MAHATMA GANDHI UNIVERSITY, KOTTAYAM

CURRICULUM FOR UNDER GRADUATE PROGRAMMES IN

PHYSICS

UNDER CHOICE BASED CREDIT SYSTEM (UG CBCS) 2017

2017 ADMISSIONS ONWARDS

B. Sc. Physics (Model -III) Programme (2 Core Courses)

(1) ELECTRONIC EQUIPMENT MAINTENANCE

Semester	Title of the Course	Hours per week	No. Of Credits	Total hrs/semester	Marks	
					IA	EA
1	English I	5	4	90	20	80
	PH1CRT01 – Methodology and Perspectives of Physics	2	2	36	15	60
	PH1CRT21 - Principles of Electronics	3	2	54	20	80
	PH1CRT22 - Communication Engineering	3	2	54	15	60
	Complementary I: Mathematics I	4	3	72	20	80
	Complementary II : CA1CMT01 Computer Fundamentals	2	2	36	15	60
	Core 1 Practical I: PH2CRP01 Mechanics and Properties of Matter	2	-	36	-	-
	Core 2 Practical I: PH2CRP21	2	-	36	-	-
	Complementary II Practical I: CA2CMP01	2	-	36	-	-
2	English II	5	4	90	20	80
	PH2CRT02 – Mechanics and Properties of Matter	2	2	36	15	60
	PH2CRT23 - Power Electronics	3	2	54	20	80
	PH2CRT24 – Analogue Integrated Circuits	3	2	54	15	60
	Complementary I – Mathematics II	4	3	72	20	80
	Complementary II: CA2CMT02 Programming in C Language	2	3	36	15	60
	Core 1 Practical I: PH2CRP01 Mechanics and Properties of Matter	2	2	36	10	40
	Core 2 Practical I: PH2CRP21	2	2	36	10	40
	Complementary II Practical I: CA2CMP01	2	2	36	10	40
	PH2OJO01- On Job Training I	0	2	0	100	-

3	**PH3CRT03 – Optics, Laser and Fiber Optics**	**3**	**3**	**54**	**15**	**60**
	PH3CRT25 Microprocessor and its applications	**3**	**3**	**54**	**15**	**60**
	PH3CRT26- Network Theory	**3**	**3**	**54**	**15**	**60**
	Complementary I - Mathematics III	**5**	**4**	**90**	**20**	**80**
	Complementary II: CA3CMT03 Web Technology and Programming	**3**	**2**	**54**	**15**	**60**
	Core 1 Practical II: PH4CRP02 Optics and Semiconductor Physics	**2**	**-**	**36**	**-**	**-**
	Core 2 Practical II: PH4CRP22	**2**	**-**	**36**	**-**	**-**
	Core 2 Practical III: PH4CRP23	**2**	**-**	**36**	**-**	**-**
	Complementary II Practical II: CA4CMP02	**2**	**-**	**36**	**-**	**-**
4	**PH4CRT04 - Semiconductor Physics**	**3**	**3**	**54**	**15**	**60**
	PH4CRT27 - Trouble Shooting of Audio Equipments	**3**	**3**	**54**	**15**	**60**
	PH4CRT28 Trouble Shooting of Video Equipments	**3**	**3**	**54**	**15**	**60**
	Complementary I: Mathematics IV	**5**	**4**	**90**	**20**	**80**
	Complementary II: CA4CMT04 Visual Programming Techniques	**3**	**3**	**54**	**15**	**60**
	Core 1 Practical II: PH4CRP02 Optics and Semiconductor Physics	**2**	**2**	**36**	**10**	**40**
	Core 2 Practical II: PH4CRP22	**2**	**2**	**36**	**10**	**40**
	Core 2 Practical III: PH4CRP23	**2**	**2**	**36**	**10**	**40**
	Complementary II Practical II: CA4CMP02	**2**	**2**	**36**	**10**	**40**
	PH4OJ02: On Job Training II	**0**	**2**	**0**	**100**	**-**
	PH5CRT05 – Electricity and Electrodynamics	**3**	**3**	**54**	**15**	**60**
	PH5CRT06 –Classical and Quantum Mechanics	**3**	**3**	**54**	**15**	**60**
	PH5CRT07 –Digital Electronics and Programming	**3**	**3**	**54**	**15**	**60**
	PH5CRT08 – Environmental Physics and Human Rights	**4**	**4**	**72**	**15**	**60**
	PH5OPT0X* -Open Course	**4**	**3**	**72**	**20**	**80**

5	**Core 1 Practical III: PH6CRP03 Electricity, Magnetism and Laser**	**2**	**-**	**36**	**-**	**-**
	Core 1 Practical IV: PH6CRP04 Digital Electronics	**2**	**-**	**36**	**-**	**-**
	Core 1 Practical V: PH6CRP05 Thermal Physics, Spectroscopy and C++ Programming	**2**	**-**	**36**	**-**	**-**
	Core 1 Practical VI: PH6CRP06 Acoustics, Photonics and Advanced Semiconductor Physics	**2**	**-**	**36**	**-**	**-**

