FAROOK COLLEGE (AUTONOMOUS)

Farook College PO, Kozhikode-673632

U.G Programme in Physics

Under

Choice Based Credit Semester System

SYLLABUS

Core, Complementary & Open Courses

(2022 Admission Onwards)

Prepared By:

Board of Studies in Physics

Farook College (Autonomous)

CERTIFICATE

I hereby certify that the documents attached are the bona fide copies of the syllabus of Core Courses offered to B.Sc. Physics programme and Complementary & Open Courses offered by the Department of Physics to be effective from 2022 admission onwards.

Date: Principal
Place: Farook College

PROGRAMME OUTCOMES (POs)

Programme Outcomes (POs) indicate the generic knowledge, skills and attitudes that every student graduating from a UG programme should attain. While every course of the programme can address only a subset of POs, all the core courses together should be able to address all the POs.

Programme Outcomes (POs) for General Undergraduate Programme:

- Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

- Problem Solving: Understand and solve the problems of relevance to society to meet the specified needs using the knowledge, skills and attitudes acquired from humanities/ sciences/mathematics/social sciences.

- Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

- Effective Citizenship: Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

- Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

- Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context of socio- technological changes.

Programme Specific Outcomes

PSO1: Understand the basic concepts of methodology of science and the fundamentals of mechanics, properties of matter and electrodynamics

PSO2: Understand the theoretical basis of quantum mechanics, relativistic physics, nuclear physics, optics, spectroscopy, solid state physics, astrophysics, statistical physics, photonics and thermodynamics

PSO3: Understand and apply the concepts of electronics in the designing of different analog and digital circuits

PSO4: Understand the basics of computer programming and numerical analysis

PSO5: Apply and verify theoretical concepts through laboratory experiments

Abbreviations used:

CL – Cognitive level; **U** – understand; **Ap** – apply; **An** – analyze; **C -** create

KC – Knowledge category; **C** – conceptual; **F** – factual; **P -** procedural

CREDIT AND MARK DISTRIBUTION IN EACH SEMESTERS

Total Credits: 120; Total Marks: 3075

Semester	*Course*	*Credit*	*Marks*
I	Common course: English	4	100
	Common course: English	3	75
	Common course: Additional Language	4	100
	Core Course I: Mechanics-I	2	75
	Complementary course: Mathematics	3	75
	Complementary course: II	2	75
	Total	**18**	**500**
II	Common course: English	4	100
	Common course: English	3	75
	Common course: Additional Language	4	100
	Core Course II: Mechanics-II	2	75
	Complementary course: Mathematics	3	75
	Complementary course: II	2	75
	Total	**18**	**500**
III	Common course: English	4	100
	Common course: Additional Language	4	100
	Core Course III: Electrodynamics-I	3	75
	Complementary course: Mathematics	3	75
	Complementary course: II	2	75
	Total	**16**	**425**
IV	Common course: English	4	100
	Common course: Additional Language	4	100
	Core Course IV: Electrodynamics-1I	3	75
	Core Course V: Physics Practical 1	5	100
	Complementary course: Mathematics	3	75
	Complementary course: II	2	75
	Complementary course: II Practical	4	100
	Total	**25**	**625**
V	Core Course VI: Computational Physics	3	75
	Core Course VII :Quantum Mechanics	3	75
	Core Course VIII: Optics	3	75
	Core Course IX: Electronics	3	75
	Open course	3	75
	Total	**15**	**375**
VI	Core Course X: Thermodynamics	3	75
	Core Course XI: Statistical Physics, Solid State Physics ,Spectroscopy and Photonics	3	75
	Core Course XII: Nuclear and Particle Physics	3	75
	Core Course XIII: Relativistic mechanics and Astrophysics	3	75
	Core Course XIV: Elective	3	75
	Core Course XV: Practical II	5	100
	Core Course XVI: Practical III	5	100
	Core Course XVII: Project and Tour report	3	60,15
	Total	**28`**	**650**
Grand Total		**120**	**3075**

****** Four audit courses are Mandatory for the program, but not counted for the calculation of SGPA or CGPA. Student can attain only pass (Grade P) for these courses.

COURSE STRUCTURE PHYSICS(CORE)

Credit Distribution

Semester	*Common course*		*Core Course*	*Complementary course*		*Open course*	*Total*
	English	*Additional Language*		*Mathematics*	*Physics*		
I	4+3	4	2	3	2	-	18
II	4+3	4	2	3	2	-	18
III	4	4	3	3	2	-	16
IV	4	4	3+5*	3	2+4*	-	25
V	-	-	3+3+3+3	-	-	3	15
VI	-	-	3+3+3+3+3 +5*+5*+3**	-	-	-	28
Total	**22**	**16**	**55**	**12**	**12**	**3**	**120**

*Practical **Project

Tour Report to be evaluated with Practical Paper III

Mark Distribution and Indirect Grading System

Indirect grading system for examinations of all courses. After external and internal evaluations marks are entered in the answer scripts. All other calculations, including grading, will be done by the university using the software. Indirect Grading System in 8 point scale is followed. Each course is evaluated by assigning marks with a letter grade (O, A^+, A, B+,B, C, P or F to that course by the method of indirect grading.

Mark Distribution

Sl. No.	*Course*	*Marks*
1	English	550
2	Additional Language	400
3	Core course: Physics	1350
4	Complementary course I: Mathematics	300
5	Complementary course II: Chemistry/….	400
6	Open Course	75
Total Marks		**3075**

Eight point Indirect Grading System

% of Marks	*Grade*	*Interpretation*	*Grade Point Average*	*Range of Grade points*	*Class*
95 and above	O	Outstanding	10	9.5 - 10	First Class with distinction
85 to below 95	A^+	Excellent	9	8.5 – 9.49	
75 to below 85	A	Very good	8	7.5-8.49	
65 to below 75	B+	Good	7	6.5 –7.49	First Class
55 to below 65	B	Satisfactory	6	5.5 – 6.49	
45 to below 55	C	Average	5	4.5 – 5.49	Second Class
35 to below 45	P	Pass	4	3.5 – 4.49	Third class
Below 40	F	Fail	0	0 – 3.49	Fail

Core Course Structure
Total Credits: 55 (Internal: 20%; External: 80%)

Semester	*Code No*	*Course Title*	*Hrs/ Week*	*Total Hrs*	*Credit*	*Marks*
I	BPH1B01	Core Course I: Mechanics I	2	36	2	75
	-	Core Course V : Practical-I	2	36	-*	-
II	BPH2B02	Core Course II:Mechanics II	2	36	2	75
	-	Core Course V : Practical-I	2	36	-*	-
III	BPH3B03	Core Course III: Electrodynamics-I	3	54	3	75
	-	Core Course V : Practical-I	2	36	-*	-
IV	BPH4B04	Core Course IV: Electrodynamics-II	3	54	3	75
	BPH4B05L	Core Course V : Practical-I	2	36	5	100
V	BPH5B06	Core Course VI: Computational Physics	3	54	3	75
	BPH5B07	Core Course VII: Quantum Mechanics	3	54	3	75
	BPH5B08	Core Course VIII: Optics	3	54	3	75
	BPH5B09	Core Course IX: Electronics	3	54	3	75
		Core Course XIV: Practical II	4	72	-**	-
		Core Course XV: Practical III	4	72	-**	-
		Core Course XVI: Project Work	2	36	-**	-
VI	BPH6B10	Core Course X: Thermodynamics	3	54	3	75
	BPH6B11	Core Course XI: Statistical Physics,	3	54	3	75

		Solid State Physics, Spectroscopy and Photonics					
	BPH6B12	Core Course XII: Nuclear Physics and Particle Physics		3	54	3	75
	BPH6B13	Core Course XIII Relative mechanics and Astro physics		3	54	3	75
	BPH6BE01	Core Course XIV: Elective***	1. Biomedical physics	3	54	3	75
	BPH6BE02		2. Nano science and technology				
	BPH6BE03		3. Materials science				
	BPH6B14L	Core Course XIV: Practical -II		4	72	5**	100
	BPH6B15L	Core Course XV: Practical-III		4	72	5**	100
	BPH6B16P	Core Course XVI: Project Work &Tour Report		2	36	3**	60 15
Total						**55**	

* Exam will be held at the end of 4th semester

** Exam will be held at the end of 6th semester

***An institution can choose any one among the three courses.

CORE COURSE THEORY: EVALUATION SCHEME

The evaluation scheme for each course contains two parts: *viz.*, internal evaluation, and external evaluation. Maximum marks from each unit are prescribed in the syllabus.

1. INTERNAL EVALUATION

20% of the total marks in each course are for internal evaluation. The colleges shall send only the marks obtained for internal examination to the university.

Table 1: Components of Evaluation (Theory)

Sl. No.	*Components*	Marks for 4/5 credits papers	Marks for 2/3 credits papers
1	Class room participation based on attendance	4	3
2	Test paper: I	8	6
3	Assignment	4	3
4	Seminar/ Viva	4	3
Total Marks		20	15

Table 2: Pattern of Test Papers

Duration	*Pattern*	*Total number of questions*	*Number of questions to be answered*	*Marks for each question*	*Marks*
2 Hours	Short answer	12	10-12	2	20
	Paragraph/problem	7	6-7	5	30
	Essay	2	1	10	10
*Total Marks**					60

*90% and above = 6, 80 to below 90% = 5.5, 70 to below 80% = 5, 60 to below 70% = 4.5, 50 to below 60% = 4, 40 to below 50% = 3.5, 35 to below 40% = 3, 25 to below 30% = 2.5,15 to below 20=2 less than 15

2. EXTERNAL EVALUATION

External evaluation carries 80% marks. University examinations will be conducted at the end of each semester.

Table 1: Pattern of Question Paper

Duration	*Pattern*	*Total number of questions*	*Number of questions to be answered*	*Marks for each question*	*Marks*
2 Hours	Short answer	12	10-12	2	20
	Paragraph/problem	7	6-7	5	30
	Essay	2	1	10	10
*Total Marks**					60

CORE COURSE PROJECT: EVALUATION SCHEME

Project evaluation will be conducted at the end of sixth semester.

Project:

1. Project work should be done as an extension of topics in the syllabus.
2. Project can be experimental / theoretical or done in collaboration (association) with a recognized lab or organization.
3. Project work may be done individually or as group of maximum of six students.
4. A supervisor has to guide a batch of maximum 24 students. For an additional batch another supervisor has to be appointed. However the existing work load should be maintained.

Guidelines for doing project

The project work provides the opportunity to study a topic in depth that has been chosen or which has been suggested by a staff member. Student's first carryout a literature survey which will provide the background information necessary for the investigations during the research phase of the project.

The various steps in project works are the following:-

a) Wide review of a topic.

b) Investigation on an area of Physics in systematic way using appropriate techniques.

c) Systematic recording of the work.

d) Reporting the results with interpretation in documented and oral forms.

Use of Log Book

- During the Project the students should make regular and detailed entries in to a personal laboratory log book through the period of investigation.
- The log book will be a record of progress on project and will be useful in writing the final report. It contains experimental conditions and results, ideas, mathematical expressions, rough work and calculation, computer file names etc. All entries should be dated.
- The students are expected to have regular meeting with their supervisor to discuss progress on the *project* and the supervisor should regularly write brief comments with dated signature.
- **The log book and the written/typed report must be submitted at the end of the project**.

Table 1: Internal Evaluation

Sl. No	*Criteria*	*Marks*
1	Punctuality &Log book	2
2	Skill in doing project work/data	2
3	Scheme Organization of Project Report	3
4	Viva-Voce	5
Total Marks		12

Table 2: External Evaluation

Individual presentation is compulsory and individual Log book should be submitted

Sl. No	*Criteria*	*Marks*
1	Content and relevance of the project, Methodology, Reference, Bibliography	8
2	Project Presentation, Quality of analysis, statistical tools, findings, recommendations	10
3	Project Report (written/typed copy) and Log Book	10
4	Viva-voce	20
Total Marks		48

STUDY TOUR Internal 5 marks

Minimum two days visit to National research Institutes, Laboratories and places of scientific importance. **Study tour report** has to be submitted with photos and analysis along with Practical Paper III for evaluation

Distribution of marks EXTERNAL

No	Items	External (15)
1	Documented Report	8
2	Outcome/Analysis	4
3	Photos (five photos)	3
TOTAL		**15**

Practical Evaluation (Core)

Internal		External		
Items	**Marks**	**Items**	**Marks**	**Marks for Python Programming**
Record	4	Record with 20 expts Max.one mark for each expt	10	10
Regularity in getting the expts done	4	Formulae, Theory, Principle/ Programme	22	15
Attendance	4	Adjustments& setting / Algorithm	14	15
Test 1	4	Tabulation, Observation and performance/ Execution	20	24
Test 2	4	Calculation, result, graph, unit/ Result	10	12
		Viva	4	4
Total	**20**	**Total**	**80**	**80**

CORE COURSE – XIII (ELECTIVE) :		
1	BPH6E01	Biomedical physics
2	BPH6E02	Nano science and technology
3	BPH6E03	Materials science

OPEN COURSES OFFERED BY PHYSICS DEPARTMENT (For students from other streams)		
1	BPH5 D01	Non-conventional energy sources
2	BPH5 D02	Amateur astronomy and astrophysics
3	BPH5 D03	Elementary medical physics

PHYSICS COMPLEMENTARY COURSE STRUCTURE

Total Credits: 12 (Internal: 20%; External: 80%)

Semester	*Code No*	*Course Title*	*Hrs/ Week*	*Total Hrs*	*Credit*	*Marks*
I	BPH1C01	Complementary Course I: Properties of matter and Thermodynamics	2	36	2	75
	-	Complementary Course V: PHYSICS Practical	2	36	-*	-
II	BPH2C02	Complementary Course II: Optics, Laser, Electronics and Communication	2	36	2	75
	-	Complementary Course V: PHYSICS Practical	2	36	-*	-
III	BPH3C03	Complementary Course III: Mechanics, Relativity, Waves and Oscillations	3	54	2	75
	-	Complementary Course V: PHYSICS Practical	2	36	-*	-
IV	BPH4C04	Complementary Course IV: Electricity ,Magnetism and Nuclear Physics	3	54	2	75
	BPH4C05L	Complementary Course V: PHYSICS Practical	2	36	4*	100
Total					**12**	**400**

* Examination will be held at the end of 4th semester

COMPLEMENTARY COURSE THEORY: EVALUATION SCHEME

The evaluation scheme for each course contains two parts: *viz.,* internal evaluation and external evaluation. Maximum marks from each unit are prescribed in the syllabus.

1. INTERNAL EVALUATION

20% of the total marks in each course are for internal evaluation. The colleges shall send only the marks obtained for internal examination to the university.

Table 1: Components of Evaluation

Sl. No.	*Components*	Marks for 2/3 credits papers
1	Class room participation based on attendance	3
2	Test paper: I	6
3	Assignment	3
4	Seminar/ Viva	3
Total Marks		15

Table 2: Pattern of Test Papers

Duration	*Pattern*	*Total number of questions*	*Number of questions to be answered*	*Marks for each question*	*Marks*
2 Hours	Short answer	12	10-12	2	20
	Paragraph/problem	7	6-7	5	30
	Essay	2	1	10	10
*Total Marks**					60

*90% and above = 6, 80 to below 90% = 5.5, 70 to below 80% = 5, 60 to below 70% = 4.5, 50 to below 60% = 4, 40 to below 50% = 3.5, 35 to below 40% = 3, 25 to below 30% = 2.5,15 to below 20=2 less than 15

2. EXTERNAL EVALUATION

External evaluation carries 80% marks. University examinations will be conducted at the end of each semester.

Table 1: Pattern of Question Papers

Duration	*Pattern*	*Total number of questions*	*Number of questions to be answered*	*Marks for each question*	*Marks*
2 Hours	Short answer	12	10-12	2	20
	Paragraph/problem	7	6-7	5	30
	Essay	2	1	10	10
*Total Marks**					60

Practical Evaluation (Complimentary)

Internal		External	
Record	4	Record with 20 expts Max. ½ mark for one expt	10
Regularity	4	Formulae, Theory, Principle	22
Attendance	4	Adjustments, setting	14
Test I	4	Tabulation & Observation	20
Test II	4	Calculation, graph, result, unit	10
		Viva	4
Total	**20**	**Total**	**80**

OPEN COURSE STRUCTURE

(FOR STUDENTS OTHER THAN B.Sc. Physics)

Total Credits: 2 (Internal 20%; External 80%)

Semester	Code No	Course Title	Hours/ Week	Total Hours	Marks
V	BPH5D01	NON CONVENTIONAL ENERGY SOURCES	**3**	**54**	**75**
	BPH5D02	AMATEUR ASTRONOMY AND ASTROPHYSICS			
	BPH5D03	ELEMENTARY MEDICAL PHYSICS			

The evaluation scheme contains two parts: *viz.*, internal evaluation and external evaluation. Maximum marks from each unit are prescribed in the syllabus. Problems are not required

1. INTERNAL EVALUATION

20% of the total marks are for internal evaluation. The colleges shall send only the marks obtained for internal examination to the university.

Table 1: Components of Evaluation

Sl. No.	*Components*	Marks for 2/3 credits papers
1	Class room participation based on attendance	3
2	Test paper: I	6
3	Assignment	3
4	Seminar/ Viva	3
Total Marks		15

Table 2: Pattern of Test Papers (Internal)

Duration	*Pattern*	*Total number of questions*	*Number of questions to be answered*	*Marks for each question*	*Marks*
2 Hours	Short answer	12	10-12	2	20
	Paragraph/problem	7	6-7	5	30
	Essay	2	1	10	10
*Total Marks**					60

*90% and above = 6, 80 to below 90% = 5.5, 70 to below 80% = 5, 60 to below 70% = 4.5, 50 to below 60% = 4, 40 to below 50% = 3.5, 35 to below 40% = 3, 25 to below 30% = 2.5,15 to below 20=2 less than 15

2. EXTERNAL EVALUATION

External evaluation carries 80% marks. University examination will be conducted at the end of 5th semester.

Table 1: Pattern of Question Paper

Duration	*Pattern*	*Total number of questions*	*Number of questions to be answered*	*Marks for each question*	*Marks*
2 Hours	Short answer	12	10-12	2	20
	Paragraph/problem	7	6-7	5	30
	Essay	2	1	10	10
*Total Marks**					60

B.Sc. PHYSICS
CORE PROGRAMME SYLLABUS

Semester I
Core Course I -BPH1B01: MECHANICS I
36 hours (Credit - 2)

	Course Outcome	**PSO**	**CL**	**KC**	**Class Sessions allotted**
CO1	Understand and apply the basic concepts of Newtonian Mechanics to physical systems	PSO1	U	C	16
CO2	Understand and apply the basic idea of work-energy theorem to physical systems	PSO1	Ap	C, P	8
CO3	Understand and apply the rotational dynamics of rigid bodies	PSO1	Ap	C,P	12

Unit I – Newton's Laws **16 Hrs**

Newton's First Law, Second Law and Third Law – Astronauts in space : Inertial systems and fictitious forces – Standards and units – Some applications of Newton's laws – The astronauts' tug of war, Freight train, Constraints, Block on string, The whirling block, The conical pendulum – The everyday forces of physics – Gravity and Weight; Gravitational force of a sphere; Turtle in an elevator; Gravitational field – Electrostatic force – Contact forces; Block and string; Dangling rope; Whirling rope; Pulleys; Tension and Atomic forces; Normal force; Friction; Block and wedge with friction; Viscosity – Linear restoring force; Spring and block : The equation for simple harmonic motion; Spring and 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

[Sections 2.1 to 2.5, 3.1 to 3.3 of An Introduction to Mechanics (1stEdn.) by Daniel Kleppner and Robert J. Kolenkow]

Unit II – Work and Energy **8 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 – Conical pendulum; 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

[Sections 4.1 to 4.13 of An Introduction to Mechanics (1st Edn.) by Daniel Kleppner and Robert J. Kolenkow. The problems in chapter 5 should be discussed with this.]

Unit III – Angular Momentum **12 Hrs**

Angular momentum of a particle – Angular momentum of a sliding block; Angular momentum of the conical pendulum – Torque – Central force motion and the law of equal areas – Torque on a sliding block; Torque on the conical pendulum; 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 for a 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

[Sections 6.1 to 6.7, 7.1, 7.2 and 7.5 of An Introduction to Mechanics (1st Edn.) by Daniel Kleppner and Robert J. Kolenkow]

Books of Study:

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

Reference Books:

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

Mark distribution for setting Question paper.

Unit/chapter	**Title**	**Marks**
1	Newton‟s Laws	36
2	Work and Energy	18
3	Angular Momentum	25
Total Marks *		79

*Total marks include that for choice of questions in sections A, B and C in the question paper.

Semester 2
Core Course II - BPH2B02: MECHANICS II
36 hours (Credit - 2)

	Course Outcome	**PSO**	**CL**	**KC**	**Class Sessions allotted**
CO1	Understand the features of non-inertial systems and fictitious forces	PSO1	U	C	8
CO2	Understand and analyze the features of central forces with respect to planetary motion	PSO1	An	C, P	10
CO3	Understand the basics ideas of harmonic oscillations	PSO1	U	C	10
CO4	Understand and analyze the basics concepts of wave motion	PSO1	An	C,P	8

Unit I – Noninertial Systems and Fictitious Forces **8 Hrs**

Galilean transformations – Uniformly accelerating systems – The apparent force of gravity – Pendulum in an accelerating car – The principle of equivalence – The driving force of the tides – 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 – Weather systems – Foucault's pendulum

[Sections 8.1 to 8.5 of An Introduction to Mechanics (1st Edn.) by Daniel Kleppner and Robert J. Kolenkow]

Unit II – Central Force Motion **10 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

[Sections 9.1 to 9.7 of An Introduction to Mechanics (1st Edn.) by Daniel Kleppner and Robert J. Kolenkow]

Unit III – Harmonic Oscillator **10 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 an Q-factor – Q factor of two simple oscillators – Graphical analysis of a damped oscillator – Solution of the equation of motion for the damped oscillator – Forced harmonic oscillator – Undamped forced oscillator – Resonance

[Sections 10.1 to 10.3 of An Introduction to Mechanics (1st Edn.) by Daniel Kleppner and Robert J. Kolenkow]

Unit IV – Waves **8Hrs**

Wave Motion, General Equation of Wave Motion, Plane Progressive Harmonic Wave, Energy Density for a Plane Progressive Wave, Intensity of a Wave, Transverse Waves in Stretched Strings, Modes of Transverse Vibrations of Strings, Longitudinal Waves in Rods and Gases, Fourier's Theorem, Wave Velocity and Group Velocity [Sections:11.1 to 11.9 , 11.12 to 11.13 of Mechanics by J.C Upadhyaya]

Books of Study:

1. An Introduction to Mechanics, 1st Edn. – Daniel Kleppner and Robert J. Kolenkow – McGraw-Hill.
2. Mechanics by J.C Upadhyaya 2003.
3. Berkeley Physics Course : Vol.3 : Waves, 2nd Edn. – Frank S. Crawford Jr. – McGraw-Hill

Reference Books:

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

Mark distribution for setting Question paper.

Unit/ chapter	**Title**	**Marks**
1	Noninertial Systems and Fictitious Forces	18
2	Central Force Motion	22
3	Harmonic Oscillator	18
4	Waves	21
*Total Marks **		79

*Total marks include that for choice of questions in sections A, B and C in the question paper.

Semester 3

Core Course III -BPH3B03: ELECTRODYNAMICS I

54 hours (Credit - 3)

	Course Outcome	**PSO**	**CL**	**KC**	**Class Sessions allotted**
CO1	Understand and apply the fundamentals of vector calculus	PSO1	Ap	C	10
CO2	Understand and analyze the electrostatic properties of physical systems	PSO1	An	C, P	16
CO3	Understand the mechanism of electric field in matter.	PSO1	U	C,P	8
CO4	Understand and analyze the magnetic properties of physical systems	PSO1	An	C,P	12
CO5	Understand the mechanism of magnetic field in matter.	PSO1	U	C,P	8

Unit I – Vector Calculus **10 Hrs**

Vector Algebra: Vector operations - Vector algebra: Component form – Triple products – Position, Displacement and Separation vectors – How vectors transform 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 of calculus – Fundamental theorem for Gradients – Fundamental theorem for divergences : Gauss's Divergence Theorem (no proof needed) – Fundamental theorem for curls : Stoke's theorem (no proof needed)

Spherical polar coordinates – Cylindrical coordinates – Their relationship to Cartesian coordinates – Expressing differential displacement vector, differential area vectors, differential volume element, gradient operator, divergence operator and curl operator in spherical polar and cylindrical coordinates.

