SCHEME OF EXAMS. AND SYLLABI

5 Years (10 Semesters) Integrated
M. Sc. - Engineering Physics
for Session 2013-14

5th Year (9th and 10th semesters)
(Effective from July – 2013 on ward)

5 Years (10 Semesters) – M.Sc. - Engineering Physics Degree

(After 3 Years / 6 Semesters, students may be awarded B Sc -Engineering Physics Degree)

5^{th} Year

9^{th} Semester

Code	**Paper**	**Marks**	**Examination Hours**
EP - 901	Solid State Engineering Physics	40+10*	3 Hours
EP - 902	Electronics-II for Engineering	40+10*	3 Hours
EP- 903	Electrodynamics and wave propagation Engineering	40+10*	3 Hours
EP- 904	Laser and Fiber Optics	40+10*	3 Hours
EP -Lab	Physics Lab	80+20*	4 Hours
	Total	**300**	

*Internal Assessment marks

20% marks in each paper/practical shall be reserved for Internal Assessment. The following parameters (with weightage of each) forming the basis of award of Internal Assessment:-

For Theory Papers:

(i) One test/Seminar for each paper : 50%

(ii) One Class test (one period duration) : 25%

(iii) Attendance : 25%

For Practicals:

(i) One Seminar/test/Viva/sessional
for each practical paper : 50%

(ii) One Class test (one period duration) : 25%

(iii) Attendance : 25%

10th Semester

Code	Paper	Marks	Examination Hours
EP - 1001	Materials Science for Engineers	40+10*	3 Hours
EP – 1002	Modern Characterization techniques	40+10*	3 Hours
EP--1003	Modern Medical Imaging systems	40+10*	3 Hours
EP-Project	Dissertation (External Evaluation and Viva-Voce)	150$	
	Total	**300**	

*Internal Assessment marks

For Theory Papers:

(i) One test/Seminar for each paper : 50%

(ii) One Class test (one period duration) : 25%

(iii) Attendance : 25%

$ 100 marks for Project and 50 marks for Viva-Voce

M. Sc. Engineering Physics
Semester-IX
Subject: Physics (Paper Code: EP 901)
Paper: Solid State Engineering Physics

Max. Marks: 50
Theory: 40
Internal Assessment: 10
Time: 3 hrs

Note:-

1. Nine Questions will be set in total
2. Question number 1 will be compulsory and will be based on the conceptual aspects of entire syllabus. This question may have five parts and the answer should be in brief but not in Yes/ No.
3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
4. 20% numerical problems are to be set.
5. Use of scientific (non-programmable) calculator is allowed.

Unit I

Crystal Physics

Crystalline solids, lattice, the basis, lattice translation vectors, direct lattice, two and three dimensional Bravais lattice, conventional units cells of FCC, BCC, Nacl, CsCl, Diamond and cubic ZnS, primitive lattice cell of FCC, BCC and HCP; closed packed structures: packing fraction of simple cubic, bcc, fcc, hcp and diamond structures.

Crystal Diffraction

Laue's concept of X-rays diffraction, Bragg's concept of X-ray diffraction, Brag's equation, Reciprocal lattice, Geometrical construction, Reciprocal lattice to sc, bcc and fcc lattice, some properties of reciprocal lattice, Bragg's Law in reciprocal lattice, The Laue's method- formation of Laue's spot and interpretation of photograph, uses of Laue's pattern; The oscillation/Rotation method- Measurement of identity period, interpretation of oscillation/rotation photograph; the Weissenberg Method- interpretation of Weissenberg photograph and indexing, Determination of unit cell parameters; X-ray diffraction with Polycrystalline material- the Debye-Scherrer method, measurement of Bragg's angle and interplanar spacing.

Unit-II

Defects in Crystals

Imperfection in solids; Point defects; line imperfections: The interpretation of slip, the edge dislocation, the screw dislocation, concentration of line defects, dislocation density, Frank-Read mechanism of dislocation multiplication, stress field dislocation; Surface(plane) defect:

low and high angle grain boundaries, stacking faults; Etching techniques for dislocation characterization, methods of etching, applications of etching to dislocation problem.

