KANNUR UNIVERSITY

BOARD OF STUDIES -PHYSICS (UG)

SYLLABUS FOR PHYSICS CORE, COMPLEMENTARY ELECTIVE & GENERIC ELECTIVE COURSES OF BSc PROGRAMME

CHOICE BASED CREDIT AND SEMESTER SYSTEM
(OBE – Outcome Based Education – system)

(2019 ADMISSION ONWARDS-)

KANNUR UNIVERSITY

VISION AND MISSION STATEMENTS

Vision: To establish a teaching, residential and affiliating University and to provide equitable and just access to quality higher education involving the generation, dissemination and a critical application of knowledge with special focus on the development of higher education in Kasargode and Kannur Revenue Districts and the Manandavady Taluk of Wayanad Revenue District.

Mission:

- ➢ To produce and disseminate new knowledge and to find novel avenues for application of such knowledge.
- ➢ To adopt critical pedagogic practices which uphold scientific temper, the uncompromised spirit of enquiry and the right to dissent.
- ➢ To uphold democratic, multicultural, secular, environmental and gender sensitive values as the foundational principles of higher educationand to cater to the modern notions of equity, social justice and merit in all educational endeavors.
- ➢ To affiliate colleges and other institutions of higher learning and to monitor academic, ethical, administrative and infrastructural standards in such institutions.
- ➢ To build stronger community networks based on the values and principles of higher education and to ensure the region's intellectual integration with national vision and international standards.
- ➢ To associate with the local self-governing bodies and other statutory as well as non-governmental organizations for continuing education and also for building public awareness on important social, cultural and other policy issues.

KANNUR UNIVERSITY
PROGRAMME OUTCOMES (PO)

PO 1.Critical Thinking:

1.1. Acquire the ability to apply the basic tenets of logic and science to thoughts, actions and interventions.

1.2. Develop the ability to chart out a progressive direction for actions and interventions by learning to recognize the presence of hegemonic ideology within certain dominant notions.

1.3 Develop self-critical abilities and the ability to view positions, problems and social issues from plural perspectives.

PO 2.Effective Citizenship:

2.1. Learn to participate in nation building by adhering to the principles of sovereignty of the nation, socialism, secularism, democracy and the values that guide a republic.

2.2. Develop and practice gender sensitive attitudes, environmental awareness, empathetic social awareness about various kinds of marginalisation and the ability to understand and resist various kinds of discriminations.

2.3. Internalise certain highlights of the nation's and region's history. Especially of the freedom movement, the renaissance within native societies and the project of modernisation of the post-colonial society.

PO 3.Effective Communication:

3.1. Acquire the ability to speak, write, read and listen clearly in person and through electronic media in both English and in one Modern Indian Language

3.2. Learn to articulate, analyse, synthesise, and evaluate ideas and situations in a well-informed manner.

3.3. Generate hypotheses and articulate assent or dissent by employing both reason and creative thinking.

PO 4.Interdisciplinarity:

4.1. Perceive knowledge as an organic, comprehensive, interrelated and integrated faculty of the human mind.

4.2. Understand the issues of environmental contexts and sustainable development as a basic interdisciplinary concern of all disciplines.

4.3. Develop aesthetic, social, humanistic and artistic sensibilities for problem solving and evolving a comprehensive perspective.

PREFACE

The Board of Studies in Physics (UG) strives to offer students with a solid scientific and technical foundation and to promote them to build up vision in tackling problems and seeking solutions through the reformed outcome based curriculum and syllabus. This curriculum and syllabus clearly states the graduate attributes/outcomes and is developed after numerous workshops and discussions with different stakeholders.

The B.Sc. Physics degree course will open up exciting higher studies/employment opportunities for students. The course offers essential knowledge in theoretical Physics as well as practical knowledge to the students to apply it in real-life state of affairs. B.Sc. Physics aspirant needs to have basic knowledge in mathematical tools and techniques to pursue various courses in this programme.

The teachers should place much greater emphasis on supporting curricular activities aimed for achieving the desired attributes and programme outcomes, even if these are not part of the end semester examinations. Rote learning should be discouraged. The act of seeking new information and creation of new knowledge should be encouraged.

Appropriate three-day induction programmes/bridge courses can be offered to the first year B.Sc. Physics students to cope with the UG programme in Physics. The concerned Department/Institution has a flexibility to frame/adopt the bridge courses by adjusting the teaching hours accordingly.

The Board of Studies in Physics (UG) considered the introduction of outcome based curriculum and syllabus in affiliated colleges for the UG programme in Physics and resolved to implement the same from 2019 admission onwards.

Sheela M Joseph
Chairperson
Board of Studies,Physics (UG)
Kannur University

Kannur University
Programme Specific Outcome of BSc Physics Programme

PSO1: Understand and apply the principles of Classical mechanics, Quantum mechanics, Thermodynamics, Nuclear physics and Electrodynamics

PSO 2: Understand and apply the principles of Solid state physics, Optics, Photonics and Spectroscopy

PSO 3: Understand the principles of Electronics, Design and test electronic circuits

PSO 4: Understand and apply the principles of Mathematical Physics and Computational Physics and do Error analysis in measurements

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KANNUR UNIVERSITY BSc PHYSICS PROGRAMME

WORK AND CREDIT DISTRIBUTION STATEMENT

(BSc:Common English: 22, Additional Common: 16, Core: 56,

First complementary Elective: 12,Second complementary Elective:12, Generic Elective: 2)

Semester	Course Title*	Credits	Hours per week	Total Credits	Total Hours
I	Common Course(English)I	4	5		
	Common Course(English)II	3	4		
	Common Course (Addl Lang) VII	4	4		
	Core Course(Theory 1B01PHY)	2	2	18	25
	Core Course(Practical 4B05PHY*)	-	2		
	First Complementary Elective Theory Maths I	3	4		
	Second Complementary Elective Theory I	2	2		
	Second Complementary Elective Practical I *	-	2		
II	Common Course(English)III	4	5		
	Common Course(English)IV	3	4		
	Common Course (Addl Lang) VIII	4	4		
	Core Course(Theory 2B02PHY)	2	2	18	25
	Core Course(Practical 4B05PHY*)	-	2		
	First Complementary Elective Theory Maths II	3	4		
	Second Complementary Elective Theory II	2	2		
	Second Complementary Elective Practical I *	-	2		
III	Common Course(English)V	4	5		
	Common Course (Addl Lang) IX	4	5		
	Core Course(Theory 3B03PHY)	3	3	16	25
	Core Course(Practical 4B05PHY*)	-	2		
	First Complementary Elective Theory Maths III	3	5		
	Second Complementary Elective Theory III	2	3		
	Second Complementary Elective Practical I *	-	2		
IV	Common Course(English)VI	4	5		
	Common Course (Addl Lang) X	4	5		
	Core Course(Theory 4B04PHY)	3	3		
	Core Course(Practical 4B05PHY)	4	2	24	25
	First Complementary Elective Theory Maths IV	3	5		
	Second Complementary Elective Theory IV	2	3		
	Second Complementary Elective Practical I	4	2		

V	Generic Elective Course!!	2	2	17	25
	Core Course (Theory-5B06PHY)	4	4		
	Core Course (Theory-5B07PHY)	4	4		
	Core Course (Theory-5B08PHY)	4	4		
	Core Course (Theory-5B09PHY)	3	3		
	Core Course (Practical II-6B15PHY**)	-	4		
	Core Course (Practical III 6B16PHY**)	-	4		
VI	Core Course (Theory-6B10PHY)	4	4	27	25
	Core Course (Theory-6B11PHY)	4	4		
	Core Course (Theory-6B12PHY)	4	4		
	Core Course (Theory-6B13PHY)	3	3		
	Discipline Specific elective 6B14PHY)	2	2		
	Core Course (Practical II-6B15PHY)	4	4		
	Core Course (Practical III 6B16PHY)	4	4		
	Project&Study Tour*** 6B17PHY	2	-		
Total				120	150

* External examination will be conducted at the end of Fourth Semester
** External examination will be conducted at the end of Sixth Semester
*** Study tour report (Industrial visit/ Scientific Institution visit) should be submitted along with the project report
!!Generic elective courses offered by Physics is shown in PART C

First Complementary Elective (Compulsory): Mathematics

Second Complementary Elective: Chemistry/ Electronics/ Computer Science

PART A:
PHYSICS CORE COURSES
WORK AND CREDIT DISTRIBUTION

(2019 ADMISSION ONWARDS)

Course code	Course title	Sem	Hours per week	Credit	Exam hours	Marks		
						CE	ESE	Total
1B01PHY	MECHANICS I	I	2	2	3	10	40	50
2B02PHY	MATHEMATICAL PHYSICS AND ERROR ANALYSIS	II	2	2	3	10	40	50
3B03PHY	MECHANICS II	III	3	3	3	10	40	50
4B04PHY	ELECTRONICS I	IV	3	3	3	10	40	50
4B05PHY	GENERAL PHYSICS PRACTICAL I*	IV	2	4	3	10	40	50
5B06PHY	QUANTUM MECHANICS	V	4	4	3	10	40	50
5B07PHY	ELECTROSTATICS AND MAGNETOSTATICS	V	4	4	3	10	40	50
5B08PHY	THERMODYNAMICS AND STATISTICAL MECHANICS	V	4	4	3	10	40	50
5B09PHY	ELECTRONICS II	V	3	3	3	10	40	50
6B10PHY	SOLID STATE PHYSICS AND SPECTROSCOPY	VI	4	4	3	10	40	50
6B11PHY	OPTICS AND PHOTONICS	VI	4	4	3	10	40	50
6B12PHY	NUCLEAR, PARTICLE & ASTROPHYSICS	VI	4	4	3	10	40	50
6B13PHY	ELECTRODYNAMICS AND CIRCUIT THEORY	VI	3	3	3	10	40	50
6B14PHY	DISCIPLINE SPECIFIC ELECTIVE !	VI	2	2	3	10	40	50
6B15PHY	GENERAL PHYSICS PRACTICAL II**	VI	4	4	3	10	40	50
6B16PHY	ELECTRONICS PRACTICAL III**	VI	4	4	3	10	40	50
6B17PHY	PROJECT*** &STUDY TOUR	VI	-	2	-	5	20	25

*External examination will be conducted at the end of Fourth Semester
** External examination will be conducted at the end of Sixth Semester
***External examination will be conducted at the end of Sixth Semester.

Study tour report (Industrial visit/ Scientific Institution visit) should be submitted along with the project report.

!Options available are listed in table I

Table I

COURSE CODE	COURSE TITLE
6B14 PHY(1)	PYTHON PROGRAMMING
6B14 PHY(2)	NANOSCIENCE
6B14 PHY(3)	MATERIAL SCIENCE
6B14 PHY(4)	COSMOLOGY
6B14 PHY(5)	PLASMA PHYSICS

EVALUATION

ASSESSMENT	WEIGHTAGE
EXTERNAL	80%
INTERNAL	20%

CONTINUOUS INTERNAL ASSESSMENT-THEORY

COMPONENT	WEIGHTAGE	REMARKS
COMPONENT 1 Test paper	60%	Best of two
COMPONENT 2 Open book problem solving/Seminar/Viva	40%	One

CONTINUOUS INTERNAL ASSESSMENT- PRACTICAL

COMPONENT*	WEIGHTAGE**	REMARKS
COMPONENT 1 Lab Skill	25%	
COMPONENT 2 Punctuality	25%	
COMPONENT 3 Record	25%	A logbook of practicals should be maintained which must include theory,observation,tabulation,calculation ,graph ,result etc
COMPONENT 4 Examination	25%	A model exam should be conducted before external examination & considered for internals

CONTINUOUS INTERNAL ASSESSMENT- PROJECT

COMPONENT*	WEIGHTAGE**	REMARKS
COMPONENT 1 Topic	20%	Relevance of topic
COMPONENT 2 Punctuality	20%	
COMPONENT 3 Scheme & report	20%	
COMPONENT 4 Viva-voce	20%	
COMPONENT 5 Study tour report	20%	Industrial visit/ Scientific Institution visit

CORE COURSE I: MECHANICS I

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
I	1B01PHY	2	2	3

COURSE OUTCOME

CO 1: Understand Newton's laws of motion, the concepts of linear and angular momentum and torque
CO2: Determine the Centre mass of a given configuration
CO3: Understand the principle of work, energy and power
CO4: Determine angular momentum of a body about any given axis

Unit I – Newton's Laws-The foundations of Classical Mechanics 12Hrs

Newton's First Law, Second Law and Third Law – Astronauts in space-Standards and units – Some applications of Newton's laws-Astronauts tug of war-freight train-constraints-block on string – The everyday forces of physics-turtle in an elevator-block and string-dangling rope-block and wedge with friction-spring and block-spring gun-Illustration of initial conditions – Dynamics of a system of particles – The Bola – Centre of mass – Drum major's baton – Centre of mass motion– Conservation of momentum – Spring Gun recoil

[**Book of Study**, **sections 2.1 – 2.5, 3.1 – 3.3**]

Unit II – Work and Energy 10 Hrs

Integrating the equation of motion in one dimension – Mass thrown upward in a uniform gravitational field; Solving the equation of simple harmonic motion – Work-energy theorem in one dimension – Vertical motion in an inverse square filed – Integrating the equation of motion in several dimensions – Work-energy theorem –; Escape velocity – Applying the work-energy theorem – Work done by a uniform force; Work done by a central force;Potential energy – Potential energy of a uniform force field; Potential energy of an inverse square force – What potential energy tells us about force – Stability – Energy diagrams – Small oscillations in a bound system – Molecular vibrations – Nonconservative forces – General law of conservation of energy – Power -conservation laws & particle collisions[**Book of Study**, **sections 4.1 – 4.14**].

Unit III – Angular Momentum 10Hrs

Angular momentum of a particle – Angular momentum of a sliding block; – Torque – Central force motion and the law of equal areas – Torque ona sliding block; Torque due to gravity – Angular momentum and fixed axis rotation – Moments of inertia of some simple objects – The parallel axis theorem– Dynamics of pure rotation about an axis – Atwood's machine with a massive pulley – The simple pendulum – The physical pendulum – Motion involving both translation and rotation –Angular momentum of a rolling wheel – Drum rolling down a plane – Work-energy theorem fora rigid body –

Drum rolling down a plane : energy method – The vector nature of angular velocity and angular momentum – Rotation through finite angles – Rotation in the xy-plane –Vector nature of angular velocity – Conservation of angular momentum

[**Book of Study**, **sections6.1 – 6.7, 7.1 -7.2, 7.5]**

Book of Study:

1. An Introduction to Mechanics, 1st Edn. – Special Edition 2009 .-Daniel Kleppner and Robert J. Kolenkow – McGraw-Hill

Books for Reference :

1. Berkeley Physics Course : Vol.1 : Mechanics, 2nd Edn. – Kittel*et al.* – McGraw-Hill
2. Fundamentals of Physics by Resnick and Halliday

MARKS INCLUDING CHOICE

Unit	**Marks**
I	22
II	18
III	20

PATTERN OF QUESTIONS

Part A	**Short answer**	**(6 questions x Mark 1 = 6)**
	Answer all questions	**(6 questions x Mark 1 = 6)**
Part B	**Short Essay**	**(8 questions x Marks 2 each =16)**
	Answer any 6 questions	**(6questions x Marks 2 each=12)**
Part C	**Problems**	**(6 questions x Marks 3 each =18)**
	Answer any 4 questions	**(4 questions x Marks 3 each=12)**
Part D	**Long Essay**	**(4 questions x Marks 5 each =20)**
	Answer any 2 questions	**(2 questions x Marks 5 each=10)**
• **Total marks including choice -60** • **Maximum marks of the course-40**		

CORE COURSE II:MATHEMATICALPHYSICS AND ERROR ANALYSIS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
II	2B02PHY	2	2	3

COURSE OUTCOME

CO 1: Understand vector operations and vector algebra
CO2: Determine derivative and integral of various functions
CO3: State fundamental theorems of calculus
CO4: Compare differential operators in various coordinate systems
CO5: Understand the basic concepts of modeling
CO6: Solve first order and second order ODEs
CO7: Estimate uncertainties in measured values

Unit I– Vector Calculus **10 Hrs**

Vector Algebra: Vector operations-Vector algebra: Component form–Triple products–Position, Displacement and Separation vectors

Differential Calculus:"Ordinary "derivatives–Gradient–The Del operator–Divergence–Curl–Product rules– Second derivatives

Integral Calculus: Line integral, surface integral and volume integral–Fundamental theorem ofcalculus–Fundamental theorem for Gradients–Fundamental theorem for divergences: Gauss'sDivergenceTheorem(no proof needed)–Fundamental theorem for curls:Stoke's theorem(no proof needed)—Divergence-less vector fields–Curl-less vector fields– Potentials. **[Book I sections1.1,1.2,1.3,1.6]**

UnitII Curvilinear co-ordinates **5Hrs**

Spherical polar coordinates–Cylindrical coordinates–Their relationship to Cartesian coordinates–Expressing differential displacement vector, differential area vectors, differential volume element,gradientoperator,divergence operator and curl operator in spherical polar and cylindrical coordinates. **[Book I section 1.4]**

Unit III– Differential Equation **9Hrs**

Basic concepts-modeling-geometric meaning-direction field –Euler's method-separable ODE-modeling-exact ODE-integrating factors –linear ODEs –Bernoulli equation-

Population dynamics

Homogenous linear ODEs of second order-homogenous linear ODEs with constant coefficients-modeling of free oscillations of mass spring system

[BookII sections 1.1-1.5,2.1-2.2,2.4]

Unit IV– Error Analysis **8 Hrs**.

