File Ref.No.48685/GA - IV - J3/2019/Admn

UNIVERSITY OF CALICUT

Abstract

General and Academic - Faculty of Science - Modified Syllabus of BSc Applied Physics Programme under CBCSS UG Regulations 2019 with effect from 2020 Admission onwards - Implemented- Orders Issued.

G & A - IV - J

U.O.No. 9425/2020/Admn Dated, Calicut University.P.O, 13.10.2020

Read:-1. U.O.No. 4368/2019/Admn dated 23.03.2019
2. U.O.No. 18084/2019/Admn Dated 28.12.2019
3. The item No.2 in the minutes of the meeting of the Board of Studies in Physics UG held on 13.07.2020
4. The Item No.16 in the minutes of the meeting of the Faculty of Science held on 08.09.2020
5. The Item No.II.I in the minutes of the meeting of the Academic Council held on 01.10.2020

ORDER

1. The Regulations for Choice Based Credit and Semester System for Under Graduate (UG) Curriculum-2019 (CBCSS UG Regulations 2019) for all UG Programmes under CBCSS-Regular and SDE/PrivateRegistration w.e.f. 2019 admission, has been implemented vide paper read first above and the same has been modified vide paper read second above.
2. The meeting of the Board of Studies in Physics (UG) held on 13/07/2020 has recommended the following modifications in the Syllabus for I and II semester of B.Sc Applied Physics Programme, in tune with the new CBCSS UG - 2019 Regulations with effect from 2020 Admission, vide paper read third above.

    - Two units in semester I should be removed. The title of the course changed to Mechanics-I.
    - The syllabus of the unit, “Waves” in the syllabus of semester II is modified with another standard text book as book of study.The title of the course changed to Mechanics-II.

3. The Faculty of Science has approved the modified syllabus of BSc Applied Physics programme in tune with the new CBCSS UG-2019 Regulations with effect from 2020 Admission onwards and same has been approved by the Academic Council, vide paper read fourth & fifth above.
4. Hence, the Modified Scheme and Syllabus of BSc Applied Physics Programme in accordance with CBCSS UG Regulations 2019, is therefore implemented in the University with effect from 2020 Admission onwards.
5. Orders are issued accordingly. (Syllabus appended).

Arsad M

Assistant Registrar

To

The Principals of all Affiliated Colleges
Copy to: PS to VC/PA to PVC/ PA to Registrar/PA to CE/JCE I/JCE IV/DoA/EX and EG Sections/GA I F/CHMK Library/Information Centres/SF/DF/FC

Forwarded / By Order

Section Officer

UNIVERSITY OF CALICUT

B.Sc. PROGRAMME IN APPLIED PHYSICS

(B.Sc. in Language reduced pattern)

SYLLABUS & MODEL QUESTION PAPERS

w.e.f. 2020 admission onwards

CBCSSUG Regulations 2019

B.Sc. APPLIED PHYSICS
SYLLABUS

B.Sc Applied Physics is a nonconventional course in B.Sc-language reduced pattern. All the core and complementary courses of B.Sc Physics are included in B.Sc Applied Physics. In addition to this, one advanced theory course (elective) in Electronics, and one practical course in Electronics are also included. Two Practical exams are conducted at the end of 4th semester and the next two in 6th semester. Project is evaluated in the 6th semester. Hence B.Sc Applied Physics is equivalent to B.Sc Physics for higher studies and employment

PROGRAMME: B.Sc. APPLIED PHYSICS

Programme Specific Outcomes

PSO1: Understand the basic concepts of 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

B.Sc. DEGREE PROGRAMME (APPLIED PHYSICS CORE)

COURSE STRUCTURE

Semester	Course Code	Course Title	Total hours	Hours/ Week	Credits
1	A 01	Common Course I – English	72	4	4
	A 02	Common Course II – English	90	5	3
	A 07	Common Course III – Language other than English	72	4	4
	APH1 B01	Core course I - Mechanics I	36	2	2
		Core Course V - Practical I(1)	36	2	*
		1st Complementary Course I - Mathematics	72	4	3
		2nd Complementary Course I	36	2	2
		2nd Complementary Course Practical I	36	2	*
	EO1	Environment Studies	-	-	4**
		Total	**450**	**25**	**18**
2	A 03	Common Course IV – English	72	4	4
	A 04	Common Course V – English	90	5	3
	A 08	Common Course VI – Language other than English	72	4	4
	APH2 B02	Core Course II – Mechanics II	36	2	2
		Core Course V - Practical I(1)	36	2	*
		1st Complementary Course II - Mathematics	72	4	3
		2nd Complementary Course II	36	2	2
		2nd Complementary Course Practical II	36	2	*
	E02	Disaster Management			4**
		Total	**450**	**25**	**18**
3	A 11	General Course -I engaged by Core	72	4	3
	A 12	General Course -II engaged by Core	72	4	3
	APH3 B03	Core Course III – Electrodynamics-I	54	3	3

		Core Course V(1)– Practical I(1)	36	2	*
		Core Course V(2)– Practical I(2)	36	2	*
		1st Complementary Course III – Mathematics	90	5	3
		2nd Complementary Course III	54	3	2
		2nd Complementary Course Practical III	36	2	*
	E03	Human Rights **or** Intellectual Property Rights **or** Consumer protection			4**
		Total	**450**	**25**	**14**
4	A13	General Course -III engaged by Core	72	4	3
	A14	General Course -IV engaged by Core	72	4	3
	APH4 B04	Core Course IV - Electrodynamics II	54	3	3
	APH4 B05(1)	Core Course Practical V(1) – Practical I(1)	36	2	**5**
	APH4 B05(2)	Core Course Practical V(2) – Practical I(2)	36	2	**4**
		1st Complementary Course IV– Mathematics	90	5	3
		2nd Complementary Course IV	54	3	2
		2nd Complementary Course Practical IV	36	2	4
	E04	Gender studies **or** Gerontology			4**
		Total	**450**	**25**	**27**
5	APH5 B06	Core Course VI - Computational Physics	54	3	3
	APH5 B07	Core Course VII - Quantum Mechanics	54	3	3
	APH5 B08	Core Course VIII - Optics	54	3	3
	APH5 B09	Core Course IX- Electronics (Analog and Digital)	54	3	3
		Open Course – (*course from other streams*)	54	3	3
		Core Course Practical XIV - Practical II	72	4	*
		Core Course Practical XV- Practical III	72	4	*
		Core Course XVII Project/Research methodology	36	**2**	*
		Total	**450**	**25**	**15**
6	APH6 B10	Core Course X - Thermodynamics	54	3	3
	APH6 B11	Core Course XI -Statistical Physics, Solid State Physics, Spectroscopy & Photonics	54	3	3
	APH6 B12	Core Course XII - Nuclear Physics and Particle Physics	54	3	3

	APH6 B13	Core Course XIII - Relativistic Mechanics and Astrophysics	54	**3**	3
	APH6 B14	Core Course XIV (Elective:EL1 / EL2 / EL3)	54	3	3
	APH6 B15	Core Course Practical XV – Practical II	72	**4**	**5**
	APH6 B16	Core Course Practical XVI – Practical III	72	**4**	**5**
	APH6 B17 (P/R)	Core Course XVII Project/Research methodology Tour report	36	2	2 1
		Total	**450**	**25**	**28**
Total Credits					**120**

Tour report shall be evaluated with Practical III

*****Credit for practical / project to be awarded only at the end of Semester 4 and Semester 6.

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

For the purpose of selecting general courses, B.Sc. Applied Physics is included in group 3 of the language reduced pattern subjects along with Computer Science, Electronics, Instrumentation, Printing Technology, Computer Application (page 7 of CBCSSUG Regulations 2019 vide ref U.O No. 4368/2019/Admn Dated, 23.03.2019)

General Courses:

A11-Python

A12-Sensors and Transducers

A13-Data communication and Optical fibers

A14-Microprocessors-Archetecture and Programs

CREDIT AND MARK DISTRIBUTION IN EACH SEMESTERS

Total Credits: 120; Total Marks: 3075

Semester	*Course*	*Credit*	*Marks*
1	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**
2	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**
3	General Course -I Python	3	75
	General Course -II Sensors and Transducers	3	75
	Core Course III: Electrodynamics-I	3	75
	Complementary course: Mathematics	3	75
	Complementary course: II	2	75
	Total	**14**	**375**
4	General Course -III Data Communication and Optical fibers	3	75
	General Course -IV Microprocessor-Architecture and programs	3	75
	Core Course IV: Electrodynamics-1I	3	75
	Core Course V(1): Physics Practical I(1)	5	100
	Core Course V(2): Physics Practical I(2)	4	100
	Complementary course: Mathematics	3	75
	Complementary course: II	2	75
	Complementary course: II Practical	4	100
	Total	**27**	**675**
5	Core Course VI: Computational Physics	3	75
	Core Course VII :Quantum Mechanics	3	75
	Core Course VIII: Optics	3	75
	Core Course IX: Electronics (Analog and Digital)	3	75
	Open course	3	75
	Total	**15**	**375**
6	Core Course X: Thermodynamics	3	75

	Core Course XI: Statistical Physics, Solid State Physics, Spectroscopy and Photonics	3	75
	Core Course XII: Nuclear Physics and Particle Physics	3	75
	Core Course XIII: Relativistic mechanics and Astrophysics	3	75
	Core Course XIV: Elective (EL1 / EL2 / EL3)	3	75
	Core Course XV: Practical II	5	100
	Core Course XVI: Practical III	5	100
	Core Course XVII: Project and Tour report/Research Methodology	2 1	60 15
	Total	**28**	**650**
	Grand Total	**120**	**3075**

COURSE STRUCTURE APPLIED PHYSICS(CORE)

Credit Distribution

Semester	*Common course*		*Core course*	*Complementary course*		*Open course*	*Total*
	English	*Additional Language*		*Mathematics*	*Comple.II*		
1	4+3	4	2	3	2	-	18
2	4+3	4	2	3	2	-	18
3	3 ‡	3‡	3	3	2	-	14
4	3‡	3‡	3+5* +4*	3	2+4*	-	27
5	-	-	3+3+3+3	-	-	3	15
6	-	-	3+3+3+3+3 +5*+5*+3**	-	-	-	28
Total	**22**	**16**	**55**	**12**	**12**	**3**	**120**

*Practical **Project ‡ General course engaged by Core

Tour Report to be evaluated with Practical Paper III

Mark Distribution and Indirect Grading System

Indirect grading system is to be followed 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	350
2	Additional language	200
3	General course engaged by Core	300
4	Core course: Physics	1450
5	Complementary course I: Mathematics	300
6	Complementary course II:	400
7	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 35	F	Fail	0	0 – 3.49	Fail

Core Course Structure
Total Credits: 56 (Internal: 20%; External: 80%)

Semester	*Code No*	*Course Title*	*Hours/ Week*	*Total Hours*	*Credit*	*Marks*
1	APH1B01	Core Course I: Mechanics I	2	36	2	75
	-	Core Course V (1): Practical-I(1)	2	36	-*	-
2	APH2B02	Core Course II: Mechanics II	2	36	2	75
	-	Core Course V(1) : Practical-I(1)	2	36	-*	-
3	APH3B03	Core Course III: Electrodynamics-I	3	54	3	75
	-	Core Course V(1) : Practical-I(1)	2	36	-*	-
	-	Core Course V(2) : Practical-I(2)	2	36	-*	-
4	APH4B04	Core Course IV: Electrodynamics-II	3	54	3	75
	APH4B05(1)	Core Course V(1) : Practical-I(1)	2	36	5	100
	APH4B05(2)	Core Course V(2) : Practical-I(2)	2	36	4	100
5	APH5B06	Core Course VI: Computational Physics	3	54	3	75
	APH5B07	Core Course VII: Quantum Mechanics	3	54	3	75
	APH5B08	Core Course VIII: Optics	3	54	3	75
	APH5B09	Core Course IX: Electronics (Analog and Digital)	3	54	3	75
		Core Course XIV: Practical II	4	72	-**	-
		Core Course XV: Practical III	4	72	-**	-
		Core Course XVII: Project Work	2	36	-**	-
6	APH6B10	Core Course X: Thermodynamics	3	54	3	75
	APH6B11	Core Course XI: Statistical Physics, Solid State Physics, Spectroscopy and Photonics	3	54	3	75
	APH6B12	Core Course XII: Nuclear Physics and Particle Physics	3	54	3	75
	APH6B13	Core Course XIII Relativistic mechanics and Astrophysics	3	54	3	75
	APH6B14 (EL1)	Core Course XIV: Elective*** 1. Op-amps and Digital Integrated circuits	3	54	3	75
	APH6B14 (EL2)	2.Microprocessor and Microcomputer systems				
	APH6B14 (EL3)	3. Communications systems				
	APH6B15	Core Course XV: Practical -II	4	72	5**	100
	APH6B16	Core Course XVI: Practical-III	4	72	5**	100
	APH6B17	Core Course XVII: Project Work /Research	2	36	3**	60

