mechanics: N. C. Rana and P. Joag

OR

Paper Code : PHY-305(B)

Quantum Mechanics -II

UNIT-I

Linear Harmonic Oscillator (LHO). Solution of the equation of LHO (by the method of solution of Hermite differential equation approach), zero point energy. Parity of wave function. Angular momentum operator and their commutation relation

UNIT –II

Eigen values and eigen functions of L^2 and L_z Theorem of addition of angular momenta (statement with example). Hydrogen atom problem. Schrödinger equation for hydrogen atom problem, Solution of the radial part and energy eigen values .Degeneracy of the energy eigen values.

UNIT –III

Scattering Problems in One Dimension :- (1) Finite Potential Step : Reflection and Transmission. Stationary Solutions. Probability Current. Attractive and Repulsive Potential Barriers. (2) Quantum Phenomenon of Tunneling : Tunnel Effect. Tunnel Diode (Qualitative Description). (3) Finite Potential Well (Square Well).

UNIT –IV

Special functions : Legendre, Hermite and Bessel differential equations and solutions, ortho normality. Separation of variables in time dependent Schrodinger equation, Density of states.

Books Recommended:

1. L. I. Schiff, Quantum Mechanics, 3rd edition, (McGraw Hill Book Co., New York 1968).
2. E. Merzbacher, Quantum Mechanics, 3rd edition, (John Wiley & Sons, Inc1997)
3. J.L. Powell & B. Crasemann, Quantum Mechanics, (Addison-Wesley Pubs.Co.,1965)
4. A. Ghatak & S. Lokanathan, Quantum Mechanics: Theory and Applications, 5th Edition, (Macmillan India , 2004)



RAFFLES UNIVERSITY, NEEMRANA, ALWAR (RAJASTHAN)
Japanese Zone, National Highway-8, Neemrana-307105
Tel.: +91-9214205555 www.rafflesuniversity.edu.in

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Physics
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. III Year (V Semester)

Schedule per week Practical	: 4 Hrs	
Examination Time	: 4 Hrs	Maximum Marks: 50(20+30)
Subject	: Physics Lab-V	Paper Code : PHY-307

Note: Students are required to perform minimum five experiments from given list.

1. Surface tension by Jeager's Method.
2. Young's Modulus of steel bar using tensile
3. Modulus of rigidity by torsion method
4. Elastic constant by Scarle's method.
5. Viscosity of water by its flow through a uniform capillary tube.
6. To verify the Bernoullies theorem.
7. To determine viscosity of a given fluid.
8. To calibrate the orificemeter.

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Physics
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. III Year (VI Semester)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Subject	: Atomic & Molecular Physics	Paper Code	: PHY-302

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Brief review of early models of atomic structure. Hydrogen atom spectrum and the Bohr model. Franck-Hertz experiment. The reduced mass and the discovery of the hydrogen isotopes. Correspondence principle, spectra of hydrogen-like atoms, magnetic moment due to orbital motion, normal Zeeman effect and limits of Bohr Sommerfield theory.

UNIT –II

Quantum mechanics applied to the hydrogen atom problem: Stern-Gerlach experiment and electron spin, spin orbit coupling, Fine structure of the hydrogen atom spectrum.

UNIT –III

Many-electron atoms: Hund's rule and the periodic table, spectral terms, doublet structure of alkali spectra. The effective quantum number and quantum defect, penetrating and non-penetrating orbits. Anomalous Zeeman effect, Paschen- Bach effect, Stark effect in hydrogen.

UNIT –IV

Rotational and Vibrational Spectroscopy: diatomic molecule as a rigid rotator, effect of isotopic substitution, non-rigid rotator. Vibrational energy of a molecule, diatomic molecule as a simple harmonic oscillator. The anharmonic rotator, Rotational- Vibrational Spectra, population of energy levels. Electronic spectra of molecules, dissociation, Frank-Condon principle. Raman effect.

Books Recommended:

1. Atomic physics by J.B.Rajam & foreword by Louis De Broglie.(S.Chand & Co., 2007).
2. Atomic Physics by J.H.Fewkes & John Yarwood. Vol. II (Oxford Univ. Press, 1991).
3. Physics of Atoms and Molecules, Bransden and Joachein.
4. Molecular Spectroscopy, Banwell.



RAFFLES UNIVERSITY, NEEMRANA, ALWAR (RAJASTHAN)
Japanese Zone, National Highway-8, Neemrana-307105
Tel.: +91-9214205555 www.rafflesuniversity.edu.in

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Physics
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
BSc III Year (VI Semester)

Lectures	: 2 Hrs	
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)
Subject	: Nuclear Physics	Paper Code : PHY-304

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Introduction to the nucleus, Fermi gas model, Binding energy, Bethe-Weizsaecker mass formula and its application to explain most stable isobars and nuclear fission, Inferences of nuclear size from elastic electron-nucleus experiments (no derivation).

UNIT –II

Nucleon emission, separation energy, Alpha decay and its energy spectrum, Q-value, Gamow's theory of alpha decay (no derivation), Beta decay and its energy spectrum, Need for neutrinos, Q-value for beta decay, Gamma decay, Selection rules for gamma transitions (no derivation).

UNIT -III

Types of Reactions and Conservation Laws. Concept of Compound and Direct Reaction. Compound Nucleus. Scattering Problem in One Dimension : Reflection and Transmission by a Finite Potential Step. Stationary Solutions, Attractive and Repulsive Potential Barriers.

UNIT –IV

Law of Radioactive Decay. Half-life, Theory of Successive Radioactive Transformations. Radioactive Series, Binding Energy, Mass Formula. Liquid Drop Model. Mass formula. Shell Model. Meson Theory of Nuclear Forces and Discovery of Pion.

Reference Book:

1. Introductory Nuclear Physics: S. S. M. Wong.
2. Nuclear Physics: V. Devanathan.
3. Concepts of Nuclear Physics: B. L. Cohen.
4. Fundamentals of Nuclear Physics: B. B. Srivastava.
5. Introduction to Nuclear Physics: H. A. Enge.

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Physics
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. II Year (VI Semester)

Lectures	: 2 Hrs	
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)
Subject	: Elective paper	Paper Code : PHY-306(A)

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

Particle Physics

UNIT-I

Interaction of Energetic particles with matter. Ionization chamber. GM Counter. Cloud Chambers. Wilson Cloud Chamber. Bubble Chamber. Scintillation Detectors. Semiconductor Detectors (Qualitative Discussion Only). An Idea about Detectors used in Large Hadron Collider..

UNIT –II

Elementary Particles (Qualitative Discussion Only) :- Fundamental Interactions. Classification of Elementary Particles. Particles and Antiparticles. Baryons, Hyperons, Leptons, and Mesons. Elementary Particle Quantum Numbers : Baryon Number, Lepton Number, Strangeness, Electric Charge, Hypercharge and Isospin.

UNIT -III

Supermultiplets of Mesons and Baryons. Conservation Laws and Symmetry. Different Types of Quarks and Quark Contents of Spin . Baryons. Photons, Gravitons, Gluons, Charms and Intermediate Vector Bosons. Idea of Standard Model. Higg's Boson.

UNIT –IV

Accelerators :- Van de Graaff Generator, Linear Accelerator, Cyclotron, Betatron, and Light and Heavy Ion Synchro-Cyclotron. Idea of Large Hadron Collider.

Books Recommended:

1. Introduction to Particle Physics ; M.P. khanna PHI publications
2. Nuclear and Particle Physics ; [S.L. Kakani](#) & [Shubhra Kakani](#)

OR

Paper Code : PHY-306(B)

Electromagnetic Theory

UNIT-I

Generalization of Ampere's Law, Displacement Current, Maxwell's Field Equations, Wave equation for electromagnetic (EM) field and its solution – plane wave and spherical wave solutions, transverse nature of field, relation between E and B; energy density of field, Poynting vector and Poynting's theorem, boundary conditions.

UNIT –II

Waves in an isotropic dielectric; wave equation, reflection and refraction at plane boundary, reflection and transmission coefficients, Fresnel's formula, change of phase on reflection, polarization on reflection and Brewster's law, total internal reflection.

UNIT –III

EM waves in conducting medium; wave equation in conducting medium, reflection and transmission at metallic surface – skin effect and skin depth, propagation of E-M waves between parallel and conducting plates – wave guides (rectangular only).

UNIT –IV

Dispersion : Equation of motion of an electron in a radiation field : Lorentz theory of dispersion – normal and anomalous. Scattering of radiation by a bound charge, Rayleigh's scattering (qualitative ideas), blue of the sky, absorption.

Books Recommended:

1. Electromagnetics by Joseph A. Edminister 2nd ed. (New Delhi: Tata Mc Graw Hill, 2006).
2. Fundamentals of electromagnetics by M.A.W. Miah. (Tata Mc Graw Hill, 1992)
3. Applied electromagnetism By Liang Chi Shen, Jin Au Kong (PWS Pub. Co., 1995)
4. David J. Griffiths, Introduction to Electrodynamics, 3rd edition, (Benjamin Cummings 1998).

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. III Year (VI Semester)

Schedule Per Week Practical	: 4 Hrs		
Examination Time	: 4Hrs	Maximum Marks: 50 (20+30)	
Subject	: Physics Lab-VI (Seminar& project)	Paper Code	: PHY-308

Students need to perform minimum two experiments from each section and in total eight experiments.

Activities:

1. Demonstrations

(Any four demonstrations equivalent to two experiments)

- (i) Electromagnetic induction by using two coils
- (ii) Magnet –magnet interaction
- (iii) Study of Collision by using balls
- (iv) Study of Signal generator using CRO (Sine, square wave signal, measurement of AC voltage, frequency)
- (v) Demonstration of action potential
- (vi) Moment of inertia effect on rotation

2. Computer aided demonstrations (Using computer simulations or animations)

(Any two demonstrations equivalent to two experiments)

- (i) Coulomb's law
- (ii) Vectors: visualization of vectors
- (iii) Bohr's model
- (iv) Carnot engine, diesel engine
- (v) Graphs and their slopes, and Kinematics graphs (using computer simulations)
- (vi) Model of SC, BCC, FCC, and HCP crystals.

3. Mini projects/Hand on activities

(Any one equivalent to two experiments)

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. (Six –Semester Course)



RAFFLES

UNIVERSITY

DEPARTMENT OF CHEMISTRY
SCHOOL OF BASIC AND APPLIED SCIENCES
RAFFLES UNIVERSITY, NEEMRANA, ALWAR (RAJASTHAN)
SCHOOL OF BASIC AND APPLIED SCIENCES

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Chemistry
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. I Year (I Semester)

Schedule per week Lectures: 2



RAFFLES UNIVERSITY, NEEMRANA, ALWAR (RAJASTHAN)

Japanese Zone, National Highway-8, Neemrana-307105

Tel.: +91-9214205555 www.rafflesuniversity.edu.in

Examination Time

: 3 Hrs

Maximum Marks: 50(20+30)

Subject

: Inorganic Chemistry

Paper Code : CH-101

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Atomic Structure: Idea of de-Broglie matter waves, Heisenberg uncertainty principle, atomic orbital's, quantum numbers, Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements, radial and angular wave functions and probability distribution curves, shapes of s, p, and d orbitals.

UNIT-II

Periodic Table: General principles of periodic table, effective nuclear charge, Slater's rules. and Atomic ionic radii, ionization energy, electron affinity and electronegativity definition, methods of determination or evaluation, trends in periodic table (s & p block elements).

