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SYLLABUS (CBCS)

B. Sc. Semester V & VI

PHYSICS

CODE : US CEPH - 507, 508, 509
US CEPH - 610, 611, 612

With effect from June 2016

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PATTERN OF QUESTION PAPER
FOR SEMESTER-END EXAMS

THEORY

In each theory paper there will be FOUR Questions (Q.1 to Q.4), one question from every unit. A question will be of **15 Marks**

The structure for each question is as under:

Section (A) Objective type *(no internal option)* **5 Marks**

The types of questions for section (A) are varied, like: One line answers, Two line answers, Definitions, Reasoning, Drawing figures etc.

Section (B) Descriptive type *(with internal option)* **10 Marks**

The types of questions for section (B) are varied, like: Derivations, Short notes, Problems etc.

PRACTICAL

There will be FOUR Exercises in each Practical, as under, total of **30 Marks**

(1) Approach (2) Readings and Calculations (3) Viva (4) Practical Journal

K S K V Kachchh University
B. Sc. (Physics) CBCS Syllabus
(In force from June 2016)

Semester - V

US CEPH – 507 (Mathematical physics, Classical and Quantum Mechanics)

Unit-I

Mathematical Physics

Coordinate System : Curvilinear coordinates; Orthogonal Curvilinear coordinates; Element of surface area; Volume element; Gradient in Orthogonal Curvilinear coordinates; Divergence in Orthogonal Curvilinear coordinates; Curl of a vector in Orthogonal Curvilinear coordinates; Rectangular Cartesian coordinates; Spherical polar coordinates; Cylindrical coordinates. (NO DERIVATIONS)

Ref. : Introduction to Classical Mechanics by R.G. Takwale & P.S. Puranik
(Appendix A, Art. A.1 to A.9 & A.11)

Differential Equations : Some partial differential equations in Physics; The method of separation of variables; Separation of Helmholtz equation in Cartesian coordinates; Separation of Helmholtz equation in Spherical polar coordinates; Separation of Helmholtz equation in cylindrical coordinates; Laplace's equation in various coordinate systems.

Ref. : Mathematical Physics by P.K. Chattopadhyay
(Chapter 2, Art. 2.1 & 2.2)

Second Order Differential Equations : Ordinary and singular points; Series solution around an ordinary point; Series solution around a regular singular point: The method of Frobenius.

Ref. : Mathematical Physics by P.K. Chattopadhyay
(Chapter 3, Art. 3.1 to 3.3)

Unit-II

Classical Mechanics

Lagrangian Formulation : Constraints; Generalised coordinates; D'Alembert's principle; Lagrange's equations; A general equation for kinetic energy; Symmetries and laws of conservation; Cyclic or ignorable coordinates; Velocity-dependent potential of electromagnetic field.

Ref. : Introduction to Classical Mechanics by R.G. Takwale & P.S. Puranik
(Chapter 8, Art. 8.1 to 8.8)

Motion of a rigid body : Angular momentum and kinetic energy; The inertia tensor; Euler's equations of motion; Torque-free motion.

Ref. : Introduction to Classical Mechanics by R.G. Takwale & P.S. Puranik
(Chapter 10, Art. 10.2 to 10.5)

Unit-III

Classical Mechanics

Variational Principle : Lagrange's and Hamilton's Equations : Configuration space; Some techniques of calculus of variation; Applications of variational principle; Hamilton's principle; Hamilton's equations of motion; Some applications of the Hamiltonian formulation; Phase space; Comments on the Hamiltonian formulation.

Ref. : Introduction to Classical Mechanics by R.G. Takwale & P.S. Puranik
(Chapter 11, Art. 11.1 to 11.4 & 11.10 to 11.13)

Unit IV

Quantum Mechanics

General Formalism of Quantum Mechanics: Linear Vector Space; Linear Operator; Eigenfunctions and Eigenvalues; Hermitian Operator; Postulates of Quantum Mechanics; Simultaneous Measurability of Observables; General Uncertainty Relation; Dirac's Notation

Ref. : Quantum Mechanics (Second Ed.) by G. Aruldhas
(Chapter 3, Art. 3.1 to 3.8)

US CEPH – 507 PRACTICALS

(1) Acceleration due to Gravity by Keter's Pendulum (Variable Knife Edges)