Dirac delta function: Divergence of $\hat{r}/r^2$ – One-dimensional delta function – Three-dimensional delta functionHelmholtz theorem (no proof needed) – Divergence-less vector fields – Curl-less vector fields – Potentials. [Sections 1.1 to 1.6 of Introduction to Electrodynamics (4^{th} Edn.) by David J Griffiths.]

Unit II – Electrostatics **16 Hrs**

Electrostatic field – Coulomb's law, Electric field, Continuous charge distributions - Divergence and curl of electrostatic field, Field lines and Gauss law, The divergence of **E**, Applications of Gauss law, Curl of **E** – Electric potential – Comments on potential, Poisson's equation and Laplace's equation, The potential of a localized charge distribution, Electrostatic boundary conditions – Work and energy in electrostatics, The work done in moving a charge, The energy of point charge distribution, The Energy of a continuous charge distribution, Comments on Electrostatic energy – Conductors, Basic properties of conductors, Induced charges, The Surface charge on a conductor, The force on surface charge, Capacitors.

[Sections 2.1 to 2.5 of Introduction to Electrodynamics by David J Griffiths. Additional problems should be

done from chapters 1, 2 and 3 of Berkeley Physics Course: Vol.2: Electricity and Magnetism (2nd Edn.) by Edward M Purcell.]

Unit III – Electric fields in matter **8 Hrs**

Polarization – Dielectrics, Induced dipoles, Alignment of polar molecules, Polarization – The field of a polarized object , Bound charges, Physical interpretation of bound charges, The field inside a dielectric – The electric displacement – Gauss's law in presence of dielectrics, Boundary conditions for **D** – Linear dielectrics, Susceptibility, Permittivity, Dielectric constant, Boundary value problems with linear dielectrics, Energy in dielectric systems, Forces on dielectrics.

[Sections 4.1 to 4.4 of Introduction to Electrodynamics (4th Edn.) by David J Griffiths. Additional problems should be done from chapter 10 of Berkeley Physics Course: Vol.2: Electricity and Magnetism (2nd Edn.) by Edward M Purcell.]

Unit IV – Magnetostatics **12 Hrs**

The Lorentz force law – Magnetic fields, Magnetic forces, cyclotron motion, cycloid motion, Currents, Linear, Surface and Volume current density – Biot -Savart law, The magnetic field of steady current – Divergence and curl of **B,** Straight line currents, Applications of Ampere's law, Magnetic field of a toroidal coil, Comparison of magnetostatics and electrostatics – Magnetic vector potential , Vector potential, Magnetostatic boundary conditions.

[Sections 5.1 to 5.4.2 of Introduction to Electrodynamics (4th Edn.) by David J Griffiths. Additional problems should be done from chapter 6 of Berkeley Physics Course: Vol.2: Electricity and Magnetism (2nd Edn.) by Edward M Purcell.]

Unit V – Magnetostatic fields in matter **8 Hrs**

Magnetisation – Diamagnets, Paramagnets and Ferromagnets, Torques and forces on magnetic dipoles, Effect of a magnetic field on atomic orbits, Magnetization – Field of a magnetised object, Bound Currents, Physical interpretation of bound currents, Magnetic field inside matter – Auxiliary field **H**, Ampere's law in magnetised materials, Boundary conditions – Linear and nonlinear media, Magnetic susceptibility and permeability, Ferromagnetism.

[Sections 6.1 to 6.4 of Introduction to Electrodynamics (4th Edn.) by David J Griffiths. Additional problems should be done from chapter 11 of Berkeley Physics Course: Vol.2: Electricity and Magnetism (2nd Edn.) by Edward M Purcell.]

Books of Study:

1. Introduction to Electrodynamics, 4th Edn. – David J Griffiths – Prentice Hall India Learning Pvt. Ltd
2. Berkeley Physics Course: Vol.2: Electricity and Magnetism, 2nd Edn. – Edward M. Purcell – McGraw-Hill

Reference Books:

1. Electricity and magnetism by Arthur F Kip
2. Physics Vol. II by Resnick and Halliday

3. Electricity and Magnetism-Hugh D Young and Roger A Freedman
4. Vector Analysis M R Spiegel,S Lipschutz,D Spellman -Schaum's outline-McGraw Hill
5. Div, Grad, Curl and all that ; An informal text on vector calculus H M Schey (Norton)

Mark distribution for setting Question paper.

Unit/chapter	**Title**	**Marks**
1	Vector Calculus	15
2	Electrostatics	22
3	Electric fields in matter	12
4	Magnetostatics	18
5	Magnetostatic fields in matter	12
*Total Marks **		79

*Total marks include that for choice of questions in sections A, B and C in the question paper.

Semester 4

Core Course IV- BPH4B04: ELECTRODYNAMICS II

54 hours (Credit - 3)

	Course Outcome	**PSO**	**CL**	**KC**	**Class Sessions allotted**
CO1	Understand the basic concepts of electrodynamics	PSO1	U	C	15
CO2	Understand and analyze the properties of electromagnetic waves	PSO1	An	C, P	15
CO3	Understand the behavior of transient currents	PSO1	U	C	8
CO4	Understand the basic aspects of ac circuits	PSO1	An	C,P	8
CO5	Understand and apply electrical network theorems	PSO1	Ap	C,P	8

Unit I – Electrodynamics **15 Hrs**

Electromotive force – Ohm's law, electromotive force, motional emf – Electromagnetic induction - Faraday's law, induced electric field, inductance, energy in magnetic fields – Maxwell's equations – Electrodynamics before Maxwell, Maxwell's modification of Ampere's law, Maxwell's equations, Magnetic charge, Maxwell's equations inside matter, Boundary conditions – Continuity equation – Poynting's theorem

[Sections 7.1 to 7.3 and 8.1 of Introduction to Electrodynamics by David J Griffiths. Additional problems should be done from chapter 7 of Berkeley Physics Course: Vol.2: Electricity and Magnetism (2nd Edn.) by Edward M Purcell.]

Unit II – Electromagnetic waves **15 Hr**

Waves in one dimension, The wave equation, sinusoidal waves, boundary conditions :reflection and transmission, Polarization – Electromagnetic waves in vacuum , Wave equation for **E** and **B**, monochromatic plane waves in vacuum, energy and momentum of E.M. waves, Poynting vector - Electromagnetic waves in matter, Propagation through linear media, reflection and transmission at normal incidence. Potential formulation – Scalar and vector potentials, Gauge transformations, Coulomb gauge, and Lorentz gauge.

[Sections 9.1 to 9.3.2 and 10.1of Introduction to Electrodynamics by David J Griffiths. Additional problems should be done from chapter 9 of Berkeley Physics Course: Vol.2: Electricity and Magnetism (2nd Edn.) by Edward M Purcell.]

Unit III- Transient currents **8 Hrs**

Growth and decay of current in LR and CR circuits – measurement of high resistance by leakage – growth of charge and discharge of a capacitor through LCR circuit –theory of BG – experiment to determine charge sensitiveness of BG using a standard condenser and HMS.

(Electricity and magnetism by R. Murugeshan)

Unit IV- AC circuits **8 Hrs**

AC through L, C, R, LC, CR, LR and LCR – resonance and resonant circuits – repulsion between coil and conductor – j operators, series and parallel resonance circuit.

(Electricity and Magnetism by D.N. Vasudeva, Electricity and Magnetism by R. Murugeshan)

Unit V – Network theorems **8 Hrs**

Kirchhoff's laws, Voltage sign and current direction, Solution of simultaneous equations using determinants, Source conversion, Superposition theorem, Ideal equivalent circuits, Thevenin's theorem, Reciprocity theorem, Delta / Star transformation – Star / Delta transformation – Norton's theorem, Maximum power transfer theorem.

[Electrical Technology Vol. 1 by B. L. Theraja and A. K. Theraja]

Books of Study :

1. Introduction to Electrodynamics, 4thEdn. – David J Griffiths – Prentice Hall India Learning Pvt. Ltd
2. Berkeley Physics Course: Vol.2: Electricity and Magnetism, 2nd Edn. – Edward M. Purcell – McGraw-Hill
3. A Text Book of Electrical Technology Vol. 1 – B. L. Theraja, A. K. Theraja – S. Chand Publishers, 1997
4. Electricity and Magnetism by R.Murugeshan (Third revised edition)
5. Electricity and Magnetism by D.N Vasudeva (Twelfth revised edition)

Reference Books:

1. Electricity and magnetism by Arthur F Kip
2. Physics Vol. II by Resnick and Halliday
3. Electricity and Magnetism by D.N Vasudeva (12^{th} revised edition)
4. Introductory AC Circuit theory – K Mann & G J Russell- Universities Press

Mark distribution for setting Question paper.

Unit/chapter	**Title**	**Marks**
1	Electrodynamics	22
2	Electromagnetic waves	22
3	Transient currents	12
4	AC circuits	12
5	Network theorems	11
*Total Marks **		79

*Total marks include that for choice of questions in sections A, B and C in the question paper.

Semester 5

Core Course VI- BPH5B06: COMPUTATIONAL PHYSICS

54 hours (Credit – 3)

	Course Outcome	**PSO**	**CL**	**KC**	**Class Sessions allotted**
CO1	Understand the Basics of Python programming	PSO4	U	C	16
CO2	Understand the applications of Python modules	PSO4	U	C	6
CO3	Understand the basic techniques of numerical analysis	PSO4	U	C	18
CO4	Understand and apply computational techniques to physical problems	PSO4	Ap	C,P	14

Unit 1

Chapter 1: Introduction to Python Programming **16 Hrs**

Introduction to algorithm, flowchart and high level Computer programming languages Compilers-Interpreters - Introduction to Python language- Advantages and unique features of Python language- Interactive mode and script mode- Writing and execution of programs -various data types in Python- Reading keyboard input: The raw_input function and input function - print command, formatted printing- open and write function - Variables, operators, expressions and statements- String operations, Lists, list operations (len, append, insert, del, remove, reverse, sort, +, *, max, min, count, in, not in, sum), sets, set operations (set, add, remove, in, not in, union, intersection, symmetric difference)-Tuples and Dictionaries, various control and looping statements: (if, if..else, if..ellif, while, for, break, continue) - user defined functions- Modules - File input and file output- Pickling.

Books for study:

1.Introduction to Python for Engineers and Scientists by Dr.Sandeep Nagar, Apress publications.

2.Python for Education by Dr. B P Ajithkumar, IUAC, New Delhi; e-book freely downloadable from www.expeyes.in/documents/mapy.pdf

3. Python Tutorial Release 3.0.1 by Guido van Rossum, Fred L. Drake, Jr., editor. (http://www.altaway.com/resources/python/tutorial.pdf)

Chapter 2: Numpy and Matplotlib modules **6 Hrs**

Numpy module: Introduction, creation of arrays and matrices, various array operations, matrix multiplication, inversion. Matplotlib module: Introduction, plot( ), show( ) functions, syntax for plotting graphs , multiple plots, polar plots, labeling, scaling of axes and coloring plots – Plotting of functions – sin(x), cos(x), exp(x), sin2(x), sin(x2)

Books for study:

Python for Education by Dr. B P Ajithkumar, IUAC, New Delhi; e-book freely downloadable from www.expeyes.in/documents/mapy.pdf

Unit 2

Chapter 3: Numerical Methods in Physics **18 Hrs**

Introduction to numerical methods, Comparison between analytical and numerical methods- Curve Fitting: Principle of least squares, Least square fitting of a straight line -Interpolation: Finite difference operator, Newton's forward difference interpolation formula, difference table, First and second derivative by Numerical differentiation- Solution of algebraic equations: Bisection method, Newton-Raphson method - Newton Cote's quadrature formula- Numerical integration by Trapezoidal and Simpson's (1/3) method- Solution of differential equations: Euler's method, Runge- Kutta method (Second order) -Taylor's Series expansion of Sin(x) and Cos(x).

Books for study:

1. Introductory methods of numerical analysis, S.S.Shastry , (Prentice Hall of India,1983)
2. Python for Education by Dr. B P Ajithkumar, IUAC, New Delhi; e-book freely downloadable from www.expeyes.in/documents/mapy.pdf

Unit 3

Chapter 4: Computational Physics **14 Hrs**

Formulation: From analytical to numerical methods -Significance of Computer in numerical methods- Applications of Euler's method: Theory, and graphical simulation by programming: motions of a freely falling body, a body dropped into a highly viscous medium, two dimensional projectile motion and radioactive decay - Accuracy considerations (elementary ideas) (All programs should be written using Python language Version 3.0)

Books for study:

1. Computational Physics, V.K.Mittal, R.C.Verma & S.C.Gupta-Published by Ane Books
2. Introductory methods of numerical analysis, S.S.Shastry , (Prentice Hall of India,1983)
3. Introduction to Python for Engineers and Scientists by Dr.Sandeep Nagar, Apress publications.

References:

1. Python for Education by Dr. B P Ajithkumar, IUAC, New Delhi; e-book freely downloadable from www.expeyes.in/documents/mapy.pdf
2. Programming in Python 3: A Complete Introduction to the Python Language by Mark Summerfield-2nd edition-Developer's library
3. Introduction to Python for Engineers and Scientists by Dr.Sandeep Nagar, Apress publications.
4. www.python.org
5. Python Essential Reference, David M. Beazley, Pearson Education
6. Core Python Programming, Wesley J Chun, Pearson Education
7. Python Tutorial Release 3.0.1 by Guido van Rossum, Fred L. Drake, Jr., editor. (http://www.altaway.com/resources/python/tutorial.pdf)

8. How to Think Like a Computer Scientist: Learning with Python, Allen Downey , Jeffrey Elkner , Chris Meyers, http://www.greenteapress.com/thinkpython/thinkpython.pdf
9. Numerical Methods in Engineering and Science, Dr. B S Grewal, Khanna Publishers, Newdelhi
10. Numerical methods for scientists and engineers, K. Sankara Rao, PHI
11. Introductory methods of numerical analysis, S.S.Shastry , (Prentice Hall of India,1983)
12. Computational Physics, V.K.Mittal, R.C.Verma & S.C.Gupta-Published by Ane Books

Mark distribution for setting Question paper.

Unit/ chapter	**Title**	**Marks**
1	Introduction to Python Programming	23
2	Numpy and Matplotlib modules	10
3	Numerical Methods in Physics	26
4	Computational Physics	20
Total Marks *		79

*****Total marks include that for choice of questions in sections A, B and C in the question paper.

Semester 5

Core Course VII - BPH5B07: QUANTUM MECHANICS

54 hours (Credit - 3)

	Course Outcome	**PSO**	**CL**	**KC**	**Class Sessions allotted**
CO1	Understand the particle properties of electromagnetic radiation	PSO2	U	C	8
CO2	Understand the wavelike properties of particles	PSO2	U	C	10
CO3	Describe Rutherford – Bohr model of the atom	PSO2	U	C	6
CO4	Understand and apply the Schrödinger equation to simple physical systems	PSO2	Ap	C,P	16
CO5	Apply the principles of wave mechanics to the Hydrogen atom	PSO2	Ap	C,P	14

UNIT 1

1. Particle Properties of Waves **8 hours**

Electromagnetic waves, black body radiation, ultraviolet catastrophe, Photoelectric effect, nature of light, wave particle duality, Compton Effect & its demonstration. Pair production, photons & gravity. (Sections 2.1 to 2.4 & 2.7 to 2.9 of Modern Physics- Arthur Beiser)

2. Wave Properties Of Particles **10 hours**

De Broglie waves, waves of probability, phase velocity & group velocity, particle diffraction, Davisson And Germer experiment, Electron Microscope, Uncertainty principle I, Uncertainty principle II, Applying the uncertainty principle, Energy & time uncertainty.
(Sections 3.1 to 3.5 & 3.7 to 3.9 of Modern Physics by Arthur Beiser)

Unit 2

3. Atomic Structure **6 hours**

The Bohr atom-energy levels and spectra, correspondence principle, nuclear motion, atomic excitation, Frank-Hertz experiment
(Sections 4.4 to 4.8 of Modern Physics by Arthur Beiser)

UNIT 3

4. Wave Mechanics **16 hours**

Classical mechanics is an approximation of quantum mechanics, wave function, Schrodinger equation-time dependent form, linearity & superposition, expectation values, operators, Schrodinger equation-steady state form, eigen values & eigen functions, postulates of quantum mechanics, particle in a box, finite potential well, tunnel effect scanning tunneling microscope, harmonic oscillator wave function, energy levels, zero point energy.
(Sections 5.1, 5.3 to 5.11 & appendix to chapter 5 of Modern Physics by Arthur Beiser and Section 3.5 of Quantum Mechanics by G Arunldhas]

5. Hydrogen Atom **14 hours**

Schrodinger equation for the hydrogen atom, separation of variables, quantum numbers, principal quantum number, orbital quantum number, magnetic quantum number, electron probability density, radiative transitions, selection rules, Zeeman effect, electron spin, exclusion principle, Stern-Gerlach experiment. (Sections 6.1 to 6.10 & 7.1, 7.2 of Modern Physics by Beiser]

Textbooks for study

Concepts of Modern Physics 6th Edition-By Arthur Beiser

Reference Books:

1. Modern Physics, 2nd Edn. – Kenneth S. Krane – John Wiley & sons
2. Modern Physics, 3rd Edn. – Raymond A. Serway, Clement J. Moses, Curt A. Moyer – Cengage
3. Quantum Physics of Atoms, Molecules, Solids, Nuclei & Particles by R.Eisberg & R. Resnick - John Wiley
4. Modern Physics, 2^{nd}Edn – Randy Harris – Pearson
5. Modern Physics for Scientists and Engineers, 2^{nd}Edn. – John R. Taylor, Chris D. Zafiratos, Michael A. Dubson – Prentice-Hall of India Pvt. Ltd.
6. Berkeley Physics Course: Quantum Physics by Wichmann
7. Theory and Problems in Modern Physics by Gautreau & Savin – Schaum's Outlines Series – TMH
8. Quantum mechanics: Concepts &Applications by Zettilli N, Second Edition, Wiley
9. NPTEL video lectures

Mark distribution for setting Question paper.

Unit/ chapter	**Title**	**Marks**
1	Particle Properties of waves	15
2	Wave Properties of Particles	15
3	Atomic structure	11
4	Wave mechanics	23
5	Hydrogen Atom in Wave Mechanics	15
*Total Marks **		79

*****Total marks include that for choice of questions in sections A, B and C in the question paper.

Semester 5

Core Course VIII - BPH5B08: OPTICS

54 hours (Credit - 3)

	Course Outcome	**PSO**	**CL**	**KC**	**Class Sessions allotted**
CO1	Understand the fundamentals of Fermat‟s principles and geometrical optics	PSO2	U	C	5
CO2	Understand and apply the basic ideas of interference of light	PSO2	Ap	C, P	14
CO3	Understand and apply the basic ideas of diffraction of light	PSO2	Ap	C, P	13
CO4	Understand the basics ideas of polarization of light	PSO2	U	C	8
CO5	Describe the basic principles of holography and fibre optics	PSO2	U	C	14

Unit 1 **5 Hrs**

Fermat's Principle:

Verification of laws of reflection and refraction**.**

[Sections 2.1 to 2.6 of Book No.2 Sections 3.1 to 3.2 of Book No.1]

Refraction and reflection by spherical surfaces: Refraction and reflection at a single spherical surfaces. The thin lens, The Principal Foci, and Focal length of a lens, The Newton formula, Lateral magnification. [Sections 4.1 to 4.7 of Book No.1]

Unit 2

Interference **14 Hrs**

Superposition of two sinusoidal waves, Interference, coherence, conditions for interference, the interference patterns, intensity distribution. Fresnel's Biprism, Determination of λ and dλ of Sodium Light. Interference by a plane film illuminated by a plane wave, cosine law, non reflecting films (the subsections excluded), interference by a film with two nonparallel reflecting surfaces, colours of thin films, Newton's rings, white light fringes.

[Sections 14.1 to 14.4, 14.6 to 14.9 of Book No.2, and Sections 14.1 to 14.8 of Book No.1. Additional problems should be done from chapter 7 of Book No.3, Sections 15.1 to 15.4,15.7, 15.9, 15.11 of Book No 1, and Sections 2.1 to 2.6 of Book No.2. Additional problems should be done from chapter 7 of Book No.3]

Unit 3 **13 Hrs**

Fraunhofer Diffraction: Preliminaries, single slit diffraction pattern, diffraction by circular aperture, limit of resolution, two slit Fraunhofer diffraction pattern, N slit diffraction pattern, plane diffraction grating, resolving power.

Fresnel Diffraction: Preliminaries, Fresnel half period zones, explanation of rectilinear propagation of light, zone plate [Sections 18.1 to 18.3, 18.5 to 18.8 of Book No. 1. Additional problems should be done from chapters 11 and 12 of Book No.3, Sections 20.1 to 20.3 of Book No.1]

Unit 4 **8 Hrs**

Polarization

Huygene's explanation of double refraction, positive and negative uniaxial crystals, quarter and half wave plates, types of polarized light, production and analysis of plane, circularly and elliptically polarized light, optical activity.

[Sections 20.9, 20.17 to 20.20,20.24 of Book No.2 and corresponding sections of Book No.1]

Unit 5 **14 Hrs**

Holography and Fibre Optics

Principles of holography, theory of construction and reconstruction of Hologram, Applications of Holography. [Sections 23.1 to 23.6 of Book No 2 and Sections 21.1 to 21.4 of Book No 1] (Qualitative Study Only) Optical fibre, Numerical aperture, step index fibre, pulse dispersion, graded index fibre, fibre optic sensors.

[Sections 27.4, 27.7, 27.10, 27.12 of Book No 1 and corresponding sections from Book No 2]

Books of study:

1. Optics by Ajoy Ghatak – 4th edition(Book No 1)
2. Optics by Subramaniam, Brijlal&Avadhanulu – 2018(Reprint)(Book No 2)
3. Introduction to Optics by Frank.L,Pedrotti,Leno M Pedrotti and Leno S Pedrotti(Book No.3)

Reference Books :

1. Optics – EugineHetch and A RGanesan
2. Optics by D S Mathur– New edition
3. Wave Optics and its Applications – Rajpal S Sirohi – Orient Longman
4. Optical Communications – M MukundaRao – Universities Press
5. NPTEL video lectures available online

Mark distribution for setting Question paper

Unit/chapter	Title	Marks
1	Fermat's Principle, Refraction and reflection by spherical surfaces	7
2	Interference	21
3	Fraunhofer Diffraction and Fresnel Diffraction	19
4	Polarization	12
5	Holography and Fibre Optics	20
*Total Marks **		79

*****Total marks include that for choice of questions in sections A, B and C in the question paper.

Semester 5

Core Course IX-BPH5B09: ELECTRONICS

54 hours (Credit - 3)

	Course Outcome	**PSO**	**CL**	**KC**	**Class Sessions allotted**
CO1	Understand the basic principles of Rectifiers	PSO3	U	C	6
CO2	Understand the principles of transistor	PSO3	U	C	18
CO3	Understand the working and designing of transistor amplifiers and oscillators	PSO3	U	C, P	8
CO4	Understand the basic operation of Op – Amp and its applications	PSO3	U	C	6
CO5	Understand the basics of digital electronics	PSO3	U	C	16

UNIT I

1. Semiconductor Rectifiers **6 Hrs**

PN Junction, V-I characteristics, Preliminaries of rectification- Bridge rectifier- Efficiency- Nature of rectified output- Ripple factor- different types of filter circuits- voltage multipliers- Zener diode- voltage stabilization

[Sections5.14-5.19, 6.2, 6.4, 6.7-6.8, 6.11-6.12, 6.13-6.15, 6.17 - 6.27 of V.K Mehta]

2. Transistors and Amplifiers **18 Hrs**

Different transistor amplifier configurations: - CB, CE, CC and their characteristics- amplification factors- their relationships- Load line Analysis- Expressions for voltage gain- current gain and power gain of C.E amplifier- cut-off and saturation points- Transistor biasing- Different types of biasing - Base resistor, voltage divider bias method- single stage transistor amplifier circuit- load line analysis- DC and AC equivalent circuits. R.C coupled amplifier- frequency response and gain in decibels- Transformer coupled Amplifiers -Direct Coupled Amplifier-Comparison

[Section 8.7 - 8.10, 8.12-8.22, 9.2-9.8, 9.11-9.12, 10.4-10.5, 10.7-10.9, 11.1-11.8, of V K Mehta]

3. Feedback Circuits and Oscillators **8 Hrs**

Basic principles of feedback- negative feedback and its advantages- positive feedback circuits- Oscillatory Circuits-LC, RC oscillators- tuned collector oscillator- Hartley, Colpitt's, phase shift oscillators - their expressions for frequency

[Sections 13.1-13.5, 14.1 - 14.13 VK Mehta]

4. Operational Amplifier and its Applications **6 Hrs**

Differential amplifier (basics ideas only), OP-amp: basic operation, application, inverting, Non-inverting, summing amplifiers, Differentiator integrator [Sections 25.1 – 25.5, 25.16, 25.15-25.17,25.23-25.26, 25.32, 25.34-25.35, 25.37 VK Mehta]

Unit II

5. Number systems and Logic gates and circuits 16 Hrs

Binary number system, conversions from one system to another(Binary, octal, Hexa decimal), Binary arithmetic, Compliments and its algebra.