Ordered phases of matter

Translational and orientational order, kinds of liquid crystalline order, quasi crystals.

Unit III

Band theory of solids:

The quantum mechanics of particles in a periodic potential: Bloch's theorem, the periodic potential, Born-von Karman boundary conditions, The Schrodinger equation in a periodic potential, Bloch's theorem, Electronic band-structure.

The nearly-free electron model: Introduction, Dispersion E(k), Nearly free electron model, Consequences of the nearly-free-electron model.

The tight-binding model: Introduction, Band arising from a single electronic level, General points about the formation of tight-binding bands-An example: the transition metals.

Some general points about band-structure: Comparison of tight-binding and nearly-free-electron band-structure, the physical significance of k, Group velocity, The effective mass, The effective mass and the density of states.

Unit IV

Superconductivity

Superconductivity, effect of magnetic field on superconductivity, Meissner effect, heat capacity, energy gap, micro-wave and infra-red properties, isotopic effect.

Thermodynamics of the superconductive transition, London equation, coherence length, BCS theory of superconductivity, Bose-Einstein condensation, Laser cooling, flux quantization in superconducting ring, duration of persistent currents, Type-I and type-II superconductors-vortex state, estimation of Hc1 and Hc2, Ginzburg-Landau theory, Josephon effect, superconductor tunneling- DC Josephson effect, AC Josephson effect and Macroscopic quantum interference.

Application of superconductivity, High temperature superconductors- structure, synthesis, properties and their applications, Superconducting Quantum Inference Devices (SQUID), Superconducting magnets.

Text and Reference Books :

Verma and Srivastava : Crystallography for Solid State Physics

Azaroff : Introduction to Solids

Omar : Elementary Solid State Physics

Kittel : Solid State Physics

Rajnikant; Solid State Physics, Willey India, 2011.

De Gennes & Prost : The Physics of Liquid Crystals

M. Sc. Engineering Physics
Semester-IX
Subject: Physics (Paper Code: EP 902)
Paper : Electronics-II for Engineering

Max. Marks: 50
Theory: 40
Internal Assessment: 10
Time: 3 hrs

Note:-

1 Nine Questions will be set in total
2 Question number 1 will be compulsory and will be based on the conceptual aspects of entire syllabus. This question may have five parts and the answer should be in brief but not in Yes/ No.
3 Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
4 20% numerical problems are to be set.
5 Use of scientific (non-programmable) calculator is allowed.

Unit I

OPERATIONAL AMPLIFIERS

The basic Operational-Amplifier: Ideal Op-Amp, block diagram of Op. Amp, Practical Inverting & Noninverting Op-Amp; Differential amplifier: CMRR, circuit configuration, Emitter-coupled differential amplifier, Differential amplifier supplied with constant current, transfer characteristics of a differential amplifier; Off-set Error currents and voltages: Input bias current, Input offset current, input offset drift, input offset voltage, input offset voltage drift, output offset voltage, PSRR, Slew rate; Universal balancing techniques;

Inverting and non-inverting Op-Amp's basic applications: Sign changer or inverter, Scale changer, Phase changer, Adder or Summing operation, current to voltage & voltage to current signal conversion, differential dc amplifier, voltage follower, analog integrator & differentiator, Electronic analog computation, Logarithmic & antilogarithmic amplifier, Waveform generator-square wave generator (astable multivibrator), Pulse generator (monostable multivibrator) & Triangular wave generator.