	(P/R)	Methodology and Tour Report	1			15
				Total	**56**	**1450**

* 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=0

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 laboratory 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. The students 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 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 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 are mandatory. **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

CORE COURSE: PRACTICAL EVALUATION SCHEME

Internal		External		
Items	**Marks**	**Items**	**Marks**	**Marks for Python Programming**
Record	4	Record with 20 experiments Max.one mark for each experiment	10	10
Regularity in doing the experiment	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	APH6B14 (EL1)	1. OP-AMPS AND DIGITAL INTEGRATED CIRCUITS
2	APH6B14 (EL2)	2. MICROPROCESSOR AND MICROCOMPUTER
3	APH6B14 (EL3)	3. COMMUNICATIONS SYSTEMS

OPEN COURSES OFFERED BY PHYSICS DEPARMENT (For students from other streams)		
1	APH5D01(1)	NON CONVENTIONAL ENERGY SOURCES
2	APH5D01(2)	AMATEUR ASTRONOMY AND ASTROPHYSICS
3	APH5D01(3)	ELEMENTARY MEDICAL PHYSICS

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*
5	APH5D01(1)	Open Course 1: Non conventional Energy Sources	3	54	75
	APH5D01(2)	Open Course 2: Amateur Astronomy and Astrophysics			
	APH5D01(3)	Open Course 3: Elements of Medical Physics			

OPEN COURSE: EVALUATION SCHEME

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 = 0

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. APPLIED PHYSICS
CORE PROGRAMMES SYLLABUS

Semester 1 | Core Course I

APH1B01: MECHANICS I

36 hours (Credit - 2)

	Course Outcome	**PSO**	**CL**	**KC**	**Class Sessions Allotted**
C01	Understand and apply the basic concepts of Newtonian Mechanics to Physical Systems	PSO1	Ap	C,P	16
C02	Understand and apply the basic idea of work-energy theorem to physical systems	PSO1	Ap	C,P	8
C03	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 (1stEdn.) 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 (1stEdn.) by Daniel Kleppner and Robert J. Kolenkow]

Books of Study :

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

Reference Books :

1. Berkeley Physics Course : Vol.1 : Mechanics, 2ndEdn. – 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

APH2B02: MECHANICS II

36 hours (Credit - 2)

	Course Outcome	**PSO**	**CL**	**KC**	**Class Sessions Allotted**
C01	Understand the features of non-inertial systems and fictitious forces	PSO1	U	C	8
C02	Understand and analyze the features of central forces with respect to planetary forces	PSO1	An	C,P	10
C03	Understand the basic ideas of Harmonic Oscillations	PSO1	U	C	8
C04	Understand the analyze the basic concepts of wave motion	PSO1	An	C,P	10

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 (1stEdn.) 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 (1stEdn.) by Daniel Kleppner and Robert J. Kolenkow]

Unit III – Harmonic Oscillator **8 Hrs**

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

[Sections 10.1 to 10.3 (except the topic, *The Forced Damped Harmonic Oscillator*) and Note 10.1 of An Introduction to Mechanics (1st Edn.) by Daniel Kleppner and Robert J. Kolenkow]

Unit IV – Waves **10Hrs**

What is a wave ? – Normal modes and travelling waves – Progressive waves in one direction – Wave speeds in specific media – Superposition – Wave pulses – Motion of wave pulses of constant shape – Superposition of wave pulses – Dispersion; Phase and Group Velocities – Energy in a mechanical wave – Transport of energy by a wave – Momentum flow and mechanical radiation pressure – Waves in two and three dimensions

[Chapter 7 – Progressive Waves (except the topic, *The Phenomenon of Cut-off*)of Vibrations and Waves by A. P. French]

Books of Study :

1. An Introduction to Mechanics, 1st Edn. – Daniel Kleppner and Robert J. Kolenkow – McGraw-Hill
2. Vibrations and Waves – A. P. French – The M.I.T. Introductory Physics Series – CBS Publishers & Distributors

Reference Books :

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

Mark Distribution for Setting Question Paper

Unit/ Chapter	Title	Marks
1	Non-inertial 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

APH3B03: 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 1 – Vector Calculus **10 Hours**

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 function. Helmholtz 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 2 – Electrostatics **16 Hours**

Electrostatic field – Coulomb's law, Electric field, Continuous charge distributions - Divergence and curl of electrostatic field, Field lines and Gauss's 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 3 – Electric fields in matter **8 Hours**

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 (4^{th} 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 4 – Magnetostatics **12 Hours**

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 (4^{th} 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 5 – Magnetostatic fields in matter **8 Hours**

Magnetization – 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 magnetized materials, Boundary conditions – Linear and nonlinear media, Magnetic susceptibility and permeability, Ferromagnetism.

[Sections 6.1 to 6.4 of Introduction to Electrodynamics (4^{th} 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, 4^{th} 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)
6. Electromagnetics by Edminister – Schaum's Outline – Tata McGraw Hill
7. NPTEL video lectures available online

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

APH4B04: 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	12
CO5	Understand and apply electrical network theorems	PSO1	Ap	C,P	8

Unit 1 – Electrodynamics **15 Hours**

Electromotive force – Ohm's law, electromotive force, motional emf – Electromagnetic induction - Faraday's law, induced electric field, inductance, energy inmagnetic fields – Maxwell's equations – Electrodynamics before Maxwell, Maxwell'smodification of Ampere's law, Maxwell's equations, Magnetic charge, Maxwell'sequations 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 2 – Electromagnetic waves **15 Hours**

Waves in one dimension, The wave equation, sinusoidal waves, boundary conditions :reflection and transmission, Polarization – Electromagnetic waves in vacuum , Waveequation for **E** and **B**, monochromatic plane waves in vacuum, energy and momentum ofE.M. waves, Poynting vector - Electromagnetic waves in matter, Propagation throughlinear 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 3 – Transient currents **8 Hours**

Types of transients – DC transient currents in R-L circuits – Short circuit current – Time constant – DC transient currents in R-C circuits – Double energy transients – Theory ofBG

[Sections 22.1, 22.2, 22.4, 22.5, 22.6, 22.8, 22.10 and 10.52 of Electrical Technology Vol. 1 by B. L. Theraja and A. K. Theraja]

Unit 4 – AC circuits **8 Hours**

A resonant circuit – Alternating current – Alternating current networks – Admittance and impedance – Power and energy in AC circuits

[Sections 8.1 to 8.5of Berkeley Physics Course: Vol.2: Electricity and Magnetism (2nd Edn.) by Edward M Purcell.Additional problems should be done from the relevant sections from chapters 13 and 14 of the book of Electrical Technology Vol. 1 by B. L. Theraja and A. K. Theraja]

Unit 5 – Network theorems **8 Hours**

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

[Sections 2.2 to 2.6, 2.14 to2.23, 2.25, 2.26, 2.27 and 2.30 from 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

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 (12threvised edition)
4. Introductory AC Circuit theory – K Mann & G J Russell- Universities Press
5. NPTEL video lectures available online

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

APH5B06: COMPUTATIONAL PHYSICS

54 hours (Credit – 3)

	Course Outcome	PSO	CL	KC	Class Sessions allotted
CO1	Understand the Basics of Python programming	PSO4	U	C	14
CO2	Understand the applications of Python modules	PSO4	U	C	8
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 Hours**

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 Hours**

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), $\sin^2(x)$, $\sin(x^2)$

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 Hours**

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 Hours**

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

APH5B07: 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	Describe Rutherford – Bohr model of the atom	PSO2	U	C	10
CO3	Understand the wavelike properties of particles	PSO2	U	C	10
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	10

Unit 1

1. Particle like Properties of Electromagnetic Radiation 8 Hours

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

[Sections 3.1 to 3.6 of Modern Physics by Kenneth Krane]

2. Rutherford-Bohr Model of the Atom 10 Hours

Basic properties of atoms – Thomson model – Rutherford nuclear atom – Line spectra – Bohr model – Frank-Hertz experiment – Correspondence principle – Deficiencies of Bohr model

[Sections 6.1 to 6.8 of Modern Physics by Kenneth Krane]

Unit 2

3. Wavelike Properties of Particles 10 Hours

De Broglie hypothesis - Uncertainty relationships for classical waves – Heisenberg uncertainty relationships – Wave packets - Probability and randomness – Probability amplitude

[Sections 4.1 to 4.6 of Modern Physics by Kenneth Krane]

Unit 3

4. The Schrodinger Equation 16 Hours

Justification of the Schrodinger equation – The Schrodinger recipe – Probabilities and normalization– Applications – Free particle, Particle in a box (one dimension), Particle in a box (two

dimensions), Simple harmonic oscillator – Time dependence – Potential energy steps and potential energy barriers

[Sections 5.1 to 5.7 of Modern Physics by Kenneth Krane]

5. Hydrogen Atom in Wave Mechanics 10 Hours

Schrodinger equation in spherical coordinates – Hydrogen atom wave functions – Radial probability densities – Angular momentum and probability densities – Intrinsic spin – Energy levels and spectroscopic notation – Zeeman effect – Fine structure

[Sections 7.1 to 7.8 of Modern Physics by Kenneth Krane]

Book of study:

1. Modern Physics, 2nd Edn. – Kenneth S. Krane – John Wiley & sons

Reference Books :

1. Concepts of Modern Physics, 7th Edn. – Arthur Beiser – Tata McGraw-Hill

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, 2nd Edn – Randy Harris – Pearson

5. Modern Physics for Scientists and Engineers, 2nd 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 available online

Mark distribution for setting Question paper.

Unit/ chapter	Title	Marks
1	Particle like Properties of Electromagnetic Radiation	11
2	Rutherford-Bohr Model of the Atom	15
3	Wavelike Properties of Particles	15
4	The Schrodinger Equation	23
5	Hydrogen Atom in Wave	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

APH5B08: 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

Fermat's Principle, verification of laws of reflection and refraction 2 Hours

[Sections 2.1 to 2.6 of Brijlal, Subramaniyam, & Avadhanuluand Sections 3.1 to 3.2 ofAjoyGhatak]

Refraction and reflection by spherical surfaces : **3 Hours**

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 Ajoy Ghatak]

Unit 2

2. Interference by division of wave front 6 Hours

Superposition of two sinusoidal waves, Interference, coherence ,conditions for interference, the interference patterns, intensity distribution .Fresnel's two mirror arrangement, Fresnel's Biprism, Determination of λ and dλ of Sodium Light

[Sections 14.1 to 14.4, 14.6 to 14.9 of Brijlal, Subramaniyam, & Avadhanulu, and Sections 14.1 to 14.8 of Ajoy Ghatak. Additional problems should be done from chapter 7 of Introduction to Optics by Frank.L,Pedrotti,Leno M Pedrotti and Leno S Pedrotti.]

3. Interference by division of amplitude 8 Hours

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, The Michelson interferometer, white light fringes-

[Sections 15.1 to 15.4,15.7, 15.9, 15.11 of Ajoy Ghatak, and Sections 2.1 to 2.6 of Brijlal, Subramaniyam, &Avadhanulu. Additional problems should be done from chapter 7 of Introduction to Optics by Frank.L,Pedrotti, Leno M Pedrotti and Leno S Pedrotti.]

Unit 3

4. Fraunhofer Diffraction **10 Hours**

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.

[Sections 18.1 to 18.3, 18.5 to 18.8 of Ajoy Ghatak. Additional problems should be done from chapters 11 and 12 of Introduction to Optics by Frank.L,Pedrotti, Leno M Pedrotti and Leno S Pedrotti.]

5. Fresnel Diffraction **3 Hours**

Preliminaries, Fresnel half period zones, explanation of rectilinear propagation of light, zone plate

[Sections 20.1 to 20.3 of Ajoy Ghatak]

Unit 4 **8 Hours**

6. 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, Laurentz half shade polarimeter

[Sections 20.9,20.17 to 20.20,20.24 of Brijlal, Subramaniyam, & Avadhanulu and corresponding sections of Ajoy Ghatak]

Unit 5 **6 Hours**

7. Holography

Principles of holography, theory of construction and reconstruction of Hologram, Applications of Holography.