	PH6CRT09 Thermal and Statistical Physics	**3**	**3**	**54**	**15**	**60**
	PH6CRT10 - Relativity and Spectroscopy	**4**	**3**	**72**	**15**	**60**
	PH6CRT11 – – Nuclear, Particle and Astrophysics	**3**	**3**	**54**	**15**	**60**
	PH6CCRT12- Solid State Physics	**4**	**3**	**72**	**15**	**60**
	PH6CBT0X *-Choice Based Course	**3**	**3**	**54**	**20**	**80**
6	**Core 1 Practical III: PH6CRP03 Electricity, Magnetism and Laser**	**2**	**2**	**36**	**10**	**40**
	Core 1 Practical IV: PH6CRP04 Digital Electronics	**2**	**2**	**36**	**10**	**40**
	Core 1 Practical V: PH6CRP05 Thermal Physics, Spectroscopy and C++ Programming	**2**	**2**	**36**	**10**	**40**
	Core 1 Practical VI: PH6CRP06 Acoustics, Photonics and Advanced Semiconductor Physics	**2**	**2**	**36**	**10**	**40**
	PH6PRO01 – Project and Industrial Visit	**-**	**1**	**-**	**20**	**80**

***- X Stands for 1, 2, 3, … depending upon Open course and Choice based course**

Choice Based Course

Sl. No.	Paper Code	Semester	Paper Title
1	PH6CBT01	VI	IT
2	PH6CBT02	VI	Material Science
3	PH6CBT03	VI	Computational Physics
4	PH6CBT04	VI	Instrumentation
5	PH6CBT05	VI	Astronomy & Astrophysics

Open Course

Sl. No.	Paper Code	Semester	Paper Title
1	PH5OPT01	V	Our Universe
2	PH5OPT02	V	Physics in Daily Life
3	PH5OPT03	V	Computer Hardware and Networking

1. Complementary Physics for Mathematics and Statistics

Semester	Title of the Course	Hours per week	No. Of Credits	Total hrs/semester	Marks	
					IA	EA
1	**PH1CMT01: Properties of Matter & Error Analysis**	2	2	36	15	60
	PH2CMP01: Practical 1	2	-	36	-	-
2	**PH2CMT01: Mechanics and Astrophysics**	2	2	36	15	60
	PH2CMP01: Practical 1	2	2	36	10	40
3	**PH3CMT01: Modern Physics and Electronics**	3	3	54	15	60
	PH4CMP01: Practical 2	2	-	36	-	-
4	**PH4CMT01: Optics & Electricity**	3	3	54	15	60
	PH4CMP01: Practical 2	2	2	36	10	40

2. Complementary Physics for Chemistry and Geology

Semester	Title of the Course	Hours per week	No. Of Credits	Total hrs/semester	Marks	
					IA	EA
1	**PH1CMT02: Properties of Matter and Thermodynamics**	**2**	**2**	**36**	**15**	**60**
	PH2CMP02: Practical 1	**2**	**-**	**36**	**-**	**-**
2	**PH2CMT02: Mechanics and Superconductivity**	**2**	**2**	**36**	**15**	**60**
	PH2CMP02: Practical 1	**2**	**2**	**36**	**10**	**40**
3	**PH3CMT02: Modern Physics and Magnetism**	**3**	**3**	**54**	**15**	**60**
	PH4CMP02: Practical 2	**2**	**-**	**36**	**-**	**-**
4	**PH4CMT02: Optics and Solid State Physics**	**3**	**3**	**54**	**15**	**60**
	PH4CMP02: Practical 2	**2**	**2**	**36**	**10**	**40**

8.SYLLABUS CORE PHYSICS

B.Sc. Physics Programme (Model – I, II &III)

Semester-I

Core Course: I **Credit – 2 (36 hours)**

PH1CRT01: METHODOLOGY AND PERSPECTIVES OF PHYSICS

Module I

Concepts and Development Physics: (8hours)

Development of physics in the last century and the birth of new scientific concepts with reference to s*cientific contributions of Galileo, Newton, Einstein, J J Thomson, Curies, Rayleigh, Max Plank, Heisenberg and Schrodinger* (qualitative understanding). Contributions of Indian physicists -*C V Raman, H J Babha, J C Bose, S N Bose, M Saha, S Chandrasekhar, Vikram Sarabhai,* (Topics in this part require qualitative study only)

References:

1. Feynman lectures of Physics
2. Concepts of Modern Physics: ArtherBeisser,
3. Modern Physics: Kenneth Krane
4. Modern Physics: R Murugeshan
5. https://www.nobelprize.org/nobel_prizes/physics/laureates/

Module II **(18 hours)**

Number systems- Decimal, hexadecimal and Binary.Conversions, Binary arithmetic addition, subtraction and multiplication. 1's and 2's complement subtraction –signed binary numbers. Signed binary arithmetic, BCD code, ASCII code, Significance of binary number system in digital electronics, microprocessors and in computers,

Introductory Vector Analysis - Applications of vectors in Physics. Differential and integral vector calculus: – The operator ∇- physical significance of Gradient, Divergence and Curl, Line integral, surface integral and volume integral of vectors

Co-ordinate systems:Cartesian Co-ordinate system, plane polar and spherical polar coordinates, cylindricalcoordinates (Basic ideas with examples in physics),

References:

6. Introduction to Electrodynamics, David J. Griffiths, Prentice Hall India Pvt. Ltd., Chapter 1
7. Mathematical Physics: Charlie Harper
8. University Physics, Roger A Freedman, Hugh D Young 14th edition
9. Digital electronics: Albert Paul Malvino
10. Digital logic and computer design – M. Morris Mano, PHI.