Unit II

DIGITAL CIRCUITS

Digital (Binary) operation of a system; Logic system: DC Positive and negative logic designations, Positive and negative pulse logic; The OR gate & The AND gate: Circuit in Diode logic (DL), Boolean expression, truth table, Boolean Identities; The NOT gate: Boolean expression, truth table, Boolean Identities, Transistor logic circuit; The NAND gate

& The NOR gate: Diode Transistor logic circuit, Boolean expression, truth table, Boolean Identities; The Exclusive OR gate: Boolean notation, truth table and two logic block diagrams for XOR gate; DeMorgan's Laws & Boolean algebra

Unit III

COMBINATIONAL DIGITAL SYSTEMS

Binary adders: Half adders, full adders, MSI adder, serial operation; Arithmetic functions; True/complement, Zero/one element, Binary subtraction, Digital comparator, parity checker/generator; Decoder: Binary-coded-decimal (BCD) system, BCD-to-decimal decoder, Demultiplexer: 4-to-16 line decoder, decoder/lamp driver, Multiplexer (Data selector): Applications- Parallel to serial conversion, sequential data selection; Encoders; Read Only Memory (ROM): Conversion of Binary to a Gray code & Gray to Binary conversion, ROM applications-Look-up table, sequence generator, seven segment visible display, combinational logic & character generator.

Unit IV

SEQUENTIAL DIGITAL SYSTEMS

A 1-BIT Memory: A sequential system, A 1-BIT storage cell, The clocked S-R Flip-Flop; Flip-Flops: The JK flip Flop- Logic symbol, truth table, preset and clear & race-around condition , Master slave JK flip-flop: T-type & D-type flip flops – Logic symbols and truth table; Shift-register and applications-serial to parallel converter, series in series out register, Parallel to serial converter, Parallel in Parallel out , Right shift, left shift register, digital delay line, sequence generators, shift-Register as ring counter, twisted-ring counter; Ripple (Asynchronous) counters: Ripple counter, Up-down counter, Divide by N counter; Synchronous counters: series carry, parallel carry, Applications of counters: Direct counting, Divide the frequency by N, measurement of frequency, time, distance & speed, wave form generator.

D/A And A/D Systems

Digital to analog converters: Weighted resistor type D/A converter, Ladder type D/A converter; Analog to Digital converter.

Text and Reference Books

Integrated Electronics by J. Millman and C.C.Halkias (Tata-McGraw Hill)
Fundamental of Electronics by J.D.Ryder (Prentice Hall Publication).
Linear Integrated Circuits by D.Roy Choudhury and Shail Jain (Wiley Eastern Ltd)

M. Sc. Engineering Physics
Semester-IX
Subject: Physics (Paper Code: EP 903)
Paper : Electrodynamics and wave propagation Engineering

Max. Marks: 50
Theory: 40
Internal Assessment: 10
Time: 3 hrs

Note:-

1 Nine Questions will be set in total
2 Question number 1 will be compulsory and will be based on the conceptual aspects of entire syllabus. This question may have five parts and the answer should be in brief but not in Yes/ No.
3 Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
4 20% numerical problems are to be set.
5 Use of scientific (non-programmable) calculator is allowed.

Unit I

Time Varying Fields and Maxwell Equations

Faraday's Law of induction. displacement current. Maxwell equations. Scalar and vector potentials. Gauge transformation, Lorentz and Coulomb gauges, General Expression for the electromagnetic fields energy, conservation of energy, Poynting's Theorm. Conservation of momentum, time-Harmonic Fields.

Unit-II

Electromagnetic Wave Propagation

Wave equation, plane waves in free space and isotropic dielectrics, polarization, energy transmitted by a plane wave, waves in conducting media. Skin depth. Reflection and Refraction of EM waves at plane interface, Fresnel's amplitude relations. Propagation of electromagnetic wave through ionosphere; Reflection of electromagnetic waves by ionosphere.

Unit III

Waveguides and Resonant Cavities:

Field at the surface of and within a conductor, Cylindrical cavities and waveguides, Waveguides, modes in a rectangular waveguide, Energy flow and attenuation in waveguides, Perturbation of boundary conditions, Resonant cavities, Power losses in a cavity: Q of a cavity, Multimode propagation in optical fibers, Expansion in normal modes; Field generated by a localized source in a hollow metallic Guide.

Unit-IV

Radiating systems

Field and radiation of a localized oscillating source, Electric dipole fields and radiation, Magnetic dipole and electric Quadrupole Fields, Centre fed linear antenna, Sources of multipole radiation; Multipole moments, Multipole radiation from a linear, Center-Fed antenna.