UNIT-III

Covalent Bond: Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions (BeF₂, BF₃, CH₄, PF₅, SF₆, IF₇, SO₄⁻², ClO₄⁻¹) Valence shell electron pair repulsion (VSEPR) theory to NH₃, H₃O⁺, SF₄, ClF₃, ICl₂⁻ and H₂O. MO theory of heteronuclear (CO and NO) diatomic molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.

UNIT-IV

Ionic Solids: Ionic structures (NaCl, CsCl, ZnS (Zinc Blende), CaF₂) radius ratio effect and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy (mathematical derivation excluded) and Born- Haber cycle, solvation energy and its relation with solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule.

Suggested books:

1. Inorganic Chemistry, by Malik, Tulji Madan, S.Chand . & company.
2. A text book of Inorganic Chemistry, O P Tandon, G R Bathla Publication pvt Ltd
3. Inorganic Chemistry, by James E. Huheey, E.A. Keiter, R. L. Keiter, O. K. Medhi
4. Concise Inorganic Chemistry, by J. D. Lee, Oxford

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Chemistry

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. I Year (I Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Gaseous States: Maxwell's distribution of velocities and energies (derivation excluded) Calculation of root mean square velocity, average velocity and most probable velocity. Collision diameter, collision number, collision frequency and mean free path. Deviation of Real gases from ideal behaviour. Derivation of Vander Waal's Equation of State, its application in the calculation of Boyle's temperature (compression factor) Explanation of behavior of real gases using Vander Waal's equation.

UNIT-II

Critical Phenomenon: Critical temperature, Critical pressure, critical volume and their determination. PV isotherms of real gases, continuity of states, the isotherms of Vander Waal's equation, relationship between critical constants and Vander Waal's constants. Critical compressibility factor. The Law of corresponding states. Lequifaction of gases.

UNIT-III

Liquid States: Structure of liquids. Properties of liquids – surface tension, viscosity vapour pressure and optical rotations and their determination.

UNIT-IV

Solid State: Classification of solids, Laws of crystallography – (i) Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Law of symmetry. Symmetry elements of crystals, Definition of unit cell & space lattice. Bravais lattices, crystal system. X-ray diffraction by crystals. Derivation of Bragg equation. Determination of crystal structure of NaCl, KCl.

Liquid crystals: Difference between solids, liquids and liquid crystals, types of liquid crystals, Applications of liquid crystals.

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Chemistry

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. I Year (I Semester)

Schedule per week Practical: 6

Examination Time : 4 Hrs

Subject : Chemistry Lab-I

Maximum Marks: 50 (20+30)

Paper Code : CH-107

UNIT-I (Inorganic)

Volumetric Analysis

- 1. Redo titrations:** Determination of Fe^{2+} , $\text{C}_2\text{O}_4^{2-}$ (using KMnO_4 , $\text{K}_2\text{Cr}_2\text{O}_7$)
- 2. Iodometric titrations:** Determination of Cu^{2+} (using standard hypo solution).
- 3. Complexometric titrations:** Determination of Mg^{2+} , Zn^{2+} by EDTA.

UNIT-II (Physical)

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
2. To prepare arsenious sulphide sol and compare the precipitating power of mono, bi and trivalent anions.

UNIT-III (Organic)

1. Preparation and purification through crystallization or distillation and ascertaining their purity through melting point or boiling point
 - (i) Iodoform from ethanol (or acetone)
 - (ii) *m*-Dinitrobenzene from nitrobenzene (use 1:2 conc. HNO_3 H_2SO_4 mixture if fuming HNO_3 is not available)
 - (iii) *p*-Bromoacetanilide from acetanilide
 - (iv) Dibenzalacetone from acetone and benzaldehyde
 - (v) Aspirin from salicylic acid

Distribution of marks

1. UNIT-I	10 (6+4) marks
2. UNIT-II	10 (6+4) marks
3. UNIT-III	10 (6+4) marks
4. Viva-voce	10 (6+4) marks
5. Lab Record	10 (6+4) marks

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Chemistry

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. I Year (II Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Subject : Inorganic Chemistry

Maximum Marks: 50(20+30)

Paper Code : CH-102

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire

syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Hydrogen Bonding & Vander Waals Forces: Hydrogen Bonding-Definition, Types, effects of hydrogen bonding on properties of substances, application Brief discussion of various types of Vander Waals Forces. Metallic Bond and Semiconductors Metallic Bond- Brief introduction to metallic bond, band theory of metallic bond Semiconductors- types and applications.

UNIT-II

s-Block Elements: Comparative study of the elements including, diagonal relationships, salient features of hydrides (methods of preparation excluded), solvation and complexation tendencies including their function in biosystems.

Chemistry of Noble Gases: Chemical properties of the noble gases with emphasis on their low chemical reactivity, chemistry of xenon, structure and bonding of fluorides, oxides & oxyfluorides of xenon.

UNIT-III

p-Block Elements: Emphasis on comparative study of properties of p-block elements (including diagonal relationship and excluding methods of preparation).

Boron family (13th gp): Diborane-properties and structure (as an example of electron-deficient compound and multicentre bonding), Borazene-chemical properties and structure Trihalides of Boron – Trends in few is acid character structure of aluminium (III) chloride.

Carbon Family (14th group): Catenation, p– d bonding (an idea), carbides, fluorocarbons, silicates (structural aspects), silicons – general methods of preparations, properties and uses.

UNIT-IV

Nitrogen Family (15th group): Structures of oxides of N, P. oxyacids–structure and relative acid strengths of oxyacids of N and P. Structure of white, yellow and red phosphorus

Oxygen Family (16th group): Oxyacids of sulphur – structures and acidic strength H₂O₂ structure, properties and uses.

Halogen Family (17th group): Basic properties of halogen, interhalogens, types, properties, hydro and oxyacids of chlorine – structure and comparison of acid strength

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Chemistry

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. I Year (II Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Subject : Organic Chemistry

Maximum Marks: 50(20+30)

Paper Code : CH-104

Note: *Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.*

UNIT-I

Alkenes: Nomenclature of alkenes, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes and mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration-oxidation, oxymercuration-reduction, ozonolysis, hydration, hydroxylation and oxidation with KMnO_4 ,

UNIT-II

Arenes and Aromaticity: Nomenclature of benzene derivatives, Aromatic nucleus and side chain. Aromaticity: the Huckel rule, aromatic ions, annulenes up to 10 carbon atoms, aromatic, antiaromatic and non aromatic compounds. Aromatic electrophilic substitution general pattern of the mechanism, mechanism of nitration, halogenation, sulphonation, and Friedel-Crafts reaction. Energy profile diagrams ; Activating , deactivating substituents and orientation.

UNIT-III

Dienes and Alkynes: Nomenclature and classification of dienes isolated, conjugated and cumulated dienes. Structure of butadiene, Chemical reactions 1, 2 and 1, 4 additions (Electrophilic & free radical mechanism), Diels-Alder reaction, Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation of alkynes,

UNIT-IV

Alkyl and Aryl Halides: Nomenclature and classes of alkyl halides, methods of formation, chemical reactions. Mechanisms and stereochemistry of nucleophilic substitution reactions of alkyl halides, SN^2 and SN^1 reactions with energy profile diagrams. Methods of formation and reactions of aryl halides, The addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Chemistry

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. I Year (II Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Subject : Physical Chemistry

Maximum Marks: 50(20+30)

Paper Code : CH-106

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer type questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each

UNIT-I

Kinetics-I: Rate of reaction, rate equation, factors influencing the rate of a reaction concentration, temperature, pressure, solvent, light, catalyst. Order of a reaction, integrated rate expression for zero order, first order, second and third order reaction. Half life period of a reaction. Methods of determination of order of reaction,

UNIT-II

Kinetics-II: Effect of temperature on the rate of reaction-Arrhenius equation. Theories of reaction rate –Simple collision theory for unimolecular and bimolecular collision, Transition state theory of Bimolecular reactions.

UNIT-III

Electrochemistry-I: Electrolytic conduction, factors affecting electrolytic conduction, specific, conductance, molar conductance, equivalent conductance and relation among them, their variation with concentration. Arrhenius theory of ionization, Ostwald's Dilution Law, Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only) Transport number, definition and determination by Hittorfs methods, (numerical included),

UNIT-IV

Electrochemistry-II: Kohlrausch's Law, calculation of molar ionic conductance and effect of viscosity temperature & pressure on it. Application of Kohlrausch's Law in calculation of conductance of weak electrolytes at infinite dilution. Applications of conductivity **Measurements:** determination of degree of dissociation, determination of K_a of acids determination of solubility product of sparingly soluble salts, conductometric titrations. Definition of pH and pKa, Buffer solution, Buffer action, Henderson – Hazel equation, Buffer mechanism of buffer action.

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Chemistry

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. I Year (II Semester)

Schedule per week Practical: 6

Examination Time : 4 Hrs

Subject : Chemistry Lab-II

Maximum Marks: 50 (20+30)

Paper Code : CH-108

UNIT-I (Inorganic)

Volumetric Analysis

Complexometric titrations: Determination of Hardness of Water by EDTA

Paper Chromatography

Qualitative Analysis of the any one of the following Inorganic cations and anions by paper chromatography (Pb^{2+} , Cu^{2+} , Ca^{2+} , Ni^{2+} , Cl^- , Br^- , I^- and PO_4^{3-} and NO_3^-).

UNIT-II (Physical)

1. To determine the surface tension of a given liquid by drop number method.
2. To determine the viscosity of a given liquid.
3. To determine the specific refractivity of a given liquid

UNIT-III (Organic)

To study the process of sublimation of camphor and phthalic acid,

Distribution of marks

1. UNIT-I	10 (6+4) marks
2. UNIT-II	10 (6+4) marks
3. UNIT-III	10 (6+4) marks
4. Viva-voce	10 (6+4) marks
5. Lab Record	10 (6+4) marks

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Chemistry
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. II Year (III Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Subject : Inorganic Chemistry

Maximum Marks: 50(20+30)

Paper Code : CH-201

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Chemistry of Elements of I transition series: Definition of transition elements, position in the periodic table, General characteristics & properties of I transition elements, Structures & properties of some compounds of transition elements-TiO₂, VOCl₂, FeCl₃, CuCl₂ and Ni (CO)₄

UNIT-II

Chemistry of Elements of IInd & IIIrd transition series: General characteristics and properties of the IInd and IIIrd transition elements Comparison of properties of 3d elements with 4d & 5d elements with reference only to ionic radii, oxidation state, magnetic and Spectral properties and stereochemistry

UNIT-III

Coordination Compounds: Werner's coordination theory, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes

UNIT-IV

Non-aqueous Solvents: Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH₃ and liquid SO₂

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Chemistry

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. II Year (III Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Subject

: Organic Chemistry

Maximum Marks: 50(20+30)

Paper Code : CH-203

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Alcohols: Monohydric alcohols nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature. Reactions of alcohols. Dihydric alcohols — nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$\text{Pb}(\text{OAc})_4$ and HIO_4] and pinacol-pinacolone rearrangement.

Epoxides: Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides

UNIT-II

Phenols: Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols — electrophilic aromatic substitution, Mechanisms of Fries rearrangement, Claisen rearrangement, Reimer-Tiemann reaction, Kolbe's reaction and Schotten and Baumann reactions.

UNIT-III

Ultraviolet (UV) absorption spectroscopy: Absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones, Woodward-Fieser rules, calculation of λ_{max} of simple conjugated dienes and -unsaturated ketones. Applications of UV Spectroscopy in structure elucidation of simple organic compounds.