Propagation of Uncertainties-uncertainities in direct measurement- Square root rule for counting experiments, Sums and differences, products and quotients, special cases – measured quantity times exact number, power, arbitrary function of one variable, Example-simple pendulum, General formula for error propagation.-Random and systematic errors, mean and standard deviation, standard deviation as uncertainty, standard deviation of the mean, examples, systematic errors

[Book III sections 3.1-3.4, 3.8, 3.9, 3.11, 4.1- 4.6]

Book of Study :

1. Electrodynamics – DavidGriffiths
2. AdvancedEngineering Mathematics, 10th Edn.– ErwinKreyszig– John Wliey&sons
3. AnIntroduction to Error Analysis, J R Taylor, (University Science Books).

Books for Reference :

1. AfirstcourseinDifferentialequationswithapplications–A.H.Siddiqui,P.Manchanda– Macmillan IndiaLtd
2. Mathematical Methods for PhysicsandEngineering, 3rdEdn.–K. F.Riley, M. P.Hobson, S. J.Bence

MARKS INCLUDING CHOICE

Unit	Marks
I	18
II	12
III	18
IV	12

PATTERN OF QUESTIONS

Part A	**Short answer**	(6 questions x Mark 1 = 6)
	Answer all questions	(6 questions x Mark 1 = 6)
Part B	**Short Essay**	(8 questions x Marks 2 each =16)
	Answer any 6 questions	(6questions x Marks 2 each=12)
Part C	**Problems**	(6 questions x Marks 3 each =18)
	Answer any 4 questions	(4 questions x Marks 3 each=12)
Part D	**Long Essay**	(4 questions x Marks 5 each =20)
	Answer any 2 questions	(2 questions x Marks 5 each=10)
• **Total marks including choice -60** • **Maximum marks of the course-40**		

CORE COURSE III: MECHANICS II

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
III	3B03PHY	3	3	3

COURSE OUTCOME

CO1: Understand the concept of Galilean transformations and uniformly accelerating systems

CO2: Determine the trajectory of a body in central force problem using Newton's laws

CO3: Understand Kepler's laws of planetary motion

CO4: Formulate the mathematical equation of waves

CO5: Understand the concept and consequences of special theory of relativity

Unit I – Noninertial Systems and Fictitious Forces 7Hrs

Galilean transformations – Uniformly accelerating systems – The apparent force of gravity –Pendulum in an accelerating car – The principle of equivalence –Physics in a rotating coordinate system – Time derivatives and rotating coordinates –Acceleration relative to rotating coordinates – The apparent force in a rotating coordinate system– The Coriolis force – Deflection of a falling mass – Motion on the rotating earth **[Book1 sections 8.1 – 8.5]**

Unit II – Central Force Motion 9 Hrs

Central force motion as a one-body problem – General properties of central force motion –Motion is confined to a plane – Energy and angular momentum are constants of the motion –The law of equal areas – Finding the motion in real problems – The energy equation and energy diagrams – Noninteracting particles – Planetary motion – Hyperbolic orbits – Satellite orbit –Kepler's laws – The law of periods – Properties of the ellipse **[Book1 sections 9.1 – 9.7]**

Unit III – Harmonic Oscillator 8 Hrs

Introduction and review – Standard form of the solution – Nomenclature – Initial conditions and the frictionless harmonic oscillator – Energy considerations – Time average values – Average energy – Damped harmonic oscillator – Energy and Q-factor – –Graphical analysis of a damped oscillator – Solution of the equation of motion for

the damped oscillator – Forced harmonic oscillator – Undamped forced oscillator – Resonance **[Book 1 sections 10.1 – 10.3]**

Unit IV-Waves **6Hrs**

Waves-Progressive wave-General equation of wave motion- plane progressive harmonic wave-Energy density-Transverse waves in stretched strings-longitudinal waves in rodslongitudinal waves in gases-Fouriers theorem-mathematical expression-conditions **(Book 2 11.1-11.9,11.12)**

Unit V–Special Theory of Relativity **18 Hrs**

Classical relativity-,Michelson –Morley experiment,Einstein's postulates-consequences of Einstein's postulates-relativity of time-relativity of length-relativistic velocity addition-relativistic Doppler effect, Lorentz transformation-length contraction-velocity transformation-simultaneity and clock synchronization-twin paradox-space time diagram-relativistic dynamics-relativistic kinetic energy-relativistic total energy and kinetic energy–conservation laws in relativistic decay and collision,experimental tests of special relativity-universality of speed of light-time dialation- Doppler effect-relativistic momentum and energy-twin paradox

(Book 3 Sections 2.1-2.9)

Books of Study :

1. An Introduction to Mechanics, 1st Edn. – Daniel Kleppner and Robert J. Kolenkow – McGraw- Hill
2. Mechanics by J C Upadhyaya 5th edn.
3. Modern Physics by Kenneth S Krane, 2nd edn.

Books for Reference:

1. Berkeley Physics Course : Vol.1 : Mechanics, 2nd Edn. – Kittel *et al.* – McGraw-Hill

MARKS INCLUDING CHOICE

Unit	Marks
I	8
II	10
III	10
IV	8
V	24

PATTERN OF QUESTIONS

Part A	**Short answer**	(6 questions x Mark 1 = 6)
	Answer all questions	(6 questions x Mark 1 = 6)
Part B	**Short Essay**	(8 questions x Marks 2 each =16)
	Answer any 6 questions	(6questions x Marks 2 each=12)
Part C	**Problem**s	(6 questions x Marks 3 each =18)
	Answer any 4 questions	(4 questions x Marks 3 each=12)
Part D	**Long Essay**	(4 questions x Marks 5 each =20)
	Answer any 2 questions	(2 questions x Marks 5 each=10)
• **Total marks including choice -60** • **Maximum marks of the course-40**		

CORE COURSE IV: ELECTRONICS I

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
IV	4B04PHY	3	3	3

COURSE OUTCOME

CO 1: Understand the basics of PN junction diode, Zener diode and their applications

CO2: Understand the structure, operations and characteristics of BJT and FET

CO3 :Understand the biasing methods and design of BJT and FET circuits

CO4: Understand the different number systems, conversions and binary arithmetic operations

CO5 : Understand the basic combinational logic gates

CO6 : Understand the Boolean algebra &logic simplification using Boolean algebra

Unit I : Semiconductor Diodes and their Applications 8 Hrs.

PN junction diode, Characteristics and parameters, Diode approximations, DC load line analysis, Zener diodes, Half wave rectification, Full wave rectification, Half wave rectifier power supply, Full wave rectifier power supply, Zener diode voltage regulators. **(Book 1, Sections 2.1-2.4, 2.9, 3.1-3.4, 3.7)**

Unit II: Bipolar Junction Transistors and their Biasing 12 Hrs.

BJT Operation, BJT Voltages and Currents, BJT amplification, Common Base Characteristics, Common Emitter Characteristics, Common Collector Characteristics, DC Load line and Bias point, Base bias, Collector to base bias, Voltage divider bias, Comparison of basic bias circuits, Bias circuit design, Thermal stability of bias circuits, Switching circuits. **(Book 1, Sections 4.1-4.3, 4.5-4.7, 5.1-5.5, 5.7, 5.9, 5.10)**

Unit III: Field Effect Transistors and their Biasing 10 Hrs

Junction field effect transistors, JFET characteristics, JFET Parameters, DC load line and bias point, Gate bias, Self bias and Voltage divider bias, Comparison of basic JFET bias circuits, MOSFET, Types of MOSFETs, D-MOSFET – Symbol, Circuit operation, Transfer Characteristics; E-MOSFET.

. **(Book 1, Sections 9.1-9.3, 10.1-10.5; Book 2, Sections 19.27-19.31, 19.36)**

Unit IV: Number Systems, Operations and Codes 8 Hrs.

Binary numbers, Decimal to Binary Conversion, Binary Arithmetic, 1's and 2's Complements of Binary Numbers, Signed Numbers, Arithmetic Operations with Signed

Numbers, Hexadecimal Numbers, Octal Numbers, Binary Coded Decimals, Gray code, ASCII code. **(Book 3, Sections 2.2-2.11)**

Unit V: Logic gates, Boolean Algebra and Logic Simplification 10 Hrs

The inverter, AND, OR, NAND, NOR, Exclusive- OR and Exclusive - NOR Gates, Boolean Operations and Expressions, Laws and rules of Boolean Algebra, DeMorgan's Theorems, Boolean Analysis of Logic circuits, Simplification using Boolean Algebra, Basic combinational Logic circuits, The universal property of NAND and NOR gates, Combinational logic using NAND and NOR gates.

. **(Book 3, Sections 3.1-3.6, 4.1-4.5, 5.1, 5.3, 5.4)**

Books for Study:

1.Electronic Devices and Circuits - 5th Edition, David A Bell (Oxford University Press)
2. Principles of Electronics - 11th Edition, V K Mehta & Rohit Mehta (S Chand & Co.)
3. Digital Fundamentals - 10th Edition, Thomas L. Floyd (Pearson Education)

Books for Reference:

1.Electronic Devices and circuit theory - Robert L Boylestad & Louis Nashelsky (Pearson Eduaction)
2. Electronic Principles - A P Malvino (TMH)
3. Electronic Devices and circuits -Theodore F Bogart, Jeffrey S. Beasley & Guilermo Rico (Pearson)
4.The Art of Electronics - Paul Horowitz and Winfield Hill (Cambridge University Press)
5. Digital Principles and Applications - D P Leach and A P Malvino (TMH)
6. Fundamentals of Digital Ciruits - A Anandakumar (PHI)

MARKS INCLUDING CHOICE:

Unit	Marks
I	10
II	16
III	12
IV	10
V	12

PATTERN OF QUESTIONS

Part A	**Short answer**	(6 questions x Mark 1 = 6)
	Answer all questions	(6 questions x Mark 1 = 6)
Part B	**Short Essay**	(8 questions x Marks 2 each =16)
	Answer any 6 questions	(6questions x Marks 2 each=12)
Part C	**Problems**	(6 questions x Marks 3 each =18)
	Answer any 4 questions	(4 questions x Marks 3 each=12)
Part D	**Long Essay**	(4 questions x Marks 5 each =20)
	Answer any 2 questions	(2 questions x Marks 5 each=10)
• **Total marks including choice -60** • **Maximum marks of the course-40**		

CORE COURSE V: - GENERAL PHYSICS PRACTICAL I

BASIC EXPERIMENTS IN PROPERTIES OF MATTER, OPTICS, ELECTRICITY &MAGNETISM

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
IV	4B05PHY	2	4	3

COURSE OUTCOME

CO1: Familiarize with apparatus for mechanical, electrical, magnetic and optical experiments.

CO2: Develop skill in setting up of apparatus for accurate measurement of physical quantities.

CO3: Understand multiple experimental techniques for determining physical quantities.

CO4: Develop skill in systematic way of measurements by minimizing possible errors.

CO5: Develop skill to analyze by plotting graphs using software.

CO6: Develop skill for systematic trouble shooting.

CO7: Perform error analysis for experiments.

Note: A brief theoretical background of each experiment must be given to the students before each cycle of experiments and assess it. Students have to maintain a practical log book regularly signed by the teacher in charge and should be submitted at the time of University Examination. Fair record is not required. All the 20 experiments have to be performed.

1. Flywheel- Moment of inertia
2. Torsion pendulum- Moment of inertia of a disc and rigidity modulus (using two identical masses)

3. Compound pendulum- To find ‘g’ and radius of gyration
4. Young’s modulus of the material of bar-Non-uniform bending using pin & microscope
5. Young’s modulus of the material of bar -Uniform Bending using optic lever
6. Surface Tension by capillary rise method
7. Coefficient of viscosity –Poiseuille’s formula (by measuring radius of capillary tube using mercury)
8. Rigidity modulus of a material-Static torsion
9. Spectrometer – Refractive index of the material of a prism
10. Spectrometer –Dispersive power of a prism
11. Melde’s String- Frequency of a tuning fork
12. Lee’s disc- Thermal conductivity of a bad conductor
13. Newton’s law of cooling- Specific heat of a liquid
14. Potentiometer- - resistance &resistivity
15. Potentiometer- Calibration of low range voltmeter (null Method)
16. Carey Fosters Bridge- resistance &resistivity
17. Deflection Magnetometer- Tan A , Tan B and Tan C
18. Deflection Magnetometer & Box type vibration magnetometer- m and B0
19. Searle’s Vibration magnetometer- moment and ratio of moments
20. Liquid Lens I –Refractive index of a liquid and material of the lens
    (i) using mercury
    (ii) using another liquid of known refractive index

Reference Books

1. Practical Physics by P R Sasi Kumar PHI Learning Private Limited
2. BSc Practical Physics by C L Arora ,S Chand
3. An advanced course in Practical Physics by D.Chattopadhyay& P C Rakhit New Central Book Agency(P)Ltd

MARKS DISTRIBUTION

Sections	**Marks**
I Principle with theory	10
II Performance	6
III Observation	14
IV Viva to evaluate the skill & knowledge about the experiment	4
V Calculation ,Graph etc	6

CORE COURSE VI: QUANTUM MECHANICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5B06PHY	4	4	3

COURSE OUTCOME

CO 1: Understand the limitations of classical mechanics
CO2: Explain Blackbody radiation problem, Photoelectric effect and Compton Effect using quantum theory of radiation
CO3: Understand Rutherford,Bohr atom models and concept of energy and angular momentum quantisation
CO4: Understand de-Broglie hypothesis,concept of wave nature of matter and Heisenberg uncertainty principle
CO5: Determine probability of finding a particle and expectation values of variable using its wave function
CO6: Write and solve Schrodinger equation for simple quantum mechanical systems
CO7: State and explain Pauli's exclusion principle

Unit I – Particle like Properties of Electromagnetic Radiation 12 Hrs

Review of electromagnetic waves – Photoelectric effect – Blackbody radiation – Compton effect – Other photon processes – What is a photon ?