Radiation by moving charges

Lienard-Wiechert potentials and fields for a point charge, Total power radiated by an accelerated charge: Larmor's formula and its relativistic generalization, Angular distributation of radiation emitted by an accelerated charge, Distribution in frequency and angle of energy radiated by accelerated charges: Basic results, Thomson scattering of radiation.

Text and Reference Books :

Classical Electrodynamics by J.D. Jackson
Introduction to Electrodynamics by D.J. Griffiths
Electromagnetic by B.B. Laud
Field and Wave Electromagnetics by D. K. Cheng
Classical Electricity and Magnetism by Panofsky and Phillips
Fundamentals of Electromagnetics by M.A. Wazed Miah

M. Sc. Engineering Physics
Semester-IX
Subject: Physics (Paper Code: EP 904)
Paper: Laser and Fiber optics

Max. Marks: 50
Theory: 40
Internal Assessment: 10
Time: 3 hrs

Note:-.
1 Nine Questions will be set in total
2 Question number 1 will be compulsory and will be based on the conceptual aspects of entire syllabus. This question may have five parts and the answer should be in brief but not in Yes/ No.
3 Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
4 20% numerical problems are to be set.
5 Use of scientific (non-programmable) calculator is allowed.

Unit I

Laser: Laser characteristics, Spontaneous and Stimulated Emission, Absorption, population inversion, Laser pumping and pumping process: A two level system, a three level system, Optical pumping & pumping efficiency, Electrical pumping and pumping efficiency, Passive Optical Resonators, Rate Equations, Four-level Laser, Three-level Laser, Methods of Q-switching: Electro optical shutter, mechanical shutter.

Unit II

Laser systems: General description-Laser structure-excitation mechanism-Different laser systems- He-Ne laser, Argon-ion laser, Nitrogen laser, Carbon-dioxide laser, Nd:YAG; Nd:Glass, Pulsed-CW dye laser, Semiconductor Laser.

Applications of Lasers: Laser induced fusion, application in material procession (laser welding, hole drilling, laser cutting), lasers in Medicine & Military.

Holography Introduction, recording and reconstruction process, applications, holographic Interferometry, holographic memories.

Unit III

Fiber optics: Introduction; step index fiber, numerical aperture, pulse dispersion in step index fiber, graded index fibers, material dispersion, single mode fibers, fiber optics sensors; multimode and single mode fiber sensors.

Fiber materials and manufacture, glass fiber, plastic fiber, losses of fibers, bending losses, intrinsic fiber losses, scattering losses and absorption losses.

Unit IV

Optical Communication Systems: (Qualitative study only)

Modulation schemes, analog modulation, digital modulation, free space communication, fiber optical communication system, operating wave length, local area networks, integrated optics, slab and strip waveguides, devices, emitters (sources) and detectors. (Qualitative idea only).

Text and Reference Books :

Optics-Azoy Ghatak, TMH Pub. Co.
Principles of Lasers by Svelto
Optical Electronics-Ajoy Ghatak and K. Thyagarajan, Cambridge Uty Press
Lasers and Non-linear Optics by B.B. Laud.
Lasers Theory and Applications- K. Thyagarajan and A.K. Ghatak
Optoelectronics an introduction- J. Wilson and J.F.W. Halkes , Printice hall of India.
High Power Lasers and Their Applications- Dr. M. Premasundern ,Law and commercial Publishers, New Delhi.

M.Sc- Engineering Physics
Semester- IX
Paper: PH Lab (Physics Lab Practical)

Max. Marks: 100
Practical: 80
Internal Assessment: 20
Time: 4 hours

Special Note: -

1. Do eight experiments, selecting any four from each section.
2. The students are required to calculate the error involved in a particular experiment.
3. The Practical examination will be held in one session of 4 hours.