UNIT-IV

Carboxylic Acids & Acid Derivatives: Nomenclature of Carboxylic acids, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids. Reactions of carboxylic acids. Hell-Volhard Zelinsky reaction. Reduction of carboxylic acids. Mechanism of decarboxylation. Structure, nomenclature and preparation of acid chlorides, esters, amides and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Mechanisms of esterification and hydrolysis (acidic and basic)

OR

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Subject : Polymer Chemistry(Elective)

Paper Code : CH-203

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.

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

UNIT-II

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

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

Nature and structure of polymers-Structure, Property relationships.

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.

Glass transition temperature (T_g) and determination of T_g , Free volume theory, WLF equation, Factors affecting glass transition temperature (T_g).

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.

Properties of Polymers (Physical, thermal, Flow & Mechanical Properties). Brief introduction to preparation, structure, properties and application of the following polymers: polyolefins, polystyrene and styrene copolymers, poly(vinyl chloride) and related polymers, poly(vinyl acetate) and related polymers, acrylic polymers, fluoro polymers, polyamides and related polymers. Phenol formaldehyde resins (Bakelite, Novalac), polyurethanes, silicone polymers, polydienes, Polycarbonates, Conducting Polymers, [polyacetylene, polyaniline, poly(p-phenylene sulphide polypyrrole, polythiophene)].

Reference Books:

1. Seymour's Polymer Chemistry, Marcel Dekker, Inc.
2. G. Odian: Principles of Polymerization, John Wiley.
3. F.W. Billmeyer: Text Book of Polymer Science, John Wiley.
4. P. Ghosh: Polymer Science & Technology, Tata Mcgraw-Hill.
5. R.W. Lenz: Organic Chemistry of Synthetic High Polymers.

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Chemistry

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. II Year (III Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Subject : Physical Chemistry

Paper Code : CH-205

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each

UNIT-I

Thermodynamics-I: Definition of thermodynamic terms: system, surrounding etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work. Zeroth Law of thermodynamics, First law

of thermodynamics: statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship.

UNIT-II

Thermodynamics-II: Joule's law, Joule Thomson coefficient for ideal gas and real gas: and inversion temperature. Calculation of w q dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process, Temperature dependence of enthalpy, Kirchoffs equation. Bond energies and applications of bond energies.

UNIT-III

Chemical Equilibrium: Equilibrium constant and free energy, concept of chemical potential, Thermodynamic derivation of law of chemical equilibrium. Temperature dependence of equilibrium constant; Van't Hoff reaction isochore, Van't Hoff reaction isotherm. Le-Chatelier's principle and its applications Clapeyron equation and Clausius-Clapeyron equation its applications.

UNIT-IV

Distribution Law: Nernst distribution law – its thermodynamic derivation, Modification of distribution law when solute undergoes dissociation, association and chemical combination. Applications of distribution law: (i) Determination of degree of hydrolysis and hydrolysis constant of aniline hydrochloride. (ii) Determination of equilibrium constant of potassium triiodide complex and process of extraction.

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Chemistry

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. II Year (III Semester)

Schedule per week Practical: 6

Examination Time : 4 Hrs

Maximum Marks: 50 (20+30)

Subject : Chemistry Lab-III

Paper Code : CH-207

UNIT-I (Inorganic)

1. Gravimetric Analysis

Quantitative estimations of, Cu^{2+} as copper thiocyanate and Ni^{2+} as Ni – dimethylglyoxime.

2. Colorimetry:

To verify Beer - Lambert law for $KMnO_4/K_2Cr_2O_7$ and determine the concentration of the given $KMnO_4/K_2Cr_2O_7$ solution.

UNIT-II (Physical)

1. To determine the CST of phenol – water system.

2. To determine the solubility of benzoic acid at various temperatures and to determine the H

of the dissolution process.

UNIT-III (Organic)

Laboratory Techniques

(a) **Steam distillation** (non evaluative) Naphthalene from its suspension in water

Separation of *o*- and *p*-nitrophenols

(b) **Column chromatography** (non evaluative) Separation of fluorescein and methylene blue

Separation of leaf pigments from spinach leaves

Distribution of marks

1. UNIT-I	10 (6+4) marks
2. UNIT-II	10 (6+4) marks
3. UNIT-III	10 (6+4) marks
4. Viva-voce	10 (6+4) marks
5. Lab Record	10 (6+4) marks

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Chemistry

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. II Year (IV Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Subject : Inorganic Chemistry

Maximum Marks: 50(20+30)

Paper Code : CH-202

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Chemistry of f -block elements:

Lanthanides: Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds.

UNIT-II

Chemistry of f -block elements

Actinides: General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, Comparison of properties of Lanthanides and Actinides and with transition elements.

UNIT-III

Theory of Qualitative and Quantitative Inorganic Analysis-I:

Chemistry of analysis of various acidic radicals, Chemistry of identification of acid radicals in typical combinations, Chemistry of interference of acid radicals including their removal in the analysis of basic radicals.

UNIT-IV

Theory of Qualitative and Quantitative Inorganic Analysis-II:

Chemistry of analysis of various groups of basic radicals, Theory of precipitation, co-precipitation, Post- precipitation, purification of precipitates.

OR

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Subject : Coordination Chemistry (Elective)

Paper Code : CH-202

UNIT-I

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

IUPAC nomenclature of coordination compounds, isomerism in coordination compounds.

Stereochemistry of complexes with 4 and 6 coordination numbers. Chelate effect, polynuclear complexes, Labile and inert complexes.

UNIT-II

Transition Elements: General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, ability to form complexes. Stability of various

oxidation states and e.m.f. (Latimer diagrams) Different between the first, second and third transition series. Chemistry of Cr, Mn, Fe and Co in various oxidation states with special reference to the following compounds: peroxo compounds of chromium, potassium dichromate, potassium permanganate, potassium ferrocyanide, potassium ferricyanide, sodium nitroprusside and sodium cobaltinitrite.

UNIT-III

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

UNIT-IV

Inorganic Reaction Mechanism :Introduction to inorganic reaction mechanisms. Substitution reactions in square planar complexes, Trans- effect, theories of trans effect. Thermodynamic and Kinetic stability.

Reference Books:

1. Purcell, K.F. & Kotz, J.C., Inorganic Chemistry W.B. Saunders Co, 1977.
2. Huheey, J.E., Inorganic Chemistry, Prentice Hall, 1993.
3. Cotton, F.A. & Wilkinson, G., Advanced Inorganic Chemistry Wiley-VCH, 1999
4. Basolo, F, and Pearson, R.C., Mechanisms of Inorganic Chemistry, John Wiley & Sons, NY, 1967.
5. Greenwood, N.N. & Earnshaw A., Chemistry of the Elements, ButterworthHeinemann,1997.
6. Miessler, G. L. & Tarr, Donald A. Inorganic Chemistry 3 rd Ed.(adapted), Pearson, 2009

OR

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Subject : Novel Inorganic Solids (Elective)

Maximum Marks: 50(20+30)

Paper Code : CH-202

UNIT-I

Synthesis and modification of inorganic solids: Conventional heat and beat methods, Co-precipitation method, Sol-gel methods, Hydrothermal method, Ion-exchange and Intercalation methods.

Inorganic solids of technological importance: Solid electrolytes – Cationic, anionic, mixed Inorganic pigments – coloured solids, white and black pigments.

One-dimensional metals, molecular magnets, inorganic liquid crystals.

UNIT-II

Nanomaterials: Overview of nanostructures and nanomaterials: classification. Preparation of gold and silver metallic nanoparticles, self-assembled nanostructures-control of nanoarchitecture onedimensional control. Carbon nanotubes and inorganic nanowires. Bioinorganic nanomaterials, DNA and nanomaterials, natural and antisical nanomaterials, bionano composites. Introduction to engineering materials for mechanical construction:

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

UNIT-III

Composite materials:

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

UNIT-IV

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

Reference Books:

1. Atkins, Peter, Overton, Tina, Rourke, Jonathan, Weller, Mark and Armstrong, Fraser • Shriver & Atkins' Inorganic Chemistry, 5 th Edition, Oxford University Press 2011- 2012
2. Adam, D.M. Inorganic Solids: An introduction to concepts in solid-state structural • chemistry, John Wiley and Sons, London, New York, Sydney, Toronto, 1974
3. Poole Jr., Charles P., Owens, Frank J., Introduction to Nanotechnology John Wiley and • Sons, 2003.

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Chemistry

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. II Year (IV Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Subject : Organic Chemistry

Paper Code : CH-204

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Infrared (IR) absorption spectroscopy: Molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds. Applications of IR spectroscopy in structure elucidation of simple organic compounds.

UNIT-II

Amines: Structure and nomenclature of amines, physical properties. Separation of a mixture of primary, secondary and tertiary amines. Structural features affecting basicity of amines. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles, reductive amination of aldehydic and ketonic compounds. Gabrielphthalimide reaction, Hofmann bromamide reaction. electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid.

UNIT-III

Diazonium Salts: Mechanism of diazotisation, structure of benzene diazonium chloride, Replacement of diazo group by H, OH, F, Cl, Br, I, NO₂ and CN groups, reduction of diazonium salts to hydrazines, coupling reaction and its synthetic application.

Nitro Compounds: Preparation of nitro alkanes and nitro arenes and their chemical reactions. Mechanism of electrophilic substitution reactions in nitro arenes and their reductions in acidic, neutral and alkaline medium.

UNIT-IV

Aldehydes and Ketones: Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, advantage of oxidation of alcohols with chromium trioxide (Sarett reagent) pyridinium chlorochromate (PCC) and pyridinium dichromate., Physical properties. Comparison of reactivities of aldehydes and ketones. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction. Mannich reaction. Oxidation of aldehydes, Baeyer–Villiger oxidation of ketones, Cannizaro reaction. MPV, Clemmensen, Wolff-Kishner, LiAlH₄ and NaBH₄ reductions.

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Chemistry

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. II Year (IV Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Subject : Physical Chemistry

Paper Code : CH-206

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each

UNIT-I

Thermodynamics-III: Second law of thermodynamics, need for the law, different statements of the law, Carnot's cycles and its efficiency, Carnot's theorem, Thermodynamics scale of temperature. Concept of entropy– entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases.

UNIT-II

Thermodynamics-IV: Third law of thermodynamics: Nernst heat theorem, statement of concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs function(G) and Helmholtz function (A) as thermodynamic quantities, A &G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T.

UNIT-III

Electrochemistry-III: Electrolytic and Galvanic cells, reversible & Irreversible cells, conventional representation of electrochemical cells, EMF of cell and its measurement, Weston standard cell, activity and activity coefficients, Calculation of thermodynamic quantities of cell reaction (G,H& K).Types of reversible electrodes metal-metal ion gas electrode, metal-insoluble salt anion and redox electrodes. Electrode reactions, Nernst equations, derivation of cell EMF and single electrode potential. Standard Hydrogen electrode, reference electrodes, standard electrodes potential, sign conventions, electrochemical series and its applications.

UNIT-IV

Electrochemistry-IV: Concentration cells with and without transference, liquid junction potential, application of EMF measurement i.e. valency of ions, solubility product activity coefficient, potentiometric titration (acid- base and redox). Determination of pH using Hydrogen electrode, Quinhydrone electrode and glass electrode by potentiometric methods.

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Chemistry

(Syllabus and Scheme of Studies w.e.f. 2016-17 onwards)

B. Sc. II Year (IV Semester)

Schedule per week Practical: 6

Examination Time : 4 Hrs

Subject : Chemistry Lab-IV

Maximum Marks: 50(20+30)

Paper Code : CH-208

UNIT-I (Inorganic)

Preparations: Preparation of Cuprous chloride, prussian blue from iron fillings, tetraammine cupric sulphate, chrome alum, potassium trioxalatochromate (III).