Fundamental gates, Universal gates, De Morgan's theorem, Exclusive OR gate, Boolean relations, Half adder, Full adder, RS Flip Flop, JK Flip flop.

(Sections - 2.2 to 2.8 Aditya P Mathur).

[Sections - 2.2 to 2.4, 3.1 to 3.5, 5.1 to 5.6, 6.3, 6.4, 7.1, 7.3, 7.5, 7.6, 8.2 Malvino & Leach)

Text books for study :

1. Principles of Electronics - VK Mehta - 2008 edition (S. Chand)
2. Introduction to Microprocesors - Aditya P Mathur (Tata McGarw Hill)
3. Digital Principles and Applications - Leach and Malvino (Tata McGraw Hill)

References

1. Electronic Principles by Malvino - TMH
2. Digital Computer Fundamentals (Thomas.C. Bartee)
3. Physics of Semiconductor Devices- Second Edition – Dilip K Roy – Universities Press
4. Digital Fundamentals –Thomas L Floyd – Pearson Education
5. The Art of Electronics-Paul Herowitz & Winfield Hill
6. Digital Technology – principles and practice by Virendrakumar
7. Electronic Principles and Applications – A B Bhattacharya

Mark distribution for setting Question paper.

Unit/chapter	**Title**	**Marks**
1	Semiconductor Rectifiers	9
2	Transistors	26
3	Feedback Circuits and Oscillators	12
4	Operational amplifier and its applications	9
5	Number systems, Logic gates and Circuits	23
*Total Marks **		79

*****Total marks include that for choice of questions in sections A, B and C in the question paper.

Semester 6
Core Course X-BPH6B10:THERMODYNAMICS
54 hours (Credit - 3)

	Course Outcome	PSO	CL	KC	Class Sessions allotted
CO1	Understand the zero and first laws of thermodynamics	PSO2	U	C	18
CO2	Understand the Second Law of thermodynamics and Its Application	PSO2	U	C, P	12
CO3	Understand the basic ideas of entropy	PSO2	U	C	14
CO4	Understand the concepts of thermodynamic potentials.	PSO2	U	C	10

Unit 1 **18 Hrs**

Thermodynamic system- Thermal equilibrium-zeroth law-concept of heat and temperature-thermodynamic equilibrium- quasistatic process -extensive andintensive variables- thermodynamic process (cyclic and non-cyclic)-indicator diagram- work done in isothermal, adiabatic, isobaric and isochoric — cyclic processes- concept of path and point functions-internal energy- first law of thermodynamics-relation between P,T,V ,in adiabatic process-slope of adiabatic and isothermal process -application of first law to heat capacities-(relation between Cp and Cv) and latent heat— adiabatic and isothermal elasticity of a gas)

Unit 2 **12 Hrs**

Reversible and irreversible processes, Conditions for reversibility-second law of thermodynamics-heat engine, Carnot engine, derivation for expression for efficiency, efficiency, Carnot's refrigerator-thermodynamical scale of temperature- Carnot's theorem and its proof. - application of second law (Clausius-Clapyron equation)- internal combustion engine-otto engine, diesel engine -its efficiencies

Unit 3 **14 Hrs**

Entropy and adiabatics- definition of entropy-Change of entropy in a Carnot cycle- Change of entropy in an reversible cycle (Claussius theorem) -Change of entropy in an irreversible cycle (Claussius inequality)-Change in entropy of a perfect gas during a process-Change in entropy in a irreversible process-change in entropy due to free expansion-Change in entropy due to spontaneous cooling by conduction, radiation….etc, - Principle of increase of entropy-Entropy andavailable energy-Entropy and disorder-Nernst heat theorem-entropy temperature diagrams

(Relevant topics from Chapters 8 & 9 – Heat and Thermodynamics by D S Mathur -Revised fifth edition)

Unit 4 **10 Hrs**

Thermodynamic functions- Enthalpy, Helmhlotz function, Gibbs function- Maxwell's thermodynamic relations- TdS relations-application of Maxwell's thermodynamical relations-1. variation of intrinsic energy with volume-2. Joule- Kelvin coefficient-3. Claussius-Clapeyron equation from Maxwell's thermodynamic

relations- changes of phase. (Relevant topics from Ch. 10-Heat and Thermodynamics by D S Mathur- Revised fifth edition)

References:

Heat and Thermodynamics-DS Mathur (V Edn.)
Thermodynamics and statistical mechanics-Brijlal Subramanium
Heat and Thermodynamics-Zemansky
Heat and Thermodynamics- A Manna
Thermodynamics – Y V C Rao – Universities Press
Physics- Resnick and Halliday
Advanced Physics Second Edition – Keith Gibbs – Cambridge University Press

Mark distribution for setting Question paper

Unit/ chapter	**Title**	**Marks**
1	Unit -1	26
2	Unit-2	15
3	Unit -3	23
4	Unit -4	15
Total Marks *		79

*****Total marks include that for choice of questions in sections A, B and C in the question paper.

Semester 6

Core Course XI-BPH6B11: Statistical Physics, Solid State, Spectroscopy and Photonics

54 hours (Credit - 3)

	Course Outcome	**PSO**	**CL**	**KC**	**Class Sessions allotted**
CO1	Understand the basic principles of statistical physics and its applications	PSO2	U	C	12
CO2	Understand the basic aspects of crystallography in solid state physics	PSO2	U	C	16
CO3	Understand the basic elements of spectroscopy	PSO2	U	C	4
CO4 & CO5	Understand the basics ideas of microwave and infra red spectroscopy	PSO2	U	C	12
CO6	Understand the fundamental ideas of photonics	PSO2	U	C	10

Unit I

1. Statistical Physics (12 hrs)

Introduction, Boltzman's canonical distribution law, The partition function, the uncertainty principle, The three statistics, Maxwell-Boltzmann statistics, Application of Maxwell-Boltzmann distribution law, Quantum statistics, Bose Einstein statistics.

[Sections 16.1 to 16.9 of Heat and thermodynamics by D.S Mathur Fourth Edition]

Unit II

2. Solid State Physics (16 hrs)

Lattice Points and Space Lattice-Basis and crystal structure, unit cells and lattice Parameters, Unit cells versus primitive cells, Crystal systems, Crystal symmetry, Bravais space lattices – Metallic crystal structures – simple cubic, body-centered cubic, face-centered cubic and hexagonal closed packed structure – Other crystal structures – Diamond, Zinc sulphide, Sodium chloride, Caesium chloride – Directions, Planes and Miller indices – Important features of Miller indices – Important planes and directions, distribution of atoms and separation between lattice planes in a cubic crystal – X-Ray diffraction – Bragg's law – Bragg's X-ray spectrometer – Powder crystal method

[Sections4.1 to 4.7, 4.14 to 4.22 and 5.7 to 5.10 of Solid State Physics by S.O. Pillai**]**

Unit III

3. Basic Elements of Spectroscopy (4 hrs)

Quantization of Energy-Regions of Spectrum-Representation of Spectra-Basic Elements of Practical Spectroscopy-Signal to Noise Ratio-Resolving Power-Width and Intensity of Spectral Transitions

[Sections 1.2 to 1.7 of Fundamentals of Molecular Spectroscopy by Banwell and McCash**]**

4. Microwave Spectroscopy (6 hrs)

Rotation of molecules – Rotational spectra – Rigid diatomic molecules – Bond length of CO molecule – Intensities of spectral lines

[Sections 2.1 to 2.3.2 of Fundamentals of Molecular Spectroscopy by Banwell and McCash]

5. Infra Red Spectroscopy (6 hrs)

Energy of a diatomic molecule – Simple harmonic oscillator – Anharmonic oscillator – Morse curve – Selection rules and spectra – The spectrum of HCl – Hot bands – Diatomic vibrating rotator – Born-Oppenheimer approximation

[Sections3.1 to 3.2 of Fundamentals of Molecular Spectroscopy by Banwell and McCash]

6. Photonics (10 hrs)

Interaction of light with matter – Absorption, spontaneous emission, stimulated emission, Einstein coefficients – Einstein relations – Light amplification – condition for stimulated emission to dominate spontaneous emission – condition for stimulated emission to dominate absorption – population inversion – metastable states – components of laser – lasing action – types of laser – Ruby laser, NdYAG laser, He-Ne laser, semiconductor laser – Applications – Raman effect – quantum theory

[Sections 22.4 to 22.9, 22.14, 22.15, 22.19 and 22.20 of Textbook of optics by Brijlal, Subramanium & Avadhanulu]

Books of Study :

1. Solid State Physics, 3rd Edn. – S. O. Pillai – New Age International Pvt. Ltd.
2. Fundamentals of Molecular Spectroscopy, 4th Edn. – Colin N. Banwell and Elaine M. McCash – McGraw-Hill
3. A Text Book of Optics, 25thEdn. – Subrahmanyam and Brijlal, S. Chand & Company Ltd., 2016

ReferenceBooks :

1. Solid State Physics by M A Wahab
2. Molecular Structure & Spectroscopy by G Aruldhas
3. Introduction to Molecular Spectroscopy by G M Barrow
4. Raman Spectroscopy by Long D A.

Mark distribution for setting Question paper.

Unit/chapter	**Title**	**Marks**
1	Statistical Physics	15
2	Solid State Physics	25
3	Basic Elements of Spectroscopy	6
4	Microwave Spectroscopy	9
5	Infra Red Spectroscopy	9
6	Photonics	15
*Total Marks **		79

*****Total marks include that for choice of questions in sections A, B and C in the question paper.

Semester 6

Core Course XII-BPH6B12: Nuclear Physics and Particle Physics

54 hours (Credit - 3)

	Course Outcome	**PSO**	**CL**	**KC**	**Class Sessions allotted**
CO1	Understand the basic aspects of nuclear structure and fundamentals of radioactivity	PSO2	U	C	14
CO2	Describe the different types of nuclear reactions and their applications	PSO2	U	C, P	12
CO3	Understand the principle and working of particle detectors	PSO2	U	C, P	8
CO4	Describe the principle and working of particle accelerators	PSO2	U	C, P	8
CO5	Understand the basic principles of elementary particle physics	PSO2	U	C	12

Unit I

1. Nuclear Structure and Radioactivity **14 Hrs**

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

[Sections 12.1 to 12.11 of Modern Physics by Kenneth Krane; Sections 11.5, 11.6 of Beiser]

2. 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

[Sections 13.1 to 13.6 of Modern Physics by Kenneth Krane]

Unit II

3. Particle Detectors **8 Hrs**

Particle Detectors – Wilson Cloud Chamber – Bubble Chamber – Ionization Chambers – Proportional Counter – Geiger-Muller Counter – Scintillation Counters and Semiconductor Counters – Spark Chamber – Cerenkov Counter – Neutron Counting – The Photographic Plate.

[Sections 17.1 to 17.11of Atomic and Nuclear Physics – An Introduction by Littlefield and Thorley]

4. Particle Accelerators **8 Hrs**

Particle Accelerators – Cockcroft-Walton Proton Accelerator – Van de Graaff Electrostatic Generator – Linear Accelerator – Lawrence Cyclotron – Synchrocyclotron – Electron Accelerating Machines :

Betatron– Electron Synchrotron – Proton Synchrotron – Alternating-Gradient Synchrotron – Intersecting Beam Accelerators – The Growth and Future of Large Accelerating Machines
[Sections 18.1 to 18.12 of Atomic and Nuclear Physics – An Introduction by Littlefield and Thorley]

Unit III

5. Elementary Particles **12 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
[Sections 14.1 to 14.9 of Modern Physics by Kenneth Krane]

Books of study :

1. Modern Physics, 2ndEdn. – Kenneth S. Krane – John Wiley & sons
2. Atomic and Nuclear Physics – An Introduction, 3rdEdn. – T.A. Littlefield and N. Thorley – Springer
3. Concepts of Modern Physics, 7thEdn. – Arthur Beiser – Tata McGraw-Hill

Reference Books :

1. Modern Physics, 3rdEdn. – Raymond A. Serway, Clement J. Moses, Curt A. Moyer – Cengage
2. Quantum Physics of Atoms, Molecules, Solids, Nuclei & Particles By R.Eisberg & R. Resnick – John Wiley
3. Theory and Problems in Modern Physics by Gautreau & Savin – Schaum's Outlines Series – TMH
4. Modern Physics for Scientists and Engineers, 2nd Edn. – John R. Taylor, Chris D. Zafiratos, Michael A. Dubson – Prentice-Hall of India Pvt. Ltd
5. Modern Physics, 2nd Edn – Randy Harris – Pearson

Mark distribution for setting Question paper.

Unit/chapter	**Title**	**Marks**
1	Nuclear Structure and Radioactivity	20
2	Nuclear Reactions and Applications	18
3	Particle Detectors	12
4	Particle Accelerators	12
5	Elementary Particles	17
Total Marks *		79

*****Total marks include that for choice of questions in sections A, B and C in the question paper.

Semester 6

Core Course XIII-BPH6B13: Relativistic Mechanics and Astrophysics

54 hours (Credit - 3)

	Course Outcome	**PSO**	**CL**	**KC**	**Class Sessions allotted**
CO1	Understand the fundamental ideas of special relativity	PSO2	U	C	18
CO2	Understand the basic concepts of general relativity and cosmology	PSO2	U	C	8
CO3	Understand the basic techniques used in astronomy	PSO2	U	C	10
CO4	Describe the evolution and death of stars	PSO2	U	C	12
CO5	Describe the structure and classification of galaxies	PSO2	U	C	6

Unit I

1. Special Relativity **18 Hrs**

The need for a new mode of thought – Michelson-Morley experiment – Postulates of Special Relativity – Galilean transformations – Lorentz transformations – Simultaneity – The order of events : Time like and space like intervals – Lorentz length contraction – The orientation of a moving rod – Time dilation – Muon decay – Role of time dilation in an atomic clock - Relativistic transformation of velocity – Speed of light in a moving medium - Doppler effect – Doppler shift in sound – Relativistic Doppler effect – Doppler effect for an observer off the line of motion – Doppler navigation – Twin paradox – Relativistic Momentum and Energy – Momentum – Velocity dependence of the electron's mass – Energy – Relativistic energy and momentum in an inelastic collision – The equivalence of mass and energy – Massless particles – Photoelectric effect – Radiation pressure of light – Photon picture of the Doppler effect – Does light travel at the velocity of light ? – The rest mass of the photon – Light from a pulsar

[Sections 11.1 to 11.5, 12.1 to 12.6, 13.1 to 13.4 of An Introduction to Mechanics (1stEdn.) by Daniel Kleppner and Robert J. Kolenkow]

Unit II

2. General Relativity and Cosmology **8 Hrs**

The principle of equivalence – General theory of relativity – Tests of general relativity – Stellar evolution – Nucleosynthesis – White dwarf stars – Neutron stars – Black holes – The expansion of the universe – Cosmic microwave background radiation – Dark matter – Cosmology and general relativity – The big bang cosmology – Formation of nuclei and atoms – Echoes of the big bang – The future of the universe

[Sections 15.1 to 15.8 and 16.1 to 16.8 of Modern Physics (2ndEdn.) by Kenneth Krane]

Unit III

3. Basic Tools of Astronomy **10 Hrs**

Stellar distance – Relationship between stellar parallax and distance – Brightness and luminosity – Relationship between Luminosity, brightness and distance – Magnitudes – Apparent magnitude and brightness ratio – Relationship between apparent magnitude and absolute magnitude – Color and temperature of stars – Size and mass of stars – Relationship between flux, luminosity and radius – Star constituents – Stellar spectra – Stellar classification – Hertzsprung-Russell diagram – H-R diagram and stellar radius – H-R diagram and stellar luminosity – H-R diagram and stellar mass

[Sections 1.1 to 1.12 of Astrophysics is Easy : An Introduction for the Amateur Astronomer by Mike Inglis]

4. Stellar Evolution **12 Hrs**

Birth of a Star – Pre-Main-Sequence evolution and the effect of mass – Galactic star clusters – Star formation triggers – The Sun – Internal structure of the sun – Proton-proton chain – Energy transport from the core to the surface – Binary stars – Masses of orbiting stars – Life times of main-sequence stars – Red giant stars - Helium burning – Helium flash – Star clusters, Red giants and the H-R diagram – Post-Main-Sequence star clusters : Globular clusters – Pulsating stars – Why do stars pulsate – Cepheid variables and the period-luminosity relationship – Temperature and mass of Cepheids – Death of stars – Asymptotic giant branch – The end of an AGB star's life – Planetary nebulae – White dwarf stars – Electron degeneracy – Chandrasekhar limit – White dwarf evolution – White dwarf origins – High mass stars and nuclear burning – Formation of heavier elements – Supernova remnants – Supernova types – Pulsars and neutron stars – Black holes

[3.1, 3.2, 3.4 to to 3.15, 3.19 to 3.24 of Astrophysics is Easy : An Introduction for the Amateur Astronomer by Mike Inglis]

5. Galaxies **6 Hrs**

Galaxy types – Galaxy structure – Stellar populations – Hubble classification of galaxies – Observing galaxies – spiral, barred spiral, elliptical, lenticular galaxies – Active galaxies and active galactic Nuclei (AGN) – Gravitational lensing – Hubble's law – Clusters of galaxies

[Sections 4.1 to 4.11 of Astrophysics is Easy : An Introduction for the Amateur Astronomer by Mike Inglis]

Books of Study:

1. An Introduction to Mechanics, 1st Edn. – Daniel Kleppner and Robert J. Kolenkow – McGraw-Hill
2. Modern Physics, 2nd Edn. – Kenneth S. Krane – John Wiley & sons
3. Astrophysics is Easy : An Introduction for the Amateur Astronomer – Mike Inglis – Spriger

ReferenceBooks :

1. Introduction to Special Relativity – Robert Resnick – Wiley & Sons
2. Special Relativity – A P French – Viva Books India
3. An introduction to Astrophysics – BaidyanathBasu, PHI
4. Introduction to Cosmology -3rd Edn.–J.V.Narlikar, Cambridge University Press, 2002.
5. Principles of Cosmology and Gravitation – Michael Berry, Overseas Press, 2005.
6. Concepts of Modern Physics – Arthur Beiser, Tata McGraw-Hill
7. The Big and the Small (Vol II) by G. Venkataraman, Universities Press (India)
8. NPTEL video lectures

Mark distribution for setting Question paper.

Unit/ chapter	**Title**	**Marks**
1	Special Relativity	27
2	General Relativity and Cosmology	12
3	Basic Tools of Astronomy	15
4	Stellar Evolution	17
5	Galaxies	8
*Total Marks **		79

*****Total marks include that for choice of questions in sections A, B and C in the question paper.

Semester 6

Core Course XIV-BPH6E01-ELECTIVE BIOMEDICAL PHYSICS

54 hrs – 3 credits

	Course Outcome	**CL**	**KC**	**Class Sessions allotted**
CO1	Understand the basic principles of biophysics	U	C	14
CO2	Understand the fundamentals of medical instrumentation	U	C	11
CO3	Understand the principles of ultrasound and x-ray imaging	U	C	10
CO4	Understand the basic principles of NMR	U	C	10
CO5	Describe the applications of lasers in medicine	U	C	9

Unit I- Physical Foundations of Biophysics 14 Hrs

Free energy, Internal energy, Thermodynamics and Statistical mechanics, Reaction kinetics.(Sections 4.1, 4.2, 4.3, 4.4 from "Biophysics: An Introduction"by Rodney Cotterlie, Wiley) Transport Processes: Diffusion, Osmosis, Surface tension, Viscosity, thermal conduction. (Sections 5.1, 5.2, 5.3 from "Biophysics: An Introduction "by Rodney Cotterlie, Wiley.Oxidation and reduction, redox potential, examples of redox potential in biological systems.Sections 4.5 and 9.3 from "Biophysics: An Introduction "by Rodney Cotterlie, Wiley.Membrane Physics: Diffusion through cell membrane, factors affecting diffusion Membrane potentials: Resting potentials, action potentials, Hodgkin-Huxley model for membrane transport . Donnan equilibrium, Goldman equation.

(Sections 11.1, 11.2, 12.1, and 12.2 from "Biophysics: An Introduction "by Rodney Cotterlie, Wiley.

Also refer: Principles of Biomedical engineering by Sundararajan V Madihally , Artech house.

Unit II- Fundamentals of medical instrumentation 11 Hrs

Physiological systems of the body, sources of biomedical signals, basic medical instrumentation systems, performance, constraints, and regulations, intelligent medical instrumentation systems. Origin of bioelectric signals, ECG, EEG, EMG.Recording electrodes and microelectrodes. Transducers and biosensors.

(Sections 1.1 to 1.8, 2.1 to 2.8 & 3.1 to 3.10 from "Handbook of Biomedical Instrumentation", R S Khandpur, Tata Mcgraw Hill)

Unit III- Ultrasound and x ray medical imaging systems 10 Hrs

Ultrasonic Imaging-properties of ultrasound, modes of ultrasound transmission-pulsed, continuous, pulsed Doppler, ultrasound imaging, ultrasonic diagnosis, ultrasonic transducers.

(Sections 9.2, 9.3 from Leslie Cromwell, "Biomedical Instrumentation and measurement", Prentice hall of India, New Delhi)

X-rays- Instrumentation for diagnostic X-rays, visualization of X-rays-flouroscopy, X-ray filters, X-ray films, Image intensifiers, Special technique-grid, contrast media, Angiography.
(Sections 14.1, 14.2, 14.3 from Leslie Cromwell, "Biomedical Instrumentation and measurement", Prentice hall of India, New Delhi)
X-ray computed tomography – Computed tomography, basic principle, contrast scale, system components-scanning system, processing unit, viewing part, storage unit, Helical CT scanner.
(Sections 20.1, 20.2 from Handbook of Biomedical Instrumentation by R S Khandpur, Tata Mc GrawHill)

Unit IV- Nuclear medical imaging systems 10 Hrs

Nuclear Medical imaging systems-radio isotopes in medical imaging systems, physics of radioactivity, uptake monitoring equipment, radioisotope rectilinear scanner, gamma camera, Emission computed tomography, Positron emission tomography (PET Scanner)
(Sections 21.1, 21.2 from Handbook of Biomedical Instrumentation by R S Khandpur, Tata Mc GrawHill)
Principles of NMR, Image reconstruction techniques, Basic NMR components, Biological effects of NMR imaging, advantages of NMR imaging.
(Sections 22.1, 22.2, 22.3, 22.4, 22.5 from Handbook of Biomedical Instrumentation by R S Khandpur, Tata Mc GrawHill Publications)
(Reference- Medical Imaging Physics, William Hendee, John Wiley, and Sons Publications)

Unit V- Lasers in medicine 9 Hrs

Special properties of laser beam (coherence, collimation, monochromaticity), laser active medium, focal length of the laser lens, Laser-tissue interactions, Basic principles of Nd-YAG, CO2, and Argon Lasers, An overview of their clinical applications with special reference to Gynecology, pulmonary, neurosurgery, dermatology, ophthalmology. Photodynamic therapy, Laser safety measures.
(Sections of Chapter 1, Chapter 2, Chapter 3, Chapter 5 from Lasers in Medicine - An Introductory Guide, Gregory Absten, Springer Science Publications)

Books for Reference

1. Medical Physics by J R Cameron and J G Skofonick, Wiley Eastern)
2. The physics of medical imaging by S Webb, Hilger Publications
3. Techniques for radiation dosimetry by K Mahesh and D R Vij, Wiley Eastern Limited
4. Clinical nuclear medicine by Maisey, Britton, Chapman and Hall
5. Ultra sound in Medicine, by F Duck, IOP Publications
6. Medical Instrumentation Application and Design, by John G. Webster, John Wiley and sons, New York
7. Introduction to Biomedical equipment technology, John M. Brown, John Wiley and sons, New York
8. Medical Imaging Physics, W.R.Hendee & E.R.Ritenour, (3rd eds), Mosbey Inc.,

Mark distribution for setting Question paper.