Distribution of Marks:

Experiments	50 marks
Viva- voce	30 marks
Internal Assessment	20 marks
Total	100 marks

Section A:

1. **To study uncertainty principle using Laser.**
2. **To study Faraday Effect using He-Ne Laser.**
3. **Measurement of thickness of thin films using Michelson interferometer.**
4. **Measurement of coherence length using Michelson interferometer.**
5. **Measurement of atomic spectra of discharge lamp (H_2, He, Ne).**
6. **Construction and reconstruction of an object using holography.**
7. **To determine Planck's constant using photocell.**
8. **To study non-radiative transition in LED.**
9. **Stern-Gerlach experiment.**
10. **Flashing and quenching of Neon gas.**

Section B:

1. **Design/study of a Regulated Power Supply.**
2. **Design and performance study of a constant current source.**
3. **To design (i) Low pass filter (ii) High pass filter (iii) All pass filter (iv) Band pass filter (v) Band reject filter Using 741 OPAMP.**
4. **To study the use of operational amplifier for different mathematical operations.**
5. **Characteristics and applications of Silicon Controlled Rectifier.**
6. **Differential Amplifier.**
7. **Differentiating and integrating circuits.**
8. **To study SR and JK flip flop circuits using logic gates.**
9. **A/D and D/A conversion.**
10. **BCD to Seven segment display.**

M. Sc. Engineering Physics
Semester-X
Subject: Physics (Paper Code: EP 1001)
Paper: Materials Science for Engineers

Max. Marks: 50
Theory: 40
Internal Assessment: 10
Time: 3 hrs

Note:-

1 Nine Questions will be set in total
2 Question number 1 will be compulsory and will be based on the conceptual aspects of entire syllabus. This question may have five parts and the answer should be in brief but not in Yes/ No.
3 Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
4 20% numerical problems are to be set.
5 Use of scientific (non-programmable) calculator is allowed.

UNIT – 1

CERAMICS AND COMPOSITES

Introduction, Structure of Ceramics, Production of ceramics other than glass and cement: Raw materials, forming process, post forming process; Mechanical properties of ceramics; wear and erosion resistance; thermal shock; Commercial ceramic system: silica-alumina system; Technical ceramics: Zirconia and sialons; Cement and concrete; Composites; Mechanical properties of Continuous fiber composites: strength, Young's modulus; Mechanical properties of Discontinuous fiber composites; anisotropy; toughness; comparison of polymer, metal and ceramic matrix composites; some commercial composites: carbon-carbon and zirconia-toughened alumina, alumina reinforced aluminum alloys, polymer matrix composites.

Unit- 2

Polymeric material

Introduction, molecular structure: Monomers and polymers, molecular weight, branching, tacticity and copolymers; Mechanics of flexible polymer chains: chain conformations, entanglements; Thermoplastic melts: viscosity, processing of thermoplastics; Amorphous polymers: The rubbery state, glass transition, time dependence; Crystallinity and orientation: Lamellae and spherulites, orientation; Thermosets and elastomers: thermosets, elastomers, thermoplastic elastomers; Mechanical properties: Stress-strain behaviour, crepe recovery and stress relaxation, time-temperature correspondence, viscoelastic models, crack and craze growth, impact and fatigue; Physical and chemical properties: optical properties-transparency, absorption & reflection, electrical conductivity, density, degradation, oxidation and ageing.

Unit – 3

Nanomaterials;

Introduction to Nanomaterials, Advances in Nanomaterials, Quantum Mechanics: Electron confinement in infinitely deep square well, confinement in two and one dimensional well, Idea of quantum well structure, Quantum dots, and Quantum wires.

Different methods of preparation of Nanomaterials: Sol-gel process, chemical vapor deposition method, electro-deposition method, ball milling technique and synthesis using vacuum deposition; Selected Application of Nanomaterials: Fuel cells- Carbon nanotubes & Microbial fuel cell, Phosphors for High-Definition TV, Next-Generation Computer Chips, Elimination of Pollutants, Sun-screen lotion, Sensors; Disadvantages of Nanomaterials;

Unit – 4

Magnetic Materials

Classification of magnetism - Concept of magnetic domain structure - Soft magnetic materials: iron and iron based materials, permalloys, Ni_Zn and Mn_Zn ferrites - Microwave ferrites and garnets - Amorphous magnets (metglasses) - Hard magnetic materials : High carbon steel, AINiCo alloys - Structure and magnetic properties of Barium ferrites, Sm-co and Nd2Fe4B magnets - Rare earth element magnets - Effects of 3d transition elements – Applications of hard Vs Soft magnets.