[Book 1 Sections 3.1 to 3.6]

Unit II – Rutherford-Bohr Model of the Atom 10Hrs

Basic properties of atoms – Thomson model – Rutherford nuclear atom – Line spectra – Bohr model – Frank-Hertz experiment – Correspondence principle – Deficiencies of Bohr model **[Book 1Sections 6.1 to 6.8]**

Unit III – Wavelike Properties of Particles 10 Hrs

De Broglie hypothesis – Uncertainty relationships for classical waves – Heisenberg uncertainty relationships – Wave packets – Probability and randomness – Probability amplitude **[Book 1Sections 4.1 to 4.6]**

Unit IV – The Schrodinger Equation 14 Hrs

Justification of the Schrodinger equation – The Schrodinger recipe – Probabilities and normalization – Applications – Free particle, Particle in a box (one dimension), Particle in a box (two dimensions), Simple harmonic oscillator – Time dependence – Potential energy steps and potential energy barriers **[Book 1Sections 5.1 to 5.7]**

Unit V– Hydrogen Atom in Wave Mechanics 12Hrs

Schrodinger equation in spherical coordinates – Hydrogen atom wave functions – Radial probability densities – Angular momentum and probability densities – Intrinsic spin –Stern –Gerlachexpt– Energy levels and spectroscopic notation – Zeeman effect – Fine structure **[Book 1Sections 7.1 to 7.8]**

UnitVI-Many electron atom 6hrs

Electron spin, Pauli's Exclusion principle- many electron atom- Spin orbit coupling- total angular momentum- X-Ray spectra

[Book 2Sections 7.1,7.2,7.4,7.8,7.9,7.10]

Book of study :

1. Modern Physics, 2nd Edn. – Kenneth S. Krane – John Wiley & sons
2. Concepts of Modern Physics ,6th Edn–Arthur Beiser

Books of Reference:

1. Modern Physics, 3rd Edn. – Raymond A. Serway, Clement J. Moses, Curt A. Moyer – Cengage
2. Modern Physics, 2nd Edn – Randy Harris – Pearson
3. Modern Physics for Scientists and Engineers, 2nd Edn. – John R. Taylor, Chris D. Zafiratos, Michael A. Dubson – Prentice-Hall of India Pvt. Ltd.

MARKS INCLUDING CHOICE

Unit	Marks
I	12
II	10
III	10
IV	14
V	10
VI	4

PATTERN OF QUESTIONS

Part A	**Short answer**	(6 questions x Mark 1 = 6)
	Answer all questions	(6 questions x Mark 1 = 6)
Part B	**Short Essay**	(8 questions x Marks 2 each =16)
	Answer any 6 questions	(6questions x Marks 2 each=12)
Part C	**Problems**	(6 questions x Marks 3 each =18)
	Answer any 4 questions	(4 questions x Marks 3 each=12)
Part D	**Long Essay**	(4 questions x Marks 5 each =20)
	Answer any 2 questions	(2 questions x Marks 5 each=10)

- **Total marks including choice -60**
- **Maximum marks of the course-40**

CORE COURSE VII: ELECTROSTATICS AND MAGNETOSTATICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5B07 PHY	4	4	3

COURSE OUTCOME

Course Outcomes

CO1: Understand the concept of Electric field, electric potential, magnetic field and magnetic potentials

CO2: Use the principle of superposition and law of Gauss to calculate electric field Intensity

CO3: Determine Electric potential of charge distributions and hence specify electric field intensity

CO4: Understand the basic properties of conductors and capacitors

CO5: Calculate the magnetic fields due to currents using Biot-Savart and Ampere laws.

CO6: Compare Magnetostatics and Electrostatics.

CO7: Understand Diamagnets, Paramagnets and Ferro magnets.

Unit I- Electric field and Electric potential. 16 hrs

Coulomb's law for a group of point charges, Idea of electric field , Electric field for (i) a point charge, (ii) group of point charges,(iii)continuous charge distributions, Electric Field lines, Gauss's law - its differential form and proof using Dirac delta function, Applications of Gauss's Law : E due to (i) a Uniformly charged solid sphere ,(ii) an Infinite plane of uniform charge density, and (iii) Two infinite parallel planes with equal & opposite charge densities. The curl of E . Electric potential V due to (i) a point charge, (ii) a group of point charges, (iii)charge distribution. Relation between E and V in differential and integral form, Poisson's equation and Laplace's equation, Potential inside and outside spherical shell, Electrostatic boundary conditions.

(Book 1, Sections 2.1, 2.2, 1.5.1, 1.52, 1.53, 2.3)

Unit II: Work and Energy in Electrostatics. 6hrs

Work done to move a charge,The energy of a point charge distribution ,The energy of a continuous charge distribution ,Electrostatic energy of a (i)uniformly charged spherical shell and (ii)uniformly charged solid sphere, Comments on electrostatic energy, Capacitors: capacitance of a parallel plate capacitor , work done to charge up a capacitor. **(Book 1, Sections 2.4, 2.5.4)**

Unit III: Electrostatic Fields in Matter. 14 hrs

Induced charges,Faraday cage,Dielectrics :induced dipoles - Alignment of polar molecules,Polarization P, Bound charges, Physical interpretation of bound charges,The

field inside a dielectric. Electric displacement vector D, Gauss's law in the presence of a dielectric, A deceptive parallel between E and D, Boundary conditions, Electrical susceptibility,permittivity & dielectric constant, Relation between E,P and D. Forces on dielectrics **(Book 1, Sections 2.5.2, 4.1, 4.2, 4.3, 4.4.1, 4.4.4)**

Unit IV : Magnetostatics. 16hrs

The Lorenz force law, Cyclotron motion, Cycloid motion, Magnetic force on (i)a Line current ,(ii) Surface current & (iii)Volume current, Continuity equation,Steady currents, The Biot Savart law, Magnetic field due to (i) Infinitely long current carrying wire, (ii) circular loop carrying current, The Divergence & Curl of B, Ampere's law, Applications of Ampere's law: (i) B due to a long straight current carrying wire, (ii) Magnetic field of a very long solenoid. Comparison of magnetostatics & electrostatics,Magnetic vector potential,Magnetostatic boundary conditions, Multipole expansion of vector potential , magnetic dipole moment.

(Book 1, Sections 5.1, 5.2, 5.3)

Unit V*:* Magnetic Fields in Matter: 12hrs

Diamagnets,Paramagnets and Ferromagnets,Torques and forces on magnetic dipoles, Effect of a magnetic field on atomic orbits.Magnetization,The field of a magnetized object,Bound currents and its Physical interpretation.The magnetic field inside matter,The auxiliary field **H**, Amperes law in Magnetized material,Deceptive parallel between **B** and **H**, Magnetostatic Boundary conditions. Linear and Nonlinear Media,magnetic susceptibility and permeability.Ferromagnetism

. **(Book 1, Sections 6.1, 6.2, 6.3, 6.4)**

Book for Study:

1.Introduction to electrodynamics -David .J .Griffiths ,3rd Edn,1999,Prentice Hall of India

Books for Reference:

1.Electricity and Magnetism, J.H.Fewkes & J.Yarwood. Vol.I, 1991, Oxford Univ. Press.

. 2.Feynman Lectures Vol.2, R.P.Feynman, R.B.Leighton, M.Sands, 2008, Pearson Education

MARKS INCLUDING CHOICE

Unit	Marks
I	16
II	6
III	14
IV	14
V	10

PATTERN OF QUESTIONS

Part A	**Short answer**	(6 questions x Mark 1 = 6)
	Answer all questions	(6 questions x Mark 1 = 6)
Part B	**Short Essay**	(8 questions x Marks 2 each =16)
	Answer any 6 questions	(6questions x Marks 2 each=12)
Part C	**Problems**	(6 questions x Marks 3 each =18)
	Answer any 4 questions	(4 questions x Marks 3 each=12)
Part D	**Long Essay**	(4 questions x Marks 5 each =20)
	Answer any 2 questions	(2 questions x Marks 5 each=10)

- **Total marks including choice -60**
- **Maximum marks of the course-40**

CORE COURSE VIII: THERMODYNAMICS AND STATISTICAL MECHANICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5 B08PHY	4	4	3

COURSE OUTCOME

CO 1: Understand the concept of temperature ,the thermodynamic state and equilibrium.
CO2: Explain the first law of thermodynamics through work and heat and its Mathematical Formulation.
CO3: Understand the ideal gas equation and kinetic theory of gases
CO4: Understand the second law of thermodynamics and thermodynamic temperature scale.
CO5: Define entropy and thermodynamic potentials
CO6: Understand the basic concepts of Statistical mechanics

Unit I: **Temperature &Zeroth law of Thermodynamics** **8hrs**

Macroscopic and microscopic point of view- Macroscopic vs. microscopic point of view –scope of Thermodynamics-thermal equilibrium- zeroth law-concept of temperature-thermo meters & measurement of temperature- ideal gas temperature – Celsius temperature scale-Celsius & Fahrenheit temperature scale- thermodynamic equilibrium –equation of state-hydrostatic systems-mathematical theorems -intensive and extensive parameters

(Book 1 sections 1.1 – 1.7,1.10-1.11,1.17,2.1-2.4,2.10)

Unit II: Work, heat and first law of thermodynamics **14 hrs**

Work- Quasistatic process- work in changing volume of a hydrostatic system-PV diagram-hydrostatic work depends on path-calculation of $\int pdv$ for Quasistatic process-generalized work-composite systems-work & heat-Adiabatic work-internal energy function-mathematical formulation of first law-concept of heat – concept of path and state function -differential form of first law-heat capacity & measurements – sp heat of water: the calorie-equations for a hydrostatic system- heat reservoir- conduction-convection-radiation- Kirchoff& Stefan-Boltzmann law.

(Book 1 sections 3.1-3.6,3.12-3.13,4.1-4.11,4.13-4.16)

8 hrs

Unit III: Ideal gas

Equation of state of a gas –internal energy of a real gas-ideal gas-quasistatic adiabatic process-kinetic theory of the ideal gas. **(Book 1 sections 5.1-5.3, 5.5, 5.9)**

Unit IV: The second law of thermodynamics, Carnot cycle& Thermodynamic temperature scale 15 hrs

Conversion of work into heat and vice-versa- principle of heat engines , cyclic process-gasoline engine and its efficiency, Diesel engine and its efficiency- heat engine kelvin Planck statement of second law-refrigerator ; clausius statement of second law – equivalence of both- reversibility & irreversibility –external-internal mechanical irreversibility- external-internal thermal irreversibility-chemical irreversibility-conditions for reversibility- Carnot cycle- Carnot Refrigetor- Carnot's theorem & corollary- the thermodynamic temperature scale-Absolute zero & Carnot efficiency-equality of ideal gas & thermodynamic temperatures.

(Book 1 sections 6.1-6.3, 6.6-6.14, 7.1.7.3-7.7)

Unit V:**Entropy &Thermodynamic potentials 14 hrs**

Entropy , thermodynamic potentials & open systems Reversible part of second law-Entropy- entropy of an ideal gas - T-S diagram –entropy & reversibility - entropy & irreversibility- irreversible part of second law- heat & entropy in irreversible processes-entropy & non equilibrium states-principle of increase of entropy-entropy & disorder Thermodynamic potentials-Internal energy, Enthalpy- Helmholtz free energy, Gibbsfunction- Maxwells relations,-joule Thomson expansion-first order phase transition ;clausiusclapeyron equation- clausiusclapeyron equation& phase diagrams.

(Book 1 sections 8.1-8.2, 8.4-8.11,8.13,12.1,12.3-12.4)

Unit **VI**: **Statistical mechanics 5hrs**

Statistical distribution-MB statistics-Molecular Energies in an ideal gas-quantum statistics- Specific heat of solids **(Book 2Section 9.1-9.4)**

Books for study:

1. Heat and Thermodynamics-Mark W Zemansk,Richard H Dittman (8th Edn.)
2. .Modern Physics by Arthur Beiser

Books for Reference:

1. Basic thermodynamics by E V Guha
2. Statistical Physics by F.Reif

MARKS INCLUDING CHOICE

Unit	Marks
I	8
II	12
III	6
IV	14
V	14
VI	6

PATTERN OF QUESTIONS

Part A	**Short answer**	(6 questions x Mark 1 = 6)
	Answer all questions	(6 questions x Mark 1 = 6)
Part B	**Short Essay**	(8 questions x Marks 2 each =16)
	Answer any 6 questions	(6questions x Marks 2 each=12)
Part C	**Problems**	(6 questions x Marks 3 each =18)
	Answer any 4 questions	(4 questions x Marks 3 each=12)
Part D	**Long Essay**	(4 questions x Marks 5 each =20)
	Answer any 2 questions	(2 questions x Marks 5 each=10)

- **Total marks including choice -60**
- **Maximum marks of the course-40**

CORE COURSE IX: ELECTRONICS II

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5B09PHY	3	3	3

COURSE OUTCOME

CO 1: Understand the AC analysis of BJT circuits and CE amplifiers
CO2:Understand the feedback circuits, oscillators and power amplifiers
CO3:Understand OPAMP basics and different OPAMP circuits
CO4:Understand the standard forms Boolean Expressions, Functions of Combinational Logic and K map simplifications.

Unit I: AC analysis of BJT circuits and Small signal amplifiers 10 Hrs.
Coupling and bypass capacitors, AC load lines, transistor models, r-parameters, h-parameters, CE circuit analysis, Decibels and half power points, BJT circuit Frequency response, Single stage CE amplifier, Capacitor coupled and Direct coupled two stage CE amplifiers, Emitter follower.
(Book 1, Sections 6.1-6.4, 8.2, 8.4, 12.1, 12.3, 12.4; Book 2, Section 13.9)

Unit II: Feedback in amplifiers, Signal generators and Power amplifiers 14 Hrs.
Types of feedback, Series voltage negative feedback - advantages, Single stage emitter series current feedback circuit, Concept of positive feedback, Barkhausen criterion, Phase shift, Colpitts, Hartley, and Wien bridge Oscillators, Audio power amplifiers - Transformer coupled Class A, Class B and Class AB amplifiers, Class C tuned amplifier. **(Book 1, Sections 13.1, 13.5, 16.1-16.4, 19.1, 19.2, 19.11)**

Unit III: Operational Amplifiers and their Applications 10 Hrs
Integrated circuit operational amplifiers, Op-amp – Important Parameters, Output voltage, AC analysis, Bandwidth, Slew rate; Ideal Op-amp properties, Applications of Op-amps - Inverting amplifier, Non Inverting amplifier, Voltage follower, Summing amplifier, Difference amplifier, Integrator and Differentiator.
(Book 1, Sections 14.1, 14.7; Book 2, Sections 25.17-25.20, 25.23-25.27, 25.32, 25.34, 25.35, 25.37)

Unit IV: Standard forms of Boolean Expressions 8 Hrs.
The SOP and POS forms, Conversion of a general expression to SOP and POS forms, Converting standard SOP to POS and vice versa, Boolean Expressions and Truth Tables, Karnaugh Map (up to 4 variables), Karnaugh Map SOP minimization.
(Book 3, Sections 4.6-4.9)

Unit V: Functions of Combinational Logic 6 Hrs.

Basic Adders - Half Adder, Full Adder; Parallel Binary Adders - 4 Bit Parallel Adder, Comparators, Basic binary Decoder, 4-bit Decoder, Decimal to BCD Encoder.