[Sections 23.1 to 23.6 of Brijlal, Subramaniyam, &Avadhanulu and Sections 21.1 to 21.4 of Ajoy Ghatak]

Unit 6 **8 Hours**

8. Fibre Optics

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 Ajoy Ghatak and corresponding sections from Brijlal, Subramaniyam, &Avadhanulu]

Books of study:

1. Optics by Ajoy Ghatak – 4th edition
2. Optics by Subramaniam, Brijlal&Avadhanulu – 2018(Reprint)
3. Introduction to Optics by Frank.L,Pedrotti,Leno M Pedrotti and Leno S Pedrotti

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, verification of laws of reflection and refraction Refraction and reflection by spherical surfaces	7
2	Interference by division of wave front	9
3	Interference by division of amplitude	12
4	Fraunhofer Diffraction	15
5	Fresnel Diffraction	4
6	Polarization	12
7	Holography	9
8	Fibre Optics	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 –IX

APH5B09: ELECTRONICS (ANALOG & DIGITAL)

54 hours (Credit – 3)

	Course Outcome	PSO	CL	KC	Class Sessions allotted
CO1	Understand the basic principles of rectifiers and dc power supplies	PSO3	U	C	6
CO2	Understand the principles of transistor	PSO3	U	C	14
CO3	Understand the working and designing of transistor amplifiers and oscillators	PSO3	Ap	C, P	12
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 1

1. Semiconductor rectifiers and DC Power supplies 6 Hours

Preliminaries of rectification- Bridge rectifier- Efficiency- Nature of rectified output- Ripple factor- different types of filter circuits- voltage multipliers- Zener diode- voltage stabilization

[Sections 6.13-6.15, 6.17 - 6.27 of V.K Mehta]

2. Transistors 14 Hours

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

[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 of V K Mehta]

Unit 2

3. Multistage Transistor amplifiers 4 Hours

R.C coupled amplifier- frequency response and gain in decibels- Transformer coupled Amplifiers - Direct Coupled Amplifier-Comparison [Section 11.1-11.8 of VK Mehta]

4. Feedback Circuits and Oscillators 8 Hours

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 of VK Mehta]

5. Operational amplifier and its applications **6 Hours**

Differential amplifier (basic 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 of VK Mehta]

Unit 3

6. Number systems **6 Hours**

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

(Sections - 2.2 to 2.8 of Aditya P Mathur).

7. Logic gates and circuits **10 Hours**

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 2.4, 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 Micro Processors - Aditya P Mathur (Tata McGarw Hill)
3. Digital principles and applications - Leach and Malvino (Tata McGraw Hill)

References

1. Electronic Principles by Malvino - (Tata McGraw Hill)
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
8. NPTEL video lectures available online

Mark distribution for setting Question paper.

Unit/ chapter	Title	Marks
1	Semiconductor rectifiers and DC Power supplies	9
2	Transistors	20
3	Multistage Transistor amplifiers	6
4	Feedback Circuits and Oscillators	12
5	Operational amplifier and its applications	9
6	Number systems	9
7	Logic gates and circuits	14
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

APH6B10: 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	14
CO2	Understand the thermodynamics description of the ideal gas	PSO2	U	C	8
CO3	Understand the second law of thermodynamics and its applications	PSO2	U	C, P	12
CO4	Understand the basic ideas of entropy	PSO2	U	C	8
CO5	Understand the concepts of thermodynamic potentials and phase transitions	PSO2	U	C	12

Unit 1 – Zeroth Law and First Law of Thermodynamics **14 Hours**

Macroscopic point of view – Microscopic point of view – Macroscopic versus Microscopic points of view – Scope of Thermodynamics – Thermal equilibrium and Zeroth Law – Concept of temperature – Ideal-Gas temperature – Thermodynamic equilibrium – Equation of state – Hydrostatic systems – Intensive and extensive coordinates – Work – Quasi-static process – Work in changing the volume of a hydrostatic system – PV diagram – Hydrostatic work depends on the path – Calculation of work for quasi-static processes – Work and Heat – Adiabatic work – Internal energy function – Mathematical formulation of First Law – Concept of Heat – Differential form of the First Law – Heat capacity – Specific heat of water; the Calorie – Quasi-static flow of heat; Heat reservoir

[Sections 1.1 to 1.6, 1.10, 2.1 to 2.3, 2.10, 3.1 to 3.6 and 4.1 to 4.8, 4.10 of Heat and Thermodynamics by Zemansky and Dittman]

Unit 2 – Ideal Gas **8 Hours**

Equation of state of a gas – Internal energy of a real gas – Ideal gas – Experimental determination of heat capacities – Quasi-static adiabatic process – The microscopic point of view – Kinetic theory of the ideal gas

[Sections 5.1 to 5.5, 5.8 and 5.9 of Heat and Thermodynamics by Zemansky and Dittman]

Unit 3 – Second Law of Thermodynamics **12 Hours**

Conversion of work into heat and vice versa – Heat engine; Kelvin-Planck statement of the Second Law – Refrigerator; Clausius' statement of the Second Law – Equivalence of Kelvin-Planck and Clausius statements – Reversibility and Irreversibility – Conditions for reversibility – Carnot engine and Carnot cycle – Carnot refrigerator – Carnot's Theorem and corollary – Thermodynamic temperature scale – Absolute zero and Carnot efficiency – Equality of ideal-gas and thermodynamic temperatures

[Sections 6.1, 6.6 to 6.9, 6.14, 7.1 and 7.3 to 7.7 of Heat and Thermodynamics by Zemansky and Dittman]

Unit 4 – Entropy **8 Hours**

Reversible part of the Second Law – Entropy – Entropy of the ideal gas – TS diagram – Entropy and reversibility – Entropy and irreversibility – Irreversible part of the Second Law – Heat and entropy in irreversible processes – Principle of increase of entropy – Applications of the Entropy Principle – Entropy and disorder – Exact differentials

[Sections 8.1, 8.2, 8.4 to 8.9, 8.11 to 8.14 of Heat and Thermodynamics by Zemansky and Dittman]

Unit 5 – Thermodynamic Potentials and Phase Transitions **12 Hours**

Characteristic functions – Enthalpy – Joule-Thomson expansion – Helmholtz and Gibbs functions – Condition for an exact differential – Maxwell's relations – TdS equations – PV diagram for a pure substance – PT diagram for a pure substance; Phase diagram – First-order phase transitions and Clausius-Clapeyron equation – Clausius-Clapeyron equation and phase diagrams

[Sections 10.1 to 10.6, 9.1, 9.2, 11.3 and 11.4 of Heat and Thermodynamics by Zemansky and Dittman]

Book of Study :

1. Heat and Thermodynamics, 7thEdn. – Mark W. Zemansky and Richard H. Dittman – McGraw-Hill

Reference Books :

1. Classical and Statistical Thermodynamics – Ashley H. Carter – Pearson, 2012
2. Basic Thermodynamics – Evelyn Guha – Narosa, 2002
3. Heat and Thermodynamics – D. S. Mathur – S. Chand Publishers, 2008
4. NPTEL video lectures available online

Mark distribution for setting Question paper.

Unit/ chapter	Title	Marks
1	Zeroth Law and First Law of Thermodynamics	20
2	Ideal Gas	12
3	Second Law of Thermodynamic	18
4	Entropy	12
5	Thermodynamic Potentials and Phase Transitions	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 XI

APH6B11: STATISTICAL PHYSICS, SOLID STATE PHYSICS, SPECTROSCOPY & 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	16
CO2	Understand the basic aspects of crystallography in solid state physics	PSO2	U	C	14
CO3	Understand the basic elements of spectroscopy	PSO2	U	C	4
CO4	Understand the basics ideas of microwave and infra red spectroscopy	PSO2	U	C	10
CO5	Understand the fundamental ideas of photonics	PSO2	U	C	10

Unit 1 Statistical Physics **16 Hours**

Statistical Analysis – Classical versus quantum statistics – Distribution of molecular speeds – Maxwell-Boltzmann distribution – Quantum Statistics – Applications of Bose-Einstein statistics – Blackbody radiation – Applications of Fermi-Dirac statistics

[Sections 10.1 to 10.7 of Modern Physics by Kenneth Krane]

Unit 2 Solid State Physics **14 Hours**

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

[Sections 4.1 to 4.7, 4.14 to 4.22 and 5.7 to 5.10 of Solid State Physics by S.O. Pillai**]**

Unit 3 Basic Elements of Spectroscopy **4 Hours**

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**]**

Unit 4

Microwave Spectroscopy **5 Hours**

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]

Infra Red Spectroscopy **5 Hours**

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]

Unit 5 Photonics **10 Hours**

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 – Classical explanation – 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

5. NPTEL video lectures available online

Mark distribution for setting Question paper.

Unit/ chapter	Title	Marks
1	Statistical Physics	23
2	Solid State Physics	21
3	Basic Elements of Spectroscopy	6
4	Microwave Spectroscopy	7
5	Infra Red Spectroscopy	7
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

APH6B12: 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 1

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

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 hours**

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 2

3. Particle Detectors **8 hours**

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 hours**

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 3

5. Elementary Particles **12 hours**

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
6. A practical approach to Nuclear Physics, 1st Edition, K. Muraleedhara Varier- Narosa Publishing House
7. NPTEL video lectures available online

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

APH6B13: 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	12

Unit 1

1. Special Relativity **18 Hours**

The need for a new mode of thought – Michelson-Morley experiment – Postulates of Special Relativity – Galilean transformations – Lorentz transformations – Simultaneity – The order of events : Timelike and spacelike 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 2

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

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 (2nd Edn.) by Kenneth Krane]

Unit 3

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

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 Hours**

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 Hours**

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 – Springer

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. Chandrasekhar and His Limit by G. Venkataramn. Universities Press (India)
9. A Brief History of Time by Stephen Hawking, Bantam Books
10. NPTEL video lectures available online

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 (Elective)

APH6B14 (EL1): OP-AMP AND DIGITAL INTEGRATED CIRCUITS

54 hours (Credit - 3)

	Course Outcome	PSO	CL	KC	Class Sessions allotted
CO1	Understand the basic principles of Operational amplifiers.	PSO3	U	C	8
CO2	Understand the applications of Linear operational amplifier.	PSO3	U	C	10
CO3	Understand the working and designing of filters and waveform generators.	PSO3	Ap	C, P	9
CO4	Understand the basic operations of comparators and its applications	PSO3	U	C	9
CO5	Understand the basics of TTL logic families and CMOS circuits.	PSO3	U	C	18

Unit 1 **18 hours**

Op-amp parameters, ideal op-amp, open loop op-amp configuration-differential amplifier, Inverting amplifier, non-inverting amplifier, equivalent circuit of an op-amp, ideal voltage transfer curve (section 3.3 to 3.6 of ref.1)

Op-amp inverting amplifier with feedback (closed loop gain (proof required), input & output resistance (equation only)), Op-amp non-inverting amplifier with feedback (closed loop gain (proof required), input & output resistance (equation only)), Voltage follower, Op-amp linear applications - summing amplifier, scaling amplifier, averaging amplifier, instrumentation amplifier, integrator, differentiator.

(sec 4.1 to 4.3.5, 4.3.8, 4.4 to 4.4.4, 4.5.1, 7.2.2, 7.5, 7.6, 7.12, 7.13 of ref.1)

Unit 2 **18 hours**

Active filters-low pass, high pass, band pass, band reject, all pass filter(sec 8.1 to 8.10 of ref.1) Wave form generators-square wave, triangular, saw tooth. (sec 8.15 to 8.17 of ref 1) Comparators-basic comparator types, characteristics, applications, zero crossing detector, Schmitt trigger. (sec 9.1 to 9.4 of ref 1)

Unit 3 **18 hours**

Digital ICs-logic families, TTL circuits, TTL types, TTL parameters, TTL gates,

(sec 14.2 to14.6 of ref 2) CMOS Circuits-CMOS gates, characteristics. (sec.14.9 to 14.10 of ref 2)

Book of Study

1. Op-amps and linear integrated circuits-R.Gayakwad, Prentice Hall,India
2. Digital principles and applications-Malvino and Leach 7th edn TMH

Additional references

1. Operational amplifiers and applications-Subirkumar Sarkar,S.Chand&Co
2. Digital fundamentals-Thomas L Floyd, Merril publishing Co gh, US

Mark distribution for setting Question paper.