Text and Reference Books:

1. J.C. Anderson, KD. Leaver, R.D. Rawlings and J.M. Alexander, Materials Science, 4th Edition (ChapmanHall, London, 1990).
2. V. Raghavan, Materials Science and Engineering, 3rd Ed. (Prentice-Hall India, New Delhi, 1993). (For units 2, 3 & 5).47
3. C.M. Srivastava and C. Srinivasan Science of Engineering Materials, Wiley-Eastern Ltd., New Delhi, 1987). (For units 1, 2 & 5).
4. Nanomaterials-synthesis, properties, & applications by A.S. Edelstein & RC Cammarata.
5. Nanotechnology-An introduction to nanostructuring techniques by Wolfgang Fritzsche.
6. G.K. Narula, K.S. Narula and V.K. Gupta, Materials Science (Tata McGraw-Hill, 1988).
7. Z.D. Jaberezki, The Nature and Properties of Engineering Materials, (Wiley Eastern).
8. E.P. Wohlfarth, Ferromagnetic materials, Vols. 1, 2 & 3 (North rolland, 1980).
9. H. Ibach and H. Luth, Solid State Physics – An Introduction to Principles of Material Science, 2nd Ed. (2001).
10. R.K. Gupta (Editor), Physics of Particles, Nuclei and Materials - Recent Trends (New Horizons of Physics Series, Narosa, New Delhi, 2002).

M. Sc. Engineering Physics
Semester-X
Subject: Physics (Paper Code: EP 1002)
Paper: Modern Characterization techniques

Max. Marks: 50
Theory: 40
Internal Assessment: 10
Time: 3 hrs

Note:-

1 Nine Questions will be set in total
2 Question number 1 will be compulsory and will be based on the conceptual aspects of entire syllabus. This question may have five parts and the answer should be in brief but not in Yes/ No.
3 Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
4 20% numerical problems are to be set.
5 Use of scientific (non-programmable) calculator is allowed.

Unit I

Electron Microscopy: introduction, Electron optics; Principle, instrumentation, methodology and applications of Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM) and Atomic Force Microscope (AFM).

X-ray photoelectron spectroscopy (XPS): principle, instrumentation, methodology and applications;

Glancing angle X-ray diffraction: Basic concept, Instrumentation and structural analysis applications.

Unit - II

Rutherford backscattering spectrometry (RBS): Principle, kinematics, instrumentation, depth profile and applications;

Elastic recoil detection analysis (ERDA): Principle, instrumentation, methodology and applications;

Auger Electron spectroscopy (AES): Principle, instrumentation, methodology and applications of AES in composition analysis and depth profiling;

Secondary ion mass spectroscopy (SIMS): Principle, instrumentation, working and application.

Unit - III

NMR: The principle of NMR, NMR spectrometer, Types of NMR, Types of nuclei viewed from the stand point of NMR, High Resolution and Broad line NMR, Relaxation mechanisms, chemical shift; spin-spin coupling, applications of NMR spectroscopy.

ESR: ESR spectrometer, substances which can be studied by ESR, Resonance condition. Description of ESR by Precession, Relaxation mechanisms, Features of ESR spectra (a) the g factor (b) Fine structure (c) hyperfine structure (d) ligand hyperfine structure, applications of ESR.

Unit - IV

Ultraviolet and Visible Spectroscopy: Introduction, instrumentation and sampling techniques and applications.

Thermal analysis tools: TGA, DTA and DSC- Basic principle, instrumentation and applications.

FTIR spectroscopy: Basic concept, instrumentation, different mode of operation and applications.

Photoluminance spectroscopy: introduction: Basic concept, instrumentation and applications.