Module III

Experimental methods and error analysis (10 hrs)

Experimental methods, least count of instruments, Instruments for measuring mass- common balance; length-vernier, screw gauge, travelling microscope, and sonar; time- pendulum clock and atomic clock; angle- spectrometer and stellar parallax; current- ammeter and conversion of galvanometer to ammeter; voltage- voltmeter and conversion of galvanometer to voltmeter. Fundamental units. Precision and accuracy of measurements, source of error in measurements, necessity of estimating errors , types of errors, reading error of instrument, calibration error, random error, systematic error, significant digits, order of magnitude and rounding of numbers, rounding error, absolute and relative errors, Errors of computation- addition, subtraction, multiplication, division, error in power and roots, Propagation of errors, analysis of data, standard deviation, calculation of mean value.

References:

1. Text book: Advanced course in Practical Physics by D Chattopadhyay- Chapter-1
2. Practical Physics, G L Squires, Third edn. Cambridge University Press.

3. The theory of Errors in Physical Measurements- J C Pal- New Central Book Agency- 2010

Semester-II

Core Course: II **Credit – 2(36 hours)**

PH2CRT02: MECHANICS AND PROPERTIES OF MATTER

Module I

Wave motion **(4 hours)**

General equation of wave motion, plane progressive harmonic wave, energy density, intensity of a wave, superposition of waves, beats, transverse waves in stretched strings, modes.

Text Book: Mechanics by D.S. Mathur – Chapter 9.

Oscillations **(8 hours)**

Periodic motion, simple harmonic motion and harmonic oscillator, energy of a harmonic oscillator, examples of harmonic oscillator – simple and compound pendulum.Theory of Damped harmonic oscillator.Theory of forced oscillator, resonance, applications.

Text Book: Mechanics by D.S. Mathur – Chapter 7, 8.

Module -II

Rotational mechanics (7 Hours)

Angular velocity- angular acceleration- angular momentum- conservation- torque-moment of inertia- Parallel and perpendicular axes theorems - calculation of moment of inertia- (rod, ring, disc, cylinder, and sphere). Theory of flywheel.

Text Book: Mechanics by D.S. Mathur – Chapter 10.

Module III

Elasticity **(10 hours)**

Basic ideas on elasticity – Young's modulus, bulk modulus, rigidity modulus, Poisson's ratio, relations connecting various elastic constants.Work done per unit volume in a strain. Bending of beams, bending moment, flexural rigidity.Young's modulus – uniform and non-uniform bending, cantilever.I –section girders. Determination of rigidity modulus using Static and Dynamic methods.

Text Book: Mechanics by D.S. Mathur – Chapter 12, 13.

Hydrodynamics (7 hours)

Streamline and turbulent flows, coefficient of Viscosity – Determination of viscosity by Poiseuille's method. Equation of continuity, energy possessed by a liquid, Bernoulli's theorem.

Surface tension, surface energy, excess pressure in a liquid drop and bubble, factors affecting surface tension, applications.

Text Book: Mechanics by D.S. Mathur – Chapter 14.

Text books:

1. Mechanics by J.C. Upadhayaya, Ramprasad Pub.
2. Mechanics -D.S.Mathur, S.Chand.
3. Advanced course in Practical Physics by D Chattopadhyay, Central Book
4. Properties of Matter and Acoustics by Murugeshan and K. Sivaprasath, S. Chand

References:

1. Mechanics- Hans and Puri, TMH
2. Classical Mechanics by J.C. Upadhyaya, Himalaya Pub.
3. Classical Mechanics-Takwale and Puranik, TMH.
4. Classical mechanics- K.SankaraRao, PHI.
5. Properties of Matter by Mathur, S. Chand,
6. Mechanics by Somnath Datta, Pearson
7. Mechanics by H.D Young and R.A Freedman, Pearson.

9. COMPLEMENTARY PHYSICS FOR MATHEMATICS AND STATISTICS

Semester I **2 credits (36 hours)**

PH1CMT01: PROPERTIES OF MATTER & ERROR ANALYSIS

Module I

Elasticity **(13 hours)**

Stress- strain- Hooke's law- Elastic moduli- Poisson's ratio- twisting couple- determination of rigidity modulus- static and dynamic methods- static torsion- torsion pendulum, bending of beams- cantilever, uniform and non-uniform bending, I section girder.

Module II

Surface tension **(3 hours)**

Molecular theory of surface tension - surface energy - excess pressure in a liquid drop, factors affecting surface tension - applications

Hydrodynamics **(7 hours)**

Streamline and turbulent flow - critical velocity - Coefficient of viscosity - Derivation of Poiseuille's equation, Stokes equation-Determination of viscosity by Poiseuille's method - Brownian motion – Viscosity of gases – Bernoulli's theorem.