(Book 3, Sections 6.1, 6.2, 6.4-6.6)

Books for Study:

1. Electronic Devices and Circuits - 5th Edition, David A Bell (Oxford University Press)
2. Principles of Electronics - 11th Edition, V K Mehta & Rohit Mehta (S Chand & Co.)
3. Digital Fundamentals - 8th Edition, Thomas L. Floyd (Pearson Education)

Books for Reference:

1. Electronic Devices and circuit theory - Robert L Boylestad & Louis Nashelsky (Pearson Eduaction)
2. Op-Amps & Linear Integrated Circuits - Ramakant A. Gayakwad (Pearson Eduaction)
3. Electronic Principles - A P Malvino (TMH)
4. The Art of Electronics - Paul Horowitz and Winfield Hill (Cambridge University Press)
5. Digital Principles and Applications - D P Leach and A P Malvino (TMH)
6. Fundamentals of Digital Ciruits - A Anandakumar (PHI)

MARKS INCLUDING CHOICE:

Unit	Marks
I	14
II	16
III	12
IV	12
V	6

PATTERN OF QUESTIONS

Part A	**Short answer**	(6 questions x Mark 1 = 6)
	Answer all questions	(6 questions x Mark 1 = 6)
Part B	**Short Essay**	(8 questions x Marks 2 each =16)
	Answer any 6 questions	(6 questions x Marks 2 each=12)
Part C	**Problems**	(6 questions x Marks 3 each =18)
	Answer any 4 questions	(4 questions x Marks 3 each=12)
Part D	**Long Essay**	(4 questions x Marks 5 each =20)
	Answer any 2 questions	(2 questions x Marks 5 each=10)

- **Total marks including choice -60**
- **Maximum marks of the course-40**

CORE COURSE X: SOLID STATE PHYSICS & SPECTROSCOPY

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B10PHY	4	4	3

COURSE OUTCOMES

CO 1: Understand basic crystal structure and compare various crystal systems
CO2: State and prove Bragg's law
CO3: Explain X-ray diffraction and various methods to obtain diffraction pattern
CO4: Understand basic properties of semiconductors and band structure of solids
CO5: Discuss Hall Effect and list its applications
CO6: Describe various regions of EM spectrum
CO7: Distinguish between microwave and infrared spectroscopy
CO8: Define Raman Effect and explain its quantum theory

Unit I Structural study of crystalline solids 15Hrs

Introduction – Lattice points and space lattice – The basis and crystal structure – Unit cells and lattice parameters – Unit cell verses primitive cell – Crystal systems – Symmetry elements in crystals – Metallic crystal structures SC, BCC, FCC and HCP structures – Directions, planes and Miller indices – Important features of Miller indices

(Book 1 Chapter 4, Sections I-XVI, XVIII-XIX))

Unit II X-Ray diffraction 8hrs

Bragg's law – Bragg's X Ray Spectrometer – Powder crystal method – Rotating Crystal method **(Book 1 Chapter 5, Sections VII-XI)**

Unit III Semiconducting properties of materials 15hrs

Semiconductors – Intrinsic and extrinsic semiconductors – Band structure of semiconductors – Fermi level of intrinsic and extrinsic semiconductors - Fermi level and carrier concentration in semiconductors – Mobility of charge carriers – Electrical conductivity in semiconductors – Hall effect – Applications of Hall effect

(Book 2: Chapter 13 .1-13.4,13.6, Book 1 section XIV)

Unit IV Spectroscopy **12hrs**

Regions of the spectrum-Microwave spectroscopy-The rotation of molecules-Rotational spectra-The rigid diatomic molecule-Intensities of spectral lines-The effect of isotopic substitution-The microwave oven

(Book 3 chapter 1 section 1.3, chapter2 sections 2.1 - 2.2, 2.3.1 - 2.3.3 , 2.7)

Unit V Infrared spectroscopy **12hrs**

The vibrating diatomic molecule-The energy of diatomic molecule-The Simple Harmonic Oscillator - The Anharmonic Oscillator-The diatomic Vibrating Rotator-The vibration-rotation spectrum of carbon monoxide

(Book 3 chapter 3 sections3.1.1-3.1.3,3.2-3.3)

Unit V Raman Effect **2hrs**

Stokes and Antistokeslines-classicalexplanation-QuantumTheory

[Book 4 section 21.20]

Books for Study:

1. Solid State Physics by S O Pillai, New age international Publishers 8th edition(2018)
2. Solid State Physics Structure and Properties of materials 2nd Edition,MA Wahab Narosapublishing house (2005)
3. Fundamentals of Molecular Spectroscopy-Colin N. Banwell and Elaine M. Mc Cash, 5 th edition Tata McGraw-Hill Publishing Company Ltd.
4. Optics by N.Subrahmniam, Brijlal and Dr. M.N Avandhalu, 25th revised edn

Books for Reference

1. Introduction to Solid State Physics, Charles Kittel, Wiley and Sons, 8th Edition.
2. Solid state Physics, Saxena, Guptha, Mandal, PragathiPrakashan
3. Solid State Physics by J.Dekker, MacMillan India Ltd
4. Elementary Solid State Physics by M.A.Omar, Pearson Education
5. Introduction to Spectroscopy, Donald L PaviaCengage Learning Pvt Ltd

MARKS INCLUDING CHOICE

Unit	Marks
I	14
II	5
III	14
IV	12
V	13
VI	2

PATTERN OF QUESTIONS

Part A	**Short answer**	(6 questions x Mark 1 = 6)
	Answer all questions	(6 questions x Mark 1 = 6)
Part B	**Short Essay**	(8 questions x Marks 2 each =16)
	Answer any 6 questions	(6questions x Marks 2 each=12)
Part C	**Problems**	(6 questions x Marks 3 each =18)
	Answer any 4 questions	(4 questions x Marks 3 each=12)
Part D	**Long Essay**	(4 questions x Marks 5 each =20)
	Answer any 2 questions	(2 questions x Marks 5 each=10)
• **Total marks including choice -60** • **Maximum marks of the course-40**		

CORE COURSE XI :OPTICS &PHOTONICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B11PHY	4	4	3

COURSE OUTCOME

CO 1: Understand the concept of interference and diffraction

CO2: Distinguish between Fresnel and Fraunhoffer diffraction

CO3: Analyse mathematically diffraction pattern due to slits and apertures

CO4: Understand the concept of polarization and double refraction

CO5: Understand the basic principle and working of lasers

CO6: Explain different types of lasers

CO7:Understand the principle of holography and its applications

CO8:Understand the principle of total internal reflection and propagation of light through optical fibres

CO9:Compare different types of optical fibres and their applicationsOptics and Photonics

Unit 1: **Two beam interference by division of wave front** **8hrs**

Introduction-Interference pattern produced on the surface of water-Coherence—Interference of light waves- The interference pattern-Intensity distribution-Fresnel biprism-Interference with white light-Displacement of fringes-The Lloyd's mirror-Phase change on reflection.

[Book1 sections 14.1-14.6, (14.6.1excluded), 14.8-14.12]

Unit 2: **Interference by division of amplitude** **10hrs**

Introduction-Interference by a parallel film when illuminated by a plane wave-The cosine law-Non-reflecting films-Highly reflecting films by thin film deposition-Interference by a film with two non-parallel reflecting surfaces-Colour of thin films-Newton's Rings (reflected system)-Michelson's Interferometer-determination of wavelength of monochromatic source

[Book1 sections 15.1-15.4(15.4.1,15.4.2 excluded)15.5,15.7-15.11]

Unit3:**Fraunhoffer Diffraction** **8hrs**

Introduction-Single slit diffraction pattern-Position of maxima and minima-Two slit Fraunhoffer diffraction pattern-position of maxima and minima-N slit diffraction

pattern- position of maxima and minima-Width of principal maxima-The plane diffraction grating- Grating spectrum-Resolving power of a grating-resolving power of a prism **[Book1 sections18.1-18.2,18.6-18.8]**

Unit4: Fresnel Diffraction **7hrs**

Introduction-Fresnel half period zones-Diffraction by a circular aperture-Diffraction by an opaque disc-The zone plate- comparison between zone plate and convex lens-Diffraction by a straight edge **[Book1 sections20.1-20.3, 20.6]**

Unit5:**Polarization and Double refraction** **11hrs**

Introduction- Malus's law- Polarization by reflection-Brewster's law- Nicol prism-Polarization by scattering- -Superposition of two disturbances-Mathematical analysis-The phenomenon of double refraction-Interference of polarized lights-Quarter wave and Half wave plates-Analysis of polarized light. **[Book1Chapter 22.1-22.7]**

Unit 6: Photonics **20 hrs**

Lasers-introduction-Interaction of light with matter-Einsteins coefficients and their relations-light amplification-meeting the three requirements-components of a laser-lasing action-principal pumping schemes-role of resonant cavity-types of lasers-Ruby laser-He-Ne laser-semiconductor laser-laser beam characteristics-applications*

[Book2 sections 22.1, 22.4-22.11, 22.14-22.17]

Holography-Introduction-principle of holography-recording and reconstruction-holograms-holograhy and photography-important properties of holograms-applications*

[Book2 sections 23.1-23.2,23.6,23.6.2,23.7,23.9]

Fibre optics-optical fibre-total internal reflection-propagation of light through optical fibre-fractional refractive index-numerical aperture-classification of optical fibres-the three types of fibres-applications*-fibre optic communication system-merits of optical fibres

[Book2 sections 24.1-24.6,24.10-24.11,24.20-24.22]

***Applications of Lasers, Holography and optical fibres –self study by students**

Book for study:

1. Optics by AjoyGhatak (6th Edition) -Tata MC Graw hill publishing company
2. A text book of Optics by Dr.N.Subramhaniam ,Brijlal, Dr. M.N Avandhalu, 25th Revised Edn-S Chand

Books for Reference :

1. Optics –Frank L .Pedrotti, S J Leno S Pedrotti, Leno M Pedrotti
2. Geometrical and Physical optics by P.K.Chakroborthy
3. Optics by Eugene Hecht & A R Ganesan

MARKS INCLUDING CHOICE

Unit	Marks
I	8
II	10
III	6
IV	6
V	12
VI	18

PATTERN OF QUESTIONS

Part A	**Short answer**	(6 questions x Mark 1 = 6)
	Answer all questions	(6 questions x Mark 1 = 6)
Part B	**Short Essay**	(8 questions x Marks 2 each =16)
	Answer any 6 questions	(6questions x Marks 2 each=12)
Part C	**Problems**	(6 questions x Marks 3 each =18)
	Answer any 4 questions	(4 questions x Marks 3 each=12)
Part D	**Long Essay**	(4 questions x Marks 5 each =20)
	Answer any 2 questions	(2 questions x Marks 5 each=10)
• **Total marks including choice -60** • **Maximum marks of the course-40**		

CORE COURSE XII

6B12 PHY NUCLEAR, PARTICLE & ASTROPHYSICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
6	6B12PHY	4	4	**3**

COURSE OUTCOME

CO 1: Understand the structure nucleus and nuclear constituents
CO2: Define nuclear forces and nuclear reactions
CO3: Familiarize elementary particles and their properties
CO4: Understand stellar classifications
CO5: Understand basic concepts of birth of the star
CO6: Identify different stars in HR diagram
CO7: Understand the theory of death of the star
CO8: Define white dwarf, neutron star and black hole

Unit I – Nuclear Structure and Radioactivity **14 Hrs**

Nuclear Constituents – Nuclear sizes and shapes – Nuclear masses and binding energies – Nuclear force – Radioactive decay – Conservation laws in radioactive decay – Alpha decay – Beta decay – Gamma decay – Natural radioactivity – Mossbauer effect

[Book 2; Sections 12.1 to 12.11]

Unit II– Nuclear Reactions and Applications **12 Hrs**

Types of nuclear reactions – Radioisotope production in nuclear reactions – Low-energy reaction kinematics – Fission – Fission reactors – Fusion – Fusion processes in stars – Fusion reactors – Applications of nuclear physics – Neutron activation analysis, Medical radiation physics, Alpha decay applications, Synthetic elements

[Book 2; Sections 13.1 to 13.6]

Unit III Elementary Particles **10 Hrs**

The four basic forces – Particles and antiparticles – Families of particles – Conservation laws – Particle interactions and decays – Resonance particles – Energetics of particle decays – Energetics of particle reactions – The Quark Model – The Standard Model

[Book 2; Sections 14.1 to 14.9]

Unit IV Basic Tools of Astronomy **14Hrs**

Stellar distance-relationship between stellar parallax and distance -– brightness and luminosity –relation between luminosity, brightness and distance Magnitudes-Apparent magnitude and brightness ratio-relationship between apparent magnitude and absolute magnitude-Colour and temperature of the star-relationship between flux, luminosity and radius-stellar spectra-stellar classification-HertzprungRussel diagram-H-R diagram and stellar radius- -H-R diagram and stellar luminosity-H-R diagram and stellar mass

[Book 1 sections 1.1 to 1.12][sections 1.1.1,1.3.1,1.4.1,1.5.1and 1.8.1 are excluded]

Unit V Stars **14Hrs**

Star clusters, Red Giants and the H-R Diagram -The Death of Stars-The Asymptotic Giant Branch- Dredge-Ups- Mass Loss and Stellar Winds- Infrared Stars-The End of an AGB Star's Life.- White Dwarf Stars- High-Mass Stars and Nuclear Burning - The End Result of High-Mass Stars' Evolution: Pulsars, Neutron Stars, and Black Holes

[Book 1 sections 3.11, 3.14, 3.15, 3.16, 3.17 ,3.18 ,3.19, 3.21 ,3.21.1, 3.21.2 ,3.21.3 3.21.4 ,3.22 ,3.24.1, 3.24.2] [sections 3.19.1,3.21.2 are excluded]

Books for study

1. Astrophysics is Easy: An introduction for the Amateur Astronomer- Mike Ingis-Springer
2. Modern Physics (second edition) by Kenneth Krane, Wiley student edition

Books for reference

1. Modern Physics by R. Murugeshan ,Er. KrithigaSivaprasath-(revised Edition), S.Chand
2. Nuclear Physics by S.N.Ghoshal- S.Chand and Co
3. The Atomic nucleus by R.D Evans -McGrawHill,Newyork

MARKS INCLUDING CHOICE

Unit	Marks
I	14
II	10
III	10
IV	14
V	12

PATTERN OF QUESTIONS

Part A	**Short answer**	(6 questions x Mark 1 = 6)
	Answer all questions	(6 questions x Mark 1 = 6)
Part B	**Short Essay**	(8 questions x Marks 2 each =16)
	Answer any 6 questions	(6questions x Marks 2 each=12)
Part C	**Problems**	(6 questions x Marks 3 each =18)
	Answer any 4 questions	(4 questions x Marks 3 each=12)
Part D	**Long Essay**	(4 questions x Marks 5 each =20)
	Answer any 2 questions	(2 questions x Marks 5 each=10)

- **Total marks including choice -60**
- **Maximum marks of the course-40**

CORE COURSE XIII :ELECTRODYNAMICS AND CIRCUIT THEORY

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B13PHY	3	3	3

COURSE OUTCOME

CO 1 : Understand the basic concepts of Electrodynamics

CO2 : Explain the mathematical theoryof Electromagnetic waves

CO3 : Understand different Network theorems

CO4 : Understand the basic concepts of Transient currents

Unit I: Electrodynamics 16Hrs

Ohm's law - Electromotive force – Motional e.m.f - Electromagnetic induction- Induced electric field - Inductance –Self inductance and mutual inductance –Inductance of coupled coils – Energy in a magnetic field –Electrodynamics before Maxwell-How Maxwell fixed Ampere's law– Maxwell's equations – 'Magnetic charge' –Maxwell's equations inside matter - -boundary conditions- Conservation laws-Charge and energy- The continuity equation – Poynting's theorem- Newton's third law in electrodynamics – Potential formulations of electrodynamics – Scalar & vector potentials- Gauge transformations-Coulomb Gauge and Lorenz Gauge .