(2) e/k by Power Transistor

(3) Stefan's Constant of Radiation

(4) Febry Parot Etalon – Determination of thickness of air film

(5) Michelsion Interferometer – to determine the wavelength of light

(6) I – V Characteristics of Solar Cell – to find Fill Factor and Fill Voltage

(7) To Study the Edser – Butler Bands

(8) Eigenvalues and Eigenfunctions of a Matrix

US CEPH – 508 (Molecular Spectroscopy, Solid State Physics)

Unit-I

Molecular Spectroscopy

Types of Molecular Energy States and Molecular Spectra : Types of molecular spectra.
Ref. : Atomic And Molecular Spectra by Raj Kumar
(Chapter 17, Art. 2)

Pure Rotational Spectra : Salient features of rotational spectra; Molecular requirement for rotational spectra; Experimental arrangement; Molecule as a rigid rotator – Explanation of rotational spectra (without solving Schrodinger equation to get energy formula); The non rigid rotator; Isotope effect.
Ref. : Atomic And Molecular Spectra by Raj Kumar
(Chapter 18, Art. 1 to 6)

Vibrational Rotational Spectra : Salient features of vibrational rotational spectra; Molecule as a harmonic oscillator; Molecule as anharmonic oscillator; Vibrational frequency and force constant for anharmonic oscillator; Isotope effect on vibrational levels; Molecule as vibrating rotator- Fine structure of infra red bands; Thermal distribution of vibrational and rotational levels.

Ref. : Atomic And Molecular Spectra by Raj Kumar
(Chapter 19, Art. 1 to 6 and 8)

Unit-II

Molecular Spectroscopy

Raman Spectra : Nature of Raman spectra; Experimental arrangement of Raman spectra; Classical theory of Raman effect; Quantum theory of Raman effect; Raman spectra and molecular structure; Infra red spectra versus Raman spectra.

Ref. : Atomic And Molecular Spectra by Raj Kumar
(Chapter 20, Art. 1 to 6)

Classification of Molecular Electronic States : Molecular electronic states; Symmetry properties of electronic eigen functions.

Ref. : Atomic And Molecular Spectra by Raj Kumar
(Chapter 24, Art. 1 and 2)

Types of Molecular Energy States and Molecular Spectra : Separation of electronic and nuclear motion : The Born-Oppenheimer Approximation.

Ref. : Atomic And Molecular Spectra by Raj Kumar
(Chapter 17, Art. 1)

Unit-III

Solid State Physics

Atomic Cohesion and crystal binding : Cohesion of atoms; Primary bonds; Covalent bond; The metallic bond; The Ionic bond; Secondary bonds; The Van-der walls bond; The hydrogen bond; The Cohesive energy; Ionic crystals; The Repulsive overlap energy; Nobel gas crystal; Atomic radii verses lattice constant; Elastic constants of crystals; Elastic stress; Elastic strain; Dilation; Elastic compliance and stiffness constant; Elastic energy density; Application to cubic crystals; Bulk modulus and compressibility; Elastic waves in cubic crystal; Propagation of waves in the [100] direction.

Ref. : Elements of Solid State Physics by J. P. Srivastava
(Chapter 2, Art. 2.1 to 2.8.1)

Unit-IV

Solid State Physics

Free Electron Theory of metals : Drude model; Electrical conductivity of metals; Thermal conductivity of metals; The Fermi- Dirac distribution function; The Sommerfeld model; The Density of states; The Free Electron gas at 0 K; Energy of Electron Gas at 0 K; The Electron Heat Capacity; The Sommerfeld theory of Electric conduction in metals; The Hall Coefficient (R_H); Matthiessen's Rule; Thermoelectric Effects; Thermoelectric power; The Thomson Effect; The Peltier Effect; Kelvin (Thomson) Relations.

Ref. : Elements of Solid State Physics by J. P. Srivastava
(Chapter 6, Art. 6.1, 6.3 to 6.8.4)

US CEPH – 508 PRACTICALS

(1) Hysterisis by Magnetometer

(2) Comparison of Capacities by Mixture Method

(3) Measurement of Phase and Frequency by C.R.O.

(4) Hartley Oscillator – Measurement of Frequency by C.R.O.