Module III **(13 hours)**

Error Analysis

Basic ideas – uncertainties of measurement – importance of estimating errors – dominant errors – random errors – systematic errors - rejection of spurious measurements. Estimating and reporting errors – errors with reading scales, errors of digital instruments – number of significant digits –absolute and relative errors – standard deviation. Propagation of errors – sum and differences – products and quotients – multiplying by constants – powers

References:

1. *Elements of properties of matter, D S Mathur*
2. *Advanced course in Practical Physics by D Chattopadhyay*
3. *Properties of Matter- Brijlal and N. Subrahmanyam (S. Chand and Co.)*
4. *Concepts of Modern Physics- A. Beiser (Tata McGraw-Hill, 5th Edn.)*
5. *Modern Physics- G. Aruldas and P. Rajagopal (PHI Pub)*
6. *Physics- Resnick and Halliday*
7. *An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements, John R. Taylor - Univ. Science Books*

Semester II **2 credits (36 hours)**

PH2CMT01: MECHANICS AND ASTROPHYSICS

Module I

Motion under Gravity **(5 hours)**

Velocity- acceleration- force – acceleration due to gravity - compound pendulum (symmetric and asymmetric) radius of gyration – Kater's Pendulum- centripetal acceleration and force - centrifugal force

Rotational Dynamics **(10 hours)**

Angular velocity- angular momentum- torque- conservation of angular momentum- angular acceleration- moment of inertia- parallel and perpendicular axes theorems- moment of inertia of rod, ring, disc, cylinder and sphere- flywheel

Module II

Oscillations **(9 hours)**

Periodic and oscillatory motion- simple harmonic motion- differential equation, expression for displacement, velocity and acceleration- graphical representation- energy of a particle executing simple harmonic motion - damped oscillation- forced oscillation and resonance.

Waves **(4 hours)**

Waves-classifications- progressive wave- energy of progressive wave- superposition of waves-theory of beats- Doppler Effect.

Module III

Astrophysics **(8 hours)**

Temperature and color of a star- elements present in a stellar atmosphere- mass of star- life time of a star- main sequence stars-HR diagram- evolution of stars- white dwarf- supernova explosion- neutron star- black hole- (all topics to be treated qualitatively)

References

1. Elements of properties of matter, D S Mathur Mechanics- H.S.Hans and S.P.Puri. (TMH)
2. Mechanics, D S Mathur
3. Modern Physics- R. Murugeshan, Er. Kirthiga Sivaprasad

4. A text book on oscillations waves and acoustics, M.Ghosh , D Bhattacharya
5. Introduction to Astrophysics-Baidyanath Basu.
6. Mechanics by D.S. Mathur and P.S. Hemne, S. Chand.
7. Waves, Mechanics & Oscillations- S B Puri

Semester III **3 credits (54 hours)**

PH3CMT01: MODERN PHYSICS AND ELECTRONICS

Module I

Modern Physics **(18 hours)**

Basic features of Bohr atom model-formula for energy- vector atom model- various quantum numbers-coupling schemes – LS & JJ-Pauli's exclusion principle- magnetic moments of orbital electrons

Atomic nucleus-classification-basic properties of nucleus-charge, mass, spin, magnetic moment binding energy and packing fraction-nuclear forces-salient features

Radioactivity- properties of alpha, beta and gamma-Soddy Fajan's displacement law, law of radioactive disintegration-decay constant-half life and mean life-radioactive equilibrium - measurement of radioactivity-radio carbon dating

Module II

Quantum Mechanics **(12 hours)**

Inadequacies of classical physics-experimental evidences-evidences for quantum theory-Planck's hypothesis-foundation of quantum mechanics-wave function & probability density- Schrödinger equation-time dependent and time independent particle in a potential box.

Spectroscopy **(6 hours)**

Optical spectra- spectral terms, selection rules, hyperfine structure; molecular spectra-rotational, vibrational and electronic spectra; Raman effect- experimental study, quantum theory; fluorescence and phosphorescence; comparison of Raman, fluorescence and IR spectra; NMR

10. COMPLEMENTARY PHYSICS FOR CHEMISTRY AND GEOLOGY

Semester 1

PH1CMT02: PROPERTIES OF MATTER AND THERMODYNAMICS

Module I

Elasticity (13 hours)

Stress- strain- Hooke's law- Elastic moduli- Poisson's ratio- twisting couple- determination of rigidity modulus- static and dynamic methods- static torsion- torsion pendulum, bending of beams- cantilever, uniform and non-uniform bending, I section girder.

Module II

Surface tension (3 hours)

Molecular theory of surface tension - surface energy - excess pressure in a liquid drop, factors affecting surface tension - applications

Hydrodynamics (7 hours)

Streamline and turbulent flow - critical velocity - Coefficient of viscosity - Derivation of Poiseuille's equation, Stokes equation-Determination of viscosity by Poiseuille's method - Brownian motion – Viscosity of gases- Bernoulli's theorem.