(Book 1 sections 7.1, 7.2, 7.3, 8.1, 8.2.1,10.1)

Unit II: Electromagnetic Waves 12Hrs

Introduction –The wave equation in one dimension – Sinusoidal waves –Boundary conditions – Reflection and transmission – Polarization - Electromagnetic waves in vacuum- The wave equation for E & B –Monochromatic plane waves –Energy and momentum in electromagnetic waves –Propagation in linear media –Reflection and transmission at normal incidence. **(Book 1 sections 9.1, 9.2, 9.3.1, 9.3.2)**

Unit III: **Network Theorems** **10Hrs**

DC Network theorems:-Kirchoff's laws –voltage and current sources-source conversion-superposition theorem- Maximum power transfer theorem- Reciprocity theorem- Thevenin's and Norton's theorems –equivalent circuits-star/delta ,delta/star transformations **(Book 2 sections 2.2,2.15,-2.18,2.21,2.22,2.25,2.30)**

Unit IV: **Transient Currents** **10Hrs**

Charging of a capacitor , time constant ,Discharging of a capacitor ,transient relations during capacitor charging cycle , transient relations during capacitor discharging cycle , AC through Resistance , Inductance and Capacitance , AC through L and R , Power factor , Q factor of a coil , AC through R and C , AC through Series LCR , Resonance in LCR , Q factor of series LCR

(Book 2 5.18 - 5.22,11.28 -11.30,11.32,13.1,13.2,13.5,13.,713.9,13.10;13.17)

Books for study:

1. Introduction to electrodynamics -David .J .Griffiths 3rd edition
2. A text book of Electrical Technology,Volume1, 24thEdn.,B.L.Theraja&A.K.Theraja.

Books for Reference:

1. Feynman lectures on Physics VolumeII
2. Schaum's outline of Theory and Problems of Electromagnetism.

MARKS INCLUDING CHOICE

Unit	Marks
I	20
II	15
III	13
IV	12

PATTERN OF QUESTIONS

Part A	**Short answer**	(6 questions x Mark 1 = 6)
	Answer all questions	(6 questions x Mark 1 = 6)
Part B	**Short Essay**	(8 questions x Marks 2 each =16)
	Answer any 6 questions	(6questions x Marks 2 each=12)
Part C	**Problems**	(6 questions x Marks 3 each =18)
	Answer any 4 questions	(4 questions x Marks 3 each=12)
Part D	**Long Essay**	(4 questions x Marks 5 each =20)
	Answer any 2 questions	(2 questions x Marks 5 each=10)

- **Total marks including choice -60**
- **Maximum marks of the course-40**

CORE COURSE XIV: DISCIPLINE SPECIFIC ELECTIVE

COURSE CODE	COURSE TITLE
6B14 PHY(1)	PYTHON PROGRAMMING
6B14 PHY(2)	NANOSCIENCE
6B14 PHY(3)	MATERIAL SCIENCE
6B14 PHY(4)	COSMOLOGY
6B14 PHY(5)	PLASMA PHYSICS

6B14PHY(1).PYTHON PROGRAMMING

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B14PHY 1	2	2	3

COURSE OUTCOME

CO 1: Develop skills in creating program sketches of scientific problems

CO2: Develop basic skills in logical thinking and programming

CO3: To make real-life scientific problems easier on a computer with user interaction and graphics

Unit I: Introduction to Python Programming 12 hrs

Introduction to Python language- Python interpreter -interactive and script modes-Variables and data types-Numbers, None, Sequences-string (create, access and manipulate string)-list (create, access and manipulate list objects)-tuple-Mutable and immutable variables-Operators and Operands-arithmetic, relational, logical and assignment operators-Expressions and Statements-Precedence of operators-Input and Output-Comments in python- File input/output-*Programming exercises with applications in Physics*

Unit II: Functions in Python **6 hrs**

Functions- Parameters and Arguments-Modules (NumPy and Mathplotlib modules)-Use of Modules in Program (Import and From)-Python packages-Built-in and User defined functions- Composition of functions-Recursion-Vectorised functions- *Programming exercises with applications in Physics*

Unit III Conditional and Looping constructs in Python **5 hrs**

Control flow structure- if, elif and else-Nested condition- Looping Constructs- While and For loops- Nested loops-Break and Continue statements- *Programming exercises with applications in Physics*

Unit IV: Arrays and Matrices in Python **5 hrs**

Creating arrays and Matrices using functions Arrange, Linspace, Zeros, Ones, Reshape-Arithmetic operations- cross product- dot product - Matrix inversion-Saving and Restoring arrays - *Programming exercises with applications in Physics*

Unit V: Data visualization and Introduction to Numerical Methods **4 hrs**

Plotting functions- Plot, Show, Subplot, Polar and Pie functions-Plotting Sine function-Derivative of a function- *Programming exercises with applications in Physics*

Suggested Programming exercises (2 hours from each module; 10 hours):

Calculate the solar mass, Moment of inertia about center of mass (Sphere and Cylinder), Half-life period of a radioactive material, Calculate Rydberg's constant, Newton's law of gravitation, Heisenberg's uncertainty relation, Capacitor discharge in an RC circuit, Plot relativistic and classical momentum against velocity (velocity range 0c to 0.9c, where c is the velocity of light), Planck's law – plot 'Planck curves', Planetary motion - plot the actual orbits of the planet for three eccentricities, Projectile motion – plot x(t) and y(t) for different values of θ, Emission lines of hydrogen atom using Rydberg's formula (wavelengths), Derivative of Sine function.

Books for reference:

Any standard book can be used as reference. Use of GNU/Linux platforms may be encouraged.

1. Python for Informatics, Charles Severance
2. Core Python Programming, Wesley J Chun, Pearson Education
3. Python Essential Reference, David M. Beazley, Pearson Education
4. A Primer on scientific Programming with Python by Hans PetterLangtangen ; Springer
5. Python tutorial release 2.6.1 by Guido Van Rossum, Fred L Drake (http://www.altway.com/resources/python/tutorial.pdf)
6. How to Think Like a Computer Scientist: Learning with Python, Allen Downey , JeffreyElkner,ChrisMeyers,http://www.greenteapress.com/thinkpython/thinkpython.pdf
7. Numerical Methods in Engineering and Science, Dr. B S Grewal, Khanna Publishers,New Delhi
8. Introductory methods of numerical analysis, S.S.Shastry , (Prentice Hall of India,1983)
9. Programming exercises with applications in physics - Morten Hjorth-Jense (https://www.uio.no/studier/emner/matnat/ifi/IN1900/h17/ressurser/physics_exer.pdf)

Note: *This course introduces programming in the high level language Python. Examples and exercises must be taken from natural science, and instructors must show how problems in physics can be solved by means of mathematics and programming. Instructors can select suitable exercises from the list provided to introduce the content of different modules.*

MARKS INCLUDING CHOICE:

Unit	Marks
I	18
II	10
III	10
IV	12
V	10

PATTERN OF QUESTIONS

Part A	**Short answer**	(6 questions x Mark 1 = 6)
	Answer all questions	(6 questions x Mark 1 = 6)
Part B	**Short Essay**	(8 questions x Marks 2 each =16)
	Answer any 6 questions	(6questions x Marks 2 each=12)
Part C	**Problems**	(6 questions x Marks 3 each =18)
	Answer any 4 questions	(4 questions x Marks 3 each=12)
Part D	**Long Essay**	(4 questions x Marks 5 each =20)
	Answer any 2 questions	(2 questions x Marks 5 each=10)

- **Total marks including choice -60**
- **Maximum marks of the course-40**

6B14PHY(2) NANOSCIENCE

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B14PHY 2	2	2	3

COURSE OUTCOME

CO 1: Understand the basic concepts of Nanoscience

CO2: Understand the properties of materials in the nano range

CO3: Identify different techniques for the production of nanomaterials

CO4: Understand characterization techniques & applications of nanomaterial.

Unit I-Nanoscience: Introduction **4 hrs**

History of nanoscience- Definition of nanometer, nanomaterials and nanotechnology-classification of nanostructured materials with examples-increased surface area of nanoparticles **(Book 1, Chapter 1, 1.1 to 1.3.2)**

Unit II- Properties of materials in the nano-regime **9 hrs**

Effect of size reduction on bulk materials- Optoelectronic property of bulk and nanostryuctures- relation between optical properties and electronic structure- electronic structure and Fermi surfaces- electron –Phonon coupling- size effect on physical properties- Luminescence from nanoparticles-thermodynamics of nanoparticles **(Book 1, Chapter 2, 2.7 to 2.12, exclude 2.11)**

Unit III- Synthesis of Nanomaterilas **6 hrs**

Bottom Up approaches- Sol-gel technique- thin film growth-physical vapour deposition-chemical vapour deposition- top-down approaches-ball milling-lithography **(Book 1, Chapter 4, 4.4 to 4.4.2.4)**

Unit IV-Characterization of Nanomaterials **8 hrs**

Scanning Electron Microscopy-Transmission Electron Microscopy-Scaning Probe Microscopy- Atomic force Microscopy **(Book 1, Chapter 8, 8.3 to 8.4 and 8.6 to 8.7.1)**

Unit V- Application of Nanotechnology **5hrs**

Applications in: Material Science- Biology and Medicine-Energy and Environment Carbon Nanotechnology: Different carbon structures (fullerenes, Carbon nanotubes-Graphene- Graphite and Diamond) - Applications of different carbon structures **(Book 1, Chapter 10,10.1 to 10.5, 10.8, 10.8.3 to10.8.5)**

Books for Study:

1. Nanoscience and Nanotechnology: Fundamentals to Frontiers by M S Ramachandra Rao, Shubra Singh, Wiley India Pvt. Ltd.

Book for References:

1. T. Pradeep, "Nano: The Essentials", Tata-McGraw Hill Publishers 2007.
2. Introduction to Nanotechnology, Charles P. Poole, Jr. and Frank J. Owens, Wiley
3. Introduction to Nanoscience & Nanotechnology by K. K. Chattopadhyay and A. N.Banerjee, PHI L earning and Private Limited

MARKS INCLUDING CHOICE:

Unit	Marks
I	10
II	16
III	12
IV	12
V	10

PATTERN OF QUESTIONS

Part A	**Short answer**	(6 questions x Mark 1 = 6)
	Answer all questions	(6 questions x Mark 1 = 6)
Part B	**Short Essay**	(8 questions x Marks 2 each =16
	Answer any 6 questions	(6questions x Marks 2 each=12)
Part C	**Problems**	(6 questions x Marks 3 each =18)
	Answer any 4 questions	(4 questions x Marks 3 each=12)
Part D	**Long Essay**	(4 questions x Marks 5 each =20)
	Answer any 2 questions	(2 questions x Marks 5 each=10)

- **Total marks including choice -60**
- **Maximum marks of the course-40**

6B14PHY(3) MATERIAL SCIENCE

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B14PHY (3)	2	2	3

COURSE OUTCOME

CO 1: Understand the basic concepts of material science

CO2: Understand the properties of materials

CO3: Identify different engineering materials & their properties

CO4: Understand the properties & characteristics of semiconducting,insulating &magnetic materials

Unit I -Materials Science: Introduction 3hrs

Definition –Classification of Engineering materials- Levels of structure- Material Structure **(Book 1, Chapter Sections 1,3, 9,10)**

Unit II- Mechanical Properties of metals 4hrs

Types of mechanical properties- Technological properties-Factors affecting mechanical properties **(Book 2, sections 6.1-6.30)**

Unit III-Engineering materials 14hrs

Organic materials-types of organic materials-polymers- types of polymerization-strengthening mechanism of polymers-Plastics—Types of plastics-comparison between thermoplastics and thermosetting plastics-rubber-types of rubbers-vulcanization-composite materials-types of composite materials (in detail)-ceramics-classification of ceramics (in detail) Modern Engineering materials-Metallic Glasses-types of metallic glasses-Shape memory alloys-types of shape memory alloys-Application- Nonlinear materials (qualitative) (**Book 2, sections 14.1-14.14,14.22-14.31,15.1-15.3**,

Book 1, Chapter 20sections 1 to 4)

Unit IV –Semiconductors, Insulators & magnetic material 11hrs

Bonding ,classification of semiconductors-expression for conductivity-P-N junction-Application of voltage across P-N junction-flow of current & V –I Characteristic of a

P-N junction.-semiconducting materials –semiconductor devices-Insulating materials-electric field-flux density-permittivity-dielectric polarization-polarization mechanisms-capacitor-dielectric properties-dielectric loss-dielectric strength-ferroelectric materiaks-hysterisis curve- Magnetic materials -Magnetic field-magnetic moment – Origin of magnetic moment-magnetic field strength- flux density-permeability-magnetization-susceptibility-classification of magnetism –magnetic hysteresis-eddy current loss ferrimagnetism- ferrites-classification of magnetic materials.

(Book 2, sections 18.1-18.28)

Books for Study:

1. Materials Science, S L Kakkani, AmitKakkani, New Age International Publishers, Second Edition
2. Material Science, R S Kurumi, R S Sedha, S Chand & Company Fifth Edition

Book for References:

1. Materials Science and Engineering: An introduction, Wiiliam D Callister Jr., John Wiley and Sons,Inc.

MARKS INCLUDING CHOICE

Unit	Marks
I	6
II	10
III	24
IV	20

PATTERN OF QUESTIONS

Part A	**Short answer**	(6 questions x Mark 1 = 6)
	Answer all questions	(6 questions x Mark 1 = 6)
Part B	**Short Essay**	(8 questions x Marks 2 each =16
	Answer any 6 questions	(6questions x Marks 2 each=12)
Part C	**Problems**	(6 questions x Marks 3 each =18)
	Answer any 4 questions	(4 questions x Marks 3 each=12)
Part D	**Long Essay**	(4 questions x Marks 5 each =20)
	Answer any 2 questions	(2 questions x Marks 5 each=10)

- **Total marks including choice -60**
- **Maximum marks of the course-40**

6B14PHY (4): COSMOLOGY

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B14PHY (4)	2	2	3

COURSE OUTCOME

CO 1: Understand history of cosmology at different era
CO2: Explain general theory of relativity and curvature of space
CO3: Understand cosmological principle and Friedmann model
CO4: Explain expansion of universe based on Hubble's law and to state big bang theory

Unit 1 **6 hrs**
A brief History- the universe in myth - the Greek- the renaissance- towards the modern era- cosmology today **(Chapter 1)**

Unit II. **8 hrs**
Einstein and all that- universal gravitation- the Einstein revolution-the equivalence principle- the general theoryof relativity- the curvature of space- black holes and the universe **(Chapter 2)**

Unit III **8 hrs**
First principles- simplicity and symmetry- the cosmological principle- the Friedman models- the singular natureof gravity **(Chapter 3)**

Unit IV **10 hrs**
The expanding universe- Hubble's law- Doppler shift-Interpreting the- Hubble Law-the quest for H_o- the age of the universe- the big bang **(Chapter 4)**

Books for study
1.Cosmology – A Very Short Introduction by Peter Coles (OXFORD)

MARKS INCLUDING CHOICE

Unit	Marks
I	12
II	14
III	14
IV	20

PATTERN OF QUESTIONS

Part A	**Short answer**	(6 questions x Mark 1 = 6)
	Answer all questions	(6 questions x Mark 1 = 6)
Part B	**Short Essay**	(8 questions x Marks 2 each =16)
	Answer any 6 questions	(6questions x Marks 2 each=12)
Part C	**Problems**	(6 questions x Marks 3 each =18)
	Answer any 4 questions	(4 questions x Marks 3 each=12)
Part D	**Long Essay**	(4 questions x Marks 5 each =20)
	Answer any 2 questions	(2 questions x Marks 5 each=10)