Unit/ chapter	**Title**	**Marks**
1	Operational Amplifiers	27
2	Filter circuits	26
3	Digital ICs	26
*Total Marks **		79

Semester 6 | Core Course XIV (Elective)

APH6B14 (EL2): MICROPROCESSOR AND MICROCOMPUTER SYSTEMS

54 hours (Credit - 3)

	Course Outcome	PSO	CL	KC	Class Sessions allotted
CO1	Understand the fundamentals of a microcomputer.	PSO3	U	C	10
CO2	Understand the different number systems	PSO3	U	C	8
CO3	Understand the fundamentals of Microprocessor architecture	PSO3	U	C	12
CO4	Understand the basics of INTEL 8085	PSO3	U	C	12
CO5	Understand the instructions and various controls of INTEL 8085	PSO3	U	C	12

Unit-1 **18 hours**

1.Microcomputerfundamentals

Introduction, simplified microcomputer architecture, word length of a computer or microprocessor, Hardware, software and firmware, CPU-memory, microcomputer bus architecture, memory addressing capacity of CPU. (section1.1,1.7,1.8,1.10 of fundamentals of microprocessors and microcomputers by B.RAM.)

2.Number system

Decimal number system-binary-conversion of binary to decimal-binary addition and subtraction – BCD-hexadecimal number system-1's compliment- 2's compliment- conversion (section 2.1 to 2.11 of fundamentals of microprocessors and microcomputers by B.RAM.)

Unit-2 **36 hours**

3. Microprocessor Architecture

Introduction-Intel 8085 ALU-timing and control unit –registers-flags-stack- data and address bus – pin configuration –Intel 8085 instruction –opcode – operand-instruction cycle- machine cycle-timing diagram (sections 3.1 to 3.3 B.RAM). Instruction set of Intel 8085 Data transfer group- arithmetic group-logical- branch control-I/O and machine control-addressing modes (sections4.1 to 4.6 of B.RAM.)

Book of Study

1.Fundamentals of microprocessors and microcomputers - B.RAM.

References

2.Microprocessor Architecture Programming and Application with 8085- Ramesh S Gaonkar

Mark distribution for setting Question paper.

Unit/ chapter	**Title**	**Marks**
1	Microcomputer fundamentals	16
2	Number systems	10
3	Microprocessors	53
Total Marks *		79

Semester 6 | Core Course XIV (Elective)
APH6B14 (EL3): COMMUNICATION SYSTEMS
54 hours (Credit - 3)

	Course Outcome	PSO	CL	KC	Class Sessions allotted
CO1	Understand the basic principles of pulse modulation in communication systems.	PSO3	U	C	18
CO2	Understand the basic aspects of digital communication systems.	PSO3	U	C	18
CO3	Understand the fundamentals of fiber optic communications.	PSO3	U	C	6
CO4	Understand the basic aspects of modes of propagation in optical fibers.	PSO3	U	C	6
CO5	Understand the basics of light sources for fibre optics communication systems.	PSO3	U	C	6

Unit 1 **18 hours**

1.Pulse modulation techniques-Pulse amplitude modulation (PAL), Pulse coded modulation (PCM)-quantisation, compression, PCM receiver, differential PCM, Delta modulation, Sigma-delta A/D conversion, Pulse frequency modulation (PFM),Pulse time modulation (PTM),Pulse position modulation (PPM),Pulse width modulation (PWM) (Sec 11.1 to 11.7 of ref 1)

Unit 2 **18 hours**

2. Digital communication-Synchronisation, asynchronous transmission, probability of bit error, digital carrier system, amplitude shift keying (ASK),Frequency shift keying (FSK),Phase shift keyinf (PSK),Differential phase shift keying (DPSK) Sec12.1,12.4,12.9,12.11 of ref 1)

Unit 3 **18 hours**

1.Fiber optic communication-principles of light transmission in a fiber, propagation with in fiber, fiber index profiles, modes of propagation, number of propagated modes in step index fibers, single mode propagation in step index fiber losses in fibers, dispersion-effect of dispersion on pulse transmission, inter model, chromatic and wave guide dispersion, light sources for fiber optics, light emitting diodes, semi conducter laser diodes, photo detectors- pn, pin and avalanche(APD)-photo diodes, optical receiver circuits**,** connectors and splices, fiber optic communication link (sec 20.1 to 20.8 of ref 1)

Book of study

1. Electronic communication-Dennis Roddy & John Collen 4th edn Prentice Hall

Additional reference

1. Principles of communication system-Taub & Schilling-TMH

Mark distribution for setting Question paper.

Unit/ chapter	Title	Marks
1	Modulation	26
2	Digital Communication	26
3	Fiber optic communication	27
Total Marks *		79

B.Sc PROGRAMME IN APPLIED PHYSICS (CORE)

PRACTICAL

Centres 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 1/2 mark can be awarded to an experiment which is neatly recorded.** Total mark for record in external valuation is 10. The principle or the logic 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. Digital balance is allowed for mass measurements.

Number of questions in the question paper shall be 8 for Paper –I(1), I(2) & II: and 6 from Electronics & 2 from Python programs PAPER- III: out of these a minimum of 75% of the questions are to be set for the examination at a centre.

Semesters 1 to 4 | Core Course V (1)

APH4B05(1) PRACTICAL-I(1)

36 hours in each semester (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 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 magnetism through experiments	Ap	P	36

(Any Ten from Each Part)

Part A

1. Young's modulus-non uniform bending-using pin and microscope-(load-extension graph).
2. Young's modulus-Uniform bending-using optic lever
3. Young's modulus-Angle between the tangents
4. Surface Tension-cAPHllary rise method-radius by vernier microscope
5. Viscosity-Poiseuille's method –(Variable Pressure head, radius by mercury pellet method, sensibility method to find mass)
6. Moment of inertia-Flywheel
7. Moment of Inertia-Torsion Pendulum
8. Rigidity modulus-static torsion
9. Compound pendulum-acceleration due to gravity, Radius of gyration
10. Liquid lens-Refractive index of liquid and glass
11. Spectrometer-solid prism-Refractive index of glass measuring angle of minimum deviation.
12. Spectrometer-solid prism- Dispersive power

Part B

13. Deflection magnetometer-TAN A, Tan B positions
14. Deflection magnetometer -Tan C Position-moment of moments
15. Searle's vibration magnetometer-moment & ratio of moments
16. Box type vibration magnetometer-m & B_h

17. Melde's string arrangement-Frequency, relative density of liquid and solid (both modes)
18. Mirror galvanometer-figure of merit
19. Potentiometer-measurement of resistance
20. Potentiometer-calibration of ammeter
21. Ballistic Galvanometer- BG constant using HMS-then find B_h.
22. B.G.-Comparison of capacities Desauty's method.
23. Spectrometer- i-d curve
24. Verification of Thevenin's theorem.

Books of Study:

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

Reference Books:

1. Advanced Practical Physics for students – B L Worksnop and H T Flint
2. A practical approach to Nuclear Physics, 1st Edition, K. Muraleedhara Varier- Narosa Publishing House.

Semesters 1 to 4 | Core Course V (2)

APH4B05(2) PRACTICAL-I(2)

36 hours in each semester (Credit - 5)

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

(Any 20)

1. Spectrometer- i_1-i_2 curve
2. Spectrometer-Cauchy's constants
3. Spectrometer-Diffraction Grating-Normal incidence
4. Laser-wavelength using transmission grating
5. Diffraction Grating-minimum deviation
6. Spectrometer-Quartz prism-Refractive indices of quartz for the ordinary and extra-ordinary rays
7. Newton's rings-wavelength of sodium light
8. Air wedge-angle of the wedge, radius of a thin wire
9. Lee's Disc
10. Potentiometer-calibration low range and high range voltmeters
11. Potentiometer- Reduction factor of TG
12. Variation of field with distance-Circular coil-moment of magnet & B_h
13. Carey Foster's bridge-resistance & resistivity
14. Carey Foster's bridge-Temperature coefficient of Resistance
15. Conversion of Galvanometer to voltmeter-checking with standard voltmeter.
16. Conversion of Galvanometer to ammeter -checking with standard ammeter.
17. BG Absolute Capacity
18. BG-High resistance by leakage method

19. BG Mutual inductance
20. Planck's constant using LED's (3no.s)
21. Polarimeter-Specific rotation of sugar solution.
22. Cathode ray oscilloscope-Familiarisation, Voltage sweep operations, synchronization and triggering with signal generator, multimeter.
23. Numerical aperture of an optical fibre by semiconductor laser
24. Frequency of AC using sonometer

Books of Study:

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

Reference Books:

1. Advanced Practical Physics for students – B L Worksnop and H T Flint
2. A practical approach to Nuclear Physics, 1st Edition, K. Muraleedhara Varier- Narosa Publishing House.

Semester 5-6 | Core Course XV

APH6B15: PRACTICAL II

72 hours in each semester (Credit - 5)

	Course Outcome	CL	KC	Class Sessions allotted
CO1	Apply and illustrate the principles of semiconductor diodes and transistors 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 using C programming	Ap	P	36

(Minimum Fifteen from Unit: 1 and Five from Unit: 2)

Unit 1

1. Construction of full wave, Centre tapped and Bridge rectifiers
2. Characteristics of Zener diode and construction of Voltage regulator.
3. Transistor characteristics and transfer characteristics in Common Base

Configuration- current again

4. Transistor characteristics and transfer characteristics in Common Emitter

Configuration- current again

5. CE Transistor Amplifier-Frequency response.
6. Clipping & Clamping circuits
7. Negative feed back amplifier
8. LC Oscillator (Hartley or Colpitt's)
9. Phase shift oscillator
10. Operational Amplifier –inverting, non inverting, Voltage follower
11. LCR circuits-Resonance using CRO
12. Realisation of gates using diodes(AND, OR) & transistors (NOT), verification using IC's
13. Voltage multiplier (doubler, tripler)
14. Multivibrator using transistors.
15. Flip-Flop circuits –RS and JK using IC's
16. Verification of De-Morgan's Theorem using basic gates.
17. Half adder using NAND gates and decade counter (7490 IC)

Unit 2

C-Programming

18. Solution of equations by iteration method
19. Work done and Angular momentum
20. Projectile motion-List the height, horizontal range, range and time of flight (Plot graph in graph sheet).
21. LCR Circuit
22. Taylor series - Sin θ, Cos θ
23. Decimal to binary and Binary to decimal
24. Motion of a rocket- velocity at different instances
25. Mean & standard deviation

Semester 5-6 | Core Course XVI

APH6B16: PRACTICALS III

72 hours in each semester (Credit - 5)

	Course Outcome	CL	KC	Class Sessions allotted
CO1	Apply and illustrate the ideas of Network theorems through experiments	Ap	P	36
CO2	Apply and illustrate the concepts of multivibrators through experiments	Ap	P	36
CO3	Apply and illustrate the ideas of Operational amplifiers through experiments	Ap	P	36
CO4	Apply and illustrate the ideas of digital electronics through experiments	Ap	P	36

Any 20 Experiments to be done from Section A/Section B

Section A

1. Network Theorems-Verification
2. Wein Bridge Oscillator using Op-Amp
3. Emitter follower
4. Astable multivibrator using 555 IC
5. Op-amp Adder
6. Op-amp Differentiator-study of wave forms
7. Op-amp Integrator-study of wave forms
8. Op-amp-Square wave generator
9. Op-amp-Triangular wave generator
10. First order low pass filter using Op-amp
11. First order high pass filter using Op-amp
12. Karnaugh map: To minimize 3 variable truth table using K-map & realize it using NAND gate.
13. Clocked J-K Flip-Flop-to familiarise IC 7476
14. Four Bit Binary Adder-to familiarise IC 7483
15. For Bit Magnitude Comparator-to familiarise IC 7485
16. To implement 4:1 Multiplexer using IC 7400,7408,7432
17. To implement 1:4 De Multiplexer using IC 7400,7408
18. To implement BCD to Decimal Decoder using IC 7445
19. To implement Four Bit Binary Counter using IC 7493

20. To implement Four Bit Decade Counter using IC 7490

21. Digital to Analog Convertor-Four Bit R-2R Ladder Network

22. Analog to digital conversion (2 bit) using comparator and nand gates

23. Monostable multivibrator using 555 IC

24. Seven To set up Schmitt trigger using opamp & trace figures using curve

Section B

Digital Electronics

1. Voltage Multiplier

2. Wein Bridge Oscillator using Op-Amp

3. Diode Clipper

4. Saw Tooth Generator

5. Verification of Network Theorems

6. Low voltage Power Pack

7. Differentiator and Integrator circuit using Op-Amp

8. Astable Multivibrator using IC 555

9. Low Pass Filter

10. High Pass Filter

Microprocessor

11. Subtraction of 8 bit

12. Addition of two consecutive numbers

13. Addition of 8 bit No-sum16 bit

14. Decimal Addition of two 8 bit Numbers

15. addition of 8 bits

16. Data Transfer Operations

17. Larger of 2 numbers

18. Largest number in an array

19. Smallest number in an array

20. Even or Odd

21. Mask off Least Significant 4 bits of an 8 bit number

22. Mask off Most Significant 4 bits of an 8 bit number

Books for study

1. Fundamentals of microprocessors and microcomputers - B.RAM.

2. Op-amps and linear integrated circuits by R.Gayakwad, PHI Publishers

Semester 5-6 | Core Course XVII

Course: APH6B17(P) – PROJECT

36 hours in each semester (Credits: 2)