Text Book: Elements of properties of matter, D S Mathur, Chapter- 14

Module III

Thermodynamics (13 hours)

Thermodynamic systems- thermodynamic equilibrium- thermodynamic processes- isothermal process- adiabatic process- zeroth law of thermodynamics, first law of thermodynamics- heat engine- the Carnot engine- refrigerator, concept of entropy- second law of thermodynamics- third law of thermodynamics- Maxwell's thermodynamic relations

Text Books:

1. Elements of properties of matter, D S Mathur- S Chand
2. Heat and Thermodynamics-Brijlal & Subrahmanyam (S.Chand)

References

1. Mechanics - H.S.Hans and S.P.Puri. (Tata McGraw-Hill)
2. Properties of Matter - Brijlal and N. Subrahmanyam (S. Chand and Co.)
3. Mechanics - J.C. Upadhyaya (Ram Prasad and sons)
4. Heat and Thermodynamics – Mark W Zemanski (Tata McGraw-Hill)

Semester 2

PH2CMT02: MECHANICS AND SUPERCONDUCTIVITY

Module I

Motion under gravity **(5 hours)**

Velocity- acceleration- force – acceleration due to gravity - compound pendulum (symmetric and asymmetric) radius of gyration –centripetal acceleration and force - centrifugal force

Rotational dynamics **(10 hours)**

Angular velocity- angular momentum- torque- conservation of angular momentum- angular acceleration- moment of inertia- parallel and perpendicular axes theorems- moment of inertia of rod, ring, disc, cylinder and sphere- flywheel

Module II

Oscillations **(9 hours)**

Periodic and oscillatory motion- simple harmonic motion- differential equation, expression for displacement, velocity and acceleration- graphical representation- energy of a particle executing simple harmonic motion damped oscillation- forced oscillation and resonance.

Waves **(4 hours)**

Waves-classifications- progressive wave- energy of progressive wave- superposition of waves-theory of beats- Doppler effect.

Module III

Superconductivity (8 hours)

Super conducting phenomenon- Occurrence- BCS theory (qualitative) Meissner Effect- Type I and Type II superconductors- Josephson effects (qualitative) - High temperature superconductors- Applications of Superconductivity

Text Books:

1. *Elements of properties of matter, D S Mathur- S Chand*
2. *Mechanics- D S Mathur- S Chand*
3. *Solid State Physics- P K Palanisamy- Scitech*

References

1. *Properties of Matter- Brijlal and N. Subrahmanyam (S. Chand and Co.)*
2. *A text book on oscillations waves and acoustics, M.Ghosh , D Bhattacharya*
3. *Solid State Physics- R. K. Puri and V.K. Babbar (S. Chand and Co.)*
4. *Elementary Solid State Physics,Ali Omar*
5. *Modern Physics- Murugeshan- S Chand*

Semester III

PH3CMT02: MODERN PHYSICS AND MAGNETISM

Module I

Modern Physics (18 hours)

Basic features of Bohr atom model-formula for energy-vector atom model- various quantum numbers- Coupling schemes-LS and JJ coupling-Pauli's exclusion principle- magnetic moment of orbital electrons,

Atomic nucleus classification-basic properties of nucleus-charge, mass, spin, magnetic moment binding energy and packing fraction-nuclear forces-salient features

Radioactivity- properties of alpha, beta and gamma- Soddy Fajan's displacement law, law of radioactive disintegration -decay constant-half life and mean life-radioactive equilibrium - measurement of radioactivity-.Radio carbon dating

COMPLEMENTARY PHYSICS PRACTICALS

Semester I & II

Complementary Physics Practical 1: PH2CMP01

1. Vernier Calipers -- Volume of cylinder (solid and hollow), sphere and beaker
2. Screw gauge – Radius of wire, volume of sphere and glass piece
3. Beam balance - Mass of a solid (sensibility method)
4. Spectrometer - Refractive Index of material of prism.
5. Diode characteristics- ac and dc resistance
6. Coefficient of viscosity of the liquid – Constant **OR** Variable pressure head method
7. Surface Tension – Capillary rise method
8. Determination of Young's Modulus- Cantilever (Scale and Telescope)
   OR - Uniform bending (Optic lever method)
   OR- Non-uniform bending (Pin and Microscope method)
9. Acceleration due to gravity (g)- Symmetric Compound Pendulum
   OR Kater's pendulum
10. Symmetric Compound Pendulum - Determination of Radius of gyration and moment of inertia
11. Fly wheel – Moment of Inertia
12. Torsion pendulum -Rigidity modulus
13. Determination of moment of inertia of rotationally symmetric body (solid sphere **OR** cylinder **OR** disc) from their period of oscillation on a torsion axle
14. Spring constant - Hooke's law - oscillation
15. Resistivity of the material of the wire- Ohm's law and verification by multimeter
16. Construction of half wave rectifier with and without filter – Ripple factor
17. Laser- Transmission **OR** Reflection Grating- Determination of wavelength
18. Liquid lens - Refractive Index of glass using a liquid of known refractive index
19. Poisson's ratio of rubber
20. Temperature dependence of capacitance- polymer and ceramic capacitors
21. Resistance of a galvanometer and its figure of merit.