- **Total marks including choice -60**
- **Maximum marks of the course-40**

PLASMA PHYSICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
6	6B 14 PHY(5)	2	2	3

COURSE OUTCOME

CO 1: define plasma and plasma parameters
CO2: understand applications of plasma
CO3: determine the behavior of plasma in various E and B Fields
CO4: determine the nature of plasma as a fluid

Unit I Introduction **8 hrs**

Definition of plasma –Concept of temperature-Debye shielding-the plasma parameter-Criteria for Plasma-Applications of Plasma Physics-M.H.D Energy Conversion and ion propulsion-solid state plasmas- Gas Lasers

(Book for study 1.1,1.2,1.3.1.4,1.5,1.6,1.7)

Unit II **Single Particle Motion** **12hrs**

Introduction-Uniform E and B fields- gravitational field-non uniform B field- time varying E field- time varying B field- summary of guiding centre drifts

(Book for study 2.1,2.2,2.3,2.5,2.6,2.7)

Unit III Plasma as Fluids 12 **hrs**

Introduction-Relation of plasma physics to ordinary electromagnetics- the equation of motion-the convective derivative-collisions-equation of continuity-equation of state- the complete set of fluid equations

(Book for study 3.1,3.2,3.3 [3.32excluded])

Book for study

1.Introduction to Plasma Physics and Controlled Fusion by Francis F.Chen (3rd edition) -Springer

Books for reference

1.Plasma Physics by S.N.Sen
2. Plasma Physics –an Introduction by Richard Fitzpatrick

Marks including choice

Unit	Marks
I	18
II	22
III	20

PATTERN OF QUESTIONS

Part A	**Short answer**	(6 questions x Mark 1 = 6)
	Answer all questions	(6 questions x Mark 1 = 6)
Part B	**Short Essay**	(8 questions x Marks 2 each =16)
	Answer any 6 questions	(6questions x Marks 2 each=12)
Part C	**Problems**	(6 questions x Marks 3 each =18)
	Answer any 4 questions	(4 questions x Marks 3 each=12)
Part D	**Long Essay**	(4 questions x Marks 5 each =20)
	Answer any 2 questions	(2 questions x Marks 5 each=10)

- **Total marks including choice -60**
- **Maximum marks of the course-40**

CORE COURSE XV: Practical II General Physics II

Semester	Course code	Hours per week	Credit	Exam hours
VI	6B15PHY	4	4	3

COURSE OUTCOME

CO1 : Familiarise with apparatus for mechanical, electrical, magnetic and optical experiments.

CO2: Develop skill in setting up of apparatus for accurate measurement of physical quantities.

CO3: Understand multiple experimental techniques for determining physical quantities.

CO4: Develop skill in systematic way of measurements by minimising possible errors.

CO5: Develop skill to analyse by plotting graphs using software.

CO6: Develop skill for systematic trouble shooting.

CO7: Perform error analysis for experiments.

Note: A brief theoretical back ground of each experiment must be given to the students before each cycle of experiments and assess it. Students have to maintain a practical log book regularly signed by the teacher in charge and to be submitted at the time of University Examination. Fair record is not required. All the 20 experiments have to be performed.

Special Instructions

1. For plotting graphs of experiments mentioned, any software (excel, origin etc) must be used.
2. Error analysis should be done for the mentioned experiments.

LIST OF EXPERIMENTS

1. Spectrometer –i-d curve (Graph using software)
2. Spectrometer –i-i' curve (Graph using software)
3. Spectrometer-Cauchy's constants assuming wavelengths
4. Spectrometer –grating-normal incidence
5. Spectrometer –grating- minimum deviation

6. Air Wedge-Diameter of a thin wire

7. Newton's Rings- wavelength of sodium light

8. Laser-Slit width from diffraction pattern

9. Potentiometer- Calibration of ammeter (Graph using software)

10. Potentiometer-Calibration of High range voltmeter (Graph using software)

11. Potentiometer-Reduction factor of TG and B_0(Error analysis is required)

12. Circular coil - Determination of m and B_0 (Error analysis is required)

13. Carey Fosters' Bridge-Temp-coefficient of resistance

14. Conversion of Galvanometer into voltmeter- calibration using potentiometer

15. Conversion of Galvanometer into ammeter- calibration using potentiometer

16. Verification of The venin's and Norton's theorem

17. Verification of Maximum Power Transfer Theorem

18. Mirror Galvanometer-Figure of Merit

19. Ballistic Galvanometer- absolute capacity of a capacitor

20. Ballistic Galvanometer- high Resistance by Leakage (Error analysis is required)

Reference Books

1. Practical Physics by P R Sasi Kumar PHI Learning Private Limited
2. BSc Practical Physics by C L Arora ,S Chand
3. An advanced course in Practical Physics by D.Chattopadhyay& P C Rakhit New Central Book Agency(P)Ltd

MARKS DISTRIBUTION

Sections	**Marks**
I Principle with theory	10
II Performance	6
III Observation	14
IV Viva to evaluate the skill & knowledge about the experiment	4
V Calculation ,Graph etc	6

CORE COURSE XVI: PRACTICAL III ELECTRONICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B16PHY	4	4	3

COURSE OUTCOME

CO1: Familiarise active and passive electronic components.

CO2: Familiarise multimeter, power supply, signal generator and cathode ray oscilloscope.

CO3: Develop skill in soldering and use of breadboard.

CO4: Develop skill in construction of rectifiers, voltage regulators, amplifiers and oscillators.

CO5: Observe, measure and analyse electrical signals.

CO6: Develop skill for trouble shooting circuits and components.

CO7: Develop skill to analyse by plotting graphs using software.

Note: A brief theoretical background of each experiment must be given to the students before each cycle of experiments. Students have to maintain a practical log book regularly signed by the teacher in charge and to be submitted at the time of University Examination. Fair record is not required. All the 20 experiments have to be performed. Students may refer the diode/transistor/IC data manual to get details of the components.

1. Characteristics of a semiconductor diode
2. Half wave & Full wave (2 diodes) Rectifiers - Study of ripple factor with and without filter (by soldering)
3. Bridge Rectifier- Study of ripple factor with and without filter (by soldering)
4. Voltage multiplier (Quadrupler) circuit (by soldering)
5. Voltage regulator using Zener diode after finding Zener voltage (Line and Load regulations)
6. Common Emitter characteristics of BJT
7. Realization of basic logic gates (OR, AND & NOT) using transistors (by soldering)
8. Single stage Common Emitter amplifier - Gain and Frequency response (by soldering)
9. Power amplifier (Class A) using transistor - Frequency response and band width
10. Voltage series and Current series Feedback circuits using transistors
11. Single transistor voltage regulator (Line and Load regulations)
12. Hartley Oscillator using transistor (by soldering)

13. Phase Shift Oscillator using transistor
14. Astable Multi vibrator using transistors
15. Inverting amplifier, Non-inverting amplifier and voltage follower using Op-amp
16. Summing and Difference amplifier using Op-amp
17. Differentiator and Integrator using Op-amp
18. Wien Bridge Oscillator using Op-amp
19. Half and Full Adders using XOR and NAND gates
20. Minimization of a three variable Boolean expression/Truth table using Karnaugh Map and realization using NAND gates.

References:

1. Electronics Lab Manual - Dr. K A Navas (Rajath Publishers, Vol. I & II)
2. Advanced Practical Physics - S P Singh (Pragati Prakashan Meerut, Vol. II)
3. The Art of Electronics - Paul Horowitz and Winfield Hill (Cambridge University Press)
4. BSc Practical Physics - C L Arora (S Chand & Co.)
5. A text book of Advanced Practical Physics - Samir Kumar Ghosh (New Central Book Agency)

MARKS DISTRIBUTION

Sections	**Marks**
I Principle with theory	10
II Performance	6
III Observation	14
IV Viva to evaluate the skill & knowledge about the experiment	4
V Calculation ,Graph etc	6

6B17 PHY PROJECT EXTERNAL EVALUATION MARK DISTRIBUTION

Sections	**Marks**
I Relevance of topic	10%
II Methodology	20%
III Quality of analysis & findings	20%
IV Viva -Voce	50%

PART B:

PHYSICS COMPLEMENTARY ELECTIVE COURSES

[FOR BSc PROGRAMMES]

WORK AND CREDIT DISTRIBUTION

(2019 ADMISSION ONWARDS)

COURSE CODE	COURSE TITLE	SEMESTER	HOURS PER WEEK	CREDIT	EXAM HOURS	MARKS		
						CE	ESE	TOTAL
1C01PHY	MECHANICS	I	2	2	3	8	32	40
2C02PHY	ELECTRICITY, MAGNETISM AND THERMODYNAMICS	II	2	2	3	8	32	40
3C03PHY	OPTICS AND PHOTONICS	III	3	2	3	8	32	40
4C04PHY	ELECTRONICS AND MODERN PHYSICS	IV	3	2	3	8	32	40
4C05PHY	PHYSICS PRACTICAL	IV	2	4	3	8	32	40

EVALUATION

ASSESSMENT	WEIGHTAGE
EXTERNAL	80%
INTERNAL	20%

INTERNAL ASSESSMENT THEORY

COMPONENT*	WEIGHTAGE**	REMARKS
COMPONENT 1 Test paper	60%	Best of any two
COMPONENT 2 Assignment /Seminar/Viva	40%	One

CONTINUOUS INTERNAL ASSESSMENT PRACTICAL

COMPONENT*	WEIGHT AGE**	REMARKS
COMPONENT 1 Lab Skill	25%	
COMPONENT 2 Punctuality	25%	
COMPONENT 3 Record	25%	A logbook of practicals should be maintained which must include theory,observation,tabulation,calculation ,graph ,result etc
COMPONENT 3 TEST PAPER	25%	A model exam should be conducted before external examination &should be considered for internals

COMPLEMENTARY ELECTIVE COURSE I: -MECHANICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
I	ICO1PHY	2	2	3

COURSE OUTCOME

CO 1: Understand the basic concepts of Properties of matter
CO2: Explain the dynamics of rigid bodies.
CO3: Understand the basic concepts of wave motion and oscillations

UNIT 1: Properties of matter :13 Hours

Elasticity: Hooke's law, moduli of elasticity- Poisson ratio, Twisting Couple on a cylindrical rod- Bending of Beams-Bending Moment, Cantilever, Transverse vibrations of a loaded cantilever, Uniform and Non-uniform Bending, Determination of Young modulus using uniform bending – mirror and telescope method

Viscosity: Viscosity, Critical velocity, Flow of liquid through a capillary tube, Poiseulle's formula, Stokes formula.

Surface tension: Surface energy - expression for excess pressure on a curved surface – Capillary action – Explanation of capillary action - Measurement of surface tension by capillary tube method

(Book 1: Section – 12.1-12.10, 12.13-12.14, 12.15-12.23, 14.1-14.3, 14.6, 15.1-15.4, 16.1-16.13.16.21-16.22)

UNIT 2: Dynamics of Rigid Bodies: **- 6 Hours**

Rigid body , Centre of mass , Angular momentum and Torque, Moment of inertia , Radius of gyration, Theorems on moment of Inertia, Moment of inertia of thin Rod, Circular Disc, Annular Ring, Cylinder (solid and hollow) and Sphere (solid). Moment of inertia of fly wheel

Book 1: Section – 6.2, 8.1, 8.5- 8.6.8.9)

UNIT 3: Oscillation and waves: (13 Hours)

Harmonic Oscillator : Periodic motion, Simple harmonic oscillator, Energy of Simple harmonic oscillator, Compound Pendulum , Torsion pendulum, Damping force , Damped Harmonic oscillator , Quality factor, Galvanometer with low damping , LCR circuit

Wave Motion: General equation of wave motion, Plane progressive harmonic wave, Energy density and Energy flow/current for plane progressive wave, Transverse waves in stretched strings, Longitudinal waves in rods and gases, Stationary waves, Waves in a linear bounded medium, Flow of energy in stationary waves.

Book 1: Section – 9.1- 9.4, 9.8,10.1-10.2, 10.4- 10.5, 11.1-11.4, 11.6- 11.10

Books for study:

1. Mechanics – J.C. Updhyaya
2. Mechanics - D.S.Mathur

Books for reference:

1. Feynman lectures on Physics by Richard Feynman
2. Fundamentals of Physics by Resnick & Haliday

MARKS INCLUDING CHOICE:

Unit	Marks
I	20
II	10
III	22

PATTERN OF QUESTIONS

Part A	**Short answer**	(5 questions x Mark 1 = 5**)**
	Answer all questions	(5 questions x Mark 1 = 5)
Part B	**Short Essay**	(6 questions x Marks 2 each =12)
	Answer any 6 questions	(4questions x Marks 2 each=8)
Part C	**Problems**	(5questions x Marks 3 each =15
	Answer any 4 questions	(3questions x Marks 3 each=9)
Part D	**Long Essay**	(4 questions x Marks 5 each =20)
	Answer any 2 questions	(2 questions x Marks 5 each=10)

- **Total marks including choice -52**
- **Maximum marks of the course-32**

COMPLEMENTARY ELECTIVE COURSE II:ELECTRICITY, MAGNETISM AND THERMODYNAMICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
II	2CO2PHY	2	2	3

COURSE OUTCOME

CO 1: Understand the basic concepts of Magnetism &electricity
CO2: Explain the magnetic effects of electric currents
CO3: Understand the basic principles of Thermodynamics

UNIT 1: Magnetism and Electricity **10 Hours**

Magnetism: Magnetic properties of materials – Magnetic Induction, Magnetisation, Relation between the three magnetic vectors B,H and M, Magnetic susceptibility, Magnetic permeability, properties of Dia, Para and Ferro magnetic materials, Anti ferromagnetism and ferrimagnetisms, magnetic element at a place, Deflection magnetometer, Searle's vibration magnetometer, Box type vibration magnetometer.

Electricity : Carey Foster bridge-theory, determination of resistance, resistivity and temperature coefficient, Potentiometer- theory, Calibration of Ammeter, Calibration of Voltmeter (low &High Range) conversion of galvanometer into ammeter and voltmeter.

(Book 1: Section – 15.1 – 15.9, 42.1, 7.1-7.2, 39.2-39.3,42.10-42.15)

UNIT 2: Magnetic effect of electric current **9 Hours**

Biot-Savart law, Magnetic induction at a point due to a straight conductor carrying current, Magnetic induction at a point on the axis of a circular coil, Lorentz force, Force on a current carrying conductor, Torque on a current loop in a uniform magnetic field, Theory and working of moving coil Ballistic Galvanometer, figure of merit of B.G and its determination.

(Book 1: Section – 10.1 - 10.4, 10.7, 10.10-10.13)

UNIT 3: Thermodynamics **13 Hours**

Thermodynamic systems, Thermodynamic processes, Thermodynamic equilibrium, Zeroth law thermodynamics, Work- A path dependent function, Internal Energy, First Law of thermodynamics, Applications of first law, The indicator Diagram, Work done during an Isothermal Process and Adiabatic Process, Adiabatic and Isothermal Elasticises, Second law of thermodynamics, Carnot's engine , Derivation of efficiency using Carnot's cycle , Carnot's theorem , Refrigerator, Coefficient of performance , Concept of entropy, Change of entropy in reversible and irreversible cycles, Principle of increase of entropy.