	Course Outcome	**CL**	**KC**	**Class 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

Semester 5-6 | Core Course XVII

APH6B17(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 Hours**

Science as facts, science as generalization, Some distinctions when describing science, Science as a social 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, 2.8.1 to 2.8.4, 3.1 to 3.3, 4.1 to 4.4, 7.1 The Aims, Practices and Ethics of Science, Peter Pruzan, Springer International Publishing Limited)

Unit 2 Measurement **16 Hours**

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 Hours**

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 22 Hours

Design

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, The Value 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, Unethics, 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 Unethics 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, New Age International Publishers, 2014

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

B.Sc. PHYSICS
OPEN COURSES SYLLABUS

Semester 5 | Open Course I

APH5D01(1): 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 Hours**

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 **12 Hours**

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, solar cookers, solar distillation, solar furnaces, solar greenhouses, solar power plants, 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 **10 Hours**

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 Hours**

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)

(Section 6.1, 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, 6.7.3 from Non-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 Hours**

Ocean Energy, Ocean Energy Sources, Tidal energy, Components of a Tidal Power Plant, Economic aspects of tidal energy conversion, Wave energy, Advantages and disadvantages, Factors affecting Wave energy, Ocean Thermal Energy Conversion (OTEC), Working principle of 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 Sources and 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 company ltd,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

APH5D01(2): 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 hours**

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 hours**

Earth The zones of earth-longitude and latitude-shape of earth. Keplers laws- perihelion-Aphelion perigee and apogee, year-month-Day. Seasons-causes of seasons

Unit 3. Sun **12 hours**

Solar system sun-structure-photosphere-chromosphere-solar constant-sun temperature-sun spots-solar eclipse corona- (planets-surface conditions and atmosphere, size, period & distance) mercury-venus-earthmars-jupiter-saturn-uranus-neptune-comets-asteroidsmeteors

Unit 4.Stars **12 hours**

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, University Press,

Reference books.

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

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

APH5D01(2): 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	Understand the basic elements of X-ray imaging	U	C	9
CO4	Understand the basic elements of ultrasound imaging and its advantages and disadvantages	U	C	9

Unit 1 Nuclear medicine physics **18 Hour**

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, Measurement of radiation dose, safety, risk, and radiation protection-Radiopharmaceuticals -Radioactive agents for clinical studies- Biological effects & Genetic effect of radiation.

Unit 2 Medical instrumentation **18 Hours**

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): Muscular servomechanism-Potentials generated during muscle actions

Unit 3 Medical imaging techniques **18 Hours**

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 New York,

2. John G. Webster, "Medical Instrumentation Application and Design", John Wiley and 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 O, Vol 1,2,3 Year Book Publisher Inc Chicago

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 Biomedical equipment 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, Medical Physics.

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. APPLIED PHYSICS
GENERAL COURSES SYLLABUS

Semester 3 | General Course I
A(3)11: PYTHON
72 hours (Credit – 3)

	Course Outcome	CL	KC	Class Sessions allotted
CO1	Understand the basic concepts of python language	U	C	20
CO2	Understand various operations in python language	U	C	20
CO3	Develop computer programmes in python language	Ap	C, P	20
CO4	Understand the basics of object oriented programming using python	U	C	12

Unit 1 Introduction to *Python* **20 Hours**

Introduction to python, features, IDLE, python interpreter, Writing and executing python scripts, comments, identifiers, keywords, variables, data type, operators, operator precedence and associativity, statements, expressions, user inputs, type function, eval function, print function.

Unit 2 Basic operations **20 Hours**

Boolean expressions, Simple if statement, if-elif-else statement, compound boolean expressions, nesting, multi way decisions. Loops: The while statement, range functions, the for statement, nested loops, break and continue statements, infinite loops.

Functions, built-in functions, mathematical functions, date time functions, random numbers, writing user defined functions, composition of functions, parameter and arguments, default parameters, function calls, return statement, using global variables, recursion.

Unit 3 Further operations and Object Oriented Programming **32 Hours**

String and string operations, List- creating list, accessing, updating and deleting elements from a list, basic list operations. Tuple- creating and accessing tuples in python, basic tuple operations. Dictionary, built in methods to access, update and delete dictionary values. Set and basic operations on a set. Files- opening a file, reading and writing to file. OOPS concept and Python – OOPS terminology, defining classes, creating objects, attributes, built in attributes.

References:

1. E. Balaguruswamy, Introduction to Computing and Problem Solving Using Python
2. Richard L. Halterman, Learning To Program With Python
3. Martin C. Brown, Python: The Complete Reference

Mark distribution for setting Question paper.

Unit/ chapter	Title	Marks
1	Introduction	28
2	Functions	20
3	String, tuple, set, files and oops	31
*Total Marks **		79

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

Semester 3 | General Course II
A(3)12: SENSORS AND TRANSDUCERS
72 hours (Credit – 3)

	Course Outcome	CL	KC	Class Sessions allotted
CO1	Understand the concepts of resistance, inductance and capacitance transducers	U	C	20
CO2	Understand the concepts of temperature and pressure transducers	U	C,	20
CO3	Understand the concepts of level and flow transducers	U	C	15
CO4	Understand the principles of electromagnetic and radiation sensors	U	C	9
CO5	Understand the working principles of force and torque transducers and sound transducers	U	C	8

Unit 1 Resistance, inductance and capacitance transducers **20 Hours**

Transducers: Definition, Principle of sensing & transduction, Classification, Characteristics of transducers. Basic requirement of transducers, Resistance Transducer: Basic principle – Potentiometer –Loading effects, Resistance strain gauge– Types. Inductance Transducer: - Basic principle – Linear variable differential transformer – RVDT-types. Capacitance Transducer: Basic principle- transducers using change in area of plates – distance between plates- variation of dielectric constants –Types

Unit 2 Thermal and pressure transducers **20 Hours**

Thermal sensors: Resistance change type: RTD - materials, construction, types, working principle, Thermistor - materials, construction, types, working principle, Thermo emf sensors: Thermocouple – Principle and types, Radiation sensors: Principle and types. Pressure Transducers: basic principle- different types of manometers-u tube manometer-well type manometers.

Unit 3 Level and Flow transducers and sensors **32 Hours**

Level transducer-continuous level measurement-discrete level measurement-mass –capacitive level gauges. Flow Transducers: Bernoulli’s principle and continuity, Orifice plate, nozzle plate, venture tube, Rotameter, anemometers, electromagnetic flow meter, impeller meter and turbid

flow meter Hall effect transducers, Digital transducers, Piezo-electric sensors, eddy current transducers, tacho generators and stroboscope, Magnetostrictive transducers. Radiation

Sensors: LDR, Photovoltaic cells, photodiodes, photo emissive cell types. Force and Torque Transducers: Proving ring, hydraulic and pneumatic load cell, dynamometer and gyroscopes. Sound Transducers: Sound level meter, Microphone.

Reference books

1. D Patranabis, Sensors and Transducers, PHI, 2nd Edition.
2. E. A. Doebelin, Measurement Systems: Application and Design McGraw Hill, New York
3. A.K. Sawhney,- A course in Electrical & Electronic Measurement and Instrumentation, DhanpatRai and Company Private Limited.
4. Murthy D.V.S., ―Transducers and Instrumentation, 2nd Edition, Prentice Hall of India Private Limited, New Delhi, 2010.
5. S.Renganathan, ―Transducer Engineering, Allied Publishers, 2005

Mark distribution for setting Question paper.

Unit/ chapter	Title	Marks
1	Resistance, inductance and capacitance transducer	22
2	Thermal and pressure transducers	22
3	Level and Flow transducers and sensors	35
Total Marks *		79

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

Semester IV | General Course III

A(3)13: DATA COMMUNICATION & OPTICAL FIBERS

72 hours (Credit – 3)

	Course Outcome	CL	KC	Class Sessions allotted
CO1	Understand the basic concepts of signal transmission	U	C	20
CO2	Understand various types of multiplexing	U	C	20
CO3	Understand the basic types of networking	U	C	20
CO4	Understand the basics of optical electronic devices	U	C	12

Unit 1 Transmission media and multiplexing **40 Hours**

Introduction- Components, Networks, Protocols and standards, Basic Concepts: Line Configuration, Topology Transmission mode, analog and digital signals, Encoding and modulating- analog-to- digital conversion, digital to analog conversion, digital data transmission, DTE-DCE interface, modems, cable modems. Transmission media: guided media, unguided media, and transmission impairment.

Multiplexing: Many to one/ one to many, frequency division multiplexing, wave division multiplexing, TDM, multiplexing applications: the telephone system, Error detection and correction : types of errors, detection , VRC, Longitudinal redundancy check, cyclic redundancy check, checksum, error correction.

Unit 2 Networking **20 Hours**

Data link Control: Line Discipline, flow control, error control, Data link Protocols: Asynchronous Protocols, synchronous protocols, character oriented protocols, bit – oriented protocols, link access procedures. Local Area Networks: Ethernet, token bus, token ring, FDDI, Comparison, Switching- circuit switching, packet switching, message switching, integrated services digital networks (ISDN): services, history, subscriber access to ISDN.

Unit 3 Optoelectronic devices **12 Hours**

(Derivation not required)

Overview Of Optical Fiber Communication - Introduction, historical development, general system, advantages, disadvantages, and applications of optical fiber communication, optical fiber

waveguides, fiber materials, Optical Sources And Detectors- Introduction, LED's, LASER diodes, Photo detectors. Ray theory, cylindrical fiber, single mode fiber, cutoff wave length, mode field diameter.

Text Books

1. Behrouz A. Forouzan, Data Communication and Networking, TMH
2. Optical Fiber Communication – Gerd Keiser, 4th Ed., MGH, 2008.

Reference Books:

1. William Stallings: Data & Computer Communications, 6/e, Pearson Education.
2. William L. Schweber : Data Communication, McGraw Hill.
3. Electronic Communication Systems - Kennedy and Davis, TMH
4. Optical Fiber Communications– – John M. Senior, Pearson Education. 3rd Impression,2007.
5. Fiber optic communication – Joseph C Palais: 4th Edition, Pearson Education

Mark distribution for setting Question paper.

Unit/ chapter	Title	Marks
1	Transmission media and multiplexing	44
2	Networking	22
3	Optoelectronic devices	13
*Total Marks **		79

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

Semester IV | General Course IV

A(3)14: MICROPROCESSORS – ARCHITECTURE AND PROGRAMMING

72 hours (Credit – 3)

	Course Outcome	CL	KC	Class Sessions allotted
CO1	Understand the basic concepts of 8085 microprocessor	U	C	20
CO2	Understand the basics of assembly level programming with 8085 microprocessor	U	C	20
CO3	Understand the different types of programming techniques	U	C	20
CO4	Understand the basics of 8086 and associated microprocessors	U	C	12

Unit 1 Basics of 8085 Microprocessor **20 Hours**

General architecture of computer, Introduction to Microprocessor, Memory classification, Introduction to 8085, Microprocessor bus organizations, data bus, address bus, control bus. Memory addressing, memory mapping. 8085 architecture in detail. General purpose registers and special purpose registers, flag register -8085 pins and signals.

Unit 2 Assembly level programming **40 Hours**

Assembly language programming basics. Opcode, Mnemonics etc. 8085 instruction set, Data transfer, Arithmetic and Logic, Shifting and rotating, Branching/Jump, Program control. Addressing modes. Memory read and write cycle. Timing diagram. Instruction cycle , machine cycle and T-states. Types of I/O addressing .Simple programs.

Types of programming techniques looping, indexing (pointers),delay generation. Stack in 8085, call and return Instructions. Data transfer between stack and microprocessor. Subroutine and delay programs. Interrupts in 8085. Interrupt driven programs. Interfacing - Programmable peripheral devices - 8255A, 8254, 8237.