Unit/ chapter	**Title**	**Marks**
1	Physical foundations of biophysics	20
2	Fundamentals of medical instrumentation	16
3	Fundamentals of medical instrumentation	15
4	Nuclear medical imaging systems	15
5	Lasers in medicine	13
*Total Marks **		79

*****Total marks include that for choice of questions in sections A, B and C in the question paper.

Semester 6

Core Course XIV-BPH6E02-Elective- Nano Science and Technology

54 Hrs (Credit-3)

	Course Outcome	CL	KC	Class Sessions allotted
CO1	Understand the elementary concepts of nanoscience	U	C	6
CO2	Understand the electrical transport mechanisms in nanostructures	U	C	10
CO3	Understand the applications of quantum mechanics in nanoscience	U	C	13
CO4 & CO5	Understand the fabrication and characterization techniques of nanomaterials	U	C	19
CO6	Enumerate the different applications of nanotechnology	U	C	6

Unit 1- Introduction: 6Hrs

Length scales in Physics- Nanometer- Nanostructures: Zero, One two and three dimensional nanostructures (Chapter3, Text2) Band Structure and Density of State at nanoscale: Energy Bands, Density of States at low dimensional structures.(Chapter3,Text1)

Unit 2-Electrical transport in nanostructure: 10 Hrs

Electrical conduction in metals, The free electron model. Conduction in insulators/ionic crystals-Electron transport in semiconductors –Various conduction mechanisms in 3D (bulk), 2D (thinfilm) and low dimensional systems: Thermionic emission, field enhanced thermionic emission (Schottky effect), Field assisted thermionic emission from traps (Poole-Frenkel effect),Arrhenius type activated conduction, Variable range, Hopping conduction, Polaron conduction.(Chapter4,Text1)

Unit 3-Introductory Quantum Mechanics for Nanoscience: 13 Hrs

Size effects in small systems, Quantum behaviors of nanometric world: Applications of Schrodinger equation –infinite potential well, potential step, potential box; trapped particle in 3D (nanodot),electrontrappedin2Dplane(nanosheet),electrons moving in lD (nanowire, nanorod, nanobelt), Excitons, Quantum confinement effect in nano materials (Chapter5,Text1)

Unit 4: Growth techniques of nanomaterials 9 Hrs

Top down vs bottom up techniques, Lithographic process, Non Lithographic techniques: Plasma arc discharge, sputtering. Evaporation: Thermal evaporation, Electron beam evaporation. Chemical Vapour Deposition (CVD).Pulsed Laser Deposition, Molecular Beam Epitaxy, Sol-Gel Technique Electro-deposition.,Ball-milling.
(Chapter6,Text1)6.1,6.2.6.3,6.4.1,6.4.2,6.4.2.1,6.4.3,6.4.3.1.6.4.3.2,6.4.4,6.4.5,6.4.6,6.4.7,6.4.8,6.4.9).

Unit 5- Characterization tools of nanomaterials: 10 Hrs

Scanning Probe Microscopy (SPM): Basic Principles of SPM techniques, the details of

STM,Tunnelingcurrent,localbarrierheight,localdensityofstates.Someapplications of STM.(Section7.1.1-7.1.3.3,7.1.3.5, Text1),GeneralconceptsofAFM(Section7.2.1–7.2.4,Textl),Electronmicroscopy(7.3.1-7.3.6,Text-1).

Unit 6- Applications of nanotechnology **6 Hrs**

Buckminster fullerene, Carbon nanotube, nano diamomd, BN Nanotune, Nanoelectronics – single electron transistor(no derivation), Molecular machine, Nano biomatrics (Chapter 8,Text!). Applications of nano material in energy, medicine, and environment(Text2)

Textbooks:

1. Introduction to Nanoscience &Nanotechnology byK. K. Chattopadhyaya andA. N.Banerjee, Publisher: PHI Learning and Private Limited
2. Nanotechnology, Rakesh Rathi, S Chand &Company, New Delhi

References:

1. Nanoparticle Technology Handbook- M. Hosokawa, K. Nogi, M. Naita, T. Yokoyama(Eds.), Elsevier 2007
2. Encyclopaedia of Materials Characterization, Surfaces, Interfaces, Thin Films, Eds.Brundle, Evans and Wilson, Butterworth- Heinmann, 1992
3. Springer Handbook of nanotechnology, Bharat Bhushan (Ed.), Springer-Verlag, Berlin,2004
4. Nano Science and Technology, VS Muraleedharan and A Subramania, Ane Books Pvt.Ltd, New Delhi
5. A Handbook on Nanophysics, John D, Miller, Dominant Publishers and Distributors, Delhi-51
6. Introduction to Nanotechnology, Charles P Poole Jr. and Frank J Owens, Wiley StudentsEdition
7. Nano-and micro materials, KOhno et. a!, Springer International Edition 2009, NewDelhi

Mark distribution for setting Question paper.

Unit/ chapter	**Title**	**Marks**
1	Introduction	9
2	Electrical transport in nanostructure	15
3	Introductory Quantum Mechanics for Nanoscience	19
4	Growth techniques of nanomaterials	12
5	Characterisation tools of nanomaterials	15
6	Applications of nanotechnology	9
*Total Marks **		79

*****Total marks include that for choice of questions in sections A, B and C in the question paper.

Semester 6
Core Course XIV-BPH6E03-ELECTIVE -MATERIAL SCIENCE
54hrs (Credit-3)

	Course Outcome	CL	KC	Class Sessions allotted
CO1	Understand the basic ideas of bonding in materials	U	C	15
CO2	Understand the types of imperfections nad diffusion mechanisms in solids	U	C	12
CO3	Describe the different properties of ceramics and polymers	U	C	15
CO4	Describe the different types of material analysis techniques	U	C	12

Unit I **15 Hrs**

Introduction

What is material science, Classification of materials-metals, ceramics, polymers, composites, Advanced materials, smart materials.
(Section1.1to1.6ofCallister's Material science Text Book)

Bonds in materials:

Atomic bonding in solids-bonding forces and energies, Primary bonding-Ionic bonding, Covalent bonding, metallic bonding, Secondary bonding-van der waals bonding, fluctuating induced dipole bonds, polar molecule induced dipole bonds, permanent dipole bonds example of anomalous volume expansion of water. (section 2.5 to 2.8 of Callister's Material science)

Crystals:

Crystalline and Non-Crystalline materials-Single crystals, polycrystals, Anisotropy, metallic crystal structures, atomic packing factors of FCC, BCC, Hexagonal close packed crystal structure, Density computations, Linear and planar densities, poly morphis mandallotropy, non crystalline solids (Section3.8 to3.11, 4.2to4.9)

Unit-II **12 Hrs**

Imperfections in Solids

Point defects,Vacancies and self interstitials, substitutional impurities, atomic point defects-Schottky defect, Frenkel defect, Dislocations-edge and screw dislocations, burgersvector, Interfacial defects-External surfaces, Grain boundaries, twin boundaries, stackingfaults, Bulkandvolumedefects.(Section5.2 to5.8)

Diffusion in solids:

Introduction, Diffusion mechanism, Vacancy diffusion, Interstitial diffusion, Steady state diffusion and Non-steady state diffusion, fick's laws, Factors that influence diffusion-temperature, diffusion species, example of aluminium for IC interconnects. Diffusion in ionic and polymeric materials (section 6.1to 6.8)

Unit-III **15 Hrs**

Ceramics and its properties:

Glasses, Glass ceramics, properties, refractories-fireclay and silicare fractories, Abrasives, cements,

advanced ceramics-optical fibers, ceramic ball bearings, piezo electric ceramics, stress-strain behavior of ceramics, flexural strength and elastic behaviour. (Section12.1to12.8, 12.11)

Polymers and its properties:
Different forms of Carbon-Diamond, Graphite, Fullerenes, Carbon nanotubes. (Qualitative aspects only) (Section4.17)
Hydrocarbon molecules, polymer molecules, homo polymers and copolymers, molecular weight calculation, linear polymers, branched polymers, cross linked polymers, network polymers, thermosetting and thermoplastic polymers, stress-strain behavior and viscoelastic deformation of polymers. (Section13.1to13.9,14.2, 14.3, 14.4)

Unit-IV **12 Hrs**

Material Analysis Techniques:
Single crystal and powder diffraction techniques with diffractometer, Laue's technique and rotating crystal method, Microscopic techniques-Optical microscopy, electronmicroscopy, transmission electron microscopy, scanning electron microscopy, Scanning probe microscopy, construction and working of each device, Grain size determination technique. (Section4.20, 5.12, 5.13)

Book for study
1. Material Science and Engineering by William D. Callister, Adapted by R.Balasubramanyam (lIT Kanpur), Published by Wiley India Pvt Ltd

Book for reference:
1. Materials science and engineering-V Edn-V Raghavan(PHI)
2. Material science by S.L.Kakani & AmitKakani, 2nd edition 2010, reprint2011
3. Material Science & Engineering,R.K.Rajput(JainBookAgency)
4. Material Science and Engineering, I.P.Singh & SubhashChander(JainBookAgency)

Mark distribution for setting Question paper.

Unit/ chapter	**Title**	**Marks**
1	Unit 1	22
2	Unit 2	18
3	Unit 3	22
4	Unit 4	17
Total Marks *		79

*****Total marks include that for choice of questions in sections A, B and C in the question paper

Semester 5-6
Core Course-XVII –BPH6B16P-PROJECT
36 hours in each semester (Credits: 2)

	Course Outcome	**CL**	**KC**	**Sessions allotted**
CO1	Understand research methodology	U	P	18
CO2	Understand and formulate a research project	C	P	18
CO3	Design and implement a research project	C	P	18
CO4	Identify and enumerate the scope and limitations of a research project	C	P	18

Semester5-6
Core Course-XVII
BPH6B16(R): RESEARCH METHODOLOGY (In lieu of Project)
36 hours in each semester (Credits: 2)

	Course Outcome	**CL**	**KC**	**Class Sessions allotted**
CO1	Understand research methodology	U	C, P	18
CO2	Understand the concept of measurement in research	C	C, P	16
CO3	Understand the significance and limitations of experimentation in research	C	C, P	16
CO4	Understand and formulate a research project, ethics and responsibility of scientific research	C	C, P	22

Unit 1- Methodology of Science **18 Hrs**

Science as facts, science as generalization, Some distinctions when describing science, Science as asocial activity, scientific revolutions and paradigms, Science and pseudo-science, Science and democratic development, The limitations of science-presuppositions, fundamental questions on reality: Rationality, Description, Causality - Prediction and Explanation in science – Mathematics and science, Hypothesis, Theories and laws, Verification, Falsification, Acceptance - Peer Review in Science - Scientific method. (Sections 2.2.1 to 2.2.5, 2.3.1, 2.4.1, 2.5.1 to 2.5.4, 2.6.1 to 2.6.4, 2.8.1to 2.8.4, 3.1 to 3.3, 4.1 to 4.4, 7.1 The Aims, Practices and Ethics of Science, Peter Pruzan,SpringerInternational Publishing Limited)

Unit 2- Measurement **16 Hrs**

Processes, Instruments and Operationalization, (Variables and Indicators), Criteria in Measurement, Validity, Reliability, Reproducibility/Replicability, Measurement Error, Potential Sources of Measurement Error, Random and Systematic Errors.

(Sections 5.2.1 to 5.2.2, , 5.2.3, The Aims, Practices and Ethics of Science, Peter Pruzan, Springer International Publishing Limited)

Unit 3 -Experimentation **16 Hrs**

The Roles and Limitations of Experimentation, Natural Experiments, Manipulative Experiments, Comparative Experiments, Experimentation and Research, Conducting Experiments, Validity and Reliability in Experimentation, Reliability, Epistemological Strategies, Design of Experiments. [Sections 6.1.1 to 6.1.2, , 6.1.3, 6.2, 6.3, 6.4 The Aims, Practices and Ethics of Science, Peter Pruzan, Springer International Publishing Limited]

Unit 4 - Scientific Method and Design of Research Design **22 Hrs**

The Scientific Method, Research Design, Components, Research Design and Your Proposal, Purpose of Your Proposal, Proposal Structure, Conceptual Framework (or Literature Review), Research Questions/Hypotheses, Methods/Methodology, Validity, Concluding sections to your proposal,

[Sections 7.1 to 7.2, , 7.2.1, 7.2,2, The Aims, Practices and Ethics of Science, Peter Pruzan, Springer International Publishing Limited]

Research

Basic, Applied and Evaluation Research, Multidisciplinary and Interdisciplinary Research, TheValue of Having Research Skills, Formulating a Research Problem, Research in Relation to Teaching and Publishing. Ethics and Responsibility in Scientific Research, Ethics, Western and Eastern Perspectives on the Source of Ethics, Un ethics, Guidelines for Ethical Practices in Research**,** Plagiarism, Integrity of data, Use and misuse of data, Ownership of and access to data, Obligation to report, Conflict of Interest, From Un ethics to Ethics in Research, The Responsibility of Scientists and of Science as an Institution.

[Sections 9.1, 9.2, , 9.3, 9.4, 9.5, 10.1, 10.2, 10.3, 10.4 The Aims, Practices and Ethics of Science, Peter Pruzan, Springer International Publishing Limited]

Book for study

1.The Aims, Practices and Ethics of Science, Peter Pruzan, Springer International Publishing Limited

Reference Books

1.Research Methodology – Methods and Techniques (3rd ed.) by C R Kothari & Gaurav Garg, NewAge International Publishers, 2014

2. Research Methodology and Scientific Writing by C George Thomas, Ane Books Pvt. Ltd., 2016

B.Sc PROGRAMME IN PHYSICS (CORE) -PRACTICALS

B.Sc PROGRAMME IN PHYSICS (CORE) PRACTICALS

All centers must arrange sufficient number of apparatus before the Practical Examination. All apparatus must be in proper condition before the Practical examination.

The external practical examination will be conducted at the end of 4^{th}& 6^{th} semesters. At the time of external examination, a student has to produce **certified fair record** with a minimum of **75%** of the experiments, listed in the syllabus. Valuation of the record must be done internally and externally. **A maximum of one mark can be awarded to an expt whichis neatly recorded.** Total mark for record in external valuation is 20. The principle or thelogic and the relevant expressions of the experiment must be shown at the time of examination

Two test papers for practical internals could be conducted by including test papers in any two convenient cycles in the place of an experiment. A batch of students can be evaluated in each class. If there are a total of 4 cycles for a practical course, a test paper each can be included in the 3^{rd} and 4^{th} cycles. If there are a total of 3 cycles for a practical course, a test paper each can be included in the 2^{nd} and 3^{rd} cycles. A model examination can also conducted after completion of all cycles. Internal grade for test papers can be awarded based on the best two performances.

NUMBER OF QUESTIONS IN THE QUESTION PAPER SHALL BE PAPER -1 EIGHT (8), PAPER- II &III SIX (6)

OUT OF THESE A MINIMUM OF 75% OF THE QUESTIONS ARE TO BE SET FOR THE EXAMINATION AT A CENTRE

BPH4B05L-PRACTICAL I
(Credit 5)

	Course Outcome	**CL**	**KC**	**Class Sessions allotted**
CO1	Apply and illustrate the concepts of properties of matter through experiments	Ap	P	36
CO2	Apply and illustrate the concepts of electricity and magnetism through experiments	Ap	P	36
CO3	Apply and illustrate the concepts of optics through experiments	Ap	P	36
CO4	Apply and illustrate the principles of electronics through experiments	Ap	P	36

PAPER 1 (1st sem to 4th sem) (any 20 experiments)

1. Young's modulus-non uniform bending-using pin and microscope-(load-extension graph)
2. Young's modulus-Uniform bending-using optic lever
3. Moment of inertia-Flywheel (Calculate percentage error and standard deviation)
4. Moment of Inertia-Torsion Pendulum
5. Rigidity modulus-static torsion
6. Compound pendulum-acceleration due to gravity, Radius of gyration
7. Katers pendulum- Acceleration due to gravity
8. Liquid lens-Refractive index of liquid and glass -a) determine R using a)water& b) Buoy's method
9. Spectrometer-solid prism-Refractive index of the material of the prism , measuring angle of minimum deviation
10. Spectrometer-solid prism- Dispersive power
11. A)Searle's vibration magnetometer- ratio of moments
    B) Searle's and box type vibration magnetometers-m &Bh.
12. Melde's string arrangement-Frequency, relative density of liquid and solid (both modes)
13. Mirror Galvanometer-figure of merit
14. Potentiometer-calibration of ammeter
15. Ballistic Galvanometer- BG constant using HMS-then find Bh.
16. Ballistic galvanometer-Comparison of capacitance- De sauty's method
17. Spectrometer- i-d curve
18. Verification of Thevenin's theorem and maximum power transfer theorem
19. Lissajous figures – Measurement of frequency and phase shift of sinusoidal signals using CRO
20. Cantilever –scale and telescope /pin and microscope
21. Single slit diffraction using LASER

22. Determination of dielectric constant of liquid/thin sheet
23. Thermo emf measurement using digital multimeters - study of Seebeck effect
24. Thermal conductivity of a good conductor by Searle's method.

BPH6B14L-Practical II (Credit – 5)
5th& 6th SEM EXPTS

	Course Outcome	**CL**	**KC**	**Class Sessions allotted**
CO1	Apply and illustrate the principles of semiconductor diode and transistor through experiments	Ap	P	36
CO2	Apply and illustrate the principles of transistor amplifier and oscillator through experiments	Ap	P	36
CO3	Apply and illustrate the principles of digital electronics through experiments	Ap	P	36
CO4	Analyze and apply computational techniques in Python programming	Ap	P	36

PAPER II (5 th & 6th SEM EXPTS Any 20 experiments)

1. e/m measurement -Thomson's apparatus
2. Spectrometer-Cauchy's constants
3. Spectrometer-Diffraction Grating-Normal incidence
4. Spectrometer- Diffraction Grating-minimum deviation
5. Spectrometer $i_1 - i_2$ curve
6. Laser-wavelength using transmission grating
7. Spectrometer-Quartz prism-Refractive indices of quartz for the ordinary and extra-ordinary rays
8. Newton's rings-wavelength of sodium light
9. Air wedge-angle of the wedge, radius of a thin wire
10. Lee's Disc –thermal conductivity of a bad conductor
11. Potentiometer-calibration low range and high range voltmeters
12. Potentiometer- Reduction factor of TG
13. Variation of field with distance-Circular coil-moment of magnet & Bh
14. Resolving power of grating
15. Carey Foster's bridge-Temperature coefficient of Resistance
16. Conversion of Galvanometer to voltmeter and calibrating using Potentiometer. (Plot using software)
17. Conversion of Galvanometer to ammeter and calibrating using Potentiometer.

18. BG Absolute Capacity
19. BG-High resistance by leakage method
20. Dispersive power of grating
21. Planck's constant using LED's (Minimum 4 nos.)
22. Polarimeter-Specific rotation of sugar solution.
23. Numerical aperture of an optical fibre by semiconductor laser
24. Frequency of AC using Sonometer

BPH6B15L

Practical III (5 th & 6th SEM EXPTS)

Unit: 1 (Any 15 experiments)

1. Construction of full wave a) Centre tapped and b) Bridge rectifiers
2. Characteristics of Zener diode and construction of Voltage regulator.
3. Transistor input, output & transfer characteristics in Common Base Configuration and calculation of current gain.
4. Transistor input, output & transfer characteristics in Common emitter Configuration and calculation of current gain
5. CE Transistor Amplifier-Frequency response.(Design the ckt for a given collector current I_C)
6. Negative feedback amplifier
7. Half adder using NAND gates
8. Full adder using NAND gates-construction & verification
9. LC Oscillator (Hartley or Colpitt's)
10. Phase shift oscillator
11. Operational Amplifier –inverting, non inverting, Voltage follower
12. LCR circuits-Resonance using CRO
13. Construction of basic gates using diodes (AND, OR) & transistors (NOT), verification by measuring voltages
14. Voltage multiplier (doubler, Tripler) (Connections to be realized through soldering.The desoldering has to be carried out at the end of the experiment.)
15. Multivibrator using transistors.
16. Flip-Flop circuits –RS and JK using IC's
17. Verification of De-Morgan's Theorem using basic gates.
18. Photo diode V-I characteristics. Determine quantum efficiency and responsivity of the PD
19. Study the characteristics of LED (3 colours) and LDR.
20. Wave shaping R-C circuits -integrator and differentiator
21. OPAMP- adder, subtractor

Experiments Using Expeyes (Electronics supporting experiments)

1. Full-wave Rectifier
2. Diode Characteristics
3. Inverting & Non-Inverting Amplifier

4. Logic Gates

Unit: II Numerical Methods Using Python: Minimum 5 programmes to be done.

21. Solution of equations by bisection and Newton-Raphson methods
22. Least square fitting – straight line fitting.
23. Numerical differentiation using difference table.
24. Numerical Integration – Trapezoidal and Simpson's 1/3 rd rule.
25. Taylor series - Sin θ, Cos θ
26. Solution of 1 st order differential equation Runge-Kutta method
27. Simulation of freely falling body. Tabulation of position, velocity, and acceleration as a function of time.
28. Simulation of projectile – Tabulation of position, velocity, and acceleration as a function of time – Plot trajectory in graph paper from tabulated values.

1. Electronics lab manual- K A Navas (vol 1 &2)
2. Bsc Practical Physics- C L Arora
3. Practical Physics- Gupta Kumar
4. User's Manual Experiments for Young Engineers and Scientists http://expeyes.in

B.Sc. PHYSICS OPEN COURSES SYLLABUS

Semester 5 Open Course I

BPH5D01: NON CONVENTIONAL ENERGY SOURCES

54 Hours (Credit – 3)

	Course Outcome	CL	KC	Class Sessions allotted
CO1	Understand the importance of non conventional energy sources	U	C	4
CO2	Understand basic aspects of solar energy	U	C	12
CO3	Understand basic principles of wind energy conversion	U	C	10
CO4	Understand the basic ideas of geothermal and biomass energy and recognize their merits and demerits	U	C	16
CO4	Understand the basic ideas of oceans and chemical energy resources and recognize their merits and demerits	U	C	12

Unit-1 **4 Hrs**

Energy Resources-Non Conventional Energy Sources-Renewable and Non-Renewable energy sources.

(Section 1.3, 1.4 and 1.5 from Non- Conventional Energy Sources and Utilisation by R.K.Rajput, S.Chand Publishers, 1st Edition.)

Unit-2

Solar energy **12Hrs**

Solar Energy Terms and Definitions- Solar Constant, Solar radiation measurements, Solar energy collector, Physical principle of the conversion of solar radiation in to heat, solar air heaters and drying,solarcookers,solardistillation,solarfurnaces,solargreenhouses,solarpowerplants,solar photovoltaic cells(no need of mathematical equations)

(Section 2.2.1 and 2.2.2, 2.3, 3.1.2, 3.1.3-3.1.5, 3.2, 3.3.1-3.3.3, 3.4.1-3.4.10, 4.16, 4.17, 4.18, 4.19,

4.20, 4.21.4, 4.21.8, 4.21.9, 4.21.10, 4.21.4 from Non- Conventional Energy Sources and Utilisation by R.K.Rajput, S.Chand Publishers, 1st Edition.)

Unit-3

Wind energy **10Hrs**

Introduction, Utilisation aspects of wind energy, Advantages and Disadvantages of wind energy, Environmental impact of wind energy, Sources/Origins of wind, Principle of wind energy conversion and wind power, Basic components of wind energy conversion system(WECS), Advantages and Diadvantages of WECS, Wind-Electric Generating Power Plant, Wind Energy Economics, Problems in operating large wind power generators.
(Section 5.1-5.6, 5.8, 5.10, 5.11, 5.20, 5.25, 5.26 from Non- Conventional Energy Sources and Utilisation by R.K.Rajput, S.Chand Publishers, 1st Edition.)

Unit-4 **16 Hrs**

Geothermal energy:

Introduction to Geothermal energy, Important aspects of Geothermal Energy, Structure of Earth's interior, Geothermal system-Hot Spring structure, Geothermal Resources (Hydrothermal, Geopressured, Petro-thermal system, Magma Resources), Advantages and disadvantages of geothermal energy over other energy forms, application of geothermal energy.
(Section 7.1, 7.2, 7.3, 7.5, 7.8.1, 7.8.2, 7.8.3, 7.8.4, 7.9, 7.10 from Non- Conventional Energy Sources and Utilisation by R.K.Rajput, S.Chand Publishers, 1st Edition.)

Energy from biomass:

Introduction to biomass, Biomass resource, Biomass Conversion process (Densification, Combustion and incineration, Thermo Chemical conversion, Biochemical conversion), Biogas: Biogas Applications, Biogas Plants (Raw materials used, Main Components of a Biogas Plant)
(Section6.1,6.2,6.5.1,6.5.2,6.5.3,6.5.4,6.6.1,6..6.2,6.7.1,6.7.2,6.7.3fromNon-Conventional
Energy Sources and Utilisation by R.K.Rajput, S.Chand Publishers, 1st Edition.)

Unit 5.