UNIT-II (Physical)

1. To determine the enthalpy of neutralisation of a weak acid/weak base vs. strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base.
2. To determine the enthalpy of solution of solid calcium chloride
3. To study the distribution of iodine between water and CCl₄.

UNIT-III (Organic)

Systematic identification (detection of extra elements, functional groups, determination of melting point or boiling point and preparation of at least one pure solid derivative) of the following simple mono and bifunctional organic compounds: Naphthalene, anthracene, acenaphthene, benzyl chloride, *p*-dichlorobenzene, *m*-dinitrobenzene, *p*-nitrotoluene, resorcinol, hydroquinone, α -naphthol, β -naphthol, benzophenone, ethyl methyl ketone, benzaldehyde, vanillin, oxalic acid, succinic acid, benzoic acid, salicylic acid, aspirin, phthalic acid, cinnamic acid, benzamide, urea, acetanilide, benzanilide, aniline hydrochloride, *p*-toluidine, phenyl salicylate (salol), glucose, fructose, sucrose, *o*-, *m*-, *p* nitroanilines, thiourea.

Distribution of marks

1. UNIT-I	10 (6+4) marks
2. UNIT-II	10 (6+4) marks
3. UNIT-III	10 (6+4) marks
4. Viva-voce	10 (6+4) marks
5. Lab Record	10 (6+4) marks

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Chemistry
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. III Year (V Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Subject : Inorganic Chemistry

Maximum Marks: 50(20+30)

Paper Code : CH-301

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Metal-ligand bonding in Transition Metal Complexes: Limitations of valence bond theory, an elementary idea of crystal-field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal-field parameters.

UNIT-II

Thermodynamic and Kinetic Aspects of Metal Complexes: A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes of Pt (II).

UNIT-III

Magnetic Properties of Transition Metal Complexes: Types of magnetic behavior, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of s and eff -values, orbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes.

UNIT-IV

Electron Spectra of Transition Metal Complexes: Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series. Orgel-energy level diagram for d^1 and d^9 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex.

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Chemistry

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. III Year (V Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Subject : Organic Chemistry

Maximum Marks: 50(20+30)

Paper Code : CH-303

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

NMR Spectroscopy-I: Principle of nuclear magnetic resonance, the PMR spectrum, number of signals, peak areas, equivalent and nonequivalent protons positions of signals and chemical shift, shielding and de-shielding of protons, proton counting, splitting of signals and coupling constants, magnetic equivalence of protons.

UNIT-II

NMR Spectroscopy-II: Discussion of PMR spectra of the molecules: ethyl bromide, n-propyl

bromide, isopropyl bromide, 1,1-dibromoethane, 1,1,2-tribromoethane, ethanol, acetaldehyde, ethyl acetate, toluene, benzaldehyde and acetophenone. Simple problems on PMR spectroscopy for structure determination of organic compounds.

UNIT-III

Carbohydrates-I: Classification and nomenclature. Monosaccharides, mechanism of osazone formation, inter-conversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threo diastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers and esters. Determination of ring size of glucose and fructose. Open chain and cyclic structure of D (+)-glucose & D (-) fructose. Mechanism of mutarotation. Structures of ribose and deoxyribose.

UNIT-IV

Carbohydrates-II: An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

Organometallic Compounds:

Organomagnesium compounds: the Grignard reagents-formation, structure and chemical reactions. Organozinc compounds: formation and chemical reactions. Organolithium compounds: formation and chemical reactions

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Chemistry

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. III Year (V Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Subject : Physical Chemistry

Maximum Marks: 50(20+30)

Paper Code : CH-305

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer type questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Quantum Mechanics-I: Black-body radiation, Planck's radiation law, photoelectric effect, heat capacity of solids, Compton effect, wave function and its significance of Postulates of quantum mechanics, quantum mechanical operator, commutation relations, Hamiltonian operator, Hermitian operator, average value of square of Hermitian as a positive quantity, Role of operators in quantum mechanics, To show quantum mechanically that position and momentum cannot be predicated simultaneously, Determination of wave function & energy of a particle in one dimensional box, Pictorial representation and its significance,

UNIT-II

Physical Properties and Molecular Structure: Optical activity, polarization-(Clausius-Mossotti equation). Orientation of dipoles in an electric field, dipole moment, measurement of dipole moment-temperature method and refractivity method, dipole moment and structure of molecules, Magnetic permeability, magnetic susceptibility and its determination. Application of magnetic susceptibility, magnetic properties-paramagnetism, diamagnetism and ferromagnetics.

UNIT-III

Spectroscopy-I: Electromagnetic radiation, regions of spectrum, basic features of spectroscopy, statement of Born-Oppenheimer approximation, Degrees of freedom.

Rotational Spectrum: Diatomic molecules. Energy levels of rigid rotator (semi-classical principles), selection rules, spectral intensity distribution using population distribution (Maxwell-Boltzmann distribution), determination of bond length, qualitative description of non-rigid rotor, isotope effect.

UNIT-IV

Spectroscopy-II, Vibrational spectrum: Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effects of anharmonic motion and isotopic effect on the spectra., idea of vibrational frequencies of different functional groups.

Raman Spectrum: Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules, Quantum theory of Raman spectra

OR

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Subject : Green Chemistry (Elective)

Maximum Marks: 50(20+30)

Paper Code : CH-305

UNIT-I

Introduction to Green Chemistry

What is Green Chemistry? Need for Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry

Principles of Green Chemistry and Designing a Chemical synthesis

Twelve principles of Green Chemistry with their explanations and special emphasis on the following with examples:

1. Designing a Green Synthesis using these principles; Prevention of Waste/ byproducts; maximum incorporation of the materials used in the process into the final products, Atom Economy, calculation of atom economy of the rearrangement, addition, substitution and elimination reactions.
2. Prevention/ minimization of hazardous/ toxic products reducing toxicity risk = (function) hazard x exposure ; waste or pollution prevention hierarchy
3. Green solvents– super critical fluids, water as a solvent for organic reactions, ionic liquids, fluorinated biphasic solvent, PEG, solventless processes, immobilized solvents and how to compare greenness of solvents

UNIT-II

4. Energy requirements for reactions – alternative sources of energy: use of microwaves and ultrasonic energy
5. Selection of starting materials; avoidance of unnecessary derivatization – careful use of blocking/protecting groups;
6. use of catalytic reagents (wherever possible) in preference to stoichiometric reagents; catalysis and green chemistry, comparison of heterogeneous and homogeneous catalysis, bio catalysis, asymmetric catalysis and photo catalysis.
7. Prevention of chemical accidents designing greener processes, inherent safer design, principle of ISD —What you don't have cannot harm you||, greener alternative to Bhopal Gas Tragedy (safer route to carbaryl) and Flixiborough accident (safer route to cyclohexanol) subdivision of ISD, minimization, simplification, substitution, moderation and limitation.
8. Strengthening/ development of analytical techniques to prevent and minimize the generation of hazardous substances in chemical processes.

UNIT-III

Examples of Green Synthesis/ Reactions and some real world cases

1. Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis)
2. Microwave assisted reactions in water: Hofmann Elimination, methyl benzoate to benzoic acid, oxidation of toluene and alcohols; microwave assisted reactions in organic solvents Diels-Alder reaction and Decarboxylation reaction
3. Ultrasound assisted reactions: sonochemical Simmons-Smith Reaction (Ultrasonic alternative to Iodine)
4. Surfactants for Carbon Dioxide – replacing smog producing and ozone depleting solvents with CO₂ for precision cleaning and dry cleaning of garments.
5. Designing of Environmentally safe marine antifoulant.
6. Rightfit pigment: synthetic azopigments to replace toxic organic and inorganic pigments.
7. An efficient, green synthesis of a compostable and widely applicable plastic (poly lactic acid) made from corn.
8. Healthier Fats and oil by Green Chemistry: Enzymatic Inter esterification for production of no Trans-Fats and Oils
9. Development of Fully Recyclable Carpet: Cradle to Cradle Carpeting

UNIT-IV

Future Trends in Green Chemistry

Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Combinatorial green chemistry; Proliferation of solvent less reactions; co crystal controlled solid state synthesis (C² S³); Green chemistry in sustainable development.

Reference Books:

1. Ahluwalia, V.K. and Kidwai, M.R. New Trends in Green Chemistry, Anamalaya Publishers, 2005

- Anastas, P.T. and Warner, J.K. Oxford Green Chemistry -Theory and Practical, University Press, 1998
- Matlack, A.S. Introduction to Green Chemistry, Marcel Dekker, 2001
- Cann, M.C. and Connely, M.E. Real-World Cases in Green Chemistry, American Chemical Society, Washington, 2000
- Ryan, M.A. and Tinnesand, M., Introduction to Green Chemistry, American Chemical Society Washington, 2002
- Lancaster, Mike, Green Chemistry an Introductory Text 2nd Ed., RSC Publishing,. ISBN: 978- 1-84755-873-2

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Chemistry
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B.Sc. III Year (V Semester)

Schedule per week Practical: 6

Examination Time : 4 Hrs

Maximum Marks: 50(20+30)

Subject : Chemistry Lab-V

Paper Code : CH-307

UNIT-I (Inorganic)

Semimicro qualitative analysis of mixture containing not more than four radicals (including interfering, Combinations and excluding insolubles):

Pb²⁺, Hg²⁺, Hg₂²⁺, Ag⁺, Bi³⁺, Cu²⁺, Cd²⁺, As³⁺, Sb³⁺, Sn²⁺, Fe³⁺, Cr³⁺, Al³⁺, Co²⁺, Ni²⁺, Mn²⁺, Zn²⁺, Ba²⁺, Sr²⁺, Ca²⁺, Mg²⁺,

UNIT-II (Physical)

- To determine the strength of the given acid solution (mono and dibasic acid) conductometrically.
- To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically

UNIT-III (Organic)

Chromatography Method

Determination of R_f values and identification of organic compounds

(a) Separation of green leaf pigments (spinach leaves may be used) by paper chromatographic method

(b) Separation of a mixture of colored organic compounds using common organic solvents by TLC.

Distribution of marks

1. UNIT-I	10 (6+4) marks
2. UNIT-II	10 (6+4) marks
3. UNIT-III	10 (6+4) marks
4. Viva-voce	10 (6+4) marks
5. Lab Record	10 (6+4) marks

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Chemistry
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. III Year (VI Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Subject : Inorganic Chemistry

Paper Code : CH-302

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Organometallic Chemistry: Definition, nomenclature and classification of organometallic compounds. Preparation, properties, and bonding of alkyls of Li, Al, Hg, and Sn a brief account of metal-ethylenic complexes, mononuclear carbonyls and the nature of bonding in metal carbonyls.

UNIT-II

Acids and Bases, HSAB Concept: Arrhenius, Bronsted-Lowry, the Lux-Flood, Solvent system and Lewis concepts of acids & bases, relative strength of acids & bases, Concept of Hard and Soft Acids & Bases. Symbiosis, electronegativity and hardness and softness

UNIT-III

Bioinorganic Chemistry: Essential and trace elements in biological processes, metalloporphyrins with special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca^{2+} . Nitrogen fixation.

UNIT-IV

Silicones and Phosphazenes: Silicones and phosphazenes, their preparation, properties, structure and uses

OR

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Subject : Industrial Chemicals and Environment
(Elective)

paper Code : CH-302

UNIT-I

Industrial Gases and Inorganic Chemicals

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

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

UNIT-II

Industrial Metallurgy: Preparation of metals (ferrous and nonferrous) and ultrapure metals for semiconductor technology.

