SAURASHTRA UNIVERSITY
RAJKOT

Accredited Grade 'A' by NAAC

Syllabus for M.Sc. (Applied Physics) Integrated Semester - II
(Based on UGC-CBCS-2015)

Under

Department of Nano science
&
Advanced Materials

Effective from June -2016

Saurashtra University
University Road, University Campus
Rajkot– 360005
Gujarat, India

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Semester - II

Paper V: Environmental Studies

Unit-I:

Environmental Studies: Multidisciplinary Approach

Definition, Scope & Importance

Public Awareness about environmental studies

Unit II:

Renewable & Nonrenewable resources

Forest Resources, Water Resources, Mineral Resources, Food Resources, Energy Resources and Land Resources

Unit III:

Ecosystems: Concept, Structure and Functions of Ecosystems

Energy flow in ecosystems: Types of Ecosystems: Forest, Grassland, Deserts, Aquatic

Unit IV:

Environmental Pollution: Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution & Nuclear Hazards

Solid Waste Management

Disaster Management: Floods, Earthquakes, Cyclone and Landslides

Unit V:

Field Work

Visit to Local Areas to document environmental assets – river/ forest/ grasslands/ hill/ mountains

Visit to local polluted site – Urban/rural/industrial/agricultural

Study of Simple ecosystems → Pond, river, hill-slopes etc.

Book: Textbook for Environmental Studies (For Undergraduate Courses of all Branches of Higher Education) by Erach Bharucha, University Grants Commission (2004)

Semester - II
Paper VI: Applied Mathematics

Unit-I: Linear differential equations of higher order

Linear differential equations of higher order with constant coefficients. Operator D, Meaning of auxiliary equation, Roots of auxiliary equation and solution of auxiliary equation $f(D)y = 0$ for real roots and complex roots, Operator $1/D$. Solution of differential equations of the type $f(D)y = X$. Meaning of complimentary function(C.F.) and Particular integral(P.I.). Methods to obtain Particular integral (P.I.) when

$X = e^{ax}$, $X = \sin(ax+b)$, $X = \cos(ax+b)$, $X = x^m$, $X = e^{ax}.V$

Unit-II: Partial Derivatives

Partial derivatives, total differential, Euler's theorem for homogeneous functions, Maxima & Minima of functions of two variables, Lagrange's method of undetermined multipliers, Jacobians, Partial derivatives of implicit functions.

Unit-III: Partial Differential Equations

Formation of PDE, Equations solvable by direct integration, Lagrange's linear equation, Non-linear equations of first order, Homogeneous linear equations with constant coefficients, Method of separation of variables, Vibrations of a stretched string-Wave equation, One dimensional heat flow.

Unit-IV: Differential Calculus & Integral Calculus

Rolle's Theorem, Lagrange's Mean Value theorem, their geometrical interpretation, Cauchy Mean Value Theorem, Taylor's theorem, Taylor's series and Maclaurine's series, Series expansion of $\exp(x)$, $\cos(x)$, $\sin(x)$, $\log(1+x)$, $(1+x)n$ etc.

Double integrals, evaluation of double integrals, Change of order of integration for two variables, Triple integrals, evaluation of triple integral, Jacobians and change of variables, Applications to areas and volumes.

Reference Books: (for Sem-I & II)

1. Theory of matrices by Shanti Narayan
2. A Course of Mathematical Analysis by Shanti Narayan
3. Mathematical Analysis by S.C. Malik
4. Differential Calculus by Shanti Narayan
5. Integral Calculus by Shanti Narayan
6. Elementary Engg. Mathematics by B.S. Grewal, Khanna Publishers, Delhi
7. Higher Engg. Mathematics by B.S. Grewal, Khanna Publishers, Delhi.
8. A Course of Mathematical Analysis by Shanti Narayan

Semester - II

Paper VII: Modern Physics I

Unit I:

1. **Atomic Structure of Matter**

   Rutherford atom model, X-ray Scattering, Rutherford Theory, Hydrogen Spectrum, Bohr atomic theory of Hydrogen Atom its short comings, types of spectra, Fluorescence of Phosphorescence

Unit II:

1. **Basics of Quantum Mechanics**

   Space Quantization, Spinning Electron, Angular Momentum & magnetic momentum, orbital angular momentum, electron spin & Spin Quantum Number, magnetic quantum numbers, coupling schemes, selection rules, Pauli's exclusion principle, Electron Configuration of Atoms

Unit III:

1. **Origin of Quantum Theory**

   Inadequacy of Classical mechanism, experimental basics of quantum mechanics – Electromagnetic Waves, Blackbody radiation, Photoelectric effect, Compton effect, bremsstrahlung & X-ray production, Raman Effect