Energy from Oceans and Thermal and Chemical effects **12 Hrs**

Ocean Energy, Ocean Energy Sources, Tidal energy, Components of a Tidal Power Plant, Economic aspects of tidal energy conversion, Wave energy, Advantages and disadvantages, FactorsaffectingWaveenergy,OceanThermalEnergyConversion(OTEC),Workingprincipleof
OTEC, Efficiency of OTEC, Types of OTEC Plants (Closed system, Thermoelectric OTEC system), Advantages and Disadvantages and Applications of OTEC.
Thermo electric effects, Fuel Cells, Hydrogen energy, Nuclear Reactors, Advantages and

Disadvantages of Nuclear power plants (Basic Principles/concepts only)

(Section 8.1, 8.2, 8.3.1, 8.3.8, 8.3.14, 8.4.1, 8.4.2, 8.4.3, 8.5.1, 8.5.3, 8.5.4, 8.5.5.1, 8.5.5.5, 8.5.6, 9.2, 9.7.1, 9.7.2, 9.7.3, 10.1, 10.2, 10.3, 11.2.1, 11.5 from Non- Conventional Energy Sourcesand Utilisation by R.K.Rajput, S.Chand Publishers, 1st Edition.)

Books of study:

1. Non- Conventional Energy Sources and Utilisation by R.K.Rajput, S.Chand Publishers

References

1. Non- Conventional Energy Resources by G. D. Rai, Khanna Publishers,2008.
2. Solar Energy Fundamentals and application by H.P. Garg and J. Prakash,Tata McGraw- Hill Publishing company Ltd,1997.
3. Solar Energy by S. P. Sukhatme, Tata McGraw- Hill Publishing companyltd,1997.
4. Solar Energy Utilization by G.D. Rai, Khanna Publishers,1995.

Mark distribution for setting Question paper.

Unit/ chapter	Title	Marks
1	Non Conventional energy	06
2	Solar energy	18
3	Wind energy	15
4	Geothermal energy and energy from biomass	22
5	Energy from Oceans and Chemical Energy resources	18
Total Marks *		79

*****Total marks include that for choice of questions in sections A, B and C in the question paper.

Semester 5 Open Course I

BPH5D02: AMATEUR ASTRONOMY AND ASTROPHYSICS

54 Hours (Credit – 3)

	Course Outcome	CL	KC	Class Sessions allotted
CO1	Describe the history and nature of astronomy as a science	U	C	18
CO2	Understand the motion of earth in space and the cause of seasons	U	C	12
CO3	Understand the basic elements of solar system	U	C	12
CO4	Understand the elementary concepts of solar system	U	C	12

Unit 1- Introduction and Development of Astronomy **18 Hrs**

Introduction & Brief history of Astronomy Astronomy & Astrology-Fascinations of Astronomy-Two important Branches of Astronomy-Amateur observational Astronomy• Different types of Amateur Observing- Ancient Astronomy & modern astronomy-Indian &western

Unit 2-Earth **12 Hrs**

EarthThezonesofearth-longitudeandlatitude-shapeofearth.Keplerslaws-perihelion•Aphelion perigee and apogee, year-month-Day. Seasons-causes of seasons

Unit 3-Sun **12 Hrs**

Solar system sun-structure-photosphere-chromosphere-solar constant-sun temperature-sun spots-solareclipsecorona-(planets-surfaceconditionsandatmosphere,size,period&distance)mercury-venus-earthmars-jupiter-saturn-uranus-neptune-comets-asteroidsmeteors

Unit 4-Stars **12 Hrs**

The stars Unit of distance-Astronomical units--parsec-light year-Magnitudes of stars• apparent magnitude absolute magnitude-Three categories of stars-Main sequence stars Dwarfs-Giants-star formation life cycle of stars-Chandrasekher limit- Novae-Binary stars• neutron star-black holes. Expanding universe-Big bang theory

Books of study:

1. A Text book on Astronomy- K K Dey, Book Syntricate Pvt.Ltd.
2. Introduction to Astrophysics - Baidanath Basu, PHI, India
3. Elements of Cosmology- Jayant Narlikar, UniversityPress,

Reference books.

1. Astrophysics of Solar System - K D Abhyankar, Universitypress
2. Chandrasekhar and his limit- G Venkataraman, UniversityPress
3. The Big & The small (Volume II) - G Venkatararnan, UniversityPress
4. Joy of Sky Watching- Biman Basu, National BookTrust
5. Astronomy- Principles & practices, A E Roy & D Clarke, Institute ofPhysics

Mark distribution for setting Question paper.

Unit/ chapter	**Title**	**Marks**
1	Introduction	26
2	Earth	18
3	Sun	18
4	Stars	17
*Total Marks **		79

*****Total marks include that for choice of questions in sections A, B and C in the question paper.

Semester 5 Open Course I

BPH5D03: ELEMENTARY MEDICAL PHYSICS

54 Hours (Credit – 3)

	Course Outcome	CL	KC	Class Sessions allotted
CO1	Understand the basic aspects of physics of nuclear medicine	U	C	18
CO2	Recognize different bioelectric signals and their instrumentation	U	C	18
CO3 & CO4	Understand the basic elements of X-ray imaging	U	C	9
CO5	Understand the basic elements of ultrasound imaging and its advantages and disadvantages	U	C	9

Unit-1 Nuclear medicine physics 18 Hrs

Nuclear physics -Introduction to Radioactivity-Artificial and natural-Physical features of radiation, conventional sources of radiation, Interaction of different types of radiation with matter-Ionizing & Non ionizing Radiations-excitation, ionization, an radioactive losses-Neutron interactions, Rayleigh scattering-Compton scattering-photoelectric effect-Pair production (Qualitative Study only), Radiation quantity and quality-Radiation exposure, Units of radiation dose,Measurementofradiationdose,safety,risk,andradiationprotection-Radiopharmaceuticals -Radioactive agents for clinical studies• Biological effects & Genetic effect of radiation.

Unit-2 Medical instrumentation 18 Hrs

Measurements of Non electrical parameters: Respiration-heart rate-temperature-blood pressure - Electrocardiography (ECG): Function of the heart-Electrical behaviour of cardiac cells-Normal and Abnormal cardiac rhythms-Arrhythmias Electro-encephalography(EEG): Function of the brain-Bioelectric potential from the brain-Clinical EEG-Sleep patterns-The abnormal EEG, Electromyography(EMG):Muscularservomechanism-Potentialsgeneratedduringmuscleactions

Unit-3 Medical imaging techniques 18 Hrs

X-ray imaging-properties of X -rays- Production of X-rays--Planar X-ray imaging instrumentation-X-ray fluoroscopy. Ultrasound imaging- generation and detection of ultrasound-

Properties -reflection -transmission- attenuation -Ultrasound instrumentation- Principles of A mode, B-mode-M-mode Scanning, Hazards and safety of ultrasound.

Books of study:

1. W.R.Hendee & E.R.Ritenour, Medical Imaging Physics (4th edn) Wiley NewYork,

2. John G. Webster, "Medical Instrumentation Application and Design", JohnWileyand sons, New York,1998.,

3. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw• Hill,New Delhi, 1997.

Reference books:

1. Medical Physics by Glasser 0, Vol 1,2,3 Year Book Publisher IncChicago
2 Leslie Cromwell, "Biomedical Instrumentation and measurement", Prentice hall of India, New Delhi,1999.
3 John G. Webster, “Medical Instrumentation Application and Design", John Wiley and sons, New York,1998.
4 . Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi,1997.
5 Joseph J.carr and John M. Brown, "introduction to Biomedicalequipment technology", John Wiley and sons, New York,1997..
6. W.R.Hendee & E.R.Ritenour, Medical Imaging Physics (3'd eds), Mosbey Year-Book, Inc.,1992.
7. Hendee & E.R.Ritenour, MedicalPhysics.

Mark distribution for setting Question paper.

Unit/ chapter	Title	Marks
1	Nuclear medicine physics	27
2	Medical instrumentation	26
3	Medical imaging techniques	26
Total Marks *		79

*****Total marks include that for choice of questions in sections A, B and C in the question paper.

B.Sc. PHYSICS
COMPLEMENTARY COURSES SYLLABUS
(For B. Sc Programme in Mathematics, Chemistry, Computer science)

Semester I
Complementary course-1-BPH1C01: Properties of matter & Thermodynamics
36 hours (Credit - 2)

	Course Outcome	**CL**	**KC**	**Class Sessions allotted**
CO1	Understand the basic principles of elasticity	U	C	9
CO2	Understand the concepts of surface tension and viscosity	U	C	9
CO3	Understand the basic principles of thermodynamics	U	C	18

Unit 1- Elasticity **9 Hrs**

Elastic modulii. (Elementary ideas)- Work done per unit volume - Poisson'sratio and theoretical limits - relation between various elastic constants(Derivation not required)- Twisting couple on a cylinder(Derivation not required)- Torsion pendulum-Determination of rigidity modulus of a wire-Bending of beams-bending moment- I-form girders- Cantilever loaded at the free end – Loaded uniformly (Derivation required)

Unit 2- Surface Tension & viscosity **9 Hrs**

Surface tension (Elementary ideas)-Excess pressure inside a liquid drop and bubble (Effect of electrostatic pressure on a bubble-change in radius)-Work done in blowing the bubble (problem based on the formation of bigger drop by a number of smaller drops)

Viscosity-Coefficient of viscosity-Derivation of poiseuille's equation, stokes equation-Determination of viscosity by Poiseuille's method and stokes method-Brownian motion Viscosity of gases

Unit 3- Thermodynamics **18 Hrs**

Thermodynamic processes –Indicator diagram (P-V diagram, P-T diagram, T-V diagram, T-S diagram)- Work done in Quasi static process-Work done in Isothermal, Adiabatic, Isochoric, Isobaric processes-First law of thermodynamics-Application to heat capacities- Second law of thermodynamics- Carnot's engine - Derivation of efficiency using Carnot's cycle-Carnot's theorem and its proof- Carnot's refrigerator(coefficient of performance)-

Entropy- Change of entropy in a carnot's cycle, reversible cycle , irreversible cycleprinciple of increase of entropy- Entropy and available energy- entropy and disorder - Clausius-Clapyron equation(Derivation not required)-Effect of pressure on melting point and boiling point.

Text for study

1. Properties of matter-JC Upadhaya
2. Heat and Thermo dynamics- Brijlal and Subrhmanyan

Books for reference

1. Properties of matter- D S Mathur
2. Heat and Thermo dynamics- D S Mathur (V Edn)
3. Properties of matter-JC Upadhaya
4. Heat and Thermodynamics - Zemansky
5. Physics- Resnick and Halliday
6. Thermodynamics- Brijlal and Suramanium

Mark distribution for setting Question paper.

Unit/ chapter	**Title**	**Marks**
1	Elasticity	20
2	Surface Tension & Viscosity	20
3	Thermodynamics	39
*Total Marks **		79

*****Total marks include that for choice of questions in sections A, B and C in the question paper

SEMESTER - 2

Complementary course-II-BPH2C02: Optics, Laser & Electronics

36 hours (Credit - 2)

	Course Outcome	**CL**	**KC**	**Class Sessions allotted**
CO1 & CO2	Understand the basic concepts of interference and diffraction	U	C	16
CO3	Understand the concepts of polarization	U	C	6
CO4	Understand the fundamentals of electronics	U	C	10
CO5	Understand the important principles of laser physics	U	C	4

Unit 1- Interference **8 Hrs**

Superposition of two sinusoidal waves (resultant amplitude and intensity)., constructive and destructive interference- Fresnel's two mirror arrangement - Interference by a plane film- colours of thin films- Newton's rings (Reflected system)-Determination of wavelength

Unit 2- Diffraction **8Hrs**

Fresnels and Fraunhoffer class of diffraction Fraunhofer single slit diffraction pattern- Intensity distribution (qualitative ideas only)- plane diffraction Grating-resolving power and dispersive power. Experiment with grating

Unit 3- Polarisation **6 Hrs**

Elementary idea- Brewster' law- Double refraction- positive and negative crystals- Quarter and half wave plate- production of plane , elliptically and circularly polarized light- optical activity

Unit 4- Electronics **10 Hrs**

Half wave, Full wave and bridge rectifier circuits- Efficiency & ripple factor- Filter circuits (capacitor filter and π filters) – Zener diode characteristics- Voltage stabilization Transistors- CB, CE, CC Configurations- CE(only) characteristics- Current amplification factors - relation connecting α , β and γ – CE Amplifier- frequency response- band width Basic principle of feedback, concept of an oscillator circuit, Logic gates- Universal gates- De- Morgan's theorem – Exclusive OR gate

Unit 5- Laser physics **4 Hrs**

Induced absorption- spontaneous emission and stimulated emission- population inversion Principle of Laser-Types of laser- Ruby laser, Helium Neon laser

Text for study:

1. Optics - Brijlal & Subramanian
2. Principles of Electronics-VK Mehta

Books for reference

1. Optics- Ajay Ghatak
2. Optics – Brijlal&Subrahmanian
3. Laser fundamentals – Silfrast
4. Lasers – theory & applications- Thyagarajan & Ghatak
5. Principles of Electronics – VK. Mehta

Mark distribution for setting Question paper.

Unit/ chapter	**Title**	**Marks**
1	Interference	18
2	Diffraction	18
3	Polarisation	13
4	Electronics	21
5	Laser Physics	9
*Total Marks **		79

*****Total marks include that for choice of questions in sections A, B and C in the question paper.

SEMESTER - 3

Complementary course-III

BPH3C03: Mechanics, Relativity, Waves & Oscillations

54 hours (Credit - 3)

	Course Outcome	**CL**	**KC**	**Class Sessions allotted**
CO1 & CO2	Understand the basic ideas of frames of reference and the principles of conservation of energy and momentum	U	C	22
CO3	Understand the concepts of relativity	U	C	12
CO4	Understand the basic ideas of oscillations and waves	U	C	10
CO5	Understand the basic ideas of modern physics	U	C	10

Unit 1- Frames of reference. 8 Hrs

Inertial frame of reference-Galilean transformation equations and Invariance- Non inertial frames-Centrifugal force and Coriolis force

Unit 2- Conservation of Energy and Momentum 14 Hrs

Conservation of energy of a particle –Energy function- Potential energy curve- Conservative and Non conservative forces- Conservation of Linear momentum-Center of mass frame of reference-Rockets- motion under central force- Conservation of angular momentum (Illustrate suitable example)

Unit 3- Relativity 12 Hrs

Postulates of special theory-Michelson Morley experiment-Lorentz transformation equations-Length contraction-Time dilation- Twin paradox- variation of mass with velocity-Mass energy relation- momentum energy relation

Unit 4- Oscillation and waves 10 Hrs

Simple harmonic motion (Elementary idea)- equation –examples like oscillation of simple pendulum, loaded spring-An harmonic oscillator-Damped harmonic oscillator. Wave motion-Equation for plane progressive wave-Energy density- Pressure variations of plane waves.

Unit 5- Introduction to Modern Physics 10 Hrs

Electromagnetic waves -Black body radiation,UV catastrophe(Qualitative ideas), Photoelectric

effect, wave-particle duality, de Broglie hypothesis, Uncertainty Principle, Energy and momentum operators, Schrödinger's time dependent and time independent equations(elementary ideas only), Eigen values and eigen functions .

Text for Study:

1. Mechanics:J C Upadhyaya
2. Modern Physics-Arthur Beiser

Books for reference-

1. Mechanics – J C Upadhyaya
2. Special theory of relativity- Resnick
3. Waves, Mechanics & Oscillations- S B Puri

Mark distribution for setting Question paper.

Unit/ chapter	**Title**	**Marks**
1	Frames of reference.	12
2	Conservation of Energy and Momentum	19
3	Relativity	18
4	Oscillation and Waves	15
5	Introduction to Modern Physics	15
*Total Marks **		79

*****Total marks include that for choice of questions in sections A, B and C in the question paper

SEMESTER - 4

Complementary course-IV

BPH4C04: Electricity, Magnetism and Nuclear physics

	Course Outcome	**CL**	**KC**	**Class Sessions allotted**
CO1 & CO2	Understand the basic ideas of static and current electricity	U	C	20
CO3	Understand the concepts of magnetism	U	C	12
CO4	Describe the fundamental concepts of nuclear physics	U	C	12
CO5	Understand the basic ideas of cosmic rays and elementary particles	U	C	10

Unit 1- Electrostatics **10 Hrs**

Coulomb's law between charges- Electric field- field lines- Electric potential-Gauss law application to find field due to plane sheets of charge- Electrostatic shielding (Illustrate practical application) – - Dielectrics- capacitors: A parallel plate capacitor, Energy of a capacitor, capacitance of cylindrical and spherical capacitors. Capacitance of a parallel plate capacitor- partially filled with dielectric and when completely filled with dielectric.

Unit 2- Current electricity **10 Hrs**

Drift velocity of charges- electric resistance- superconductivity (basic ideas)-Galvanometer- conversion of galvanometer in to Voltmeter and ammeter – potentiometer –determination of resistance- carey fosters bridge- temperature coefficient of resistance.

Unit 3- Magnetism **12 Hrs**

Earths magnetism- magnetic elements- Dia magnets-paramagnets and ferromagnets, Hysteresis. Magnetic moment-Deflection magnetometer-Tan A, Tan B and Tan C- Searles vibration magnetometer- Tangent galvanometer.

Unit 4- Nuclear physics **12 Hrs**

Nucleus and its properties- nuclear force- stability of nucleus- binding energy- nuclear fission- fusion- reactors- Nuclear bomb, Hydrogen bomb- Radio activity- α ,β and γ radiations- half life and mean life- C_{14} dating- Effects of radiation- Nuclear waste disposal Particle accelerators- Linear accelerator- cyclotron

Unit 5- Cosmic rays and Elementary particles **10 Hrs**

Cosmic rays (primary and secondary)- cosmic ray showers- Elementary particles-Classifications- Leptons- Hadrons - Higgs boson- L H C- Origin of universe.

Books for study

1. Electricity and Magnetism-Murugesan
2. Nuclear Physics-D C Tayal

Text books

1. Introduction to Electrodynamics-David J Griffith
2. Electricity and Magnetism – Arthur F Kip
3. Concepts of Modern physics – Arthur Beiser
4. Nuclear physics – Irvin Kaplan

Mark distribution for setting Question paper.

Unit/chapter	**Title**	**Marks**
1	Electrostatics	15
2	Current electricity	15
3	Magnetism	17
4	Nuclear physic	17
5	Cosmic rays and Elementary particles	15
*Total Marks **		79

*****Total marks include that for choice of questions in sections A, B and C in the question paper

LAB PROGRAMME FOR COMPLIMENTARY COURSES
Lab examination will be conducted at the end of 4th semester.

The minimum number of experiments for appearing examination is **75% of total 24 experiments** in the syllabus Basic theory of the experiment must be shown at the time of Examination. **Students must submit a certified fair record at the time of Examination.** Number of Questions per session for the practical Examination: A minimum of 6 questions in the Question paper shall be set for the Examination at the centre.

Semester 1 to 4
Complementary Course -5-BPH4C05L - PHYSICS PRACTICALS
Hours per week-2, Hours per semester-36, Credit-4

	Course Outcome	**CL**	**KC**	**Class Sessions allotted**
CO1	Apply and illustrate the concepts of properties of matter through experiments	Ap	P	36
CO2	Apply and illustrate the concepts of electricity and magnetism through experiments	Ap	P	36
CO3	Apply and illustrate the concepts of optics through experiments	Ap	P	36
CO4	Apply and illustrate the principles of electronics through experiments	Ap	P	36

List of Experiments

1. Characteristics of Diode and Zener diode
2. Liquid lens- Refractive index of liquid and glass
3. Torsion pendulum- Rigidity modulus
4. Spectrometer- Refractive index of the material of prism
5. Deflection Magnetometer- Moment of a magnet (Tan-A & Tan - B positions)
6. Potentiometer-Measurement of resistance
7. Young's modulus – Uniform bending –using optic lever
8. Static torsion – Rigidity modulus
9. Spectrometer- Grating- Normal incidence

10. Melde's string- Frequency of fork (Transverse and Longitudinal mode)- (Mass determination by equal oscillation method / digital balance)
11. Half wave rectifier and Full wave rectifier
12. Field along the axis of a circular coil
13. Deflection Magnetometer- Moment of a magnet (Tan-C)
14. Potentiometer- Conversion of Galvanometer in to voltmeter –calibration by standard voltmeter
15. Viscosity of liquid- Capillary flow- Variable pressure head method (Mass determination by equal oscillation method / digital balance)
16. Logic gates – Verification of truth table
17. Carey Fosters bridge- Resistivity of the material of wire
18. Surface Tension-Capillary rise method - Radius by microscope.
19. Young's modulus of a cantilever- Pin and microscope method
20. Potentiometer-Calibration of low range voltmeter
21. Moment of inertia of fly wheel
22. Tangent galvanometer – Reduction factor
23. Searle's vibration magneto meter – Comparison of moments
24. Newton's rings- Wavelength of sodium light

Books of Study:

1. Electronics lab manual- K A Navas (vol 1 &2)
2. B.Sc Practical Physics- C L Arora

Reference book:

1. Practical Physics- S L Gupta & V Kumar

MODEL QUESTION PAPERS

B. Sc Physics Core
SEMESTER 1

MODEL QUESTION PAPER 1

Name…….

Reg. No…….

FIRST SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Core Course – Physics: BPH1B01 – MECHANICS I

Time: 2 hours Maximum:60 Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. What is meant by an operational definition? Give an example.
2. What is a fictitious force? How it is related to the apparent force on a system?
3. What is a central force? Show that the work done by the central force is independent of the path.
4. Name the fundamental forces in nature and compare their strengths
5. State and explain Newton's law of gravitation
6. State and explain work energy theorem
7. What are conservative forces? Give examples
8. Sketch and explain the energy diagram of a two-atom system
9. Show that angular momentum is conserved for a particle in central force motion
10. State and prove parallel axis theorem
11. What is moment of Inertia? How it is related to angular momentum?
12. Find the moment of inertia of a ring of radius 'R' and mass 'M' about an axis passing through the center and perpendicular to the plane of the ring.

(Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. What is the fundamental difference between Newtonian Mechanics and Lagrangian/Hamiltonian formulations of Mechanics? Explain the areas where Newtonian mechanics fail.

14. A Drum Major's Baton consists of two masses m1 and m2 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 $F=(4t^2i- 3tj)N$. It starts from the origin at t=0. Find its velocity and position at t=1s

16. Obtain an expression for moment of inertia of a uniform thin hoop of mass m and radius r about an axis passing through the centre and perpendicular to the plane of the hoop

17. Show that the acceleration of the masses m_1 and m_2 suspended over a pulley of mass mp in an Atwood's machine is $a=(m_1-m_2)g/(m_1+m_2+m_{p/}2)$

18. 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 $I_0=Mb^2/2$

19. Discuss the general steps involved in applying Newton's laws to a system. Consider the case of two bodies placed on a table top as an example.

(Ceiling – 30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

14. Define potential energy. Obtain potential energies of a uniform force field and an inverse square force.

15. 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. (1 X 10 =10)

MODEL QUESTION PAPER 2

Name…….

Reg. No…….

FIRST SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Core Course – Physics: BPH1B01 – MECHANICS I

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. What is meant by 'isolating a body' in Mechanics? Is it possible to isolate physical systems?
2. What is friction? What is the expression for the maximum value of friction?
3. What is Chasles' theorem?
4. Describe a conical pendulum
5. What are fictitious forces? Give an example
6. Describe the dynamics of a spring – block system
7. Explain the term centre of mass.
8. Write on the work - energy theorem in one dimension
9. State and explain the parallel axis theorem
10. Give an example of the law of conservation of angular momentum
11. Find the moment of inertia of a thin uniform stick of mass 'M' and length 'L' about an axis passing
    through the midpoint and perpendicular to the length.
12. Explain the terms (a) Physical pendulum (b) Radius of gyration

(Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Show that under the action of viscous forces, velocity decreases exponentially with time?
14. Using this theorem, obtain the expression for the displacement of a one-dimensional harmonic oscillator.
15. Find the expression for the maximum value of 'θ' at which a block begins to slide on a wedge with friction.
16. Show that angular momentum is conserved in motion under central forces.

17. Explain the principle of the Atwood's machine.

18. (a)A particle of mass '2Kg' experiences two forces, F_1= 5i+8j+7k and F_2=3i-4j+3k. What is the acceleration of the particle? (b) An object of mass '2Kg' is resting on the floor. The coefficient of static friction between the object and the floor is 'μ=0.8'. What is the minimum force required to move the object?

19. A bead of mass 'm' slides without friction on a rod that is made to rotate at a constant angular velocity 'ω'. Neglect gravity. Find the possible motion of the bead. (Find r as function of 'ω' and time 't'. Take r_0 as the initial distance of the bead from the pivot.)

(Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. (a) Discuss the general steps to analyze a physical problem using Newton's Second Law, and explain with the example of two blocks (one above the other) at rest on a table top Find the force on the Pth compartment of a train having a total of N compartments, each having masses 'M' and pulled with a force 'F'.

21. Define the term potential energy. Describe the potential energy of a system moving under a uniform force and under an inverse square law force.