(Book 2: Section – 4.1 – 4.7, 4.10-4.15, 4.21-4.29, 5.1-5.6)

Books for study:

1. Electricity and Magnetism (2008th edition)-R.Murugeshan
2 Heat and Thermodynamics (16th edition) by Brijlal and Subramanian

Books for reference:
1. Electricity and Magnetism-D.N .Vasudeva
2. Heat and Thermodynamics-D.S.Mathur.
3. Introduction to electrodynamics -David .J .Griffiths
4. Heat & Thermodynamics: W.Zemansky, McGraw Hill

MARKS INCLUDING CHOICE:

Unit	Marks
I	18
II	14
III	20

PATTERN OF QUESTIONS

Part A	**Short answer**	(5 questions x Mark 1 = 5**)**
	Answer all questions	(5 questions x Mark 1 = 5)
Part B	**Short Essay**	(6 questions x Marks 2 each =12)
	Answer any 6 questions	(4questions x Marks 2 each=8)
Part C	**Problems**	(5questions x Marks 3 each =15
	Answer any 4 questions	(3questions x Marks 3 each=9)
Part D	**Long Essay**	(4 questions x Marks 5 each =20)
	Answer any 2 questions	(2 questions x Marks 5 each=10)

- **Total marks including choice -52**
- **Maximum marks of the course-32**

COMPLEMENTARY ELECTIVE COURSE III: OPTICS AND PHOTONICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
III	3C03PHY	3	2	3

COURSE OUTCOME

CO 1: Understand the basic concepts of Interference
CO2:Understand the basic concepts of Diffraction
CO3: Understand the basic concepts of Polarization
CO4: Understand the basic concepts of Photonics and Fibre Optics

UNIT – 1: Interference **12 Hours**

Interference of light, principle of superposition, Conditions for maximum and minimum intensities, Coherent sources, Theory of interference fringes, Colours of thin films-interference due to reflected light, Interference due to transmitted light, Fringes produced by a wedge shaped thin film, Newton's Rings by reflected light, Determination of wave length of sodium light and Refractive index of a transparent liquid by Newton's rings. **(Book 1: Section: 2.1 – 2.2, 2.5 - 2.10)**

UNIT- 2: Diffraction **12 Hours**

Fresnel and Fraunhofer diffraction - Fresnel's Explanation of Rectilinear Propagation of light- Zone plate, Diffraction at a straight edge, Fraunhofer Diffraction at a single slit, Plane Transmission Diffraction Grating, Dispersive power of a Grating, Determination of wavelength of light using Transmission Grating. Comparison between interference and Diffraction **(Book 1: Section: 3.1 – 3.5, 3.7, 3.10, 3.12, 3.14, 3.17, 3.25)**

UNIT - 3: Polarization **9 Hours**

Introduction, Polarization of light, Polarization by reflection, Pile of Plate, Law of Malus, Double Refraction, Huygen's theory of double refraction in uniaxial crystal, Nicol Prism, Theory of production of Elliptically and Circularly Polarised light, Quarter wave plates, Half wave plate, Production and detection of Plane, Circularly and Elliptically polarized light **(Book 1: Section: 4.1-4.6, 4.8, 4.10 - 4.14)**

UNIT– 4: Photonics **15 Hours**

Laser: Absorption and emission of light, Induced absorption, Spontaneous emission and Stimulated emission, Einstein's relations , Principle of Laser, Meta stable state, Population inversion, Pumping, Pumping methods – Optical pumping, Electrical pumping and Direct conversion, Types of laser - Ruby laser, Helium Neon laser and Semi conductor laser, Properties of laser beams, Applications of lasers-Holography (principle, recording and reconstruction)

Fibre Optics: Introduction, Total internal reflection, Step index fibre, Graded index fibre, Light propagation in fibres, Acceptance angle, Numerical Aperture, The Coherent

Bundle, Fibre optic Communication system, Advantage of Fibre – Optic Communication system, Fibre optic sensors, Applications- Fibre optic Communication system.

(Book 2 : Section – 19.1-19.5Book 1: 8.1 – 8.6, 8.10, Ref. Book 3- chapter 38)

Books for study:

1. Optics and Spectroscopy by R Murugeshan, Kiruthiga ivaprasath, S Chand
2. Modern Physics by R Murugeshan, Kiruthiga Sivaprasath, S Chand

Books for reference:

1. Optics by Subramanayam, Brijlal, MN Avadhanalu, S.Chand
2. Optics- Ajay Ghatak
3. Basic Electronics – Solid state – B..L. Thereja
4. Laser fundamentals – Silfast

MARKS INCLUDING CHOICE:

Unit	Marks
I	12
II	12
III	10
IV	18

PATTERN OF QUESTIONS

Part A	**Short answer**	(5 questions x Mark 1 = 5**)**
	Answer all questions	(5 questions x Mark 1 = 5)
Part B	**Short Essay**	(6 questions x Marks 2 each =12)
	Answer any 6 questions	(4questions x Marks 2 each=8)
Part C	**Problems**	(5questions x Marks 3 each =15

	Answer any 4 questions	(3questions x Marks 3 each=9)
Part D	**Long Essay**	(4 questions x Marks 5 each =20)
	Answer any 2 questions	(2 questions x Marks 5 each=10)
• **Total marks including choice -52** • **Maximum marks of the course-32**		

COMPLEMENTARY ELECTIVE COURSE IV:ELECTRONICS AND MODERN PHYSICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
IV	4C04PHY	3	2	3

COURSE OUTCOME

CO 1: Understand the basic concepts of Basic electronics
CO2: Understand the basic concepts of Digital electronics
CO3: Understand the basic concepts of Nuclear Physics
CO4: Understand the basic concepts of Particle physics and Astrophysics

UNIT – 1: Basic Electronics **15 Hours**

Semiconductors, pn junction, Current-voltage characteristics of pn junction- Forward and Reverse bias, Diode, Half wave, Full wave and bridge rectifier circuits, Efficiency and ripple factor, Filter circuits- capacitor filter and π filters, Zener diode and its characteristics, Voltage stabilization, Transistors- CB, CE, CC Configurations, Characteristics, Current amplification factors, Relation connecting α, β and γ , CE Amplifier, Feedback, Principle of negative voltage feedback in Amplifier, Gain and advantage of feedback – Sinusoidal oscillator , Oscillatory Circuit, Positive feedback Amplifier – Oscillator, Colpit's oscillators and Hartley oscillators.

(Book 1: 5.1, 5.8 – 5.20, 6.1, 6.7 –6.11, 6.13 - 6.15, 6.18, 6.20-6.21, 6.25, 6.27 – 6.28, 8.1 – 8.5, 8.7 – 8.10, 8.12 – 8.16, 13.1 – 13.4, 14.1 – 14.3, 14.5, 14.10- 14.11)

UNIT2– 2: Digital Electronics **9 Hours**

Introduction, Analogue and Digital signals, Number systems – Decimal, binary, Octal, Hexadecimal number systems- Conversion between different number systems, BCD Code, Logic gates - AND, OR, and NOT Universal gates – NAND and NOR , XOR gate, Boolean Algebra, Boolean Theorems, de Morgan's theorems, Binary Addition, Half adder and Full adder

(Book 1: Section – 26.1 – 26.17, 26.20 – 26.22, 26.31 – 26.32)

UNIT – 3: Nuclear Physics **12 Hours**

Introduction, Classification of Nucleus, General properties of Nucleus, Binding energy, Nuclear Stability, Nuclear force, Stability of nucleus, Radioactivity , Natural radioactivity, Alpha, Beta and Gamma Rays and its Properties, Law of radioactive decay , Half life, Mean life, Radioactive dating – age of the earth, Nuclear fission, Energy Released in Fission, Nuclear reactors, Nuclear fusion, Source of Stellar Energy

(Book 2: Section – 27.5 – 27.6, 27.7, 31.2-31.6, 31.29 – 31.33, 31.35, 35.2 – 35.3, 35.6- 35.8)

UNIT– 4: Particle physics and Astrophysics **12 Hours**

Particle Physics: Introduction, Classification of elementary particles – Particles and Anti- particles, Fundamental interaction, , Elementary particle quantum number, Idea of Quarks, The quark model, Compositions of hadrons according to quark model.

Astrophysics : Introduction, Classification of stars –The Harvard classification system, Hertzprung - Russel diagram, Luminosity of a star, Stellar Evolution, Chandrasekhar limit, White dwarfs, Neutron stars, Black Holes , Supernova Explosion.

(Book 2: Section – 38.1 – 38.2, 38.4 – 38.5, 38.7, 78.1 – 78.6, 78.8 - 78.11

Books for study:

1 Principles of Electronics-VK Mehta, S. Chand
2 Modern Physics – R .Murugeshan and Kiruthiga Sivaprasath , S. Chand

Books for reference:

1 Basic Electronics – Solid state – B..L. Thereja
2 Electronic Devices and Circuits- 5th Edition, David A Bell (Oxford)
3 Digital Principles and Applications - D P Leach and A P Malvino (TMH)
4 Concepts of Modern Physics, Arthur Beiser, TMH

MARKS INCLUDING CHOICE:

Unit	**Marks**
I	16
II	10
III	14
IV	12

PATTERN OF QUESTIONS

Part A	**Short answer**	(5 questions x Mark 1 = 5**)**
	Answer all questions	(5 questions x Mark 1 = 5)
Part B	**Short Essay**	(6 questions x Marks 2 each =12)
	Answer any 6 questions	(4questions x Marks 2 each=8)

Part C	**Problems**	(5questions x Marks 3 each =15
	Answer any 4 questions	(3questions x Marks 3 each=9)
Part D	**Long Essay**	(4 questions x Marks 5 each =20)
	Answer any 2 questions	(2 questions x Marks 5 each=10)
• **Total marks including choice -52** • **Maximum marks of the course-32**		

COMPLEMENTARY COURSE V – PHYSICS PRACTICAL

COURSE CODE	COURSE TITLE	SEMESTER	HOURS PER WEEK	CREDIT	EXAM HOURS
4C05PHY	PHYSICS PRACTICAL	IV	2	4	3

COURSE OUTCOME

CO1: Familiarise with apparatus for experiments in mechanics, optics, electricity and magnetism and electronics and electronics experiments.
CO2: Develop skill in setting up of apparatus for accurate measurement of physical quantities.
CO3: Understand multiple experimental techniques for determining physical quantities.
CO4: Develop skill in systematic way of measurements by minimizing possible errors.

Note: A brief theoretical back ground of each experiment must be given to the students before each cycle of experiments . Students are to maintain a practical log book regularly signed by the teacher in charge. Fair record not required. All the experiments are to be done.

LIST OF EXPERIMENTS

1. Flywheel- Moment of inertia
2. Compound pendulum-determination of g and K
3. Torsion pendulum- Moment of inertia of a disc
4. Young's modulus - Uniform Bending - using optic lever
5. Young's modulus – Non-uniform bending - using pin and microscope
6. Liquid lens - Refractive Index of material of lens using liquid of known refractive index
7. Spectrometer – Refractive index of the material of a prism
8. Spectrometer – grating-normal incidence
9. Surface tension-Determination of surface tension of given liquid
10. Air Wedge-Diameter of a thin wire
11. Newton's Rings- wavelength of sodium light
12. Deflection Magnetometer –Tan A and Tan B
13. Searle's Vibration magnetometer- magnetic moment
14. Carey Fosters Bridge- resistivity
15. Potentiometer- resistivity
16. Potentiometer- Calibration of ammeter
17. Newton's law of cooling- Specific heat capacity of given liquid
18. Construction of half wave rectifier with and without filter - ripple factor & load regulation

19. Construction of regulated power supply using Zener diode
20. Construction of Logic gates – AND , OR, NOT- verification of truth table

Reference Books

1. Practical Physics by P R Sasi Kumar PHI Learning Private Limited
2. BSc Practical Physics by C L Arora ,S Chand
3. An advanced course in Practical Physics by D.Chattopadhyay& P C Rakhit New Central Book Agency(P)Ltd
4. BSc Practical Physics - C L Arora (S Chand & Co.)

MARK DISTRIBUTION

Section	**Marks**
Principle and formula	6
Performance	6
Observation	14
Calculation ,Graph & Result	6

PART C:

GENERIC ELECTIVE COURSES
WORK AND CREDIT DISTRIBUTION
(2019 ADMISSION ONWARDS)

COURSE CODE	COURSE TITLE	SEMESTER	HOURS PER WEEK	CREDIT	EXAM HOURS	CE	ESE	TOTAL
5D 01 PHY	INTRODUCTION TO CLIMATE AND CLIMATE CHANGE SCIENCE	V	2	2	2	5	20	25
5D 02 PHY	RENEWABLE ENERGYSOURCES	V	2	2	2	5	20	25
5D 03 PHY	BIOPHYSICS	V	2	2	2	5	20	25
5D 04 PHY	JOY OF STAR WATCHING	V	2	2	2	5	20	25
5D 05 PHY	ELECTRICITY IN DAILY LIFE	V	2	2	2	5	20	25
5D 06 PHY	INTRODUCTION TO BASIC ELECTRONICS	V	2	2	2	5	20	25

EVALUATION

ASSESSMENT	WEIGHTAGE
EXTERNAL	80%
INTERNAL	20%

INTERNAL ASSESSMENT

COMPONENT *	WEIGHTAGE**	REMARKS
COMPONENT 1 TEST PAPER	70%	ONE
COMPONENT 2 ASSIGNMENT/VIVA	30%	ONE

5D01PHY:INTRODUCTION TO CLIMATE AND CLIMATE CHANGE SCIENCE

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5 D 01 PHY	2	2	2

COURSE OUTCOME

CO1:Understand the basic concepts of climate change science

CO2:Understand some of the potentially serious consequences of climate change

CO3:Analyse linkages between climate change adaptation and development planning.

CO4:Describe relevant policy approaches and strategic frameworks for climate change mitigation

CO5:Identify international initiatives which support countries to plan for climate change

Unit 1: The basics of climate change science. 8Hrs

An overview of key concepts such as weather, climate, and concept of energy balance; the greenhouse gas effect, and their main sources -the circulation in the atmosphere and ocean, and human contribution to climate change - some of the main observed changes in the climate since the industrial revolution- projected future trends and impacts of climate change on surface temperature, precipitation, ocean pH, sea-level and Arctic sea-ice extent. - overview of main sources of scientific climate information, relevant programmes and institutions.

Unit2: An overview of some of the potential consequences of climate change 5Hrs

sea level rise- flood, drought, extreme weather events and disruption of the global food supply that could have major negative impacts on humanity- the uncertainties in how the future may unfold, the important concept of risk as a means of dealing with uncertainty, and the different levels of risk associated with different consequences.

Unit3: Climate Change Adaptation 7Hrs

key definitions and some of the expected consequences of climate change on key sectors.-framework for assessing climate vulnerability. -different adaptation measures

that can be implemented for various vulnerable sectors- a short introduction to linkages between climate change adaptation and development- important international adaptation initiatives and programmes.

Unit 4: Climate Change Mitigation **5hrs**

Key definitions of mitigation and an overview of emissions levels and mitigation targets per country.-ways to integrate mitigation into development planning, through low-emission development strategies. -the main economic sectors where mitigation actions can be applied.-some of the key international mechanisms created to assist countries in planning and implementing mitigation actions.

Unit 5: Planning for Climate Change **7Hrs**

overview of different dimensions and entry points for climate change planning.- the roles of national and sectoral, as well as sub-national institutions in climate change planning- five-step methodology for preparing a low-emission climate- resilient development strategy- some of the main international initiatives to support climate change planning.