11. COMPLEMENTARY PHYSICS FOR B. Sc. ELECTRONICS (MODEL III) PROGRAMME

SEMESTER I

PH1CMT03: SOLID STATE PHYSICS

Objectives:

1. To provide the students of B.Sc. Electronics programme the bare minimum knowledge in Solid State Physics which is the basis of electronic devices.
2. It aims at developing a taste for solid state physics where the real advances in electronic device technology happens.
3. To enable students to catch up with the new areas related to electronics which include quantum computing, nanotechnology etc.
4. Miniaturization has made the physics of devices more demanding. One requires the application of the methods of quantum mechanics to tackle them.

Hours/Week 4

Contact Hours 72

Credit s 3

Course Outline

Module I- Crystal structure and atomic bonding (15hours)

Basic definitions - Crystal lattice, Unit cell- primitive and non primitive cells, Basis. Types of lattices-Bravais lattices and derived structures, Lattice directions and planes-Miller indices (simple calculations expected). X-ray diffraction-Bragg's law- Powder crystal method (qualitative study).Inter-atomic bonding- ionic, covalent, metallic.

Textbook

Chapter One, Two and Three.Solid State Physics-R.K Puri&V.KBabbar.

Module II – Basic quantum mechanics (15 hours)

Dual nature of matter and wave - de Broglie waves, Particle diffraction - Davison-Germer experiment, Uncertainty principle(derivation based on Fourier integral not needed),Classical mechanics as an approximation of quantum mechanics, Wave function, Wave equation, Schrodinger equation- Time dependent & Steady State forms(Eigen functions and eigen values not needed).

Textbook

Chapter Three &Five.Concepts of Modern Physics-Arthur Beiser.

Module III –Free electron theory of metals and Band theory of solids (10 hours)

Free electron theory in one dimension (qualitative study only)-fermi energy and fermilevel, Band theory -Bloch theorem (proof not required), Metals, insulators and semiconductors according to energy band picture.

Textbook

Chapter Five, Six. Solid State Physics-R.K Puri & V.K.Babbar.

Module IV-Semiconductors (12 hours)

Semiconductors –intrinsic and extrinsic types-doping. Drift velocity, mobility and conductivity of intrinsic semiconductors, Law of mass action and intrinsic carrier concentration (only essential formula required), Hall effect-hall coefficient.

Textbooks

Chapter Seven.Solid State Physics-R.K Puri & V.K.Babbar.

Chapter Six.Elementary Solid State Physics-Principles and Applications-Ali Omar, Pearson Education.

Module V – Magnetism in solids and Super conductivity (20 hours)

Magnetic terminology–Types of magnetism (derivations not needed)-dia, para and ferromagnetism –Weiss Theory of ferromagnetism-Concept Domain and Hysterisis, antiferromagnetism, ferrimagnetism.

Superconductivity, Electrical resistivity- zero resistance, Meissner effect, Critical field and critical temperature, Type I and Type II Superconductors, Applications of superconductivity (basic information only).

Textbook

Chapter Eight and Ten.Solid State Physics-R.K Puri&V.K.Babbar.

Books for study

1. Concepts of Modern Physics -Arthur Beiser, 6th edn., Tata McGraw Hill Publishing Company Ltd.
2. Solid State Physics-R.K Puri & V.KBabbar,S.Chand& Company Ltd.
3. Elementary Solid State Physics-Principles and Applications-Ali Omar, Pearson Education.

Books suggested for further reading

1. Quantum Mechanics-G Aruldhas, PHI Learning.
2. Solid State Physics-S.O Pillai, 6th revised edition. New Age International Pvt. Ltd.
3. Introduction to Solid State Physics - Charles Kittel, 8th edition, Wiley.

4. Introduction to Quantum Mechanics - Griffiths, 2nd edition. Pearson Education.
5. Solid State Physics-Structures and Properties of materials, M.A Wahab, 3rdedition, Narosa Publishing House.
6. Solid State Physics- C.L. Arora, S Chand & Company Ltd.
7. Solid State Physics-P.K. Palanisamy, Scitech Publications.
8. Solid State Physics- Blakemore, J.S. 2nd edition. Cambridge.
9. Solid State Physics - Gupta & Kumar, K.Nath& Co., Educational Publishers,
10. Fundamentals of Solid State Physics –Saxena, Gupta & Saxena, Pragati Prakashan

12. VOCATIONAL COURSES - MODEL II- APPLIED ELECTRONICS

Semester-I

Vocational Course I **Credit-2 (36 hours)**

AE1VOT01: PRINCIPLES OF ELECTRONIC COMPONENTS

Scope: This course is expected to give a familiarization of various electronic components.

Prerequisites: Basic Physics and Mathematics

Module I (12 hours)

Resistors: (6Hours)

Basic Ideas – Resistor Types – Wire wound Resistors – Carbon composition Resistors – Carbon Film Resistors – Metal Film Resistors – Power Rating – Value- tolerance – Variable Resistors – Potentiometers and Rheostat – Fusible resistor – Resistor Colour code –Resistors under 10 Ohm – Resistor troubles – Checking Resistors with an Ohmmeter –Measurement of resistance-Wheststone bridge.