(1 X 10 =10)

B. Sc Physics Core
SEMESTER 2

MODEL QUESTION PAPER 1

Name…….

Reg. No…….

SECOND SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Core Course – Physics: BPH2B02 – MECHANICS II

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. State the principle of relativity.

2. What are dispersive and nondispersive sinusoidal waves?

3. Why do we obtain slightly different result in calculating the velocity of sound waves inair using Newton's model?

4. What are the two types of wave motion?

5. What is the Bandwidth time-interval product describing apulse.

6. State Kepler's firstlaw.

7. What are Galilean transformations?

8. How do the same notes of same fundamental frequency from different musical instruments differ?

9. What is the advantage of reduced mass?

10. Explain the terms: apogee and perigee.

11. What are Lorentz transformations?

12. What is Q factor of an oscillator? (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. A damped harmonic oscillator is subjected to a sinusoidal driving force whose frequency is altered but amplitude kept constant. It is found that the amplitude of the oscillator increases from 0.02mm at very low driving frequency to 8.0mm at a frequency of 100 cps. Obtain the values of a) quality factor b) damping factor c) half-width of the resonance curve.

14. State and prove Kepler‟s third law.

15. Show that for an elliptical orbit $\boldsymbol{\varepsilon=(r_{max}-r_{min})/((r_{max}+r_{min})}$ where the letters have their usual meanings.

16. What are stationary satellites? Calculate the height at which such a satellite must revolve in its orbit around the earth.

17. What is a Focault pendulum? Calculate the time it will take the plane of oscillation of a Foucaults pendulum to turn through 90^o at a point where the co-latitude is 60^o.

18. Discuss the following terms: a) phase velocity b) group velocity.

19. For a continuous string, obtain an expression for reflection coefficient in terms of impedances. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. What is a pulse? Discuss Fourier analysis of a non-periodic function with suitable plots.

21. Discuss the origin of fictitious forces in rotating coordinate systems. Hence discuss the geographical consequences of Coriolis forces on earth. (1 X 10 =10)

MODEL QUESTION PAPER 2

Name…….

Reg. No…….

SECOND SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Core Course – Physics: BPH2B02 – MECHANICS II

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. State the principle of equivalence.

2. What is a central force?

3. What is a Foucaults pendulum?

4. Write the equation of a forced damped harmonic oscillator and describe the terms involved.

5. State two important properties of travelling waves.

6. Explain: a) phase velocity b) group velocity.

7. What is a pulse?

8. What is meant by reduced mass of system?

9. For motion in an inverse square force field, state the conditions in terms of the total energy E for the path to be a) an ellipse b) a parabola.

10. Define an inertial frame of reference.

11. What are stationary satellites?

12. A particle of mass 100 gm lies in a potential field V = $\mathbf{32x^2 + 200}$ ergs/gm. What is the frequency of oscillation? (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Discuss Newton's model to determine the velocity of sound in air? Account for the correction required to obtain observed result.

14. What are the general properties of a central force motion?

15. State and explain Kepler's laws.

16. What are uniformly accelerating systems? Discuss the origin of fictitious forces in such systems.

17. Obtain Snell's law of refraction.

18. What are Fourier integrals?

19. For a particle of mass m in a central force field, write the velocity of the particle in polar coordinates. Hence obtain the principle of conservation of energy. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. 20.What is a rotating coordinate system? Obtain expression for acceleration relative to rotating coordinates. Hence discuss Coriolis forces and centrifugal forces.

21. Write down and solve the differential equation of a damped harmonic oscillator subjected to a sinusoidal force and obtain expressions for its maximum amplitude and quality factor. (1 x 10 =10)

B. Sc Physics Core
SEMESTER 3

MODEL QUESTION PAPER 1

Name…….

Reg. No…….

THIRD SEMESTER B.Sc. DEGREE EXAMINATION ……, 20……

(CBCSS-UG)

Core Course – Physics: BPH3B03 - ELECTRODYNAMICS I

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. What does the operator stand for in Cartesiancoordinates?

2. Express the elemental displacements and volume in spherical polarcoordinates.

3. Discuss the analogy between density of electric flux and intensity of electric field due to a pointcharge.

4. What is the advantage of scalar potential formulation inelectrostatics?

5. Show that electric charge density inside a conductor iszero.

6. Get a relation between electric susceptibility and polarizability of a lineardielectric.

7. What isLorentz"force?

8. Show that surface current density is the product of charge density and velocity of charges?

9. Write down the differential form of Ampere"s circuital theorem from the integral form.

10. Explain magnetic vectorpotential.

11. Howmagneticdipolesaregeneratedinspecimenplacedinamagneticfield?

12. How volume bound current density $J_b$is related to susceptibility and free current densityJ_f. (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Obtain the relation between three electricvectors.

14. Discuss about the bound charges in a polarized dielectric medium.

15. Derive the law of refraction for the electric lines of force moving from a dielectric medium having dielectric constant K_1 to another medium of constantK_2.

16. Discuss briefly about the bound currents in a magnetizedmedium.

17. A dielectric slab of thickness 5mm and dielectric constant 3 is placed between two oppositely charged plates. If the field outside the dielectric is 10^5 V/m, calculate (i) polarization in the dielectric, (ii) electric displacement and (iii) bond charges in thedielectric.

18. Find the magnetic flux density at the centre of a square wire loop of side 10cm, carrying 1 Ampere current.

19. An electron beam passes undeviated normal to a crossed electric and magnetic field of magnitudes 4×10^4 V/m and 6×10^{-3} tesla. Find the velocity of electron leaving out undeviated from the crossed fields and also find the radius of electron path when the electric filed isswitchedoff. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. State and prove Gauss‟s law and use it find the electric field due to a charged spherical conductor and charged cylindricalconductor.

21. Briefly explain the domain theory and discuss the characteristics of ferromagnetic material with the help ofhysteresisloop. (1 □ 10 =10)

MODEL QUESTION PAPER 2

Name…….

Reg. No…….

THIRD SEMESTER B.Sc. DEGREE EXAMINATION ……, 20……

(CBCSS-UG)

Core Course – Physics: BPH3B03 - ELECTRODYNAMICS I

Time:2 hours Maximum: 60 Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. Prove law ofcosines.

2. What is the Physical interpretation of gradient of a scalarfield?

3. State Divergencetheorem.

4. Derive differential form of Gauss‟s law inelectrostatics.

5. Obtain Laplace‟sequation.

6. Draw a graph showing the variation of intensity of electric field due to a uniformly charged spherical conductor withdistance.

7. Write the electrostatics boundary conditions regarding *D* andV.

8. Get the relation between electric susceptibility and dielectric constant of a linear dielectricmedium.

9. How□ □leads to conclusion that magneticmonopoles cannot exist.

10. Derive cyclotronformula.

11. Show that no work is done by magnetic field, on a charged particle moving init.

12. Explain the magnetic saturation of a ferromagnetic material based on competing magneticdomains? (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Provethefundamentaltheoremof*Curl*usingthefunction=$(2xz+3y^2)+4yz^2$andsquare surface of unit side with one corner coinciding withorigin.

14. Using Gauss‟s law find the electric field inside and outside a spherical shell of radius R, which carries uniform charge density□.

15. Describe polar and non polar dielectricmaterials.

16. A sphere of linear dielectric material is placed in a uniform electric field E_0. Find the new

field inside thesphere.

17. Three point charges each of 100μC are placed at the three corners of a square of side 10 cm. Find the total potential energy of the system, when a forth charge of same magnitude is brought to the last corner of thesquare.

18. Find the capacitance of two concentric spherical metallic shells, with inner radius *a* and outer radius*b*.

19. Calculate the intensity of magnetization inside a metal rod if a magnetizing field results in a magnetic field of 3×10^{-4} weber/m^2 induced in vacuum and a magnetic field of 1.5×10^{-3} weber/m^2 induced in the material oftherod. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. A slab of linear dielectric material is partially inserted between the plates of a charged parallel plate capacitor. Derive an expression for force acting on theslab.

21. Discuss the motion of electric charges in cyclotron and derive expressions for cyclotron frequency a maximum energy acquired by charge fromcyclotron.

(1 □ 10 = 10 marks)

B. Sc Physics Core
SEMESTER 4

MODEL QUESTION PAPER - 1

Name…….

Reg. No…….

FOURTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Core Course – Physics: BPH4B04 - ELECTRODYNAMICS II

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. Write down thedifferentialand integral forms ofFaraday‟slaw
2. Give Maxwell‟s modification of Ampere‟slaw.
3. How refractive index of a medium can be obtained from basic electro-magnetic constants.
4. Explain polarization of electromagneticwaves.
5. Define intensity of e.m.waves and how it is related to Poyntingvector.
6. Discuss the growth of current in a CRcircuit?
7. What are the conditions for a moving coil galvanometer to beballistic?
8. Define the r.m.s value of e.m.f and write how it is related to peak value ofe.m.f.
9. Compare series LCR resonant circuit and parallel LCR resonantcircuit.
10. Draw the circuit diagram for obtaining balance using Anderson‟sbridge.
11. What is an ideal constant voltagesource?
12. StateThevenin‟stheorem (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. State Lenz’s law. Obtain the expression for energy stored in an inductor.
14. Find the reflection coefficient of an electromagnetic wave falling normally on a boundary.
15. Draw and explain circuit diagram for decay of current in L-Rcircuit.
16. Obtain the classical wave equation.
17. A square wire of side 10 cm is perpendicular to a magnetic field 4×10^{-3} Tesla. (*a*) What is the magnetic flux through the loop? (*b*) If the field drops to zero in 0.1 second, what is

the average e.m.f induced in the circuit during thistime.

18. The time averaged Poynting vector of Sun's e.m. radiation received at the upper surface of earth'satmosphere,$S=1.35\times10^{3}W/m^{2}$.Assumingthatwavesareplane&sinusoidal what are the amplitudes of electric and magnetic fields.

19. A pure resistance of 100 is in series with a pure inductance of 5 henry and a variable capacitance. The combination is connected to a 100V, 50Hz supply. At what value of capacitance will the current in the circuit be in phase with the applied voltage? Calculate the current in this condition. What will be the potential difference across the resistance, inductance and capacitance at that time? (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. A plane polarized monochromatic wave of angular frequency ω passes normally through a boundary between two linear non conducting media. Discuss the phenomenon of the reflection and transmission.

21. Define the charge sensitiveness of BG. With necessary theory, describe an experiment to determine the charge sensitiveness of BG using standard condenser and HMS.

(1 × 10 = 10 marks)

MODEL QUESTION PAPER - 2

Name…….

Reg. No…….

FOURTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Core Course – Physics: BPH4B04 - ELECTRODYNAMICS II

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. Discuss Faraday's laws of electromagnetic induction.
2. Write down general wave equation. Give its solution.
3. Write the boundary conditions for B & H at a boundary between two different media.
4. What is radian pressure? Write relation connecting intensity and radiation pressure of an electromagneticwave.
5. Write down Poyntingtheorem
6. Write down Maxwell"s equations insidematter.
7. Discuss the growth of current in a L-Rcircuit?
8. Write down the characteristics of a dead beat moving coilgalvanometer.
9. What is meant by the logarithmic decrement in a moving coilgalvanometer?
10. What is the power factor in inductor-resistor seriescircuit?
11. What you mean by Q-factor in a series resonantcircuit.
12. Statesuperpositiontheorem. (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Give brief account of magnetic charge.
14. Explain mutual inductance and get Neumann"s formula for thesame.
15. How can a voltage source be converted into equivalent current source and viceversa.
16. Describe with vector diagram, how the impedance of an LCR series circuit is expressed in terms of***j***-operator.
17. If the charge on capacitor of capacitance 2 microfarad is leaking through a high resistance of 100 megaohms is reduced to half its maximum value, calculate the time ofleakage.

18. An alternating potential of 100 volt and 50 hertz is applied across a series circuit with L=5 henry, R=100 ohm and a variable C. At what value of C, will current in the circuit be in phase with applied voltage? Calculate current in this condition. What will be the potential difference across R, L and C at thattime?
19. Show that at maximum power transfer, efficiency isonly50%. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. ExplainhowMaxwellmodifiedAmpere‟stheorem.DeriveMaxwell‟sequationinmatter.
21. Describewiththeory,theAnderson‟smethodtodetermineselfinductanceofacoil.

(1 □ 10 = 10 marks)

B. Sc Physics Core
SEMESTER 5

MODEL QUESTION PAPER - 1

Name…….

Reg. No…….

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Core Course – Physics: BPH5B06 - COMPUTATIONAL PHYSICS

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. Write an algorithm to accept two numbers compute the sum and print theresult.

2. What is the difference between a compiler and interpreter in acomputer?

3. Name the different data types inPython.

4. 12. What will be the output of theprogram?

```
>>> a =4.0
>>> x =3.0
>>> y = (x+ a/x)/2
```

5. What is a tuple? How literals of type tuple are written? Giveexample.

6. What is a list? How lists are different fromtuples?

7. Write a program to create a 1D array of numbers from 0 to 9 usingnumpy

8. Write the Python command to display the x and y axis label and title in agraph.

9. Write a Python function to calculate the two parameters of least-squaresfitting.

10. Decreasing the step size improves your result linearly in Euler's method.Justify.

11. How second order Runge-Kutta method is related to Euler'smethod?

12. What are the advantages of numerical methods overanalyticalmethods? (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. a) Write the syntax for the control statements if..elif...if and while inPython.

b) Write a program that tests whether a number is prime or not using while and if...else statements.

14. Write a Python program to simulate two dimensional projectile motion of a body moving

under gravity using Euler"smethod.

15. By the method of least squares, find the straight line that best fits the followingdata:

X	1	2	3	4	5
Y	23	29	17	37	41

16. Write a program to sum the series: $Sin(x) = x- (x^3/3!) +(x^5/5!)+(x^7/7!)+…..$

17. Write a program that plots the motion of a mass oscillating at the end of a spring. The force on the mass should be given by F = -mg +kx.

18. Find the all the roots of sin(x) between 0 and 10, using Newton-Raphsonmethod.

19. Write a program to simulate the motion of a body projected horizontally from a height onearth. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Explain Euler's method of finding solution of a differential equation. Write a program to simulate by tabulation a free fally body under gravity using Euler'smethod.

21. Deduce Newton"s forward interpolation formula and hence obtain the expressions for dy/dx and d^2y/dx^2 and find the value of first and second derivative atx=1.5.

x	1	2	3	4	5
y	1	4	9	16	25

(1 × 10 = 10 marks)

MODEL QUESTION PAPER - 2

Name…….

Reg. No…….

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Core Course – Physics: BPH5B06 - COMPUTATIONAL PHYSICS

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. Write a Python program to add an element 10 to a list x = [1, 2, 3] and to print that element.
2. What will be the result if the following Python code isexecuted?

```
for n in range(1000):
    if n% 100 = = 0 :
        print „step“ n
```

3. What is meant by indentation and what is its importance inPython?
4. Give an example for using if, elif , elsestatement.
5. Write a program to make a list of lists and convert it to anarray.
6. Write a program to make a 3×3 matrix and multiply it by 5 and print theresult.
7. Using polar () function write a program to plot a circle of radius 5cm.
8. Write a program using linspace to plot $\sin^2 x$, cos x, $\sin x^2$
9. What are functions and modules in Python?
10. Write the syntax to append, insert, del, remove an element from alist.
11. Illustrate file input and file output using anexample.
12. Python has developed as an open source project. Justify thisstatement

(Ceiling – 20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Write a Python program to integrate $f(x) = x^3$using Simpson“srule
14. Write a Python program to trace the path of a projectile moving through air and experiencing a resistive force proportional to the square ofvelocity.

15. Find the value of y for x = 4.2 from the following table using Newton‟s forward interpolation formula

X	4	4.5	5	5.5	6	6.5
Y	18	22.25	27	32.25	39	44

16. Write a program to fit a straight line by least square fit method from a set of data from user.

17. The table given below reveals the observation taken by a student for a particular experiment. Write a python program to find the first and second derivatives at x=1.5 from the tabulated set ofvalues.

X	1	2	3	4	5
Y	1	4	9	16	25

18. What are the different loop control statements available in Python? Explain with suitable examples.

19. Write the syntax for accessing, adding and deleting an element from a list and illustrate the use of user-defined functionsinPython. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. a) Explain second order Runge–Kutta method for solving differential equations.

b) Write a program to simulate a two- dimensional projectile motion using Euler method in a table.

21. a) Write a program to simulate in a table by numerical method for the motion of a body falling in a viscous medium.

b) Write a python program to find a root of the equation x^3-x-11 by Newton-Raphson method. (1 × 10 = 10marks)

MODEL QUESTION PAPER - 1

Name…….

Reg. No…….

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Core Course – Physics: BPH5B07 – QUANTUM MECHANICS

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. What is meant by work function?

2. Write down the Planck Radiation formula

3. State and explain correspondence principle

4. Mention any two deficiencies of the Bohr model of atom

5. Explain the term probability amplitude

6. What is meant by eigen function and eigen value? Give an example

7. Explain zero point energy of a harmonicoscillator

8. Describe quantum tunneling

9. Explain Zeeman effect

10. Write down the admissibility conditions for a function to represent a wavefunction

11. Explain pair production

12. What is meant by normalization? (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Explain Einstein‟s photoelectricequation

14. Describe the Frank – Hertzexperiment

15. Explain the concept of a wave packet and explain the terms phase velocity and group velocity

16. Derive Schrödinger‟s time independent equation from the time dependentone

17. The work function for Tungsten is 4.52 eV. Radiation of wavelength 198 nm is incident on a piece of Tungsten. Find (a) the cutoff wavelength for Tungsten (b) the stopping potential and (c) maximum kinetic energy of photoelectrons

18. Protons of kinetic energy 1 GeV are diffracted by Oxygen nuclei of radius 3 fm. Calculate the expected angles where the first three diffraction minima should appear

19. An electron is trapped in a one dimensional region of width 1×10^{-10} m. Find the energies of the ground state and the first excited state. If the electron happens to be in the second excited state and then drops down to the ground state, find the energyemitted.

(Ceiling – 30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Obtain the expression for wavelength change in Comptonscattering

21. Describe the quantum theory of the Hydrogen atom. ($1 \times 10 = 10$marks)

MODEL QUESTION PAPER - 2

Name…….

Reg. No…….

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Core Course – Physics: BPH5B07 – QUANTUM MECHANICS

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. What is photoelectric effect? Write down Einstein‟s photoelectricequation
2. Explain ultravioletcatastrophe
3. Compare Rutherford model of the atom with the Bohrmodel
4. Explain the probability interpretation of wavefunction
5. What is spacequantization?
6. State and explain Heisenberg‟s uncertaintyrelation
7. Write down the Schrödinger equation for a free particle and explain itssolution
8. Explain the motion of a particle incident on a potential energystep
9. What is Bohrmagneton?
10. Explain the fine structure of Hydrogenspectrum
11. What are the properties of the azimuthal quantumnumber?
12. Explain the term probabilityamplitude (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Explain Comptoneffect
14. Write down the Schrodinger equation of the Hydrogen atom and explain the angular momentum quantumnumber.
15. Describe the quantum theory of motion of a particle in a two dimensional potentialwell.
16. Explain the theory of the quantum harmonicoscillator.
17. X-rays of wavelength 0.24 nm are Compton – scattered and the scattered beam is

observed at an angle of 60^0 with the incident direction.Find (a) the wavelength of scattered rays (b) the energy of scattered X-ray photons (c) the kinetic energy of scattered electrons and (d) the direction of motion of the scatteredelectrons.

18. Anelectronisconfinedtoaregionofspacebyaspring-likeforceofforceconstantk=

95.7 eV/m^2. Find the probability to find the electron in a narrow interval of width 0.004 nm located halfway between the equilibrium position and the classical turning point.

19. Obtain the relation between phase velocity and group velocity for de Brogliewaves.

Certainoceanwavestravelwithaphasevelocityof v_p $= \frac{g\lambda}{2\pi}$. Find their group velocity

(Ceiling – 30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Describe the quantum theory of a particle confined in a one dimensionalbox

21. Explain the Frank – Hertz experiment. What is its significance for the model of anatom?

(1 × 10 = 10 marks)

MODEL QUESTION PAPER - 1

Name…….

Reg. No…….

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Core Course – Physics: BPH5B08 - OPTICS

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. State Fermat‟sprinciple
2. What are the conditions forinterference?
3. What is meant bycoherence?
4. Write down the conditions for maxima and minima in reflected light for Newton‟s rings experiment.
5. Explain cosinelaw
6. Write the expression for intensity distribution in Fraunhofer diffraction by a circular aperture.
7. Define resolving power of a diffractiongrating.
8. Mention any two differences between zone plate and a convexlens.
9. List out the differences between positive and negativecrystals.
10. Explain the terms plane of vibration and plane ofpolarization.
11. Write any two applications ofholography.
12. Give two differences between step index and gradedindex fibres. (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Derive the laws of reflection from Fermat‟sprinciple.
14. Explain the colour of thinfilms
15. An air wedge apparatus of angle 0.01 radian is illuminated by light of wavelength 6000 Angstroms. At what distance from the edge of the wedge will be 10^{th} dark fringe observed?

16. A plane grating has 15000 lines per inch. Find the angle of separation of the 5048 Angstrom and 5016 Angstrom lines of Helium in the second orderspectrum.
17. The diameter of the first ring of a zone plate is 1.1 mm. If light of wavelength 6000 Angstrom is incident on the zone plate, where should the screen be placed so that a bright spot isobtained?
18. The critical angle for total internal reflection from water is 48^0. Find the polarization angle and the angle of refraction corresponding to the polarizationangle.
19. Calculate the least thickness of a calcite plate which would convert incident plane polarized light into circularly polarized light. Given μ_o= 1.658, μ_e= 1.486 for calcite and wavelength of light used is5890Angstrom. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Describe the structure and working of Michelson‟sinterferometer
21. Explain the structure of a Nicol prism. Describe how it is used as an analyzer and as a polarizer. ($1 \times 10 = 10$marks)

MODEL QUESTION PAPER - 2

Name…….

Reg. No…….

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Core Course – Physics: BPH5B08 - OPTICS

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. Why does ordinary light never form stable interferencepattern?

2. Write the cosine law for interference by division ofamplitude

3. Why do the fringes in air wedge setup have the form of straightlines?

4. Why is the centre of interference pattern due to white light seen to bewhite?

5. What is the nature of the diffraction pattern produced by a circularaperture?

6. What are the differences between a zone plate and a convexlens?

7. Why half period zones are calledso?

8. Differentiate between uniaxial and biaxial crystals and give an example foreach

9. What is meant by circularly polarizedlight?

10. Explain the termbirefringence

11. How is a hologram different from an ordinaryphotograph?

12. Define the termnumericalaperture. (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Derive the laws of refraction from Fermat‟sprinciple

14. Explain pulse dispersion in optical fibres. How is it overcome in graded indexfibres?

15. Find the radii of the first three transparent zones of a zone plate whose first focal lengthis 1 m for light of wavelength 5893Angstrom

16. A half wave plate is designed for wavelength 3800 Angstrom. For what wavelength willit work as a quarter waveplate?

17. Newton‟sringsareobservedinreflectedlightofwavelength$5.9x10^{-7}$m.Thediameterof the 10^{th}

dark ring is 0.5 cm. Find the radius of curvature of the lens and the thickness of air film at the position of the 10^{th} darkring.

18. Calculate the highest order of spectra with a plane transmission grating of 18000 linesper inch when light of 4500 Angstrom is used

19. Derive the expression for acceptance angle of an optical fibre. In an optical fibre, the core has a refractive index of 1.6 and the cladding has a refractive index of 1.3. Find the values of critical angle and acceptance angle forthefibre. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Describe the experiment for determination of wavelength of light using Newton‟s rings arrangement.

21. Derive the grating equation for normal incidence. How is the diffraction grating used to find the wavelengthoflight? (1 × 10 = 10marks)

MODEL QUESTION PAPER - 1

Name…….

Reg. No…….

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Core Course – Physics: BPH5B09 – ELECTRONICS (Analog and Digital)

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. Derive the relation between α andβ.

2. What is the peak inverse voltage?

3. Explain the stability factor for a transistorcircuit.

4. Convert binary numbers 101010 and 111011 into decimalnumber.

5. Construct OR and AND gate by using NANDgate.

6. Define Ripple factor of a rectifier. What is its value for a full waverectifier?

7. Draw the dc and ac equivalent circuit of a CE transistoramplifier.

8. Discuss the main characteristics of an ideal Operational Amplifier.

9. What do you meant by barrier potential of a PNjunction?

10. RepresentthefollowingBooleanexpressionbyKmap

$$Y(A,B,C,D)=(A+B+C^-)(A^-+C^-+D)$$

11. The voltage gain of an amplifier without feedback is 2000. The feedback fraction is 0.01.find the voltage gain of the amplifier if negative feedback isapplied.