Book for study

1 Introduction to climate change:lecture notes for Meteorologists: Prepared byDavid D. Houghton

References:

1. An Introduction to Atmospheric Physics : D.G. Andrews
2. Descriptive Physical Oceanography : G Dietrich
3. The Physics of Atmospheres : John Houghton
4. The Discovery of Global Warming : Spencer R Weart
5. Storms Of My Grandchildren : James Hansen
6. Evaluating Climate Change Action for SustainableDevelopment: Juha I. Uitto, JyotsnaPuri, Rob D. van den Berg

MARKS INCLUDING CHOICE:

Unit	Marks
I	8
II	4
III	6
IV	4
V	8

PATTERN OF QUESTIONS

Part A	**Short answer**	(6 questions x Mark 1 = 6**)**
	Answer all questions	(6 questions x Mark 1 = 6)
Part B	**Short Essay**	(6 questions x Marks 2 each =12)
	Answer any 6 questions	(4questions x Marks 2 each=8)
Part C	**Essay**	(2questions x Marks 6 each =12
	Answer any 4 questions	(1question x Marks 6 each=6)
• **Total marks including choice -30** • **Maximum marks of the course-20**		

5D02PHY RENEWABLE ENERGY SOURCES

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5 D 02 PHY	2	2	2

COURSE OUTCOME

CO 1: Understand the sources of renewable energy
CO2: Understand the solar energy measurements &its applications
CO3: Understand the wind energy production &applications
CO4: Identify the energy from biomass,geothermal & ocean

Unit I Introduction **2hrs**

Renewable energy sources- prospects of renewable energy sources

[Book I 1.1,1.5,1.6]

Unit II Solar energy **12hrs**Solar constant –solar radiation measurements- physical principles of conversion of solar radiation in to heat-solar energy storage system-solar pond-solar water heating-solar thermal electric conversion- solar photo voltaic-solar distillation-solar pumping-solar furnace-solar cooking-solar green houses-solar production of hydrogen

[Book I 2.2,2.5,3.2,4.2,4.3,5.2,5.5,5.8-5.13]

Unit III Wind energy **10hrs**

Introduction-basic principles of wind energy conversion-site selection considerations-Basic component of WEC energy conversion systems-Classification of WEC systems-wind energy collectors –energy storage & application of wind energy

[Book I 6.1-6.2,6.4,6.5-6.6,6.8.6.12-6.13]

Unit IVBiomass energy ,geothermal energy&energy from oceans **8hrs**

Biomass conversion technologies-photosynthesis& biogas generation.-geothermal energy-geothermal sources-hydrotheralgeopressured resources-operational &environmental problems-geothermal energy in india-occean thermal energy conversion

[Book I 7.1-7.4,8.1,8.4-8.6,8.17-8.18,9.1-9.2]

Books for Study:

1.Non-conventional energy resources-G D Rai

Books for Reference:

1.Solar energy fundamentals & application-H.PGarg

2. Solar energy-G D Rai

MARKS INCLUDING CHOICE:

Unit	Marks
I	2
II	14
III	8
IV	6

PATTERN OF QUESTIONS

Part A	**Short answer**	(6 questions x Mark 1 = 6**)**
	Answer all questions	(6 questions x Mark 1 = 6)
Part B	**Short Essay**	(6 questions x Marks 2 each =12)
	Answer any 6 questions	(4questions x Marks 2 each=8)
Part C	**Essay**	(2questions x Marks 6 each =12
	Answer any 4 questions	(1question x Marks 6 each=6)
• **Total marks including choice -30** • **Maximum marks of the course-20**		

5 D 03 PHY: BIOPHYSICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5 D 03 PHY	2	2	2

COURSE OUTCOME

CO1: Understand the application of Physics in Biology and Medical fields

CO2: Understand the principles behind the movement of snakes, swimming of fishes and flying of birds

CO3: Understand about bioelectricity

CO4: Understand the principles behind EEG and ECG

CO5: Understand the sources of radiation and effects of radiation

CO6: Understand the basic principles of radiation protection and apply it in daily life.

Unit1 Bio-mechanics 12 Hrs

Types of muscles- striated, cardiac, tonic muscles, properties of muscles-Excitability – conductibility-contractibility – extensibility – tonicity – structure of striated muscles – Newton's laws – centre of mass – Bio-mechanical analysis of movements of snakes – swimming of fishes – aerodynamic basis of flights (Book-1 Chapter 12)

Unit II Bio – medical instrumentation 8Hrs,

Electrical Methods to study the brain activity- Electroencephalography (EEG) - Electrocardiography (ECG) (Book 2 Chapter 4))

Unit III Radiological Health and Safety 12 Hrs

Sources of Radiation – Natural Background exposure – Medical exposures – Consumer products – Occupational exposure – Biological effects of radiation – Deterministic

Effects – Stochastic effects – Acute radiation syndrome – Radiation risk- Principles of radiation protection – Effect of time ,distance and shielding (Book 4 Chapter 13)

Books for study

1 Introduction to Bio-Physics by Pranab Kumar Banerjee (S Chand)

2 Medical Bio- Physics by R N Roy – (Books and allied (P) Ltd)

3 The Physics of Radiology and Imaging – K Thayalan (JAYPEE Jaypee Brothers Medical Publishers (P) Ltd

MARKS INCLUDING CHOICE:

Unit	**Marks**
I	10
II	9
II	11

PATTERN OF QUESTIONS

Part A	**Short answer**	(6 questions x Mark 1 = 6**)**
	Answer all questions	(6 questions x Mark 1 = 6)
Part B	**Short Essay**	(6 questions x Marks 2 each =12)
	Answer any 6 questions	(4questions x Marks 2 each=8)
Part C	**Essay**	(2questions x Marks 6 each =12
	Answer any 4 questions	(1question x Marks 6 each=6)
• **Total marks including choice -30** • **Maximum marks of the course-20**		

5 D 04 PHY:JOY OF STAR WATCHING

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5 D 04 PHY	2	2	2

COURSE OUTCOME

CO 1: Understand Our Universe and its origin
CO2:Understand simple constellations
CO3:Explain the stars in Kerala culture
CO4:Understand the techniques of star watching

UnitI: **Astrophysics** **12Hrs**

The study of the Universe - Problems and prospects. The Universe - its origin-_Galaxies__Milkyway. A star is born. The death of a star. The comets–The pole star **(Book 1)**

Unit II: The constellations **2 Hrs**

Orion- Canis major-Taurus—Leo **(Book 2)**

Unit III Stars in Kerala culture **10Hrs**

The origin and expansion of Astrology -Stars and constellations in Kerala culture- **(Book 2)**

Unit IV: Star watching **8 Hrs**

How to experience star watching — For a better view (**Book 2)**

Books for study:

1. The Great Universe- G.K.Sasidharan- S.Chand
2. Joy of star watching – BimanBasu- National Book Trust , India.

Book for reference:

1. Jyothishavum Jyothisasthravum- K. Pappootty-K.S.S.P

MARKS INCLUDING CHOICE:

Unit	Marks
I	8
II	5
III	8
IV	9

PATTERN OF QUESTIONS

Part A	**Short answer**	(6 questions x Mark 1 = 6**)**
	Answer all questions	(6 questions x Mark 1 = 6)
Part B	**Short Essay**	(6 questions x Marks 2 each =12)
	Answer any 6 questions	(4questions x Marks 2 each=8)
Part C	**Essay**	(2questions x Marks 6 each =12
	Answer any 4 questions	(1question x Marks 6 each=6)

- **Total marks including choice -30**
- **Maximum marks of the course-20**

5 D05PHY : ELECTRICITY IN DAILY LIFE

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5 D05PHY	2	2	2

COURSE OUTCOME

CO 1: Understand the sources of Electricity
CO2: Explain the production of Electricity
CO3: Understand the basic concepts of electricity auditing

Unit I **12Hrs**

What is Electricity-Different sources of electricity- non conventional and conventional sources

Unit II **12Hrs**

Methods to produce electricity - How electricity is generated and transmitted- Uses and misuses of electricity -Methods of electricity conservations-How to save electricity

Unit III **8Hrs**

Electricity Auditing

Books for reference

Hand books on Electricity conservation and Electricity auditing by EMC of Govt of Kerala

MARKS INCLUDING CHOICE:

Unit	Marks
I	10
II	10
III	10

PATTERN OF QUESTIONS

Part A	**Short answer**	(6 questions x Mark 1 = 6**)**
	Answer all questions	(6 questions x Mark 1 = 6)
Part B	**Short Essay**	(6 questions x Marks 2 each =12)
	Answer any 6 questions	(4questions x Marks 2 each=8)
Part C	**Essay**	(2questions x Marks 6 each =12
	Answer any 4 questions	(1question x Marks 6 each=6)

- **Total marks including choice -30**
- **Maximum marks of the course-20**

5 D06PHY :INTRODUCTION TO BASIC ELECTRONICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5 D06PHY	2	2	2

CO 1: Understand the concepts of Basic electronics.

CO2: Explain the Semiconductor diode

CO3: Understand the basic electronic measurements and the instruments.

Unit I: Introduction to Electronics & Passive components 12 Hrs.

Evolution and impact of electronics, Passive components, Resistors – specifications, colour coding, preferred values, types; Capacitors – action, specifications, colour coding, reactance and q factor, classification; Inductors - self inductance and mutual inductance, specifications, reactance and q factor, comparison of inductors and capacitors, classification; Transformers - transformer efficiency, classification; Electromechanical components.

(Book 1, Chapters 0 & 1)

Unit II: Semiconductor Diodes 10 Hrs.

Energy band diagram, Intrinsic semiconductors, Extrinsic semiconductors, PN junction diode, Breakdown diodes, Varactor diode, Photodiode, Light dependent resistor, Solar cell, Light emitting diode.

(Book 1, Chapter 2)

Unit III: Electronic Measurements and Measuring Instruments 10 Hrs.

Generalized measurement system, Performance and parameters of instruments, Principle of permanent magnet moving coil meter, Galvanometer as ammeter, voltmeter and ohmmeter, Multimeter, Electronic multimeters, Testing of electronic components.

(Book 1, Chapter 6)

Books for Study:

1. Introduction to Electronics Engineering - 5th Edition, Dr. K. Gopakumar (Phasor Books)

Books for Reference:

1. Principles of Electronics - V K Mehta (S Chand & Co.)
2. Basic Electronics – B L Theraja (S Chand & Co.)

3. Basic Electronics – J B Gupta (S K Kataria& Sons)

MARKS INCLUDING CHOICE

Unit	Marks
I	12
II	9
III	9

PATTERN OF QUESTIONS

Part A	**Short answer**	(6 questions x Mark 1 = 6**)**
	Answer all questions	(6 questions x Mark 1 = 6)
Part B	**Short Essay**	(6 questions x Marks 2 each =12)
	Answer any 6 questions	(4questions x Marks 2 each=8)
Part C	**Essay**	(2questions x Marks 6 each =12
	Answer any 4 questions	(1question x Marks 6 each=6)
• **Total marks including choice -30** • **Maximum marks of the course-20**		

MODEL QUESTION PAPERS –UG (PHYSICS)

.I Sem Core

.I Sem Complementary

MODEL QUESTION PAPER
FIRST SEMESTER BSC DEGREE EXAMINATION
PHYSICS CORE COURSE
1B01PHY-MECHANICS I

Time : 3hrs **Max Marks: 40**

PART A

(All questions are compulsory. Each question carry 1 mark)

1. What do you mean by contact forces?
2. The dimensional formula of gravitational field is……
3. The differential equation for simple harmonic motion is……
4. State law of conservation of linear momentum
5. The value of escape velocity from earth is …….
6. Write the equation of motion for a simple pendulum

(6X1 = 6Marks)

PART B

(Answer any 6. Each question carries 2 marks)

Explain inertial system with reference to Newton's first law of motion

7. State and explain Newton's law of gravitation
8. Obtain an expression for fractional change in acceleration due to gravity with altitude
9. State and explain work energy theorem
10. What are conservative forces? Give examples
11. Sketch and explain the energy diagram of a two atom system
12. Show that angular momentum is conserved for a particle in central force motion
13. State and prove parallel axis theorem

(6X2 = 12 Marks)

PARTC

(Answer any 4. Each question carries 3 marks)

14. A Drum Major's Baton consists of two masses m_1 and m_2 separated by a thin rod of length l. the baton is thrown into air. Find the centre of mass and equation of motion for centre of mass of the baton
15. A 5kg mass moves under the influence of a force $F=(4t^2\mathbf{i}- 3t\mathbf{j})$N. It starts from the origin at t=0. Find its velocity and position at t=1s

16. A proton makes a head on collision with an unknown particle at rest. The proton rebounds straight back with 4/9 of its initial kinetic energy. Find the ratio of mass of unknown particle to that of proton assuming the collision to be elastic.
17. A mass 50kg is shot vertically upward from the surface of earth with 500m/s. assuming that the only force is gravity, determine its maximum altitude assuming the value of radius of earth
18. Show that the acceleration of the masses m_1 and m_2 suspended over a pulley of mass m_p in an Atwood's machine is $a=(m_1-m_2)g/(m_1+m_2+m_p/2)$
19. A uniform drum of radius **b** and mass **M** rolls down a plane inclined at an angle θ. Find its acceleration along the plane. The moment of inertia of the drum about its axis is $I_0=Mb^2/2$

(4x3=12 Marks)

PART D

(Answer any 2. Each question carries 5 marks)

20. State Newton's laws of motion. Apply them to find the force on each car of mass M in a string of three freight cars pulled with force F by a locomotive
21. Define potential energy. Obtain potential energies of a uniform force field and an inverse square force
22. Distinguish between elastic and inelastic collision. Discuss elastic collision between two particles in centre of mass system and show that their speeds remain same before and after collision
23. State the law of conservation of angular momentum. Prove that the angular momentum of a rigid body is equal to the sum of the angular momentum about the centre of mass and the angular momentum of the centre of mass about the origin

(2X5 = 10 Marks)

MODEL QUESTION PAPER
FIRST SEMESTER BSC DEGREE EXAMINATION
PHYSICS COMPLEMENTARY ELECTIVE COURSE
1C01PHY: MECHANICS

Time: 3 Hrs **Max Marks: 32**

SECTION A
(Answer all questions, each carries 1 Mark)

1. What are the limiting values of Poisson's ration?
2. If the radius of tube is doubled, the rate of flow increases by.....
3. The radius of gyration of sphere about an axis passing through the tangent.....
4. The basic solution form of simple harmonic oscillator.....
5. The velocity of sound in air is.....

(5X1 = 5Marks)

SECTION B
(Answer any four questions, each carries 2 Marks)

6. Steel is more elastic than rubber. Explain why?
7. Why should the lubricant oil be of high viscosity?
8. How does soap help us to remove dirt better in washing clothes?
9. State and prove the parallel axes theorem
10. Write the differential equation for a forced harmonic oscillator.
11. Discuss the various modes of vibration in case of an open-end pipe.

(4X2 = 8 Marks)

SECTION C
(Answer any three questions, each carries 3 Marks)

12. Find the amount of work done in twisting a steel wire of radius 1mm and length 20cm through an angle of 45^{o}. The rigidity modulus of the material of the wire is 8×10^{10} Nm^{-2}
13. Calculate the height to which water at $4^{o}C$ will rise in a capillary tube of 1 mm diameter. The surface tension of water is given $0.072 Nm^{-1}$.
14. A uniform thin bar of mass 3 kg and length 1.2m is bent to make an equilateral triangle. Calculate the moment of inertia about an axis passing through the centre of mass and perpendicular to the plane of the triangle.

15. Find whether the discharging of a capacitor through inductive circuit is oscillatory, given C= 0.2 μF, L= 10mH and R= 200 Ω.
16. A wire of length 1.5m is stretched by force of 44N. The diameter of the wire is 2mm and its density is 1.4 g/cm^{-3}. Calculate the frequency of fundamental node.

(3X3 = 9 Marks)

SECTION D
(Answer any two questions, each carries 5 Marks)

17. What do you mean by bending moment? Obtain the expression for the bending moment of a beam.
18. Derive an expression for moment of inertia of a solid sphere about the diameter.
19. Discuss the theory of damped harmonic oscillator.
20. Derive an expression for the velocity of a longitudinal wave in gases. Discuss the Laplace's correction to Newton's formula.

(2X5 = 10 Marks)