Unit 3 *8086* Microprocessor **12 Hours**

Introduction to 8086/88 microprocessors – overview, 8086 internal architecture. The execution unit, BIU, Registers, Flags, Segmentation, physical address calculation, addressing modes**.**

Text Book

1. Ramesh S. Gaonkar, Microprocessor Architecture Programming and Application with 8085, Prentice Hall
2. Doughles V Hall, Microprocessors and Interfacing: Programming and Hardware,Tata McGraw Hill

Reference Books:

1. Microprocessor and Microcomputer - Based system Design - M. Rafiquzzman - CRC press
2. A.PMathur, Introduction to Microprocessors, Tata McGraw-Hill Education
3. The Intel Microprocessors: 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro, Pentium II, III, IV and Core 2 with 64 bit Extensions, Barry B. Brey,Prentice Hall Pearson
4. Microprocessors PC Hardware and Interfacing –N.Mathivanan – PHI

Mark distribution for setting Question paper.

Unit/ chapter	**Title**	**Marks**
1	Basics of 8085 Microprocessor	22
2	Assembly level programming	44
3	*8086* Microprocessor	13
*Total Marks **		79

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

B.Sc. APPLIED PHYSICS
COMPLEMENTARY COURSES SYLLABUS
(For B. Sc Programme in Instrumentation)

APPLIED PHYSICS COMPLEMENTARY COURSE STRUCTURE

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

Semester	*Code No*	*Course Title*	*Hours/ Week*	*Total Hours*	*Credit*	*Marks*
1	APH1C01	Complementary Course I: General and Applied Physics	2	36	2	75
	-	Complementary Course V: PHYSICS Practical	2	36	-*	-
2	APH2C02	Complementary Course II: Basic Electronic Devices and Circuits	2	36	2	75
	-	Complementary Course V: PHYSICS Practical	2	36	-*	-
3	APH3C03	Complementary Course III: Digital Integrated Circuits	3	54	3	75
	-	Complementary Course V: PHYSICS Practical	2	36	-*	-
4	APH4C04	Complementary Course IV: Op-Amp and Applications	3	54	3	75
	APH4C05	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 = 0

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 (Complementary)

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**

Semester 1 | Complementary Course I
APH1C01 –GENERAL AND APPLIED PHYSICS
36 Hours (Credits-2)

	Course Outcome	CL	KC	Class Sessions allotted
CO1	Understand the basic concepts of properties of matter, fluid mechanics and viscosity	U	C	10
CO2	Understand the basic concepts of interference of light and the wave nature of particles	U	C	10
CO3	Understand and apply the fundamental ideas of current electricity and magnetism	Ap	C,P	8
CO4	Understand and apply the basic elements of spectroscopy, laser physics, fibre optics X-ray diffraction and electron microscope	Ap	C,P	8

Unit 1

1. Properties of matter **7 Hours**

Introduction, Elastic modulii, poisson's ratio (theoretical and practical limits), Twisting couple on a cylinder, Torsion pendulum, bending of beams, bending moment, I form girders (Sections 12.1 to 12.10,12.6 to 12.18(3)(a),12.9: Mechanics by J.C.Upadhyaya 5thedition)

2. Fluid mechanics-viscosity **3 Hours**

Viscosity, streamline flow and turbulent flow, critical velocity, poiseuille's formula for steady flow of a liquid through a narrow tube (Sections 15.1 to 15.3:Mechanics by J.C Upadhyaya 5th edition)

Unit 2

3. Interference, laser physics , fibre optics **10 Hours**

Principle of super position , super position of two sinusoidal waves, interference ,coherent sources, conditions for constructive and destructive interferences, Lasers-Induced absorption , spontaneous emission and stimulated emission , population inversion, pumping , metastable state, properties of laser, applications of lasers(No need of detailed study)Optical fiber , Construction , principle of wave propagation through the fibre, acceptance angle and numerical aperture, step index fiber and graded index fiber (Sections 14.3, 14.4, 14.4.1(a), 14.4.2, 22.1, 22.4, 22.7, 22.9, 22.10, 22.19, 22.20, 24.1 to 24.7, 24.8.1 to 24.8.3: Optics by Brijilal and Subrahmanyam 2006 edition)

Unit 3

4. Current electricity and magnetism **8 Hours**

Current and current density, expression for current density, drift velocity, ohm's law, electrical conductivity, potentiometer-principle , determination of resistance , calibration of ammeter, calibration of low range voltmeter, properties of diamagnets, paramagnets, and ferromagnets, magnetic moment, deflection magneto meter, Tan A position (Sections 6.1,6.2,6.4,7.2,15.6,15.7,15.8:Electricity and magnetism by R. Murugeshan 5th edition)

Unit 4

5. Elements of spectroscopy and x-ray diffraction **4 Hours**

Quantization of energy, different regions of electromagnetic spectra and spectroscopy associated with, Bragg's law, derivation, Bragg's x-ray spectrometer (Sections 1.2,1.3: Fundamentals of molecular spectroscopy 4th edition by Banwell, chapter 5-VII,VIII,IX : Solid State physics by S.O Pillai 6th edition)

6. Wave nature of particle **4 Hours**

De Broglie waves, De-Broglie wavelength, electron microscope, tunnel effect, scanning tunneling microscope (Sections 3.1,3.4,5.10: Modern physics by Arthur Beiser 6thedition)

Text Book

1. Properties of matter-J C Upadhyaya
2. Electricity and magnetism-Murukesan
3. Optics- Brijilal and Subrahmaniam
4. Modern physics-Arthur Beiser
5. Fundamentals of molecular spectroscopy-Banwell&Elaine Mcash

References

1. Properties of matter-D S Mathur
2. Electricity and magnetism –Arthur F Clip
3. Optics- AjoyGhatak
4. LASER Theory and application Thyagarajan & Ghatak

Mark distribution for setting Question paper.

Unit/ chapter	Title	Marks
1	Properties of matter	15
2	Fluid mechanics-viscosity	7

3	Current electricity and magnetism	18
4	Elements of spectroscopy and x-ray diffraction	9
5	Interference, laser physics , fiber optics	22
6	Wave nature of particle	8
*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
APH2C02 BASIC ELECTRONIC DEVICES AND CIRCUITS
36 Hours (Credits-2)

	Course Outcome	PSO	CL	KC	Class Sessions allotted
CO1	Understand the basic principles of rectifiers and dc power supplies	PSO3	U	C	8
CO2	Understand the principles of transistor	PSO3	U	C	10
CO3	Understand the working and designing of transistor amplifiers	PSO3	Ap	C, P	6
CO4	Understand the basic operation of Field Effect transistors	PSO3	U	C	6
CO5	Understand the basics of oscillators	PSO3	U	C	6

Unit 1 Rectifiers, Filters & Regulator **8 Hours**

Semiconductors – intrinsic & extrinsic, crystal diode rectifiers – half wave &full wave, ripple factor & efficiency, filter circuits – types, voltage regulation using zener diode, LED & photodiode

(Sections 8.1, 8.4, 8.8, 8.9, 9.7-9.13, 9.15, 9.17-9.22, 10.2, 10.4, 10.6, 10.7: Principles of Electronics by V.K. .Mehta &Rohit Mehta)

Unit 2 Transistor Fundamentals& Biasing **10 Hours**

Transistors,transistor as amplifier, configurations, input – output characteristics, current amplification factors & their relations, faithful amplification, transistor biasing, methods of biasing – base resistor method, biasing with feedback resistor, voltage divider bias.

(Sections 11.1-11.12, 12.1, 12.2, 12.7-12.10: Principles of Electronics by V.K. Mehta &Rohit Mehta)

Unit 3 Amplifier Classifications **6 Hours**

Single stage transistor amplifiers, phase reversal in CE configuration, multistage amplifiers, coupling methods – RC, transformer & direct, power amplifiers – class A, class B & class C

(Sections 13.1, 13.4, 13.5, 14.1, 14.3-14.5, 15.4: Principles of Electronics by V.K. Mehta &Rohit Mehta)

Unit 4 Field Effect Transistors **6 Hours**

FET – JFET & MOSFET, output characteristics, expression for drain current, parameters – ac drain resistance, trans-conductance, amplification factor.

(Sections 22.1-22.12, 22.18: Principles of Electronics by V.K. Mehta & Rohit Mehta)

Unit 5 - Oscillators **6 Hours**

Feedback – positive & negative, advantages of negative feedback, sinusoidal & non-sinusoidal oscillators, essentials of transistor oscillators, barkhausen criteria, types of oscillators – colpitts, hartley, phase shift, crystal oscillators.

(Sections 16.1, 16.4, 17.1, 17.2, 17.6-17.8, 17.10-17.13, 17.20: Principles of Electronics by V.K. Mehta & Rohit Mehta)

Text Book

1. Principles of Electronics by V.K. Mehta & Rohit Mehta, S Chand & Comp, New Delhi

References

1. Basic Electronics - Solid State by B.L. Thereja
2. Electronic Principles by Albert Paul Malvino
3. Basic Electronics and Linear Circuits by N.N. Bhargava, D.C. Kulshreshtha, S.C. Gupta
4. Electronic Principles – Devices & Circuits by M.L. Anand

Mark distribution for setting Question paper.

Unit/ chapter	**Title**	**Marks**
1	Rectifiers, Filters & Regulator	18
2	Transistor Fundamentals& Biasing	22
3	Amplifier Classifications	13
4	Field Effect Transistors	13
5	Oscillators	13
*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
APH3C03 DIGITAL INTEGRATED CIRCUITS
54 Hours (Credits-3)

	Course Outcome	PSO	CL	KC	Class Sessions allotted
CO1	Understand the fundamental principles of Logic circuits	PSO3	U	C	12
CO2	Understand the basic concepts of Logic Gate families	PSO3	U	C	15
CO3	Understand the working of flip flops, registers and counters	PSO3	U	C	15
CO4	Understand the working of data processing circuits	PSO3	U	C	12

Unit 1 Logic circuits – fundamentals **12 Hour**

Logic gates – inverter, OR, AND, timing diagram, universal gates – NAND & NOR, bubbled AND & OR, De-morgans theorems, Boolean relations and duals, SOP & POS, karnaugh map, pairs, quads, octets, simplifications.

(Sections 1.2-1.4, 1.6, 1.7, 2.1-2.6: Digital Principles and Applications by Albert Paul Malvino& Donald P. Leach)

Unit 2 Logic families **15 Hours**

Logic families – bipolar & MOS, 7400 & 5400 series, TTL gates – inverter, NAND & NOR, CMOS gates – inverter, NAND & NOR, TTL to CMOS & CMOS to TTL interface. (Sections 6.1, 6.2, 6.5, 7.1-7.3, 7.5, 7.6: Digital Principles and Applications by Albert Paul Malvino & Donald P. Leach)

Unit 3 Flip-flops, Registers & Counters **15 Hours**

RS flip-flop, clocked RS flip-flop, D flip-flop, edge triggered flip-flop, JK flip-flop, JK master slave flip-flop, Shift registers – types, asynchronous (ripple) counters, synchronous (parallel) counters, mod-n counter.

(Sections 8.1-8.4, 8.6, 8.7, 10.1-10.5, 11.1, 11.3, 11.4: Digital Principles and Applications by Albert Paul Malvino& Donald P. Leach)

Unit 4 Data processing circuits **12 Hours**

Multiplexers, de-multiplexers, decoder, encoder, X-OR gate, parity generator-checker, adders – half & full adder, controlled inverter, digital to analog converter, analog to digital converter.

(Sections 3.1-3.3, 3.6-3.8, 5.7, 13.1, 13.2, 13.5: Digital Principles and Applications by Albert Paul Malvino & Donald P. Leach)

Text Book

1. Digital principles and applications by Malvino & Leach 4thedn TMH

References

1. Digital fundamentals by Thomas Floyd
2. Modern digital electronics by R.P. Jain

Mark distribution for setting Question paper.

Unit/ chapter	**Title**	**Marks**
1	Logic circuits – fundamentals	18
2	Logic families	22
3	Flip-flops, Registers & Counters	22
4	Data processing circuits	17
*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
APH4C04 OP-AMP AND APPLICATIONS
54 Hours (Credits-3)

	Course Outcome	PSO	CL	KC	Class Sessions allotted
CO1	Understand the fundamental principles of Operational Amplifiers	PSO3	U	C	12
CO2	Understand and apply the basic concepts of Op-Amp configurations	PSO3	Ap	C, P	15
CO3	Understand the working of linear circuits and filters	PSO3	U	C	15
CO4	Understand the working of oscillators and comparators	PSO3	U	C	12

Unit 1 Operational amplifier – Fundamentals **12 Hours**

Differential amplifier – types, operational amplifier – characteristics, input offset voltage, CMRR, slew rate, gain bandwidth, ideal op-amp, and equivalent circuit.