(5) Series Resonance – Determination of Band Width and Q – Factor

(6) To study the CE Amplifier Circuit

(7) Characteristics of GM Tube

(8) To Design a Logic Circuit

US CEPH – 509 (Electronics)

Unit-I

General Amplifier Characteristics : Amplifier Input Resistance; Amplifier Output Resistance; Harmonic Distortion; Three – Point Method of Calculating Harmonic Distortion; Decibels.

Ref. : Electronic Devices and Circuits by Allen Mottershead
(Chapter 7, Art. 7.6, 7.7, 7.11, 7.12, 8.1)

Negative Feedback in Transistor Amplifiers : Introduction; General Theory of Feedback; Reasons for Negative Feedback; Loop Gain.

Ref. : Electronic Devices and Circuits by Allen Mottershead
(Chapter 17, Art. 17.0 to 17.3)

Transistor Oscillators : Effect of positive feedback; Requirement for oscillation; Phase Shift Oscillator; Resonant circuit oscillators (The Colpitts Oscillator; The Hartley oscillator).

Ref. : Electronic Devices and Circuits by Allen Mottershead
(Chapter 18, Art. 18.1 to 18.3 and 18.6)

Unit-II

Low - Frequency Response of the Transistor Amplifier: Effect of an Emitter Bypass Capacitor on Low – Frequency Response; Effect of a Coupling Capacitor on Low – Frequency Response; Cascading of CE Stages, Mid – Frequency Gains; Low – Frequency Response of Cascaded Stages.

Ref. : Electronic Devices and Circuits by Allen Mottershead
(Chapter 15, Art. 15.1, 15.4)

High - Frequency Response of the Transistor Amplifier: High – Frequency Model for the Common – Emitter Amplifier; Approximate CE High – Frequency Model with a Resistive Load; CE Short - Circuit Current Gain; High – Frequency Current Gain with a Resistive Load; High – Frequency Response of Cascaded CE Stages.

Ref. : Electronic Devices and Circuits by Allen Mottershead
(Chapter 16, Art. 16.1, 16.5)

Unit-III

Resonance : Definition of Q, the factor of merit; Series Resonance; Band width of the series resonant circuit**;** Parallel resonance or anti resonance; Currents in anti resonant circuits; Band width of anti resonant circuits.
Ref. : Networks, Lines and Fields by John D. Ryder
(Chapter 2, Art. 2.1 to 2.4, 2.6, 2.8)

Amplitude Modulation : Introduction; Amplitude modulation; Amplitude modulation index; Modulation index for Sinusoidal AM; Frequency spectrum for Sinusoidal AM; Average power for Sinusoidal AM; Effective voltage and current for Sinusoidal AM.
Ref. : Electronic Communications by Dennis Roddy, John Coolen
(Chapter 8, Art. 8.1 to 8.7)

Unit-IV

Digital Electronics

Number Systems and Codes : Hexadecimal numbers; Hexadecimal - Binary conversions; Hexadecimal - to - decimal conversion.
Ref. : Digital Computer Electronics by Albert Paul Malvino (Second Edition)
(Chapter 1, Art. 1.8 to 1.10)

More Logic Gates : NOR gates; De Morgan's First theorem; NAND gates; De Morgan's Second theorem; Exclusive OR gates.
Ref. : Digital Computer Electronics by Albert Paul Malvino (Second Edition)
(Chapter 3, Art. 3.1 to 3.5)

Boolean Algebra and Karnaugh Maps : Boolean relations; Sum - of - Products method; Algebraic simplification; Karnaugh maps; Pairs, Quads and Octets; Karnaugh simplifications; Don't Care Conditions.
Ref. : Digital Computer Electronics by Albert Paul Malvino (Second Edition)
(Chapter 5, Art. 5.1 to 5.7)

Arithmetic – Logic Units : Binary addition; Binary subtraction; Half adders; Full adders; Binary adders.
Ref. : Digital Computer Electronics by Albert Paul Malvino (Second Edition)
(Chapter 6, Art. 6.1 to 6.5)

Memories : Roms; Proms and Eproms; Rams; A small TTL Memory; Hexadecimal Addresses.
Ref. : Digital Computer Electronics by Albert Paul Malvino (Second Edition)
(Chapter 9, Art. 9.1 to 9.5)

US CEPH – 509 PRACTICALS

Project Work / Field Visit