Environment and its segments : Ecosystems. Biogeochemical cycles of carbon, nitrogen and sulphur. Air Pollution: Major regions of atmosphere. Chemical and photochemical reactions in atmosphere. Air pollutants: types, sources, particle size and chemical nature; Photochemical smog: its constituents and photochemistry. Environmental effects of ozone, Major sources of air pollution. Pollution by SO₂, CO₂, CO, NO_x, H₂S and other foul smelling gases. Methods of estimation of CO, NO_x, SO_x and control procedures. Effects of air pollution on living organisms and vegetation. Greenhouse effect and Global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens, removal of sulphur from coal. Control of particulates.

UNIT-III

Water Pollution: Hydrological cycle, water resources, aquatic ecosystems, Sources and nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems. Water purification methods. Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluents from the following industries and their treatment: electroplating, textile, tannery, dairy, petroleum and petrochemicals, agro, fertilizer, etc.

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

UNIT-IV

Energy & Environment Sources of energy: Coal, petrol and natural gas. Nuclear Fusion / Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel, etc. Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management.

Biocatalysis Introduction to biocatalysis:

Importance in —Green Chemistry|| and Chemical Industry.

Reference Books:

1. E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.
2. R.M. Felder, R.W. Rousseau: Elementary Principles of Chemical Processes, Wiley• Publishers, New Delhi.
3. J. A. Kent: Riegel’s Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
4. S. S. Dara: A Textbook of Engineering Chemistry, S. Chand• & Company Ltd. New Delhi.
5. K. De, Environmental Chemistry: New Age International Pvt., Ltd, New Delhi.
6. S. M. Khopkar, Environmental Pollution Analysis: Wiley Eastern Ltd, New Delhi.
7. S.E. Manahan, Environmental Chemistry, CRC Press (2005).
8. G.T. Miller, Environmental Science 11th edition. Brooks/ Cole (2006).
9. A. Mishra, Environmental Studies. Selective and Scientific Books, New Delhi (2005).

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Chemistry

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. III Year (VI Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Subject : Organic Chemistry

Paper Code : CH-304

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6marks each.

UNIT-I

Heterocyclic Compounds-I: Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole

UNIT-II

Heterocyclic Compounds-II: Introduction to condensed five and six- membered heterocycles. Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis. Mechanism of electrophilic substitution reactions of, quinoline and isoquinoline

Organosulphur Compounds: Nomenclature, structural features, Methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine. Synthetic detergents alkyl and aryl sulphonates.

UNIT-III

Organic Synthesis via Enolates: Acidity of hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate.

Synthetic Polymers: Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers. Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubbers.

UNIT-IV

Amino Acids, Peptides & Proteins: Classification, of amino acids. Acid-base behavior, isoelectric point and electrophoresis. Preparation of α -amino acids. Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid-phase peptide synthesis. Structures of peptides and proteins: Primary & Secondary structure.

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Chemistry
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. III Year (VI Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Maximum Marks: 50 (20+30)

Subject : Physical Chemistry

Paper Code : CH-306

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each

UNIT-I

Spectroscopy-III: - Electronic Spectrum: Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Franck- Condon principle.

Qualitative description of sigma and pie and n molecular orbital (MO) their energy level and respective transitions.

UNIT-II

Photochemistry: Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grotthus-Draper law, Stark-Einstein law (law of photochemical equivalence) Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions-energy transfer processes (simple examples).

UNIT-III

Solutions:- Dilute Solutions and Colligative Properties: Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient. Dilute solution, Colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination, Osmosis law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression of freezing point, Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes.

UNIT-IV

Phase Equilibrium: Statement and meaning of the terms – phase component and degree of freedom, thermodynamic derivation of Gibbs phase rule, phase equilibria of one component System, water and Sulphur systems. Phase equilibria of two component systems, solid-liquid equilibria, simple eutectic, Pb-Ag system, desilverisation of lead

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Chemistry
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. III Year (VI Semester)

Schedule per week Practical: 6

Examination Time : 4 Hrs

Maximum Marks: 50 (30+20)

Subject : Chemistry Lab-VI

Paper Code : CH-308

UNIT-I (Inorganic)

Semimicro qualitative analysis of mixture containing not more than four radicals (including interfering, Combinations and excluding insoluble's):

NH_4^+ , CO_3^{2-} , S^{2-} , SO_3^{2-} , $\text{S}_2\text{O}_3^{2-}$, NO_2^- , CH_3COO^- , Cl^- , Br^- , I^- , NO_3^- , SO_4^{2-} , $\text{C}_2\text{O}_4^{2-}$, PO_4^{3-} , BO_3^{3-}

UNIT-II (Physical)

1. To determine the strength of given acid solution (mono and dibasic acid)/ KMnO_4 – Mohr salt potentiometrically.
2. To determine the molecular weight of a non-volatile solute by Rast method.
3. To standardize the given acid solution (mono and dibasic acid) pH metrically.

UNIT-III (Organic)

Synthesis of the following organic compounds:

- (a) To prepare o-chlorobenzoic acid from anthranilic acid.
- (b) To prepare p-bromoaniline from p-bromoacetanilide.
- (c) To prepare m-nitroaniline from m-dinitrobenzene.
- (d) To prepare S-Benzyl-iso-thiuronium chloride from thiourea

Distribution of marks

1. UNIT-I	10 (6+4) marks
2. UNIT-II	10 (6+4) marks
3. UNIT-III	10 (6+4) marks
4. Viva-voce	10 (6+4) marks
5. Lab Record	10 (6+4) marks

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. (Six –Semester Course)



RAFFLES

UNIVERSITY

DEPARTMENT OF MATHEMATICS
SCHOOL OF BASIC AND APPLIED SCIENCES
RAFFLES UNIVERSITY, NEEMRANA, ALWAR (RAJASTHAN)

SCHOOL OF BASIC AND APPLIED SCIENCE
Department of Mathematics
(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)
B. Sc I Year (I Semester)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks:	50(20+30)
Paper Title	: Matrices and Statistics	Paper Code	: MA-101

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Symmetric, Skew symmetric, Hermitian and skew Hermitian matrices. Elementary Operations on matrices. Rank of a matrices. Inverse of a matrix. Linear dependence and independence of rows and columns of matrices. Row rank and column rank of a matrix. Eigen values, eigenvectors and the characteristic equation of a matrix. Minimal polynomial of a matrix. Cayley Hamilton theorem and its use in finding the inverse of a matrix.

UNIT-II

Applications of matrices to a system of linear (both homogeneous and non-homogeneous) equations. Theorems on consistency of a system of linear equations. Unitary and Orthogonal Matrices, Bilinear and Quadratic forms.

UNIT-III

Meaning of correlation and regression. Coefficient of correlation, Rank correlation, lines of regression. Properties of regression coefficients.

UNIT-IV

Probability distribution of random variables, Binomial distribution, Poisson's distribution, Normal distribution, Mean, Variance and Fitting.

Books Recommended:

4. S. S Seth: A Text Books Mathematical Statistics
5. Shanti Narayan : A Text Books of Matrices.
6. Chandrika Prasad : Text Book on Algebra and Theory of Equations. Pothishala Private Ltd., Allahabad.

SCHOOL OF BASIC AND APPLIED SCIENCE
Department of Mathematics
(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)
B. Sc. I Year (I Semester)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Paper Title	: Calculus	Paper Code	: MA-103

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Definition of the limit of a function. Basic properties of limits, Continuous functions and classification of discontinuities. Differentiability. Successive differentiation. Leibnitz theorem. Maclaurin and Taylor series expansions.

UNIT-II

Asymptotes in Cartesian coordinates, intersection of curve and its asymptotes, asymptotes in polar coordinates. Curvature, radius of curvature for Cartesian curves, parametric curves, polar curves. Radius of curvature for pedal curves. Tangential polar equations. Centre of curvature. Chord of curvature..

UNIT-III

Tests for concavity and convexity. Points of inflexion. Multiple points. Cusps, nodes & conjugate points. Type of cusps Tracing of curves in Cartesian, parametric and polar co-ordinates. Intrinsic equations of curves.

UNIT-IV

Indeterminate forms, Partial differentiation, Homogenous function and Euler's theorem, Jacobians, Total differentials Chain rule of partial differentiation.

Books Recommended:

1. Differential and Integral Calculus: Shanti Narayan.
2. Murray R. Spiegel: Theory and Problems of Advanced Calculus. Schaun's Outline series. Schaum Publishing Co., New York.
3. N. Piskunov: Differential and integral Calculus. Peace Publishers, Moscow.
4. Gorakh Prasad: Differential Calculus. Pothishasla Pvt. Ltd., Allahabad.
5. Gorakh Prasad: Integral Calculus. Pothishala Pvt. Ltd., Allahabad.

SCHOOL OF BASIC AND APPLIED SCIENCE
Department of Mathematics
(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)
B. Sc. I Year (I Semester)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs		Maximum
Marks: 50(20+30) Paper Title		: Three- Dimensional	Geometry
Paper Code	: MA-105		

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT -I

General equation of second degree, System of conics, Confocal conics, Polar equation of a conic and its properties.

UNIT -II

Three dimensional systems of co-ordinates, Projection and direction cosines, plane and Straight line.

UNIT-III

Sphere: Plane section of a sphere. Sphere through a given circle. Cones: Right circular cone, enveloping cone and reciprocal cone. Cylinder: Right circular cylinder and enveloping cylinder

UNIT-IV

Central Conicoids, Reduction of general equation of second degree, Tangent plane and Normal to conicoid, Generating lines, Plane sections.

Books Recommended:

1. S. P. Nigam S. S. Gangwar, Coordinary Geometry of Three Dimensions
2. R.J.T. Bill, Elementary Treatise on Coordinary Geometry of Three Dimensions, MacMillan India Ltd. 1994.
3. P.K. Jain and Khalil Ahmad: A Textbook of Analytical Geometry of Three Dimensions, Wiley Eastern Ltd. 1999.



RAFFLES UNIVERSITY, NEEMRANA, ALWAR (RAJASTHAN)

Japanese Zone, National Highway-8, Neemrana-307105

Tel.: +91-9214205555 www.rafflesuniversity.edu.in

SCHOOL OF BASIC AND APPLIED SCIENCE

Department of Mathematics

(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)

B. Sc. I Year (II Semester)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Paper Title	: Sequences and Series and Trigonometry	Paper Code	: MA-102

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each

UNIT-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. Bolzano-Weierstrass theorem, Open covers, Compact sets and Heine-Borel Theorem.

UNIT -II

Sequence: Real Sequences and their convergence, Theorem on limits of sequence, Bounded and monotonic sequences, Cauchy's sequence, Cauchy general principle of convergence, Subsequences, Sub-sequential limits. 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, Cauchy's Nth root test.

UNIT -III

De Moivre's Theorem and its Applications. Expansion of trigonometrical functions. Direct circular and hyperbolic functions and their properties.

UNIT- IV

Inverse circular and hyperbolic functions and their properties. Logarithm of a complex quantity. Gregory's series. Summation of Trigonometry series.

Books Recommended:

1. R.R. Goldberg : Real Analysis, Oxford & I.B.H. Publishing Co., New Delhi, 1970
2. S.C. Malik : Mathematical Analysis, Wiley Eastern Ltd., Allahabad.
3. Shanti Narayan : A Course in Mathematical Analysis, S.Chand and company, New Delhi
4. Murray, R. Spiegel : Theory and Problems of Advanced Calculus, Schaum Publishing co., New York
5. T.M. Apostol: Mathematical Analysis, Narosa Publishing House, New Delhi, 1985
6. Earl D. Rainville, Infinite Series, The Macmillan Co., New York
7. S.L. Loney : Plane Trigonometry Part – II, Macmillan and Company, London.
8. R.S. Verma and K.S. Sukla : Text Book on Trigonometry, Pothishala Pvt. Ltd. Allahabad.