12. Give the Barkhausen condition for gettingsustainedoscillations. (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Explain voltage divider biasing with the help of a neatdiagram.

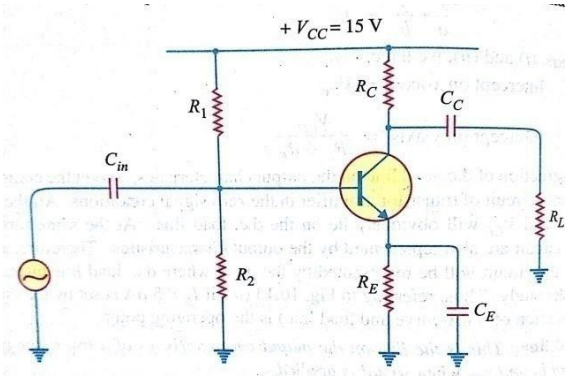
14. For a differential circuit, the input is sinusoidal voltage of peak value 10 mV and frequency 1KHz.R=100KΩ and C=0.1μF. Findoutput

15. For the transistor amplifier shown in figure, R_1 = 10 kΩ, R_2 = 5 kΩ, R_C = 1 kΩ, R_E = 3 kΩ and R_L = 1 kΩ. Assume V_{BE} = 0.7V

i. Draw the dc loadline

ii. Determine the operatingpoint

iii. Draw ac loadline



16. Explain 1‟s complement method of binary subtraction withexample.

17. In a three section phase shift oscillator $R_1=R_2=R_3=20K\Omega$, and $C_1=C_2=C_3=0.01\mu F$.The resistors are connected in series and the capacitors are shunts. Find the frequency of oscillations

18. Explain Op-Amp integrator with a neatdiagram.

19. Determine the output voltage for the op-amp circuit having V_{in}=2.5mv, R_i=2kΩ, R_f=200 kΩand±Vcc=±9v. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Draw dc and ac equivalent circuits of a transistor amplifier. Derive an expression for the voltage gain from the ac equivalentcircuit.

21. Explain the working of Colpitt‟s oscillator and Hartley oscillator with neatdiagram.and write down the equation to find frequency ofbothcircuits. (1 × 10 = 10marks)

MODEL QUESTION PAPER - 2

Name…….

Reg. No…….

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Core Course – Physics: BPH5B09 - ELECTRONICS (Analog and Digital)

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. What is the faithfulamplification?

2. Write down the mantissa and exponent of the number242506800

3. Explain the working of Zener diode as a voltagestabilizer.

4. State De Morgan‟slaw.

5. Convert the following decimal in tobinarya)$(123.88)_{10}$ b)$(225)_{10}$ c)$(100.01)_{10}$

6. What is the need for bias stability in a transistorcircuits?

7. What is XNOR gate? Draw circuit diagram with truthtable

8. Explain the working of a voltagedoubler.

9. What are the advantages of using transformer in rectifiercircuit

10. Subtract 01000111 from 01011000

11. Discuss the advantages of negative feedback inAmplifiers.

12. How is a JK flip-flop madeto Toggle? (Ceiling –20)

Section B – Paragraph / Problem type.

(**Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)**

13. A cristal diode having internal resistance r_f= 20 Ω used for half wave rectifier. If the applied voltage is equal to 50sinωt and load resistance R_L= 800 Ω.Find

i. I_m, I_{dc},I_{rms}

ii. Ac power input and dc poweroutput

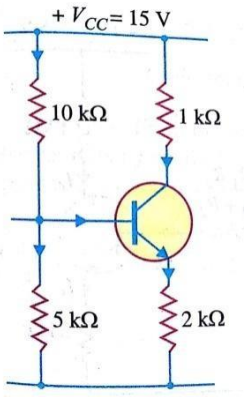
iii. Dc outputvoltage

iv. Efficiency ofrectification

14. Derive the expression for collector current in common emitter connection. Draw the input

and outputcharacteristics.

15. Draw the DC load line and determine the operating point. Assuming the transistor to be of silicon



16. Explain with suitable diagram the inverting and non-inverting configurations of an Op-Amp and derive the expression for their voltagegain.

17. Explain the working of a RSflip-flop.

18. When negative voltage feedback is applied to an amplifier of gain 100, the overall gain falls to50.

i) Calculate the fraction of the output voltagefeedback.

ii) If this fraction is maintained, calculate the value of the amplifier gain required if the overall stage gain to be75

19. Find the operating frequency of a Hartley"s oscillator. If L 1 =100µH, L 2 =1mH, mutual inductance between the coils M=20 µH and C=20pF. Also determine the feedback fraction. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. With a neat sketch, explain the working of half wave rectifier. Derive the expression for efficiency and ripplefactor.

21. What isan Op-Amp? State thecharacteristics of an ideal Op-Amp. Compare the operation of an inverting and non inverting amplifier using Op-Amp. (1 × 10 = 10marks)

B. Sc Physics Core
SEMESTER 6

MODEL QUESTION PAPER - 1

Name…….

Reg. No…….

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Core Course – Physics: BPH6B10 – THERMODYNAMICS

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. Comment on the concept of temperature andheat

2. Distinguish between intensive and extensivecoordinates

3. What is the significance of PVdiagram?

4. What is heat capacity? Write down the expression for heat capacity.

5. What is internal energy?

6. What is thermal efficiency? Write itsexpression?

7. State Carnot‟s theorem andcorollary?

8. State Second law of thermodynamics? What is the significance of Second law of thermodynamics?

9. Distinguish between Carnot‟s engine and irreversibleengine?

10. What isenthalpy?

11. What are Helmholtz and Gibbs function? Write down theformulae?

12. Write down the Clausius-Clayperon equation anditsapplications? (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Derive the equation for work done in an Adiabaticprocess.

14. State First law of thermodynamics? Derive differential form of Firstlaw?

15. Prove that $\delta s_I \leq \delta s_R$.

16. ACarnot‟s engine whose lower temperatureheat(sink)is at 27^0C has its efficiency 40 %. What is the temperate of the heat sources? By how much should the temperature of the source be raised if the efficiency if to be raised to 70%?

17. Calculate the work done when a gram molecule of an ideal gas expands isothermally at 27^0C to double its original volume? (R = 8.3 joules/degreemol).

18. Derive TdSequations?

19. What is a refrigerator? Explain the working ofarefrigerator? (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. What are thermodynamic potential functions? Derive the expressions for thermodynamic potentialfunctions?

21. (a) What is entropy? Write short note on its significance?

(b) Derive the expression for entropy ofidealgas. ($1 \times 10 = 10$marks)

MODEL QUESTION PAPER - 2

Name…….

Reg. No…….

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION ……, 20……

(CBCSS-UG)

Core Course – Physics: BPH6B10 – THERMODYNAMICS

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. State and explain Zeroth law ofthermodynamics?

2. What is meant by quasi-staticprocess?

3. What is entropy? Explain the entropy of reversible and irreversibleprocesses?

4. State the Principle of increase ofentropy?

5. State Kelvin-Planck and Clausius statement of Second law ofthermodynamics?

6. Compare the slopes of adiabatic andisothermals?

7. What is latentheat?

8. Write short note on internalenergy?

9. State and explain Carnot‟stheorem?

10. Distinguish between intensive and extensive properties of a thermodynamicsystem?

11. Draw the PV diagrams of thermodynamicprocesses?

12. State First law of thermodynamics? Write the differential form of Firstlaw?

(Ceiling – 20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Show that Cp-Cv =R.

14. ExplaintheworkingofaCarnot‟sengineandderivetheexpressionforefficiency?

15. What is meant by phase transitions? Obtain the Clausius- Clayperon equation of phase transition?

16. Calculate the depression of melting point of ice by 1 atm increase of pressure, given latent heat of ice = 3.35 x 10^5J/Kg and the specific volumes of 1 Kg of ice and water at

0^0C are 1.090 x $10^{-3}m^3$ and 10^{-3} m^3 respectively.

17. Show that for a perfect gas $(\partial u/\partial v)_T$=0ACarnot"senginewhoselowertemperaturereservoirisat7^0Chasanefficiencyof50%. It is desired to increase the efficiency to 70%. By how many degrees should the temperature of the high temperature reservoir beincreased?

18. What is TS diagram? Discuss the TS diagram of isothermal and adiabatic processes? Find theefficiencyofCarnot"sengineusingTSdiagram? (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

19. DerivetheMaxwell"sthermodynamicrelationsfromthermodynamicpotentials functions?

20. (a) What are isothermal and adiabaticprocesses?

(b) Derive the equation for work done in isothermal and adiabatic processes?

(1 × 10 = 10 marks)

MODEL QUESTION PAPER - 1

Name…….

Reg. No…….

SIX SEMESTER B.Sc. DEGREE EXAMINATION ……, 20……

(CBCSS-UG)

Core Course – Physics: BPH6B11 – STATISTICAL PHYSICS, SOLID STATE PHYSICS, SPECTROSCOPY AND PHOTONICS

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. Distinguish between a microstate and amacrostate.

2. What are Bravais lattices? Give anexample.

3. What is meant by unit cell? Give anexample.

4. What is packingfraction?

5. Give the selection rules for rotationalspectroscopy.

6. What is a symmetric top molecule? Give anexample.

7. What is zero point energy of a harmonicoscillator?

8. Discuss the Born – Oppenheimer approximation.

9. What are hotbands?

10. What is pumping? Give two examples of pumpingmechanisms.

11. List out some differences between laser light and ordinarylight.

12. What isstimulatedemission? (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. How does the Rayleigh – Jeans law fail to explain the black bodyspectrum?

14. Compare average velocity, root mean square velocity and most probablevelocity

15. Explain the three types of cubic crystal systems and the coordination number ofeach

16. Explain the anharmonic vibration spectrum of a diatomicmolecule

17. The bond length in HF molecule is 0.0927 nm. Calculate its rotationalconstant in cm^{-1} and also its moment of inertia

18. For X – ray diffraction from a Sodium Chloride crystal with lattice spacing 0.282 nm, the first order Bragg reflection is observed at an angle of $8^0 35'$. Find the wavelength of X – rays and the glancing angle for third order Braggreflection.

19. The fundamental band for HCl is centred at 2886 cm $^{-1}$. Find the wave number in cm^{-1} of the first lines in the P branch and R branch of the infrared spectrum. Take the internuclear distance to be1.276 Angstrom. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Derive the expression for molecular energy distribution of an idealgas.

21. ExplainthestructureandworkingofBragg"sX–rayspectrometer. (1 × 10 = 10marks)

MODEL QUESTION PAPER - 2

Name…….

Reg. No…….

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION ……, 20……

(CBCSS-UG)

Core Course – Physics: BPH6B11 – STATISTICAL PHYSICS, SOLID STATE PHYSICS, SPECTROSCOPY AND PHOTONICS

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. Explain the term distributionfunction.

2. What are Bosons? Give twoexamples.

3. Explain the term crystal lattice andbasis.

4. Explain Bragg‟slaw.

5. What is meant by a spherical top molecule? Give anexample.

6. What is isotopicsubstitution?

7. Give the selection rules for vibrationspectroscopy.

8. What is Morsecurve?

9. Explain the terms –(i) population inversion (ii) metastablestate.

10. Give any two applications oflasers.

11. Explain any two types of pumpingmechanism.

12. WhatareStokes‟linesandanti-Stokes‟lines? (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Compare Maxwell – Boltzmann, Fermi-Dirac and Bose – Einsteinstatistics

14. Derive and explain Bragg‟slaw

15. Explain the spectrum of a non – rigidrotator

16. Briefly explain the quantum theory of Raman scattering with a neatdiagram

17. Find the energy in cm^{-1} of the photon absorbed when an NO molecule undergoes transition v = 0,J‟‟= 0state to v = 1,J‟= 1 state wherev is the vibrational quantum number

and J is the rotational quantum number. Assume that B is the same in both states. Given ν_e = 1.904 cm $^{-1}$ and χ_e = 0.00733 and r_{NO} = 0.1151nm

18. The rotational and centrifugal constants of HCl molecule are 10.593 cm $^{-1}$ and 5.3 × 10^{-4} cm $^{-1}$. Find the vibrational frequency and the force constant of themolecule

19. Obtain the Miller indices of a plane with intercepts at a, (b / 2) and 3c in a simple cubic unitcell. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Describe the theory of pure rotational spectrum of a rigid diatomicmolecule

21. Explain, with necessary diagrams, the construction and working of a He- NeLaser

(1 x 10 = 10 marks)

MODEL QUESTION PAPER - 1

Name…….

Reg. No…….

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Core Course – Physics: BPH6B12 – NUCLEAR PHYSICS AND PARTICLE PHYSICS

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. Why do heavy nuclei have more neutrons thanprotons?

2. Comment on the property of nuclearforce.

3. Explain why a fusion reactor requires a high particle density, a high temperature anda long confinementtime?

4. Write a short note on radio isotope production in nuclearreaction.

5. Which are the three requirements to increase the probability of collision between theirons that would result infusion?

6. Explain the terms particle andantiparticle.

7. Write a short note on natural radioactivity.

8. What do you mean by resonanceparticle?

9. What is the limitation of linearaccelerator?

10. Draw neat diagram and Write essential part of Scintillationcounter.

11. Write the theoryBetatron.

12. What is the working principal ofIonizationchamber? (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5marks)

13. Write short note on Radioactive decay. The half life of ^{198}Au is 2.70 days (a) What is the decay constant of ^{198} Au (b) suppose we had a 1.00 μg sample of ^{198}Au. What is its activity?

14. Write a short note on nuclear masses and bindingenergies?

15. Explain briefly the application of nuclearphysics?

16. Discuss the Quarkmodel?

17. Discuss briefly low energy reactionkinematics?

18. Discuss the working of Protonsynchrotron?

19. Write the working ofPhotographicplate? (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Using Neat diagram explain the working principle of van de Graaf electrostaticgenerator?

21. List the families of elementary particle? Discuss the conservation law in particle interaction? (1 x 10 = 10marks)

MODEL QUESTION PAPER - 2

Name…….

Reg. No…….

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Core Course – Physics: BPH6B12 – NUCLEAR PHYSICS AND PARTICLE PHYSICS

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. Why the nuclei are so small compared to theatom?

2. What is mean by binding energy of theatoms?

3. What are the applications of nuclearphysics?

4. Mention any two conservation laws in radioactivedecay?

5. In general, would you expect fission fragment to decay by positive or negative beta decay?Why?

6. List some similarities and difference between the properties of photons andneutrinos.

7. List the four families of elementaryparticles.

8. What do you mean by delayedneutrons?

9. What is mean by particleacceleration

10. Briefly given the working ofCosmotron.

11. What are the advantages of GMCounter?

12. What is the limitation ofBubbleChamber? (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Explain Beta and Gamma decayprocesses.

14. Explain "MOSSBAUER" Effect. Find the maximum kinetic energy of the electron emitted in the negative beta decay of ^{11}Be.

15. Distinguish between fission and fusion reactions. Explain the fusion process instars?

16. Discuss briefly three different types of fissionreactors.

17. Write a short note on elementary particle interactions anddecays.

18. Discuss the working principle of Van de Graff electro staticsgenerator.

19. Discuss the working ofIonizationchamber. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Obtain an expression for the binding energy per nucleon of a nucleus using liquid drop model. Discuss the corrections to the expression from asymmetry energy and pairing energy and obtain the semi empirical binding energyformula.

21. Explain Radioisotope production in nuclear reactions. Discuss the main features of nuclear fusionreactors (1 x 10 = 10marks)

MODEL QUESTION PAPER - 1

Name…….

Reg. No…….

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Core Course – Physics: BPH6B13 – RELATIVISTIC MECHANICS AND ASTROPHYSICS

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. State the postulates of specialrelativity

2. What are Galileantransformations?

3. Explain lengthcontraction.

4. What is the concept of simultaneity in relativisticmechanics?

5. Describe the relativistic DopplerEffect.

6. State and explain the principle ofequivalence.

7. Explain the concept of darkmatter.

8. What is meant by the Chandrasekharlimit?

9. Explain the terms (a) stellar parallax (b)luminosity.

10. Write on the internal structure of theSun.

11. State and explain Hubble‟slaw.

12. Whatarepulsars? (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Obtain the relation for timedilation

14. Briefly describe the Hertzsprung – Russelldiagram

15. Describe the classification ofgalaxies

16. An observer O is standing on a platform of length 65 m. A vehicle passes parallel to the platform at a speed of 0.8c. The observer O sees the front and back ends of the vehicle coincide with the platform ata particular instant. Find (a) the rest length of the rocket (b) the time required for the vehicle to pass appoint on the platform as measured by O.

17. A spaceship moving away from the earth at a speed of 0.8c fires a rocket along its direction of motion at a speed of 0.6c relative to itself. Find the speed of the rocket relative to the earth. Compare the answer with the classicalresult.

18. Find the velocity and momentum of an electron of kinetic energy 10MeV.

19. Obtain the relation between absolute magnitude andapparentmagnitude. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Obtain the Lorentz transformationequations.

21. Describe the various mechanisms possible in the deathof star. (1 x 10 = 10marks)

MODEL QUESTION PAPER - 2

Name…….

Reg. No…….

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Core Course – Physics: BPH6B13 – RELATIVISTIC MECHANICS AND ASTROPHYSICS

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. Write down and explain the Lorentz transformation equations.

2. What is timedilation?

3. Explain relativistic addition ofvelocities.

4. Why the speed of light is considered the ultimatespeed?

5. Explain the variation of mass withvelocity.

6. Write down two experimental tests of the general theory ofrelativity.

7. What are neutronstars?

8. What is meant by Cosmic Microwave BackgroundRadiation?

9. Explain the terms (a) apparent magnitude (b) absolutemagnitude.

10. Write on the proton – proton chainreaction.

11. What is the relation between stellar parallax and distance?

12. Describegravitationallensing. (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Obtain Einstein‟s mass energyrelation.

14. Briefly describe (a) globular clusters (b) planetarynebulae.

15. Describe Cepheid variables and their period – luminosityrelation.

16. Explain the twinparadox.

17. The proper lifetime of a particle is 10 ns. How long does it live in laboratory if it moves at a speed of 0.960s. How far does it travel beforedecaying?

18. A neutral K meson at rest decays into two particles that travel in opposite directions with

speed 0.828c. If instead the K meson was travelling at a speed of 0.486c while decaying, what would be the velocities of the twoparticles?

19. Obtain the relation between relativistic momentumandenergy.

(Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Describe the Michelson – Morley experiment. How does it invalidate the concept of ether?

21. Describe the main features of the Hertzsprung –Russelldiagram. (1 x 10 = 10marks)

MODEL QUESTION PAPER - 1

Name…….

Reg. No…….

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Core Course – Physics: BPH6E01 – BIOMEDICAL PHYSICS

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. Give the essential principles of X-rayfluoroscopy.

2. Explain the concept of Donnanequilibrium.

3. What are the different signals generated inEEG?

4. Outline any two static characteristics of atransducer.

5. What is abiosensor?

6. Enumerate different valve systems of a humancardio.

7. What are the modes of transmission ofultrasound?

8. Explain the term "actionpotential".

9. What is the role of X-ray inangiography?

10. Distinguish between A-scan and B-scan in ultrasoundimaging.

11. What is a "gammacamera"?

12. What are the important lasers usedinDermatology? (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. What are the biological effects of NMR imaging?

14. When food enters the stomach, it stimulates the production and secretion of hydrochloric acid for digestion, reducing the stomach pH from 4 to 2. What is the concentration of the acid (assuming all the pH is due to HCI) before and after the change inpH?

15. Give a note on Helical CTScanner.

16. Explain Hodgkin-Huxley model for membrane transport in humanbody.

17. How Laser emission is made possible in a CO_2laser?

18. Explain the operating principle ofEMG.

19. What is the principle of PositronEmissionTomography? (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Give a brief account about the various fluid transport processes taking place in human bodycells.

21. What is the basic principle of NMR imaging? What are gradient coils? Briefly explain the different components used in a NMRimagingsystem? (1 □ 10 = 10 marks)

MODEL QUESTION PAPER - 2

Name…….

Reg. No…….

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Core Course – Physics: BPH6E01 – BIOMEDICAL PHYSICS

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. What is Brownianmotion?

2. The Reynolds number for a bacterium is 10^{11} smaller than that of a human. Comment on the relative importance of the inertial and viscous forces based on thisinformation.

3. How is a nerve impulse or action potentialgenerated?

4. What are transducers? How are theyclassified?

5. State any two bioelectric signals with primary signal characteristics referring to their frequency range and typical signalamplitude.

6. What are biomedical signals? List any four sources ofthem.

7. What is the principle of a CTscan?

8. What are tracers in diagnosticapplications?

9. List the basic NMRcomponents.

10. How does Laser light differ from ordinary light with respect tocoherence?

11. State any four potential advantages of lasersurgery.

12. What areultrasonicwaves? (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. What are the biological effects of NMR imaging?

14. What are the advantages of Computer tomography with respect to conventionalX-rays?

15. Discuss the advantages of a MRI system with respect to a CTimaging.

16. Write a short note on Nd:YAGlaser.

17. What is the Reynolds number for blood flowing through an artery 10^{-3} m in diameter, assuming that the density and dynamical viscosity of blood are comparable from the

corresponding values of water. Assume that the speed of blood is roughly $0.1ms^{-1}$. The density of water is 10^3 kgm^{-3} and dynamical viscosity 10-3Nsm^{-2}.

18. What is resting potential? Obtain Einstein equation relating mobility to the diffusion constant.

19. Write a short note on Generation of ultrasound. Discuss the biological effects of ultrasound. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Discuss the transport of substances through the cell membrane with reference to the following:
i) Diffusion and ii)Viscosity.

21. Explain the principles of NMR imaging systems. What are the biological effects of NMRimaging? (1 □ 10 = 10marks)

MODEL QUESTION PAPER - 1

Name…….

Reg. No…….

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Core Course – Physics: BPH6E02 – NANOSCIENCE AND TECHNOLOGY

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. Draw the band structure of an insulator indicating valence band, conduction bandand energygap.

2. Write down Heisenberg‟s uncertaintyprinciple.

3. Write the Schrodinger equation of particle in abox.

4. Show a graph illustrating the variation of Fermi-Dirac function withtemperature.

5. Explain Arrhenius type conductivity.

6. What is Schottkyeffect?

7. Write a short note on variable range hoppingconduction.

8. What is meant by anexciton?

9. List the names of any four solution based techniques for nanomaterialssynthesis.

10. Explain Lithographic and non lithographic processes?

11. Write merits and demerits of Ball milling process in growth techniquesof Nanotechnology.

12. Discuss the structure of BoronNitridenanotubes. (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Draw and explain the schematic diagram of the splitting of energy levels isolated atoms into energybands.

14. Discuss the conduction mechanism in ionic crystals..

15. Write a short on the energy quantization in a nano-film. Give anexample.

16. Draw the schematic diagram of electron beam evaporator system and indicate theparts.

17. Explain the charge transfer in STM in terms of local density ofstates.

18. Abeamof12eVelectronsisincidentonapotentialbarrierofheight30eVandwidth

0.05 nm. Calculate the transmission co-efficient.

19. A gold sphere of radius 2cm is converted into spherical nanoparticles of diameter 2nrn, without any loss in volume. Find a) The number of gold nanopartcles b) the ratio of surface area of all the nanospheres to that of theoriginal sphere. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Explain the Drude model of electrical conduction in metals. Obtain an expression for the DC electricalconductivity.

21. Derive an expression for the wave function of a particle confined in 1 D infinite potential well. Draw the correspondingenergydistribution. (1 x 10 = 10marks)

MODEL QUESTION PAPER - 2

Name…….

Reg. No…….

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Core Course – Physics: BPH6E02 – NANOSCIENCE AND TECHNOLOGY

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. Distinguish between intrinsic and extrinsic semiconductors.

2. Define density of states. Draw the density of states diagram of a 2-dnanostructure

3. What is field enhanced thermionicemission?

4. Name four allotropes ofcarbon.

5. Name the interactions that are monitored in a) STM b)AFM

6. WritedownSchrödinger‟s3Dsteadystateequationandexplainthesymbols.

7. What is the effect of size on thermal time constant in the nanoregime?

8. Explain conduction process in ioniccrystals.

9. What are augerelectrons?

10. Write the concept of Chemical VaporDeposition?

11. Mention the advantages and disadvantages of solution based synthesis procedures of nanomaterials.

12. Discuss the structure ofBuckminsterfullerene. (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Describe an n-type semiconductor. Draw the energy band diagram of n-type semiconductor showing Fermi level and Donorlevel.

14. Discuss the Richardson-Dushmann equation for thermionicemission.

15. Discuss the different structures of carbonnanotubes.

16. Describe a sputter depositionsystem.

17. Discuss the operating principle ofAFM.

18. At what temperature will the number of conduction electrons increase by a factor 20 over room temperature for Ge? Given band gap is 0.67eV.