(Sections 1.1-1.3, 2.1-2.3, 2.5, 3.2, 3.3, 3.4: Op-amps and Linear Integrated Circuits by Ramakant A. Gayakwad)

Unit 2 Op-amp Configurations **15 Hours**

Open loop configurations – differential, inverting and non-inverting, op-amp with negative feedback, voltage series feedback amplifier, voltage follower, voltage shunt feedback amplifier, virtual ground.

(Sections 4.1, 4.2, 4.3.1, 4.3.2, 4.3.8, 4.4.1, 4.4.2: Op-amps and Linear Integrated Circuits by Ramakant A. Gayakwad)

Unit 3 Linear applications & filters **15 Hours**

Summing, scaling and averaging amplifiers – inverting & non inverting configuration, integrator, differentiator, active filters – low-pass, high-pass, band-pass, band-reject, all-pass. (Sections 7.5.1, 7.5.2, 7.12, 7.13, 8.2, 8.3.1, 8.4.1, 8.5-8.10: Op-amps and Linear Integrated Circuits by Ramakant A. Gayakwad)

Unit 4 Oscillators & Comparators **12 Hours**

Oscillator principle, types – sine wave, square wave, triangular wave & saw tooth wave generators, basic comparator, zero crossing detector, Schmitt trigger, voltage limiters.

(Sections 8.11.1-8.11.3, 8.12, 8.15-8.17, 9.1-9.4, 9.7: Op-amps and Linear Integrated Circuits by Ramakant A. Gayakwad)

Text Book

1. Op-amps and Linear Integrated Circuits by Ramakant A. Gayakwad

References

1. Operational amplifiers and Linear Integrated Circuits by Robert Coughlin & Frederick F.
2. Operational amplifiers and applications by Subirkumar Sarkar S. Chand & Co.

Mark distribution for setting Question paper.

Unit/ chapter	**Title**	**Marks**
1	Operational amplifier – Fundamentals	18
2	Op-amp Configurations	22
3	Linear applications & filters	21
4	Oscillators & Comparators	18
*Total Marks **		79

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

LAB PROGRAMME FOR COMPLEMENTARY COURSES

APPLIED PHYSICS FOR INSTRUMENTATION

(Lab examination will be conducted at the end of 4th semester)

The minimum number of experiments for appearing examination is **75% of total 20 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 shall be 8, and a minimum of 6 questions in the Question paper shall be set for the Examination at the centre.

Semester 1 to 4 | Complementary Course V

APH4C05: PRACTICALS I

36 hours in each semester × 4 (Credit - 5)

	Course Outcome	CL	KC	Class Sessions allotted
CO1	Apply and illustrate the concepts of properties of matter, electricity, magnetism and optics through experiments	Ap	P	36
CO2	Apply and illustrate the concepts of rectifiers, amplifiers and oscillators through experiments	Ap	P	36
CO3	Apply and illustrate the concepts of Op-Amps fundamentals and applications through experiments	Ap	P	36
CO4	Apply and illustrate the logic gates, adders, counters and flip-flops through experiments	Ap	P	36

LIST OF EXPERIMENTS

1. Rigidity modulus –Torsion pendulum
2. Viscosity-Poiseuille's method, radius by vernier microscope
3. Potentiometer –calibration of a low range voltmeter
4. Deflection Magnetometer –Tan A position- moment & pole strength of a magnet
5. Numerical aperture of an optical fibre by semi conductor laser
6. Construction of full wave rectifiers
7. Single stage transistor amplifier – gain
8. CE transistor amplifier – frequency response
9. Colpitt's oscillator

10. RC phase shift oscillator
11. Inverting amplifier
12. Non-inverting amplifier
13. Voltage follower
14. Integrator
15. Differentiator
16. Realization of basic gates using NAND
17. Verification of De-Morgan's theorem
18. Half-adder using NAND
19. Decade counter
20. R S flip flop using NAND

Books of Study:

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

Reference book:

3. Practical Physics- S L Gupta & V Kumar

MODEL QUESTION PAPERS

B. Sc Applied Physics Core
SEMESTER 1

MODEL QUESTION PAPER 1

Name…….
Reg. No…….

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

(CBCSS-UG)

Core Course – Applied Physics: APH1B01 - 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 m_1 and m_2 separated by a thin rod of length l. the baton is thrown into air. Find the centre of mass and equation of motion for centre of mass of the baton

15. A 5kg mass moves under the influence of a force $F=(4t^2\mathbf{i}- 3t\mathbf{j})N$. It starts from the origin at t=0. Find its velocity and position at t=1s

16. 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 m_p 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)

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

21. 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 . 10 = 10)

MODEL QUESTION PAPER 2

Name…….
Reg. No…….

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

(CBCSS-UG)

Core Course – Applied Physics: APH1B01 - 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 '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 MI 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, F1= 5i+8j+7k and F2=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 . (b) Find the force on the P^{th} 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. $(1 * 10 = 10)$

B. Sc Applied Physics Core
SEMESTER 2

MODEL QUESTION PAPER 1

Name…….
Reg. No…….

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

(CBCSS-UG)

Core Course – Applied Physics: APH2B02 – MECHANICS II

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. 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 in air using Newton's model?

4. What are the two types of wave motion?

5. What is the Bandwidth time-interval product describing a pulse.

6. State Kepler's first law.

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 $\varepsilon = (r_{max} - r_{min}) / ((r_{max} + r_{min})$ 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 Foucault's 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. ($1 \times 10 = 10$)

MODEL QUESTION PAPER 2

Name…….
Reg. No…….

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

(CBCSS-UG)

Core Course – Applied Physics: APH2B02 – MECHANICS II

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. State the principle of equivalence.
2. What is a central force?
3. What is a Foucault's 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 accleration 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. ($1 \times 10 = 10$)

B. Sc Applied Physics Core
SEMESTER 3

MODEL QUESTION PAPER 1

Name…….
Reg. No…….

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

(CBCSS-UG)

Core Course – Applied Physics: APH3B03 - 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. What does the operator ∇ stand for in Cartesian coordinates?
2. Express the elemental displacements and volume in spherical polar coordinates.
3. Discuss the analogy between density of electric flux and intensity of electric field due to a point charge.
4. What is the advantage of scalar potential formulation in electrostatics?
5. Show that electric charge density inside a conductor is zero.
6. Get a relation between electric susceptibility and polarizability of a linear dielectric.
7. What is Lorentz' 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 vector potential.
11. How magnetic dipoles are generated in specimen placed in a magnetic field?
12. How volume bound current density J_b is related to susceptibility and free current density J_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 electric vectors.

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 constant K_2.

16. Discuss briefly about the bound currents in a magnetized medium.

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 the dielectric.

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 is switched off. (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 cylindrical conductor.

21. Briefly explain the domain theory and discuss the characteristics of ferromagnetic material with the help of hysteresis loop. ($1 \times 10 = 10$)

MODEL QUESTION PAPER 2

Name…….
Reg. No…….

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

(CBCSS-UG)

Core Course – Applied Physics: APH3B03 - 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 of cosines.
2. What is the Physical interpretation of gradient of a scalar field?
3. State Divergence theorem.
4. Derive differential form of Gauss's law in electrostatics.
5. Obtain Laplace's equation.
6. Draw a graph showing the variation of intensity of electric field due to a uniformly charged spherical conductor with distance.
7. Write the electrostatics boundary conditions regarding $\overline{D}$ and V.
8. Get the relation between electric susceptibility and dielectric constant of a linear dielectric medium.
9. How $\nabla \cdot \overline{B}$ leads to conclusion that magnetic monopoles cannot exist.
10. Derive cyclotron formula.
11. Show that no work is done by magnetic field, on a charged particle moving in it.
12. Explain the magnetic saturation of a ferromagnetic material based on competing magnetic domains? (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. Prove the fundamental theorem of *Curl* using the function $\bar{F} = (2xz + 3y^2)\hat{j} + 4yz^2\hat{k}$ and square surface of unit side with one corner coinciding with origin.

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

15. Describe polar and non polar dielectric materials.

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

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 the square.

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 of the rod. (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 the slab.

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

($1 \times 10 = 10$ marks)

B. Sc Applied Physics Core
SEMESTER 4

MODEL QUESTION PAPER - 1

Name…….
Reg. No…….

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

(CBCSS-UG)

Core Course – Applied Physics: APH4B04 - ELECTRODYNAMICS II

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. Write down the differential and integral forms of Faraday's law

2. Give Maxwell's modification of Ampere's law.

3. How refractive index of a medium can be obtained from basic electro-magnetic constants.

4. Explain polarization of electromagnetic waves.

5. Define intensity of e.m.waves and how it is related to Poynting vector.

6. Discuss the growth of current in a CR circuit?

7. What are the conditions for a moving coil galvanometer to be ballistic?

8. Define the r.m.s value of e.m.f and write how it is related to peak value of e.m.f.

9. Compare series LCR resonant circuit and parallel LCR resonant circuit.

10. Draw the circuit diagram for obtaining balance using Anderson's bridge.

11. What is an ideal constant voltage source?

12. State Thevenin's theorem (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-R circuit.

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 this time.

18. The time averaged Poynting vector of Sun's e.m. radiation received at the upper surface of earth's atmosphere, $S = 1.35 \times 10^3$ W/m^2. Assuming that waves are plane & sinusoidal what are the amplitudes of electric and magnetic fields.

19. A pure resistance of 100Ω 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 – Applied Physics: APH4B04 - ELECTRODYNAMICS II

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. Discuss Faraday's laws of electromagnetic induction.
2. Write down general wave equation. Give its solution.
3. Write the boundary conditions for $\bar{E}$, $\bar{B}$, $\bar{D}$ & $\bar{H}$, at a boundary between two different media.
4. What is radian pressure? Write relation connecting intensity and radiation pressure of an electromagnetic wave.
5. Write down Poynting theorem
6. Write down Maxwell's equations inside matter.
7. Discuss the growth of current in a L-R circuit?
8. Write down the characteristics of a dead beat moving coil galvanometer.
9. What is meant by the logarithmic decrement in a moving coil galvanometer?
10. What is the power factor in inductor-resistor series circuit?
11. What you mean by Q-factor in a series resonant circuit.
12. State superposition theorem. (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 the same.

15. How can a voltage source be converted into equivalent current source and vice versa.

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 of leakage.

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 that time?

19. Show that at maximum power transfer, efficiency is only 50%. (Ceiling – 30)

SECTION C – Essay type

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

20. Explain how Maxwell modified Ampere's theorem. Derive Maxwell's equation in matter.

21. Describe with theory, the Anderson's method to determine self inductance of a coil.

(1 × 10 = 10 marks)

B. Sc Applied Physics Core
SEMESTER 5

MODEL QUESTION PAPER - 1

Name…….
Reg. No…….

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

(CBCSS-UG)

Core Course – Applied Physics: APH5B06 - COMPUTATIONAL PHYSICS

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

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

3. Name the different data types in Python.

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

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

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

6. What is a list? How lists are different from tuples?

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

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

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

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's method?

12. What are the advantages of numerical methods over analytical methods? (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 in Python.

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's method.

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

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-Raphson method.

19. Write a program to simulate the motion of a body projected horizontally from a height on earth. (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's method.

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 at x=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 – Applied Physics: APH5B06 - COMPUTATIONAL PHYSICS
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. 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 is executed?

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

3. What is meant by indentation and what is its importance in Python?
4. Give an example for using if, elif , else statement.
5. Write a program to make a list of lists and convert it to an array.
6. Write a program to make a 3×3 matrix and multiply it by 5 and print the result.
7. Using polar () function write a program to plot a circle of radius 5 cm.
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 a list.
11. Illustrate file input and file output using an example.
12. Python has developed as an open source project. Justify this statement

(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's rule

14. Write a Python program to trace the path of a projectile moving through air and experiencing a resistive force proportional to the square of velocity.

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 of values.

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 functions in Python. (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 = 10 marks)

MODEL QUESTION PAPER - 1

Name…….
Reg. No…….

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

(CBCSS-UG)

Core Course – Applied Physics: APH5B07 – QUANTUM MECHANICS

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 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 harmonic oscillator

8. Describe quantum tunneling

9. Explain Zeeman effect

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

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 photoelectric equation

14. Describe the Frank – Hertz experiment

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 dependent one

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 energy emitted.