RAFFLES UNIVERSITY, NEEMRANA, ALWAR (RAJASTHAN)

Japanese Zone, National Highway-8, Neemrana-307105

Tel.: +91-9214205555 www.rafflesuniversity.edu.in

SCHOOL OF BASIC AND APPLIED SCIENCE

Department of Mathematics

(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)

B. Sc. I Year (II Semester)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Paper Title	: Ordinary Differential Equations	Paper Code	: MA-104

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

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. Linear differential equations with constant coefficients. Homogeneous linear ordinary differential equations. Equations reducible to homogeneous linear ordinary differential equations.

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. Method of undetermined coefficients.

UNIT-IV

Ordinary simultaneous differential equations. Solution of simultaneous differential equations involving operators $x (d/dx)$ or $t (d/dt)$ etc. Simultaneous equation of the form $dx/P = dy/Q = dz/R$. Total differential equations. Condition for $Pdx + Qdy + Rdz = 0$ to be exact. General method of solving $Pdx + Qdy + Rdz = 0$ by taking one variable constant. Method of auxiliary equations.

Books Recommended :

1. D.A. Murray : Introductory Course in Differential Equations. Orient Longman(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



RAFFLES UNIVERSITY, NEEMRANA, ALWAR (RAJASTHAN)

Japanese Zone, National Highway-8, Neemrana-307105

Tel.: +91-9214205555 www.rafflesuniversity.edu.in

SCHOOL OF BASIC AND APPLIED SCIENCE

Department of Mathematics

(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)

B. Sc. I Year (II Semester)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks:	50(20+30)
Paper Title	: Vector Calculus and Geometry	Paper Code	: MA-106

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each

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.

UNIT-II

Gradient of a scalar point function, geometrical interpretation of $\text{grad } \phi$, character of gradient as a point function. Divergence and curl of vector point function, characters of $\text{Div } \vec{f}$ and $\text{Curl } \vec{f}$ as point function, examples. Gradient, divergence and curl of sums and product and their related vector identities. Laplacian operator.

UNIT-III

Vector integration; Line integral, Surface integral, Volume integral. Theorems of Gauss, Green & Stokes and problems based on these theorems.

UNIT-IV

General equation of second degree, Tracing of conics Parabola, Ellipse and Hyperbola. Polar Equation of conic.

Books Recommended:

1. Murraray R. Spiegel: Vector Analysis, Schaum Publisghing Company, New York.
2. N. Saran and S.N. Nigam. Introduction to Vector Analysis, Pothishala Pvt. Ltd., Allahabad.
3. Shanti Narayna : A Text Book of Vector Calculus. S. Chand & Co., New Delhi.
4. S.L.Loney, The Elements of Coordinate Geometry, Macmillan and company, London
5. P. K. Jain and Khalil Ahamad, A text book of Analytic Geometry of Two Dimensions Macmillan India Ltd. 1994.
6. Sharma and Sharma A Text Book of Vector Calculus Krishna Prakashan Media



RAFFLES UNIVERSITY, NEEMRANA, ALWAR (RAJASTHAN)

Japanese Zone, National Highway-8, Neemrana-307105

Tel.: +91-9214205555 www.rafflesuniversity.edu.in

SCHOOL OF BASIC AND APPLIED SCIENCE

Department of Mathematics

(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)

B. Sc. II Year (III Semester)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs		Maximum Marks: 50(20+30)
Paper Title	: Advanced Calculus	Paper Code	: MA-201

***Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each*

UNIT-I

Continuity, Sequential Continuity, properties of continuous functions, Uniform continuity. 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.

UNIT-II

Limit and continuity of real valued functions of two variables. Taylor's theorem for functions of two variables. Maxima, Minima and saddle points of two variables. Lagrange's method of multipliers and Envelopes.

UNIT-III

Reduction formula, Beta and Gamma function.

UNIT-IV

Quadrature, Rectification, Volume and surface of solids of revolution, Pappus theorem, double and triple integrals, Change the order of integration, Dirichlet's integral.

Books Recommended:

1. C.E. Weather burn: Differential Geometry of three dimensions, Radhe Publishing House, Calcutta
2. Gabriel Klaumber : Mathematical analysis, Mrcel Dekkar, Inc., New York, 1975
3. R.R. Goldberg : Real Analysis, Oxford & I.B.H. Publishing Co., New Delhi, 1970
4. Gorakh Prasad : Differential Calculus, Pothishala Pvt. Ltd., Allahabad
5. S.C. Malik : Mathematical Analysis, Wiley Eastern Ltd., Allahabad.
6. Shanti Narayan : A Course in Mathematical Analysis, S.Chand and company, New Delhi
7. Murray, R. Spiegel : Theory and Problems of Advanced Calculus, Schaum Publishing co., New York
8. A. R. Vasishtha, J.N. Sharma, A. K. Vasishtha Advanced Calculus Krishna Prakashan Media

SCHOOL OF BASIC AND APPLIED SCIENCE
Department of Mathematics
(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)
B. Sc. II Year (III Semester)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Paper Title	: Partial Differential Equations	Paper Code	: MA-203

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each

UNIT-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.

UNIT-II

Linear partial differential equations of second and higher orders, Linear and non-linear homogeneous and non-homogeneous equations with constant co-efficient, Partial differential equation with variable co-efficient reducible to equations with constant coefficients, their complimentary functions and particular Integrals, Equations reducible to linear equations with constant co-efficients.

UNIT-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.

UNIT-IV

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.

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 BookCompany, 1988

5. Frank Ayres : Theory and Problems of Differential Equations, McGraw Hill BookCompany, 1972
6. J.N. Sharma & Kehar Singh : Partial Differential Equations

SCHOOL OF BASIC AND APPLIED SCIENCE
Department of Mathematics
(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)
B. Sc. II Year (III Semester)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs		Maximum Marks: 50(20+30)
Paper Title	: Elective paper		Paper Code : MA-
205(A)			

Statics

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each

UNIT-I

Forces acting at a point, Parallel forces. Moments and Couples.

UNIT-II

Analytical conditions of equilibrium of coplanar forces. Friction. Centre of Gravity.

UNIT-III

Virtual work. Forces in three dimensions. Poinots central axis.

UNIT-IV

Wrenches. Null lines and planes. Stable and unstable equilibrium.

Books Recommended:

1. S.L. Loney : Statics, Macmillan Company, London
2. R.S. Verma : A Text Book on Statics, Pothishala Pvt. Ltd., Allahabad

OR

SCHOOL OF BASIC AND APPLIED SCIENCE
Department of Mathematics
(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)
B. Sc.II Year (III Semester)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Paper Title	: Elective paper	Paper Code	: MA-
205(B)			

Number Theory and Cryptography

***Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each*

UNIT- I

Divisibility:- GCD, LCM , Prime number, fundamental theorem of arithmetic, perfect numbers, floor and ceiling functions, Congruence: properties, complete and reduced residue system, Fermat's theorem, Euler functions, Chinese remainder theorem.

UNIT-II

Primality testing and factorization algorithms, Pseudo primes, Fermate's pseudo-primes, Pollard's rho method for factorization.

UNIT-III

Introduction to cryptography: Attack services and mechanisms, Security services, Conventional encryption. Classical techniques: Model steganography, Clasical encryption technique, Modern techniques: DES, cryptanalysis, block cipher principles and design, key distribution problem, Random number generation.

UNIT-IV

Hash function public key cryptography, Diffie-Hellmann key exchange, Discrete logarithm-based cryptosystems, RSA crypto system signature schemes, Digital signature standard (DSA), RSA signature schemes, knapsack problem.

Books Recommended:

1. **Koblitz, Neal** A Course in Number Theory and Cryptography Publisher Springer

2. J. H. Loxton Number Theory and Cryptography Publisher: Cambridge University Press
3. Dr.Hari Kishan, Dr. Manoj Km. Baliyan Number Theory and Cryptography publisher Krishna Pvt. Ltd.

SCHOOL OF BASIC AND APPLIED SCIENCE
Department of Mathematics
(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)
B. Sc. II Year (IV Semester)

Lectures	: 2 Hrs	
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)
Paper Title	: Linear Programming	Paper Code : MA-202

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each

UNIT-I

Linear programming problems, Statement and formation of general linear programming problems, Graphical method, slack and surplus variables, standard and matrix forms of linear programming problem, Basic feasible solution.

UNIT-II

Transportation problems, Assignment problems.

UNIT-III

Fundamental theorem of linear programming, simplex method Artificial variables, Big-M method, Convex sets.

UNIT-IV

Duality in linear programming problems, Dual simplex method, Primal-dual method.

Books Recommended:

1. J.K Sharma Operations Research: Theory and Applications 5th Edition (English) 5th Edition Laxmi Publications New- Delhi
2. V. K Kapoor Operations Research: Sultan Chand and Sons
3. S.D Sharma Operations Research Publisher Kedar Nath Ram Nath
4. R. K Gupta linear programming Krishna Prakashan Media

SCHOOL OF BASIC AND APPLIED SCIENCE

Department of Mathematics

(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)

B. Sc. II Year (IV Semester)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Paper Title	: Special Functions and Integral Transforms	Paper Code	: MA-204

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each

UNIT – I

Series solution of differential equations -Power series method, Definitions of Beta and Gamma functions. Bessel equation and its solution: Bessel functions and their properties-Convergence, recurrence, Relations and generating functions, Orthogonality of Bessel functions.

UNIT – II

Legendre and Hermite differentials equations and their solutions: Legendre and Hermite functions and their properties-Recurrence Relations and generating functions. Orthogonality of Legendre and Hermite polynomials. Rodrigues' Formula for Legendre & Hermite Polynomials, Laplace Integral Representation of Legendre polynomial.

UNIT-III

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.

UNIT-IV

Inverse Laplace transforms, convolution theorem, Inverse Laplace transforms of derivatives and integrals, change the scale property and Shifting theorems for inverse Laplace, solution of ordinary differential equations using Laplace transform. Finite Fourier transforms, Infinite Fourier transforms, Fourier integral, Application of Fourier transform to boundary value problems,

Books Recommended:

1. I.N. Sneddon: the use of integral transform, McGraw Hill, 1972
2. Murray R. Spiegel: Laplace transforms, Schaum's Series.
3. S. S Seth Integral Transforms : Students' Friends & Company
4. I.N. Sneddon: Special Functions on mathematics, Physics & Chemistry.
5. W.W. Bell: Special Functions for Scientists & Engineers.

SCHOOL OF BASIC AND APPLIED SCIENCE
Department of Mathematics
(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)
B. Sc. II Year (IV Semester)

Lectures	: 2 Hrs	
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)
Paper Title	: Elective paper	Paper Code : MA-206(A)
Programming in C and Numerical Method		

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each

UNIT-I

Programmer's model of a computer, Algorithms, Flow charts, Data types, Operators and expressions, Input / outputs functions

UNIT-II

Decisions control structure: Decision statements, Logical and conditional statements, Implementation of Loops, Switch Statement & Case control structures. Functions, Preprocessors and Arrays.

UNIT-III

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. Pointers: Pointers Data type, Pointers and Arrays, Pointers and Functions. 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, Order of convergence of above methods.

UNIT-IV

Simultaneous linear algebraic equations: Gauss-elimination method, Gauss-Jordan method, Triangularization method (LU decomposition method). Crout's method, Cholesky Decomposition method. Iterative method, Jacobi's method, Gauss-Seidal's method, Relaxation method.