Unit IV:

1. **Atomic Structure and Atomic Spectra**

   Bohr's theory of hydrogen spectrum, Sommerfeld theory, Spatial (space) Quantization: Stern-Gerlach experiment, The Franck – Hertz experiment, Wave Particle duality, Davision & Germer experiment, uncertainty principle, inadequacy of Quantum theory

   Book: Modern Physics (Second Edition) – S.L. Kakani & Shubhra Kakani (Viva Books Publications)

Semester - II

Paper VIII: Basic Electronics

Unit 1 SEMICONDUCTOR PHYSICS

Introduction to Electronics, Semiconductor–Bonds in semiconductors–Crystals– Commonly used semiconductors –Energy band description of semiconductors–Effect of temperature on semiconductors–Hole current–Intrinsic semiconductor–Extrinsic semiconductor–n-type semiconductor–p-type semiconductor–Charge on ntype and p-type semiconductors– Majority and minority carriers–pn-junction–Properties of pn-junction–Applying D.C. voltage across–pn junction–Volt-ampere characteristics of pn-junction– Important terms–Limitations in the operating conditions of pn-junction.

UNIT 2 SEMICONDUCTOR DIODES AND APPLICATIONS

Semiconductor diode–Crystal diode as a rectifier– Resistance of crystal Diode–Equivalent circuit of crystal diode–Crystal diode equivalent circuits– lmportant terms–Crystal diode rectifiers–Half-wave rectifier–Output frequency of Half-wave rectifier– Efficiency of half-wave rectifier–Full-wave rectifier– Centre-tap full-wave rectifier–Full-wave bridge rectifier–Output frequency of full-wave rectifier–Efficiency of full-wave rectifier–Faults in centre-tap full-wave rectifier–Nature of rectifier output– Ripple factor–Comparison of rectifiers–Filter circuits–Types of filter circuits– Voltage multipliers–Half-wave voltage doubler–Voltage stabilisation–Zener diode–Equivalent circuit of zener diode–Zener diode as voltage stabiliser– Solving zener diode circuits–Crystal diodes versus vacuum-diodes.

UNIT 3 SPECIAL-PURPOSE DIODES AND TRANSISTORS

Zener diode–Light-emitting diode (LED)–LED voltage and current–Advantages of LED–Multicolor LEDs–Applications of LEDs–Photo-diode–Photo-diode operation– Characteristics of photo-diode–Applications of Photodiodes–Optoisolator–Tunnel diode–Tunnel diode oscillator–Varactor diode–Application of varactor diode– Shockley diode. Transistor–Naming the transistor terminals–Some facts about the transistor–Transistor action–Transistor symbols–Transistor as an amplifier–Transistor connections–Common base connection– Characteristics of common base connection– Common emitter connection–Measurement of leakage current–Characteristics of common emitter connection–Common collector connection–Comparison of transistor connections– Commonly used transistor connection–Transistor as an amplifier in CE arrangement–Transistor load line analysis–Operating point–Practical way of drawing –CE circuit–Output from transistor amplifier–Performance of transistor amplifier–Cut off and saturation points–Power rating of transistor– Determination of transistor configuration–Semiconductor devices numbering system–Transistor lead identification–Transistor testing–Applications of common base amplifiers–Transistors versus vacuum tubes

UNIT 4 TRANSISTORS BIASING AND AMPLIFIERS

Faithful amplification–Transistor biasing–inherent variations of transistor parameters–Stabilization–Essentials of a transistor biasing circuit–Stability factor–Methods of transistor biasing–Base resistor method–Emitter bias circuit–Circuit analysis of emitter bias–Biasing with collector feedback resistor Voltage divider bias method–Stability factor for potential divider bias–Design of transistor biasing circuits–Mid-point biasing–Which value of β to be used–Miscellaneous bias circuits –Silicon versus germanium–Instantaneous current and voltage waveforms—Summary of transistor bias circuits. Single stage transistor amplifiers and its applications, Multistage transistor amplifier and Audio amplifiers.

Text Book:

1. Principles of Electronics by V.K. Mehta & Rohit Mehta, S. Chand Publications

Reference Books:

1. Electronic Devices by Thomas L. Floyd, PHI Publications
2. Electronic Principles by Malvino A.P., McGraw-Hill Higher Education; 7th edition
3. Basic Electronics by Grob Bernard, McGraw-Hill Inc.,US; 8th Revised edition edition
4. Basic Electronics by Thareja B.L., S. Chand Publications
5. Fundamentals of Microelectronics by Behzad Razavi