References Books

1. Electron spectroscopy: theory, techniques and applications- C.R. Brundee and A.D. Baker Eds. Academic Press.

2. Fundamentals of surface and thin film analysis- L.C. Feldman and J.W. Mayer, North Holland.

3. Atomic and Nuclear Analytical Methods, H.R. Verma, Springer Berlin Heidelberg, New York.

4. Fundamentals of solid state engineering by Manijeh Razeghi, Springer.

5. Infrared and Raman Spectroscopy Edited by Bernhard Schrader, VCH Publishers. Inc., New York.

6. Modern Spectroscopy-J. Michael Hollas, Wiley publisher.

7. Thermal characterization of polymeric materials-E.A. Turi, Elsevier publisher.

8. Polymer characterization. Physical techniques- D. Campbell and J.R. White, Chapman and Hall.

M. Sc. Engineering Physics
Semester-X
Subject: Physics (Paper Code: EP 1003)
Paper: Modern Medical imaging systems

Max. Marks: 50
Theory: 40
Internal Assessment: 10
Time: 3 hrs

Note:-

1 Nine Questions will be set in total
2 Question number 1 will be compulsory and will be based on the conceptual aspects of entire syllabus. This question may have five parts and the answer should be in brief but not in Yes/ No.
3 Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
4 20% numerical problems are to be set.
5 Use of scientific (non-programmable) calculator is allowed.

Unit I

X-ray Machine and digital Radiography: Basis of diagnostic radiology, Nature of X-rays, Properties of X-rays, units of X-radiation, Production of X-rays; stationary anode tube, collimators and grids, exposure timing systems, automated exposure control, Visualization of X-rays Machine; X-ray films, fluorescent screens, x-ray image intensifier television system.

X-ray computed tomography: Basic principle, Contrast Scale, System components- scanning system, processing system, viewing system; Patient dose in CT Scanners.

Unit-II

Ultrasonic imaging systems: Diagnostic ultrasound, Physics of ultrasonic waves- Characteristic impedance, wavelength and frequency, velocity of propagation, absorption of ultrasonic energy, beam width, resolution, generation and detection ultrasound; Medical ultrasound; Basic pulse echo apparatus; A scan- applications; B scanner- types of scan, imaging instrumentation; Biological effects of ultrasound.

Unit – III

Nuclear Magnetic imaging systems: Radio-isotopes in medical diagnosis; Physics of radioactivity: time decay of radioactive isotopes, units of radioactivity, types and properties of particles emitted in radioactive decay; The gamma camera-basic idea and it’s electronics; emission computed tomography (ECT); Single-Photon-Emission computed tomography (SPECT); Position Emission tomography (PET scanner).

Unit – IV

Magnetic imaging system: Principles of NMR imaging system, Free induction decay (FID), Fourier Transformation of FID, The Bloch equation; Image reconstruction technique-Sequential point method, sequential line method, sequential plane method; Discrimination based on relaxation rates- saturation recovery, inversion recovery, spin-eco-imaging technique; Types of imaging sequences; Basic NMR components; Biological effects of NMR imaging system; Advantages of NMR imaging systems.

Text and Reference Books:

1. Medical Instrumentation by John. G. Webster –John Wiley
2. Principles of Applied Biomedical Instrumentation by Goddes & Baker – John Wiley
3. Biomedical Instrumentation & Measurement by Carr & Brown-Pearson
4. Biomedical Instrument by Cromwell-Prentice Hall of India, New Delhi
5. Hand book of Medical instruments by R.S. Khandpur –TMH, New Delhi
6. Medical Electronics and Instrumentation by Sanjay Guha – University Publication
7. Introduction to Biomedical electronics by Edwand J. Bukstein –sane and Co. Inc. USA

M. Sc. Engineering Physics
Semester-X
Subject: Physics (Paper Code: EP - Project)
Paper: Dissertation

Max. Marks: 150
Project: 100
Viva-Voce: 50

For students to adventures into preliminary research field both in theory and experiment, the concept of project has been introduced in the final year. In the project, the student will explore new developments from books and journals, collecting literature / data and write a dissertation based on his / her work and studies. The project can also be based on experimental work.