19. The resistivity of an intrinsic semiconductor is 4.6 □-m at 20º C and 2 □-m at 32ºC. What is the energybandgap ? (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Describe Bohr's model of the hydrogen atom and derive the expression for energy of the n^{th} level. Explain how the line spectra of hydrogen atom areobtained.

21. Discuss the working principle of STM. Explain the factors influencing the STMimage.

(1 x 10 = 10 marks)

MODEL QUESTION PAPER - 1

Name…….

Reg. No…….

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Core Course – Physics: BPH6E03 – MATERIALS SCIENCE

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. What do you mean by a point defect? GiveExample.

2. Write down Fick‟s first law of diffusion and explain the termsinvolved

3. ExplainPolymorphism?

4. What are amorphoussolids?.

5. Distinguish between homo polymers andcopolymers?

6. What is abrasiveceramics?

7. What are Secondaryelectrons?

8. What are nano materials ?

9. Distinguish between Hexagonal close packing and cubic closepacking

10. What is isomerism inpolymers

11. What arerefractories?

12. Explain Metallic bondingincrystals. (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. What are composites? Explain itsproperties.

14. Distinguish between vacancy diffusion and interstitialdiffusion.

15. Explain Hydrogen bonding inwater.

16. How will you determine grain size of asample?

17. Distinguish between Frenkel and Schottky defects insolids.

18. Explain the principle of X-ray powder diffraction method of structuralanalysis.

19. Find out the packing fractionofFCC. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Describe the defects inSolids.

21. Explain the formation of bondsin solids. (1 x 10 = 10marks)

MODEL QUESTION PAPER - 2

Name…….

Reg. No…….

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Core Course – Physics: BPH6E03 – MATERIALS SCIENCE

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. How nanomaterials aremade?

2. Explain Ionicbonding

3. Explain hydrogen bonding inwater

4. What is meant by (a) Lattice (b) Unitcell?

5. Explain Grain and Grainboundary

6. Find the number of atoms in a FCC unitcell.

7. What are Allotropes? Give oneExample

8. What are the two types of diffusion insolids?

9. What is glass ceramics? What are theproperties?

10. What is isomerism in polymers with suitable example

11. What is mean by functionality of amonomer?

12. WhatisBurger‟svector? (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Find the atomic packing factor of Hexagonal unitcell.

14. Explain the Vander waalsbonding?

15. Distinguish between vacancies and selfinterstitials.

16. Explain the factors effectingdiffusion?

17. What is stress-strain behavior ofceramics?

18. Explain viscoelastic deformation ofpolymers.

19. Write a short note onElectron microscopy. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. State and explain Bragg"slaw?Explain the workingofLaue"sTechnique and rotating crystalmethod.

21. Explain the diffusion mechanismin solids. (1 x 10 = 10marks)

Physics Open Courses
SEMESTER 5

MODEL QUESTION PAPER - 1

Name…….

Reg. No…….

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Open Course – Physics: BPH5D01 - **NON CONVENTIONAL ENERGY SOURCES**

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. Define solarconstant.

2. What is the working principle of apyranometer?

3. Explain the principle behind the working of a solarcooker.

4. What is the use of a solar greenhouse?

5. What are the factors that determine the output from a wind energyconverter?

6. Write any four disadvantages of windenergy.

7. What are the basic components of a tidal powerplant?

8. List any two advantages of geothermalenergy.

9. What do you mean bybiomass?

10. Give one example each for a primary and a secondarybattery.

11. What do you mean by energy efficiency of abattery?

12. Write four applications of afuelcell. (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Discuss the working principle of a solarfurnace.

14. What do you mean by photovoltaic effect? List three advantages of photovoltaic power conversionsystem.

15. Discuss the applications of wind energy.

16. Explain the term biomass conversion. Discuss the different biomass conversion technologies.

17. What is meant by a hydrothermal source? Discuss the different hydrothermalsources.

18. What is the origin of source of energy in waves? Discuss a method for converting wave

energy into mechanicalenergy.

19. Discuss the source ofgeothermalenergy. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Discuss the working principle of a solar water heater with help of a schematicdiagram. What are the merits of a solar water heater over a conventional waterheater?

21. What is the principle of wind energy conversion? With the help of a block diagram, discuss the basic components of a wind energy conversion system. List a few advantages of wind energyconversionsystem. (1 x 10 = 10marks)

MODEL QUESTION PAPER - 2

Name…….

Reg. No…….

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Open Course – Physics: BPH5D01 - **NON CONVENTIONAL ENERGY SOURCES**

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. Distinguish between direct and diffuse components of solarradiation.

2. What are the instruments used for measuring solar radiation and sunshine?

3. List four merits of a solarcooker.

4. List any four advantages of a solarfurnace.

5. What are the causes for localwinds?

6. Give four advantages of wind energyutilization.

7. What are the four sources of energy available fromoceans?

8. What are the essential parts of a tidal powerplant?

9. What are the environmental benefits of use ofbiomass?

10. What is an electrochemicalcell?

11. What are the main uses of a storagebattery?

12. Write down the problems associated with storage of hydrogen fuel in motorvehicles.

(Ceiling – 20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Explain the working principle of a solar distillation system, using a neatdiagram.

14. What are the essential parts of a photovoltaic system? What are the basic processes involves in a solarcell.

15. Draw the schematic diagram of a horizontal axis wind mill indicating the essentialparts.

16. Write briefly about liquid and gaseousbiofuels.

17. Write briefly on geothermal sources ofenergy.

18. List any four limitations of tidal powergeneration.

19. List the advantages and disadvantages of afuelcell. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Discuss the fundamental processes used in the conversion of solar radiation to heat energy. Using a suitable schematic diagram, discuss the essential parts of a flat plate collector.

21. Discuss the principle of ocean thermal energy conversion (OTEC). Discuss the open cycle and closed cycle methods of ocean thermal electric power conversion. (1 x 10 = 10marks)

MODEL QUESTION PAPER - 1

Name…….

Reg. No…….

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Open Course – Physics: BPH5D02 - **AMATEUR ASTRONOMY AND ASTROPHYSICS**

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. Explain longitude andlatitude.

2. What is meant byperihelion?

3. What is Kuiperbelt?

4. Define the astronomical unit of distance.

5. What is meant byequinox?

6. State and explain Hubble‟slaw.

7. What is Cosmic Microwave BackgroundRadiation?

8. Describe neutronstars.

9. What are the advantages of reflectingtelescopes?

10. Describe the formation of seasons onEarth.

11. What is meant bysupernova?

12. Discuss the main features of theplanet Jupiter. (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Differentiate between solar and lunareclipses.

14. Explain the proton – proton chainreaction.

15. Briefly explain (a) white dwarf (b)comet.

16. Explain the parallax method of distancemeasurement.

17. Explain the important regions of the HRdiagram.

18. Derive the relation between absolute luminosity and apparentluminosity.

19. Discuss elliptical andspiralgalaxies. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Describe in detail the structure of thesun.

21. Describe the theory of planetary formation in thesolarsystem. (1 x 10 = 10marks)

MODEL QUESTION PAPER - 2

Name…….

Reg. No…….

FOURTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Open Course – Physics: BPH5D02 - **AMATEUR ASTRONOMY AND ASTROPHYSICS**

Time: 2 hours Maximum: 60 Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. Explain the termsolstice

2. What is meant by perigee andapogee?

3. What is Asteroidbelt?

4. Define and explain absolute luminosity of astar

5. What are Cepheidvariables?

6. Explain quasars

7. Compare astronomy andastrology

8. What is meant by the term blackhole?

9. What are the different types oftelescopes?

10. Describe the corona of thesun

11. What is meant by solarflare?

12. Discuss the main features of theplanetSaturn. (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Explain Chandrasekharlimit

14. What is the main energy production mechanism instars?

15. Briefly explain (a) photosphere (b)chromospheres

16. Explain how the scientific method is applied inAstronomy

17. Describe the main features of the Big Bangtheory

18. Derive the Pogson‟srelation

19. Discuss the classificationofgalaxies. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Describe the Harvard classification scheme ofstars

21. Explain the Hertzsprung – Russell diagram and describe its majorregions

(1 □ 10 = 10 marks)

MODEL QUESTION PAPER - 1

Name…….

Reg. No…….

FOURTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Open Course – Physics: BPH5D03 - ELEMENTARY MEDICAL PHYSICS

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. What is anelectromyograph.

2. Write the value of Planck‟sconstant.

3. What areions?

4. Give an example of non-ionizingradiation.

5. What is REM/

6. What are evokedpotentials?

7. What is „ CT‟ in medical imaging.

8. What are tracers in diagnosticapplications?

9. What isradioactivity?

10. Who discoveredX-rays.

11. What is the unit of frequency of soundwaves?

12. What areultrasonicwaves? (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. What are biomedical signals? List any four sources ofthem.

14. Compare photoelectric effect and ComptonEffect.

15. What is piezoelectriceffect?

16. Write a note on conventional sources ofradiation.

17. Discuss cardiac cycle andarrhythmias.

18. Discuss the units of radiations. What is radiationprotection?

19. Write the properties of X-ray. What is X-ray attenuationinimaging? (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Write a short note on nuclearmedicines..

21. Discuss the generation and detectionofultrasound. (1 □ 10 = 10 marks)

MODEL QUESTION PAPER - 2

Name…….

Reg. No…….

FOURTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Open Course – Physics: BPH5D03 - ELEMENTARY MEDICAL PHYSICS

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. State the three forms of radioactiveemissions.

2. Define thecurie.

3. What is Photo-electriceffect?

4. What is ComptionScattering?

5. What is an electroencephalogram(EEG).

6. What is an electromyogram(EMG)?

7. What is„bradycardia"?

8. What areX-rays?

9. What are ultrasonicwaves?

10. What is Planck"sconstant?

11. What is the difference between an atom and anion?

12. WhatisPET? (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Describe a cardiaccycle.

14. Explain the term „the blood pressure is 120/80 mm Hg„.

15. How are X-raysproduced?

16. What isfluoroscopy?

17. Discuss the artifacts on the ECGtrace.

18. Write a summary of the history of medicalimaging.

19. Discuss X-ray attenuation inX-rayimaging. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Write a short note on Generation of ultrasound. Discuss the biological effects of ultrasound.

21. What is ionizing and non-ionizing radiations? Write a short note on non-ionizing radiation. (1 x 10 = 10marks)

B. Sc Physics Complementary
SEMESTER 1 & 2

MODEL QUESTION PAPER 1

Name…….

Reg. No…….

FIRST SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Complementary Course – Physics: BPH1C01- PROPERTIES OF MATTER & THERMODYNAMICS

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2marks)

1. What is acantilever?

2. What is„*angle of twist*"and „*angle of shear*"?

3. Define Brownian motion. Explain the effect oftemperature.

4. How does the pressure affect the boiling point of water and melting point ofice?

5. State and explain first law ofthermodynamics

6. Define surface tension. Give itsdimension

7. Write down *Clausius-Clapyron*equation

8. What do you meant by quasi staticprocess?

9. State *Carnot*theorem.

10. Distinguish between isothermal and adiabaticprocess

11. Explain why $C_P > C_V$

12. State and explain the principle of increaseof entropy (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Derive the expression for excess pressure inside a liquidbubble?

14. Obtain the relation between various elasticconstants

15. Derive the expression for work done during adiabaticprocess

16. What do you meant by entropy? Show that the entropy remains constant in reversible process but increases in irreversibleprocess

17. Calculate the work done in twisting a steel wire of radius 10^{-3} m. and length 0.25 m. through an angle 45^0. Given the rigidity modulus of the wire is $8 \times 10^{10} Nm^{-2}$.

18. Calculate the amount of energy evolved when 8 droplets of water of surface tension 0.072 N/m and radius 0.5 mm each combine to one.

19. A carnot engine works between two temperatures whose differences is 100°C. If it absorbs 746 J of heat from source and gives 546 J to sink, calculate the temperature of source and sink. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. What is tensional pendulum? Derive expression for its time period. Using the pendulum how will you determine the rigidity modulus ofwire?

21. Describe the working of a Carnot‟s engine. Define efficiency of a heat engine. Derive an expression for efficiency of a Carnot engine. (1 × 10 = 10marks)

MODEL QUESTION PAPER 2

Name…….

Reg. No…….

FIRST SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Complementary Course – Physics: BPH1C01- PROPERTIES OF MATTER & THERMODYNAMICS

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2marks)

1. What is torsional rigidity of awire.

2. What is viscosity? Give itsdimension.

3. What isPoise?

4. How does the temperature and pressure affect viscosity of aliquid?

5. Explain why liquids possess surfacetension.

6. Define rigidity modulus. Write down the relation connecting three moduli ofelasticity.

7. State and explain zero‟th law ofthermodynamics.

8. Define *carnot*theorem.

9. Draw P-V diagram for Carnotcycle.

10. What are intensive and extensiveproperties?

11. State thermodynamicprocess.

12. Whatisentropy? (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Derive the expression for the work done in blowing abubble.

14. Show that a hollow shaft of the same length, mass and material is stronger than asolid shaft.

15. Discus the various factors which control surface tension of aliquid.

16. Use Maxwell‟s equation to obtain $C_P - C_V = R$..

17. What is an I-section girder? Why I-section girders are arepreferred?

18. Calculate the work done if one mole of an ideal gas is compressed very slowly at 27 ^oC.to one fourth of the original volume. R = 8.314 $J.mol.^{-1}K^{-1}$.

19. Find the efficiency of Carnot engine working between 127 ^{o}C and 27^{o}C. If it absorbs 840J of heat from the source, calculate the amount of heat rejected tothesink. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Derive Poiseuille‟s formula for the flow of a liquid through a capillary tube. Mention its limitations.

21. What is Carnot‟s engine? Derive an expression for its efficiency in terms of temperature of sourceandSink. ($1 \times 10 = 10$marks)

MODEL QUESTION PAPER 1

Name…….

Reg. No…….

SECOND SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Complementary Course – Physics: BPH2C02-OPTICS, LASER & ELECTRONICS

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2marks)

1. State superposition principle ofwaves.

2. Distinguish between Fresnel and Faunhofferdiffraction.

3. What are filtercircuit.

4. What is meant by spontaneous emission and stimulatedemission.

5. State De-Morganstheorem

6. What is meant by feedbackcircuit

7. Draw the input characteristics graph of CEconfiguration

8. Explain interference on thinfilm

9. What is meant by resolving power of agrating

10. How does Zener diode works as a voltageregulator

11. Explain the working of a **π** filtercircuit.

12. What are halfwaveplates? (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Write a note on constructiveinterference

14. Explain the principle and working of RubyLASER

15. State and explain Brewster‟slaw

16. What is meant by circularly polarizedlight

17. Obtain the relation between current amplification factors α,β andϒ

18. A parallel beam of sodium light is incident normally on a plane transmission grating having $\mathbf{6\times10^5}$lines per meter length. The first order spectrum is found to be deviated through an angle of **20.7°** from the normal. Calculate the wavelength of lightused.

19. A transistor amplifier is biased with feedback resistor R_b of 100kΩ. If V_{cc}=20V, Rc =1kΩ β=100 determine theoperatingpoints. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Explain the theory of Newton‟s rings , explain how do we find wavelength of lightusing Newton‟s ringsexperiment

21. Explain the working of half wave rectifier. Obtain an expression for its efficiency and ripple factor. (1 × 10 = 10marks)

MODEL QUESTION PAPER 2

Name…….

Reg. No…….

SECOND SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Complementary Course – Physics: BPH2C02-OPTICS, LASER & ELECTRONICS

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2marks)

1. State superposition principle ofwaves

2. What is meant by doublerefraction

3. Explain the reverse characteristics of a zenerdiode

4. What is meant by populationinversion

5. Draw the symbol, Boolean algebra and truth table of Exclusive ORgate

6. Explain about capacitor filtercircuit

7. What is an LC oscillator

8. Explain Fresnels two mirror arrangement for producinginterference

9. What are quarter waveplates

10. Distinguish between Fresnel and Faunhofferdiffraction

11. What do you mean by positive and negativefeedback

12. What is meant byopticalactivity? (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Write a note on destructiveinterference

14. Explain the principle and working of a He-NeLaser.

15. What are positive and negativecrystals

16. What is meant by elliptically polarizedlight

17. Explain the working of a bridgerectifier

18. InaNewton‟sringsexperimentthediameterofthe15thringwasfoundtobe0.59cmand that of the 5th ring was 0.336 cm. If the radius of the Plano-convex lens is 100 cm, calculate the wave length of the lightused.

19. A full wave bridge rectifier is connected to a 12V step down transformer. If the forward resistance of each diode is 4Ω and load resistance is 400Ω, find the dc load current and efficiency oftherectifier. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Explain the theory of diffraction Grating. Discuss the experiment to find the wavelength of light using Gratingexperiment.

21. Explain the working of a CE amplifier. Explain its frequencyresponse

(1 × 10 = 10 marks)

B. Sc Physics Complementary
SEMESTER 3 & 4

MODEL QUESTION PAPER 1

Name…….

Reg. No…….

THIRD SEMESTER B.Sc. DEGREE EXAMINATION ……, 20……

(CBCSS-UG)

Complementary Course – Physics: BPH3C03-MECHANICS, RELATIVITY, WAVES AND OSCILLATIONS

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2marks)

1. State the theorem by which you can explain different quality of sound produced by different musicalinstruments.

2. What happens to the amplitude as time increases duringdamping?

3. What is TwinParadox?

4. Explain the difference between inertial frame and non inertialframe.

5. Explain the significance of mass energyrelation.

6. What is an anharmonicoscillator?

7. What is a centre of mass reference? .Is it an inertial frame or non inertial frame of reference?

8. Define Coriolisforce.

9. What is meant by lengthcontraction?

10. Comment on „Moving clock runsslow.“

11. Give two limitations of classicalmechanics.

12. What do you meant byenergydensity? (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Derive the Galilean transformation equation and explain itsinvariance.

14. What is a central force? Show that central forces areconservative.

15. What are eigen values and eigen functions? Illustrate withexamples.

16. State the law of conservation of angular momentum. Explain oneapplication.

17. Prove that for a harmonic oscillator average potential energy and average kineticenergy areequal.

18. Describe the Michelson Morleyexperiment.

19. A plane wave of frequency 256 Hz and amplitude 0.001 mm is produced in air. Calculate the energy density and energy current, given the velocity of sound in air=332 m/s and density ofair =1.29kg/m^3. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. State the postulates of special theory of relativity and hence derive the Lorentz transformationequations.

21. Discuss the motion of particle under damped motion and obtain its differential equation. Write the probable solution and representitgraphically. ($1 \times 10 = 10$marks)

MODEL QUESTION PAPER 2

Name…….

Reg. No…….

THIRD SEMESTER B.Sc. DEGREE EXAMINATION ……, 20……

(CBCSS-UG)

Complementary Course – Physics: BPH3C03-MECHANICS, RELATIVITY, WAVES AND OSCILLATIONS

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two /three sentences, each correct answer carries a maximum of 2 marks)

1. Explain the term Coriolisforce.

2. What is meant by Galileaninvariance?

3. What are fictitiousforces?

4. State and explain the law of conservation of linearmomentum.

5. Explain the principle of therocket.

6. State the postulates of specialrelativity.

7. What is meant by timedilation?

8. How did the Michelson – Morley experiment invalidate the concept ofether?

9. What is meant by damped harmonicoscillations?

10. Explain anharmonicoscillations.

11. What are matterwaves?

12. Explain uncertaintyprinciple. (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Derive the Galilean transformationequations.

14. Explaintheconceptofpotentialenergycurve.

15. Prove that for a harmonic oscillator average potential energy and average kinetic energy areequal.

16. A spring is stretched through a distance of 8 cm by a body of mass 16 kg. If the body is replaced by another body of mass 50 gm and the system undergoes oscillations, find the timeperiod.

17. A rod has length 1 m in its rest frame. It is moving with a velocity of 0.4 c relative to the earth. Fins its length when viewed in a frame (a) moving with the rod and (b) situated on theearth.

18. A particle of mass 10 g is at rest in an inertial frame. Consider a frame rotating at an angular speed of 10 radians per second in which the body is at a distance of 5 cm from the axis of rotation. Find the Coriolis and centrifugal forces on the body in the rotating frame.

19. A stone of mass 100 g is revolved at the end of a string of length 50 cm at the rate of 2 revolutions per second. Determine its angular momentum. If the stone makes only one revolution per second after 25 seconds, find thetorqueapplied. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Derive Einstein‟s mass – energy relation and hence, obtain the relations between energy and relativisticmomentum.

21. Obtain the rocket equation. State and explain the law of conservation of angular momentum with twosuitableexamples. (1 × 10 = 10marks)

MODEL QUESTION PAPER -1

Name…….

Reg. No…….

FOURTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Complementary Course – Physics: BPH4C04-ELECTRICITY, MAGNETISM AND NUCLEAR PHYSICS

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2marks)

1. State the law of radioactivedisintegration.

2. Define a Coulomb.

3. What is latitude effect if cosmic rays?

4. State Gauss theorem inelectrostatics.

5. Define electric potential and potentialdifference

6. Which are the fundamental interactions of nature? What is the IR-range?

7. Write an expression for the capacitance of a cylindrical capacitor and explain the terms.

8. What is super conductivity?

9. Distinguish between nuclear fission and fusion.

10. Define mean life of a radio element.

11. Define the unit of capacitance.

12. What are α, β and γ particles (Ceiling –20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. The half-value period of radium is 1590 years. In how many years will one gram ofpure element (a) loose one centigram, and (b) be reduced to onecentigram?

14. ApplyGauss's lawto calculate the electric field intensitydue to a uniformlycharged sphere(non-conducting) at points(i)outside the sphere(ii) at the surface of the sphere (iii) inside the sphere.

15. Obtain an expression for finding the moment of a bar magnet using deflection magnetometer in Tan A position.

16. A dipole consisting of an electron and a proton, $4 \times 10{-}10$m apart. Compute the electric

field at a distance of 2×10^{-8}m on a line making an angle of 45° with the dipole axis from the centre of the dipole.

17. With the help of diagram, explain the conversion of a galvanometer to a voltmeter.

18. Write short notes on classification of elementary particles.

19. A carbon specimen found in a cave contains 1/8 as much C14 as an equal amount of carbon in living matter. Calculate the approximate age of the specimen. Half-life period of C14 is5568years. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Explain with theory how a Carey Foster bridge may be used to compare two nearly equal resistances. Hence show how the temperature coefficient of resistance can be measured.

21. Describe the construction, working and applications of a nuclear reactor.

$(1 \times 10 = 10$ marks)

MODEL QUESTION PAPER -2

Name……. Reg. No…….

FOURTH SEMESTER B.Sc. DEGREE EXAMINATION ……., 20……

(CBCSS-UG)

Complementary Course – Physics: BPH4C04-ELECTRICITY, MAGNETISM AND NUCLEAR PHYSICS

Time: 2 hours Maximum: 60Marks

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2marks)

1. Distinguish between leptons and hadrons.

2. What is a chain reaction.

3. What are primary and secondary cosmic rays?

4. Which are the magnetic elements of earth's magnetic field?

5. Define curie.

6. Which are the main elements of a nuclear fission reactor?

7. What is azimuth effect of cosmic rays?

8. Write an expression connecting current density and drift velocity ofelectrons?

9. Write down Coulomb's law in electrostatics and explain the terms.

10. Define half-life of a radio element.

11. What are isobars? Give examples.

12. Write an expression for the capacitance of a cylindrical capacitor and explain the terms.

(Ceiling – 20)

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Calculate the energy released by 1kg of $_{92}U^{235}$. Given Avogadro number = 6.023×10^{26}.

14. A copper wire of diameter 0.5mm and length 20m is connected across a battery of emf 1.5V and internal resistance 1.25 Ω. Calculate the current density in the wire. Given atomic weight of copper =63.54.

15. Obtain an expression for finding the moment of a bar magnet using deflection magnetometer in Tan C position.

16. The radii of spheres in a spherical capacitor are 5cm and 8cm. The outer sphere is earthed and the inner sphere is given a charge of 0.005μC. Calculate the potential difference.

17. Calculate the binding energy of an α particle and express the result both in MeV and joules.

18. The number of disintegrations per minute of a certain radioactive substance are 6050 and 4465 at the 2nd and 3rd hour. Calculate the decay constant and half-life of the substance.

19. How long does it take for 60% of a sample of Radon to decay? Half-life of Radon = 3.8 days. (Ceiling –30)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. Derive an expression for the capacitance of a parallel plate capacitor. What will be the capacitance if the space between the plates is partially filled with a slab of thickness d and relative permittivity ε_r?

21. With the help of a neat diagram, explain the construction and working of Searle's vibration magnetometer

(1 × 10 = 10 marks)