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.
8. Gupta and Malik, Numerical Analysis Krishna Prakashan Media
9. Babu Ram: Numerical Methods, Pearson Publication.
10. R.S. Gupta, Elements of Numerical Analysis, Macmillan's India 2010.

OR

SCHOOL OF BASIC AND APPLIED SCIENCE

Department of Mathematics

(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)

B. Sc. II Year (IV Semester)

Lectures : 2 Hrs

Examination Time : 3 Hrs

Paper Title : Elective paper

Maximum Marks: 50(20+30)

Paper Code : MA-206(B)

Differential Geometry and Tensor Analysis

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each

UNIT-I

Local theory of curves space curves, examples, Plane curves, tangent and normal and binormal osculating normal plane and rectifying plane, Helices serret- Frenet apparatus, contact between curve and surfaces, tangent surfaces, involutes and evolutes of curves.

UNIT –II

Intrinsic equations, fundamental existence theorem for space curves, Local theory of surfaces Parametric patches on surface curve of a surface, surface of revolution, Helicoids, Metric first fundamental form and arc length.

UNIT –III

Local theory of surface (contd.) Direction coefficients, families of curves, intrinsic properties, geodesics, canonical geodesic equations normal properties of geodesics, geodesics curvature, geodesics polars, Gass-Bonnet theorem, Gaueeian curvature, normal curvature.

UNIT –IV

Contravariant and covariant vectors and tensors, Mixed tensors, Symmetric and skew –symmetric tensors, Algebra of tensors, Contraction and inner product, Quotient theorem, Reciprocal tensors.

Books Recommended:

1. Vasistha and Other Differential Geomeetry and Tenssor Analysis publisher Krishna Pvt. Ltd.
2. K.K. Dube Differential Geometry and Tensors I. K International Publishing house Pvt. Ltd.

SCHOOL OF BASIC AND APPLIED SCIENCE
Department of Mathematics
(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)
B. Sc. III Year (V Semester)

Lectures : 2 Hrs

Examination Time : 3 Hrs

Paper Title : Real Analysis

Maximum Marks: 50(20+30)

Paper Code : MA-301

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each

UNIT-I

Riemann integral, Integrability of continuous and monotonic functions, The Fundamental Theorem of integral calculus. Mean value theorems of integral calculus.

UNIT-II

Improper integrals and their convergence, Comparison tests, Abel's and Dirichlet's tests, μ -test, Integral as a function of a parameter. Continuity Differentiability and integrability of an integral of a function of a parameter.

UNIT-III

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, Baire's category theorem, contraction Principle.

UNIT-IV

Continuous functions, uniform continuity, compactness for metric spaces, sequential compactness, Bolzano-Weierstrass property, total boundedness, finite intersection property, continuity in relation with compactness, connectedness, components, continuity in relation with connectedness.

Books Recommended:

1. P.K. Jain and Khalil Ahmad: Metric Spaces, 2nd Ed., Narosa, 2004
2. T.M. Apostol: Mathematical Analysis, Narosa Publishing House, New Delhi, 1985
3. R.R. Goldberg : Real analysis, Oxford & IBH publishing Co., New Delhi, 1970
4. D. Somasundaram and B. Choudhary : A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997
5. Shanti Narayan : A Course of Mathematical Analysis, S. Chand & Co., New Delhi
6. E.T. Copson, Metric Spaces, Cambridge University Press, 1968.
7. G.F. Simmons : Introduction to Topology and Modern Analysis, McGraw Hill, 1963.
8. A. R. Vasishtha, J.N. Sharma, A. K. Vasishtha Real Analysis, Krishna Prakashan Media

SCHOOL OF BASIC AND APPLIED SCIENCE
Department of Mathematics
(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)
B. Sc. III Year (V Semester)

Lectures : 2 Hrs

Examination Time : 3 Hrs

Paper Title : Modern algebra

Maximum Marks: 50(20+30)

Paper Code : MA-303

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each

UNIT-I

Definition of a group with examples and simple properties, permutation groups, subgroup, centre and normalizer, Cyclic groups, Left and right cosets, Coset decomposition, Lagrange's theorem and its consequences.

UNIT-II

Homomorphism and isomorphism, Cayley's theorem, Normal subgroups, Quotient group, Fundamental theorem of homomorphism, conjugacy relation, class equation.

UNIT-III

Introduction to rings, subrings, integral domains and fields, Characteristics of a ring. Ring homomorphisms, ideals (prime, maximal and principal) and Quotient rings, Field of quotients of an integral domain.

UNIT-IV

Euclidean rings, Polynomial rings, Polynomials over the rational field, The Eisenstein's criterion, Polynomial rings over commutative rings, Unique factorization domain, $R[x_1, x_2, \dots, x_n]$ unique factorization domain implies so is $R[x_1, x_2, \dots, x_n]$.

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 (2nd edition).
3. Vivek Sahai and Vikas Bist : Algebra, NKarosa Publishing House.
4. I.S. Luther and I.B.S. Passi : Algebra, Vol.-II, Norsa Publishing House.
5. J.B. Gallian: Abstract Algebra, Narosa Publishing House.
6. A. R. Vasishtha, J.N. Sharma, A. K. Vasishtha Modern Algebra, Krishna Prakashan Media

SCHOOL OF BASIC AND APPLIED SCIENCE
Department of Mathematics
(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)
B. Sc. III Year (V Semester)

Lectures	: 2 Hrs	
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)
Paper Title	: Elective paper	Paper Code : MA-305(A)
	Dynamics	

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each

UNIT-I

Velocity and acceleration along radial, transverse, tangential and normal directions. Relative velocity and acceleration. Simple harmonic motion. Elastic strings.

UNIT-II

Motion of resisting medium, Constrained Motion (Circular and Cycloid only).

UNIT-III

Motion on smooth and rough plane curves. Projectile motion of a particle in a plane. Vector angular velocity.

UNIT-IV

General motion of a rigid body. Central Orbits, Kepler laws of motion. Motion of a particle in three dimensions.

Books Recommended:

1. S.L.Loney : An Elementary Treatise on the Dynamics of a Particle and a Rigid Bodies, Cambridge University Press, 1956
2. F. Chorlton : Dynamics, CBS Publishers, New Delhi
3. A.S. Ramsey: Dynamics Part-1&2, CBS Publisher & Distributors.
4. M. Ray and G.C Sharma Dynamics S. Chand Publisher & Distributors

OR



RAFFLES UNIVERSITY, NEEMRANA, ALWAR (RAJASTHAN)

Japanese Zone, National Highway-8, Neemrana-307105

Tel.: +91-9214205555 www.rafflesuniversity.edu.in

SCHOOL OF BASIC AND APPLIED SCIENCE

Department of Mathematics

(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)

B. Sc. III Year (V Semester)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Paper Title	: Elective paper	Paper Code	: MA-305(B)
	Discrete Mathematics		

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each

UNIT-I

Propositional Logic- Propositional logic, Basic logic, logical connectives, truth tables, tautologies, contradiction, normal forms (conjunctive and disjunctive), modus ponens and modus tollens, validity, predicate logic, universal and existential quantification.

UNIT-II

Relation- Definition, types of relation, composition of relations, domain and range of relation, pictorial representation of relation, properties of relation, partial ordering relation. Introduction of posets, Hasse, Diagram and Lattices, ordered set, Hasse diagram of partially ordered set.

UNIT-III

Graphs – Simple graph, multi graph, graph terminology, representation of graphs, Bipartite, regular, planar and connected graphs, connected components in a graph, Euler graphs, Hamiltonian path and circuits, Graph colouring, chromatic number, isomorphism and homomorphism of graphs.

UNIT –IV

Tree- Definition of tree, Rooted tree, properties of trees, binary search tree, tree traversal.

Boolean Algebra- Basic definition, sum of products and products of sums, Logic gates and Karnaugh maps.

Books Recommended:

1. M.K.Gupta Discrete Mathematics publisher Krishna Pvt. Ltd.

SCHOOL OF BASIC AND APPLIED SCIENCE
Department of Mathematics
(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)
B. Sc. III Year (VI Semester)

Lectures	: 2 Hrs	
Examination Time	: 3 Hrs	Maximum Marks: 50(20+50)
Paper Title	: Complex Analysis	Paper Code : MA-302

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each

UNIT-I

Function of a complex variable, Stereographic projection of complex numbers, continuity and differentiability of complex functions, Analytic functions, Cauchy-Riemann equations. Harmonic functions, Orthogonal system.

UNIT-II

Mappings by elementary functions: Translation, rotation, Conformal Mappings, Mobius transformations, Fixed points, Cross ratio, Inverse Points and critical mappings, Conformal transforms.

UNIT-III

Complex integration, Line integral, Cauchy's fundamental theorem, Cauchy's integral formula, Morera's theorem, Liouville theorem, Maximum Modulus Theorem, Taylor and Laurent series.

UNIT-IV

Singularities and zeros of an analytic function, Rouché's theorem, Fundamental theorem of algebra, Analytic continuation.

1. A. R. Vasishtha, J.N. Sharma, A. K. Vasishtha Complex Analysis Krishna Prakashan Media
2. Shanti Narayan : A Course of Mathematical Analysis, S. Chand & Co., New Delhi
3. R.V. Churchill & J.W. Brown: Complex Variables and Applications, 5th Edition, McGraw-Hill, New York, 1990
4. Shanti Narayan : Theory of Functions of a Complex Variable, S. Chand & Co., New Delhi.

SCHOOL OF BASIC AND APPLIED SCIENCE

Department of Mathematics

(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)

B. Sc. III Year (VI Semester)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs		Maximum Marks: 50(20+30)
Paper Title	: Linear Algebra	Paper Code	: MA-304

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each

UNIT-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 vector space, Finite dimensional vector spaces, Invariance of the number of elements of bases sets, Dimensions, Quotient space and its dimension.

UNIT-II

Homomorphism and isomorphism of vector spaces, Linear transformations and linear forms on vector spaces, Vector space of all the linear transformations Dual Spaces, Bidual spaces, annihilator of subspaces of finite dimensional vector spaces, Null Space, Range space of a linear transformation, Rank and Nullity Theorem,

UNIT-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.

UNIT-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.

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 (2nd edition).
3. Vivek Sahai and Vikas Bist : Algebra, Narosa Publishing House.
4. I.S. Luther and I.B.S. Passi : Algebra, Vol.-II, Narosa Publishing House.
5. A. R. Vasishtha, J.N. Sharma, A. K. Vasishtha Linear Algebra, Krishna Prakashan Media



RAFFLES UNIVERSITY, NEEMRANA, ALWAR (RAJASTHAN)

Japanese Zone, National Highway-8, Neemrana-307105

Tel.: +91-9214205555 www.rafflesuniversity.edu.in

SCHOOL OF BASIC AND APPLIED SCIENCE

Department of Mathematics

(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)

B. Sc. III Year (VI Semester)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs		Maximum Marks: 50(20+30)
Paper Title	: Elective paper		Paper Code : MA-
306(A)			

Numerical Analysis

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each

UNIT-I

Finite Differences operators and their relations. Finding the missing terms and effect of error in a difference tabular values, Interpolation with equal intervals: Newton's forward and Newton's backward interpolation formulae. Interpolation with unequal intervals: Newton's divided difference, Lagrange's Interpolation formulae, Hermite Formula.

UNIT-II

Central Differences: Gauss forward and Gauss's backward interpolation formulae, Sterling, Bessel Formula.

UNIT-III

Numerical Differentiation: 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 and three-eighth rule, Weddle's rule, Chebychev formula, Gauss Quadrature formula.