Inductors: (6Hours)

Basic Ideas – Comparison of different cores – Inductance of an Inductor – Mutual Inductance Coefficient of Coupling – Variable Inductors – Series and Parallel combination of inductors – Energy stored – troubles in coils – Reactance – Impedance – Q factor – Power factor and wattless current - Measurement of Inductance-Hay's and Maxwell's bridge.

Basic Electronics – Solid State, B.L. Theraja-S Chand (2005)

Electronic Components, D.V.Prasad- Radiant Publishing House, Hyderabad.

Module II (12 hours)

Capacitance (8Hours)

Basic ideas – Capacitor connected to the battery – Capacitance – Factors controlling capacitance – Types of Capacitors – Fixed Capacitors:- Paper, Mica, Ceramic, Electrolytic – Variable Capacitors:- Gang, Trimmer, Padder - Voltage ratings of Capacitors – Stray circuit capacitance – Leakage Resistance – Series and Parallel combination Capacitors – Energy stored – Troubles in Capacitors – Checking Capacitors with Ohmmeter – Charging of a Capacitor – Capacitor connected across and AC source – Capacitive Reactance – Q factor –Power factor – Measurement of Capacitance-Schering bridge.

Transformers (4Hours)

Principle, Symbols – Mains and isolation transformers – Auto, Audio, IF, RF and Power transformers – Impedance matching – Losses in transformers – Equivalent circuit – Frequency response – Common fault in transformers.

Electronic Instruments and Systems, R.G. Gupta – TMH (2001) Basic Electronics – Solid State, B.L. Theraja-S Chand (2005)

Electronic Components, D. V. Prasad- Radiant Publishing House, Hyderabad.

Module III (12 hours)

Switches and Relays:(9Hours)

Basic ideas: switching actions, momentary contact actions, maintained contact actions – Types of switches: SPST, SPDT, DPST, DPDT, Toggle, rotary-Fuses: General idea, fuse rating – Circuit breaker-Relays: General information, Symbol-Types of relays: electromagnetic, reed relay – Specifications – Application areas.

A text Book of Applied Electronics, R.S. Sedha – S. Chand (2005)

Electronic Components and materials, Madhuri A. Joshi – Wheeler Publishing (1996)

Display Devices: (3 Hours)

LED, LCD, Segmental Displays using LEDs, LCDs.

Electronic Instrumentation (2 Ed.) H.S. Kalsi, TMH (2 Edn)

Semester-I

Vocational Course:II Credit-2 (36 hours)

AE1VOT02: ELECTRONIC APPLICATIONS

Scope: This course is expected to provide knowledge of various electronic circuits and its application.

Pre-requisites: Basic Electronics, Physics and Mathematics

Module I

Measuring Instruments (6 Hours.)

PMMC Multimeter – Digital Multimeter– Cathode Ray Oscilloscope (CRO):- Principle – Cathode Ray Tube – Deflection of the Beam – Blanking or Flyback or Retrace-Deflection Sensitivity- Single Trace Oscilloscope – Recurrent Sweep.

Electronic Instruments and Systems, R.G. Gupta – TMH (2001)

Tuning Circuits and Filters: (6Hours)

Resonance in series and parallel LCR circuits – Operating characteristic of a tuning circuit – Q value – Bandwidth – Tuning circuit in radio receivers – Double tuned transformers – direct and indirect coupled circuits – coefficient of coupling – filters: low pass filter-high pass filter

– band pass filter-band stop filter.

Basic Electronics – Solid State, B.L. Theraja-S Chand (2005)

Module II

Time base Circuits: (6Hours)

General features of a time base signal – Types of time base circuits – Methods of Generating a time base Waveform – Exponential Sweep circuit – Sweep Circuit Using Transistor Switch– A Transistor Constant Current Sweep – Miller Sweep Circuit – Bootstrap Sweep Circuit –Current Time Base Generator.

A text Book of Applied Electronics, R.S. Sedha – S. Chand (2005)

Transducers: (6Hours)

General information-LDR-Thermistor –Thermocouple –Photodiode –Phototransistor – LVDT-Piezoelectric transducer, Microphone-moving coil.

Basic Electronics – Solid State, B.L. Theraja-S Chand (2005) Electronic Instrumentation (2 Ed.) H.S. Kalsi, TMH (2006).

Module III

Optical Recording: (4Hours).

Compact Disc – Optical recording of disc -CD playback process – Advantages and disadvantages of compact discs.

Audio and Video Systems, R.G. Gupta – TMH (2002)

Printed Circuit Board and Soldering: (8Hours)

General Information-Types of PCBs-Steps involved in development of PCB using FeCl3 solution- Preparation of layout of simple circuits, transferring the lay out to the board and etching, Advantages of PCB. Soldering and Desoldering Techniques- Solder joint, Dry solder joint, Cold solder joint, Good and bad solder joints, Soldering material, Soldering tools, Soldering iron, Ultrasonic soldering, Advantages of ultrasonic soldering, Tools for desoldering, Desoldering techniques, Soldering techniques.

A text of Applied Electronics, R.S. Sedha – S.Chand (2005)

Electronic Instrumentation and Systems, R.G.Gupta, Tata McGraw-Hill (2004), Chapter-4.