UNIT-IV

Numerical solution of ordinary differential equations: Single step methods-Picard's method. Taylor's series method, Euler's method, Runge-Kutta Methods. Multiple step methods; Predictor-corrector method, Modified Euler's 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, R.K. Jain : Numerical Method, Problems and Solutions, New Age International (P) Ltd., 1996
4. Gupta and Malik, Numerical Analysis Krishna Prakashan Media.

OR

SCHOOL OF BASIC AND APPLIED SCIENCE

Department of Mathematics

(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)

B. Sc. III Year (VI Semester)

Lectures	: 2 Hrs	
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)
Paper Title	: Elective paper	Paper Code : MA-306(B)
	Mathematical Statistics	

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each

UNIT-I

Probability Theory Three definition of probability (Mathematical, Empirical and axiomatic). Dependent, independent and compound events. Addition and multiplication theorems of probability, conditional probability. Binomial and multinomial theorems of probability, Baye's theorem, Mathematical expectation and its properties, Moment generating function (m.g.f) and cumulants.

UNIT-II

Distribution Discrete distributions- Binomial and Poisson distribution and their properties. Continuous distributions- Distribution function, Probability density function (pdf), Cauchy's distribution, rectangular distribution, exponential distribution, Beta, Gamma Normal distributions and their properties.

UNIT-III

Correlation and Regression Bivariate population, Meaning of correlation and regression. Coefficient of Correlation, rank Correlation, lines of regression. Properties of regression coefficients, Partial and multiple correlation and their simple properties.

UNIT –IV

Sampling Theory Simple and random sampling. Test of significance for large samples. Sampling distribution of Mean. Standard error. Test of significance based on χ^2 . Test of significance based on t, F and Z distribution, ANOVA.

Books Recommended:

1. Sharma and Goel Mathematical Statistics publisher Krishna Pvt. Ltd.
2. S.D Sharma mathematical Statistics

SCHOOL OF SCIENCE

Department of Computer Science

(Syllabus and Scheme of Studies w.e.f. 2015-16 onwards)

B. Sc. I Year (I Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Subject : Computer Fundamentals

Paper Code : COM-201

***Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing Six short answer types' questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.*

UNIT-I

Computer Fundamentals: Definition, Block Diagram along with its components, characteristics & classification of computers. Evolution of Computers - Generations, Types of computers, Computer system characteristics, Basic components of a Digital Computer - Control unit, ALU, Input/output functions and memory

UNIT-II

Computer Software and Hardware, relationship between hardware and software, Software and Types of Software, Programming Languages- Machine Language, Assembly Language, High Level Language, Object Oriented Language. Techniques of Problem Solving: Flowcharting, algorithms, pseudo code, decision table, Structured programming concepts, Programming methodologies viz. top-down and bottom-up programming.

UNIT-III

Number Systems & Arithmetic Number System: Positional, Non-positional, binary, octal, decimal, hexadecimal and their representation; Methods of conversion from one base to another; Unsigned, Signed, 1's Complement, 2's Complement, Binary Arithmetic: Fixed & Floating point numbers, representation, errors, overflow, underflow.

UNIT-IV

Memory - RAM, ROM, EPROM, PROM and other types of memory, Storage fundamentals - Primary Vs Secondary Data Storage, Various Storage Devices - Magnetic Tape, Magnetic Disks, Cartridge Tape, Hard Disk Drives, Floppy Disks (Winchester Disk), Optical Disks, CD, VCD, CD-R, CD-RW, Zip Drive, flash drives Video Disk, Blue Ray Disc, SD/MMC Memory cards, DVD, DVD-RW, USB Pen drive.

Reference Books:

1. S.K. Basandra, "Computers Today ", Galgotia Publications.
2. Computer Fundamentals – P. K. Sinha – BPB Publication
3. PC Software – Shree Sai Prakashan, Meerut
4. Computer Fundamentals – B. Ram – New Age International Publishers.



RAFFLES UNIVERSITY, NEEMRANA, ALWAR (RAJASTHAN)

Japanese Zone, National Highway-8, Neemrana-307105

Tel.: +91-9214205555 www.rafflesuniversity.edu.in

SCHOOL OF SCIENCE

Department of Computer Science

(Syllabus and Scheme of Studies w.e.f. 2015-16 onwards)

B. Sc. I Year (I Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Subject : Computer Fundamentals

Paper Code : COM-201

***Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing Six short answer types' questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.*

UNIT-I

Computer Fundamentals: Definition, Block Diagram along with its components, characteristics & classification of computers. Evolution of Computers - Generations, Types of computers, Computer system characteristics, Basic components of a Digital Computer - Control unit, ALU, Input/output functions and memory

UNIT-II

Computer Software and Hardware, relationship between hardware and software, Software and Types of Software, Programming Languages- Machine Language, Assembly Language, High Level Language, Object Oriented Language. Techniques of Problem Solving: Flowcharting, algorithms, pseudo code, decision table, Structured programming concepts, Programming methodologies viz. top-down and bottom-up programming.

UNIT-III

Number Systems & Arithmetic Number System: Positional, Non-positional, binary, octal, decimal, hexadecimal and their representation; Methods of conversion from one base to another; Unsigned, Signed, 1's Complement, 2's Complement, Binary Arithmetic: Fixed & Floating point numbers, representation, errors, overflow, underflow.

UNIT-IV

Memory - RAM, ROM, EPROM, PROM and other types of memory, Storage fundamentals - Primary Vs Secondary Data Storage, Various Storage Devices - Magnetic Tape, Magnetic Disks, Cartridge Tape, Hard Disk Drives, Floppy Disks (Winchester Disk), Optical Disks, CD, VCD, CD-R, CD-RW, Zip Drive, flash drives Video Disk, Blue Ray Disc, SD/MMC Memory cards, DVD, DVD-RW, USB Pen drive.

Reference Books:

1. S.K. Basandra, "Computers Today ", Galgotia Publications.
2. Computer Fundamentals – P. K. Sinha – BPB Publication
3. PC Software – Shree Sai Prakashan, Meerut
4. Computer Fundamentals – B. Ram – New Age International Publishers.

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of English and Humanities

(Syllabus and Scheme of Studies w.e.f. 2016-17 onwards)

B. Sc. I Year (I Semester)

Schedule per week Lectures: 2Hrs

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Subject : English Communication Technique

Paper Code : ECT-101

UNIT I

Grammar:

- | | |
|--------------------|--------------------------|
| 1. Tenses | 2. Passive Voice |
| 3. Indirect Speech | 4. Conditional Sentences |
| 5. Modal Verbs | |

UNIT II

Composition:

- | | |
|--|---------------------------------|
| 1. Dialogue Writing | 2. Paragraph and Précis Writing |
| 3. Report, its importance and Report Writing | |

UNIT III

Short Stories

- | | |
|-------------------------------|---|
| 1. The Luncheon: W.S. Maugham | 2. How Much Land Does a Man Need? Leo Tolstoy |
| 3. The Last Leaf: O. Henry | |

Poems:

- | | |
|-------------------------------------|--|
| 1. The Unknown Citizen: W. H. Auden | 2. The Character of A Happy Life: Sir Henry Wotton |
| 3. No Men are Foreign: James Kirkup | 4. If : Rudyard Kipling |

UNIT IV

Essays:

1. On the Rule of the Road: A. G. Gardiner
2. The Gandhian Outlook: S. Radhakrishnan
3. Our Own Civilisation: C.E.M. Joad

Suggested Readings :

1. Communication Skills for Engineers and Scientists, Sangeeta Sharma & Binod Mishra, PHI Learning Pvt. Ltd.
2. English for Engineers: Made Easy, Aeda Abidi & Ritu Chaudhary, Cengage Learning, (New Delhi)
3. A Practical Course for Developing Writing Skills in English, J.K. Gangal, PHI Learning Pvt. Ltd., New Delhi.
4. The Written Word, Vandana R. Singh, Oxford University Press (New Delhi)
5. The Great Short Stories edited by D.C. Datta, Ram Narain Lal Publishers (Allahabad)
6. "Current English Grammar and Usage with Composition" by R.P. Sinha, Oxford University Press



**RAFFLES
UNIVERSITY**

RAFFLES UNIVERSITY, NEEMRANA, ALWAR (RAJASTHAN)

Japanese Zone, National Highway-8, Neemrana-307105

Tel.: +91-9214205555 www.rafflesuniversity.edu.in

(New Delhi).

7. "Grammar of the Modern English Language", by Sukhdev Singh & Balbir Singh, Foundation Books (New Delhi).

SCHOOL OF SCIENCE

Environmental science

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. I Year (I Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Subject : Environmental science

Paper Code : EVS-102

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Basics of Environment: Definition, Scope and basic principles of ecology and environment. Biological levels of organization, Functional concepts of Ecology, Basics of species, Ecosystem, Hydrological and chemical cycles, Energy flow in ecosystems. Biodiversity, population dynamics. Environmental Acts and Regulations, Environmental Impact Assessment (EIA), Necessity and methodology of EIA. Renewable sources of energy, Potential & present status of renewable sources of energy in India. Environmental education–women and value education

UNIT-II

Air Pollution, Noise Pollution: Environmental Pollution, Air Pollution, Harmful effects of Air Pollution, Control of Air Pollution. Global warming, Acid rain, Ozone depletion. Noise Pollution, Harmful effects of noise pollution, control of noise pollution.

UNIT-III

Water Pollution: Water pollution, Harmful effects of water pollution, control of water pollution. Waste water management, Treatment & disposal of wastewater. Reuse and saving in use of water, rain water harvesting.

UNIT- IV

Solid Waste and Disaster Management: Solid Waste Management, Classification of solid waste, Collection, transportation, treatment, and disposal of solid waste. Economic recovery of solid waste. Sanitary landfill, on site sanitation.

Type of Disasters: Natural and Manmade (Earthquake, Tsunami, Cyclone, Flood, Drought, Landslides, Fire and Environmental Hazards). Disaster Management Cycle and its components. Do's and Don'ts for safety during these disasters. Earthquake.

SUGGESTING READING:

1. Robert Ricklefs (2001). The Ecology of Nature. Fifth Edition. W.H. Freeman and Company.
2. Singh K.P. and J.S. Singh (1992). Tropical Ecosystems: Ecology and Management. Wiley Eastern Limited, Lucknow, India.
3. Singh, J.S. (ed.) 1993. Restoration of Degraded Land: Concepts and Strategies. Rastogi Publications, Meerut.
4. Smith, R.L. (1996). Ecology and Field Biology, Harper Collins, New York.
5. Botkin, D.B. and Keller, E.A. 2000. Environment Science: Earth as a living planet. Third Edition. John Wiley and Sons Inc.

Recommended Textbook:

1. Environmental Studies, J Krishnawamy , R J Ranjit Daniels, Wiley India.
3. Environmental Science, 8th Ed ISV, Botkin and Keller, 9788126534142, Wiley India.
4. Environmental Studies, R Rajagopalan, 978-0195673937, Oxford University Press
5. Textbook of Environmental Science and Technology, M.Anjireddy, BS Publications
6. Environmental Studies, Soli. J Arceivala, Shyam, R Asolekar, 9781259006050, Mc Graw Hill India, 2012.
7. Environmental Studies, D.L. Manjunath, 9788131709122 Pearson Education India, 2007
8. Textbook of Environment Ecology , Singh, Acme Learning
9. Perspective in Environmental Studies, Kaushik, New Age International
10. Environmental Studies, B. Joseph, 2nd Ed, 978-0070648134, Tata McGraw Hill