Electronic Components and materials, Madhuri A. Joshi – Wheeler publishing (1996)

Semester-II

Vocational Course:III **Credit-2 (36 hours)**

AE2VOT03: BASICS OF POWER ELECTRONICS

Scope: This course is expected to provide knowledge of various Power Electronic components and its application.

Prerequisites: Basic Electronics, Physics and Mathematics

Module I

Field-Effect Transistors: 12 hours.

Introduction– Types of Field-Effect Transistor. Junction Field-Effect Transistor – Formation of Depletion Region in JFET – Operation of JFET – Characteristics of JFET – Drain Characteristics – Effect of Gate-to-Source Voltage on Drain Characteristics – Transfer Characteristics – Specifications Sheet of JFET – JFET Parameters – Mathematical Expression for Transconductance – Comparison between Junction Field Effect Transistors and Bipolar Junction Transistor

A Text book of Applied Electronics, R.S. Sedha – S. Chand (2005).

Basic Electronics – Solid State, B.L. Thereja-S Chand (2005)

Electronic Devices and Circuits, J.B.Gupta-S.K.Kataria & Sons Module II

MOSFET: 12Hours.

Types of MOSFET – Depletion-Type MOSFET – Working of a Depletion-Type MOSFET – Drain Characteristics of Depletion-Type MOSFET – Transfer Symbol for Depletion

Type MOSFET – Circuit Symbol for Depletion-Type MOSFET – Enhancement-Type MOSFET – Drain characteristics for enhancement type MOSFET - Transfer Characteristics of Enhancement-Type MOSFET – Circuit Symbol for Enhancement type MOSFET – The MOSFET as a Resistor – Advantages of N-Channel MOSFET's Over P-Channel – Complementary MOSFETs (CMOS), Handling Precautions for MOSFET's.

A Text Book of Applied Electronics, R.S. Sedha – S. Chand (2005).

Basic Electronics – Solid State, B.L. Theraja-S Chand (2005)

Electronic Devices and Circuits, J.B.Gupta-S.K.Kataria & Sons

Module III

FET Amplifiers: 12Hours.

Introduction-Biasing the FET- Biasing the JFET-Gate Bias-Self Bias-Setting a Q-Point - Setting a Q-Point Using Load Line – Biasing Against Device Parameter Variation – Voltage Divider Bias – Source Bias – Current Source Bias – Biasing the Enhancement Type MOSFET 's – Biasing the Depletion Type MOSFET 's -The Field –Effect Transistor amplifier-Common source Amplifier-Analysis of Common Source Amplifier-Effect of AC load on amplifier parameters-Effect of external source resistance on Voltage gain, Common Drain Amplifier- Analysis of Common Drain Amplifier-Common Gate Amplifier- Analysis of Common Gate Amplifier

A Text book of Applied Electronics, R.S. Sedha – S. Chand (2005)

Electronic Devices and Circuits, J.B.Gupta-S.K.Kataria & Sons

Semester-II

Vocational Course:IV **Credit-2 (36 hours)**

AE2VOT04: POWER ELECTRONICS

Scope: This course is expected to provide a knowledge of various Power electronic circuits and its application.

Prerequisites: Basic Electronics, Physics and Mathematics

Module I

Thyristors, SCR, Diac, Triac: (14 hours.)

Basic ideas and Types of Thyristors Basic construction of Silicon Controlled Rectifier – SCR biasing – SCR operation – SCR equivalent Circuit- Two transistor model of SCR –

Trigger Current and Trigger voltage- Turning ON & Turning OFF an SCR– V-I characteristics – Forward characteristic – Reverse characteristic – Thyristor Specifications and ratings – Applications. Basic construction of Diac:- V-I characteristic- Applications. Basic construction of Triac:- Operation – V-I characteristic – Applications – Difference between SCR and Triac.

Module II

Uni Junction Transistors, Silicon Controlled Switch: (10 hours.)

Unijunction Transistors (UJT) : Basic construction-Equivalent circuit, Symbol, Intrinsic Standoff ratio- UJT operation. V-I characteristic –UJT Relaxation Oscillator- Applications of UJT. Silicon Controlled Switch(SCS)-SCS operation, V-I characteristics, SCS application. Silicon Unilateral Switch (SUS)- Symbol, Operation, V-I characteristics, Application. Silicon Bilateral Switch (SBS) – Symbol, Operation, V-I characteristics, Application. Silicon Asymmetrical Switch (SAS)- Symbol, Operation, V-I characteristics, Application.

Module III

Controlled Rectifiers: 12 Hours.

Introduction-SCR – Power control using SCR – SCR half wave rectifier – Average values of load voltage and current - 90°Variable Half Wave Rectifier - 180º Variable Half Wave Rectifier – SCR Full Wave Rectifier – UJT Triggered SCR phase control – Triac power control – Diac-Triac Phase Control Circuit – General ideas of Inverters -Single phase inverter– Push-pull inverter.

A Text book of Applied Electronics, R.S. Sedha – S. Chand (2005)

Power Electronics, B.R.Gupta and V.Singhal- S.K. Kataria & Sons

Power Electronics, Dr.P.S.Bimbhra, Khanna Publishers