(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 Compton scattering

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 – Applied Physics:
APH5B07 – QUANTUM MECHANICS

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 photoelectric effect? Write down Einstein's photoelectric equation

2. Explain ultraviolet catastrophe

3. Compare Rutherford model of the atom with the Bohr model

4. Explain the probability interpretation of wave function

5. What is space quantization?

6. State and explain Heisenberg's uncertainty relation

7. Write down the Schrödinger equation for a free particle and explain its solution

8. Explain the motion of a particle incident on a potential energy step

9. What is Bohr magneton?

10. Explain the fine structure of Hydrogen spectrum

11. What are the properties of the azimuthal quantum number?

12. Explain the term probability amplitude (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 Compton effect

14. Write down the Schrodinger equation of the Hydrogen atom and explain the angular momentum quantum number.

15. Describe the quantum theory of motion of a particle in a two dimensional potential well.

16. Explain the theory of the quantum harmonic oscillator.

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 scattered electrons.

18. An electron is confined to a region of space by a spring-like force of force constant k = 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 Broglie waves. Certain ocean waves travel with a phase velocity of $v_p = \sqrt{\frac{g\lambda}{2\pi}}$. 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 dimensional box

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

(1 × 10 = 10 marks)

MODEL QUESTION PAPER - 1

Name…….
Reg. No…….

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION ……, 20……
(CBCSS-UG)

Core Course – Applied Physics:
APH5B08 - OPTICS

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. State Fermat's principle

2. What are the conditions for interference?

3. What is meant by coherence?

4. Write down the conditions for maxima and minima in reflected light for Newton's rings experiment.

5. Explain cosine law

6. Write the expression for intensity distribution in Fraunhofer diffraction by a circular aperture.

7. Define resolving power of a diffraction grating.

8. Mention any two differences between zone plate and a convex lens.

9. List out the differences between positive and negative crystals.

10. Explain the terms plane of vibration and plane of polarization.

11. Write any two applications of holography.

12. Give two differences between step index and graded index 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's principle.

14. Explain the colour of thin films

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 order spectrum.

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 is obtained?

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 polarization angle.

19. Calculate the least thickness of a calcite plate which would convert incident plane polarized light into circularly polarized light. Given $\mu_o = 1.658$, $\mu_e = 1.486$ for calcite and wavelength of light used is 5890 Angstrom. (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's interferometer

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 – Applied Physics:
APH5B08 - OPTICS

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. Why does ordinary light never form stable interference pattern?

2. Write the cosine law for interference by division of amplitude

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

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

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

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

7. Why half period zones are called so?

8. Differentiate between uniaxial and biaxial crystals and give an example for each

9. What is meant by circularly polarized light?

10. Explain the term birefringence

11. How is a hologram different from an ordinary photograph?

12. Define the term numerical aperture. (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's principle

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

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

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

17. Newton's rings are observed in reflected light of wavelength 5.9×10^{-7} m. The diameter of 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} dark ring.

18. Calculate the highest order of spectra with a plane transmission grating of 18000 lines per 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 for the fibre. (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 wavelength of light? ($1 \times 10 = 10$ marks)

MODEL QUESTION PAPER - 1

Name…….

Reg. No…….

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

(CBCSS-UG)

Core Course – Applied Physics:

APH5B09 – ELECTRONICS (Analog and Digital)

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. Derive the relation between α and β.

2. What is the peak inverse voltage?

3. Explain the stability factor for a transistor circuit.

4. Convert binary numbers 101010 and 111011 into decimal number.

5. Construct OR and AND gate by using NAND gate.

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

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

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

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

10. Represent the following Boolean expression by K map Y(A,B,C,D)=$(A + B + \bar{C})$ $(\bar{A} + \bar{C} + D)$.

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 is applied.

12. Give the Barkhausen condition for getting sustained oscillations. (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 neat diagram.

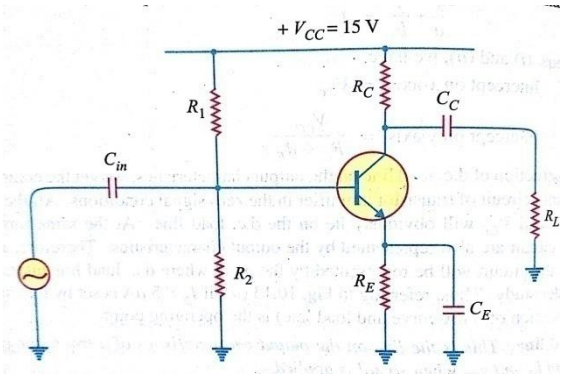
14. For a differential circuit, the input is sinusoidal voltage of peak value 10 mV and frequency 1KHz.R=100KΩ and C=0.1μF. Find output

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} = 0.7 V

i. Draw the dc load line

ii. Determine the operating point

iii. Draw ac load line



16. Explain 1's complement method of binary subtraction with example.

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

18. Explain Op-Amp integrator with a neat diagram.

19. Determine the output voltage for the op-amp circuit having V_{in}=2.5mv, R_i=2kΩ, R_f=200 kΩ and ±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 equivalent circuit.

21. Explain the working of Colpitt's oscillator and Hartley oscillator with neat diagram. and write down the equation to find frequency of both circuits. (1 × 10 = 10 marks)

MODEL QUESTION PAPER - 2

Name…….
Reg. No…….

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

(CBCSS-UG)
Core Course – Applied Physics:
APH5B09 - ELECTRONICS (Analog and Digital)

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 the faithful amplification?
2. Write down the mantissa and exponent of the number 242506800
3. Explain the working of Zener diode as a voltage stabilizer.
4. State De Morgan's law.
5. Convert the following decimal in to binary a)$(123.88)_{10}$ b)$(225)_{10}$ c)$(100.01)_{10}$
6. What is the need for bias stability in a transistor circuits?
7. What is XNOR gate? Draw circuit diagram with truth table
8. Explain the working of a voltage doubler.
9. What are the advantages of using transformer in rectifier circuit
10. Subtract 01000111 from 01011000
11. Discuss the advantages of negative feedback in Amplifiers.
12. How is a JK flip-flop made to Toggle? (Ceiling – 20)

Section B – Paragraph / Problem type.

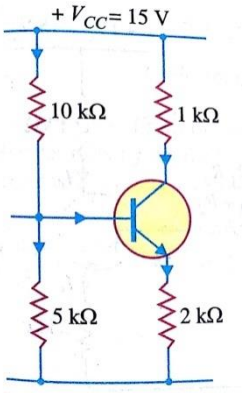
(**Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)**

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 power output
    iii. Dc output voltage

iv. Efficiency of rectification

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

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 voltage gain.

17. Explain the working of a RS flip-flop.

18. When negative voltage feedback is applied to an amplifier of gain 100, the overall gain falls to 50.

i)Calculate the fraction of the output voltage feedback.

ii) If this fraction is maintained, calculate the value of the amplifier gain required if the overall stage gain to be 75

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 ripple factor.

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

B. Sc Applied Physics Core
SEMESTER 6

MODEL QUESTION PAPER - 1

Name…….
Reg. No…….

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

(CBCSS-UG)

Core Course – Applied Physics:

APH6B10 – THERMODYNAMICS

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. Comment on the concept of temperature and heat

2. Distinguish between intensive and extensive coordinates

3. What is the significance of PV diagram?

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

5. What is internal energy?

6. What is thermal efficiency? Write its expression?

7. State Carnot's theorem and corollary?

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

9. Distinguish between Carnot's engine and irreversible engine?

10. What is enthalpy?

11. What are Helmholtz and Gibbs function? Write down the formulae?

12. Write down the Clausius-Clayperon equation and its applications? (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 Adiabatic process.

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

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

16. A Carnot's engine whose lower temperature heat (sink) is at 27 ^{0}C 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/degree mol).

18. Derive TdS equations?

19. What is a refrigerator? Explain the working of a refrigerator? (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 potential functions?

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

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

MODEL QUESTION PAPER - 2

Name…….
Reg. No…….

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION ……, 20……
(CBCSS-UG)
Core Course – Applied Physics:

APH6B10 – THERMODYNAMICS

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. State and explain Zeroth law of thermodynamics?

2. What is meant by quasi-static process?

3. What is entropy? Explain the entropy of reversible and irreversible processes?

4. State the Principle of increase of entropy?

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

6. Compare the slopes of adiabatic and isothermals?

7. What is latent heat?

8. Write short note on internal energy?

9. State and explain Carnot's theorem?

10. Distinguish between intensive and extensive properties of a thermodynamic system?

11. Draw the PV diagrams of thermodynamic processes?

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

(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. Explain the working of a Carnot's engine and derive the expression for efficiency?

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

17. Show that for a perfect gas $(\frac{\partial u}{\partial v})_T = 0$.

18. A Carnot's engine whose lower temperature reservoir is at 7 ^{0}C has an efficiency of 50%. It is desired to increase the efficiency to 70%. By how many degrees should the temperature of the high temperature reservoir be increased?

19. What is TS diagram? Discuss the TS diagram of isothermal and adiabatic processes? Find the efficiency of Carnot's engine using TS diagram? (Ceiling – 30)

SECTION C – Essay type

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

20. Derive the Maxwell's thermodynamic relations from thermodynamic potentials functions?

21. (a) What are isothermal and adiabatic processes?

(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 – Applied Physics:
APH6B11 – STATISTICAL PHYSICS, SOLID STATE PHYSICS, SPECTROSCOPY AND PHOTONICS

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. Distinguish between a microstate and a macrostate.

2. What are Bravais lattices? Give an example.

3. What is meant by unit cell? Give an example.

4. What is packing fraction?

5. Give the selection rules for rotational spectroscopy.

6. What is a symmetric top molecule? Give an example.

7. What is zero point energy of a harmonic oscillator?

8. Discuss the Born – Oppenheimer approximation.

9. What are hot bands?

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

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

12. What is stimulated emission? (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 body spectrum?

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

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

16. Explain the anharmonic vibration spectrum of a diatomic molecule

17. The bond length in HF molecule is 0.0927 nm. Calculate its rotational constant 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 Bragg reflection.

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 be 1.276 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 ideal gas.

21. Explain the structure and working of Bragg's X – ray spectrometer. ($1 \times 10 = 10$ marks)

MODEL QUESTION PAPER - 2

Name…….
Reg. No…….

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

(CBCSS-UG)

Core Course – Applied Physics:
APH6B11 – STATISTICAL PHYSICS, SOLID STATE PHYSICS, SPECTROSCOPY AND PHOTONICS

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 term distribution function.

2. What are Bosons? Give two examples.

3. Explain the term crystal lattice and basis.

4. Explain Bragg's law.

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

6. What is isotopic substitution?

7. Give the selection rules for vibration spectroscopy.

8. What is Morse curve?

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

10. Give any two applications of lasers.

11. Explain any two types of pumping mechanism.

12. What are Stokes' lines and anti-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 – Einstein statistics

14. Derive and explain Bragg's law

15. Explain the spectrum of a non – rigid rotator

16. Briefly explain the quantum theory of Raman scattering with a neat diagram
17. Find the energy in cm^{-1} of the photon absorbed when an NO molecule undergoes transition v = 0, J'' = 0 state to v = 1, J' = 1 state where v is the vibrational quantum number and J is the rotational quantum number. Assume that B is the same in both states. Given $\bar{\nu}_e = 1.904$ cm $^{-1}$ and $\chi_e = 0.00733$ and $r_{NO} = 0.1151$ nm
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 the molecule
19. Obtain the Miller indices of a plane with intercepts at a, (b / 2) and 3c in a simple cubic unit cell. (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 diatomic molecule
21. Explain, with necessary diagrams, the construction and working of a He- Ne Laser

($1 \times 10 = 10$ marks)

MODEL QUESTION PAPER - 1

Name…….
Reg. No…….

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

(CBCSS-UG)
Core Course – Applied Physics:
APH6B12 – NUCLEAR PHYSICS AND PARTICLE PHYSICS

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. Why do heavy nuclei have more neutrons than protons?

2. Comment on the property of nuclear force.

3. Explain why a fusion reactor requires a high particle density, a high temperature and a long confinement time?

4. Write a short note on radio isotope production in nuclear reaction.

5. Which are the three requirements to increase the probability of collision between the irons that would result in fusion?

6. Explain the terms particle and antiparticle.

7. Write a short note on natural radio activity.

8. What do you mean by resonance particle?

9. What is the limitation of linear accelerator?

10. Draw neat diagram and Write essential part of Scintillation counter.

11. Write the theory Betatron.

12. What is the working principal of Ionization chamber? (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 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 binding energies?

15. Explain briefly the application of nuclear physics?

16. Discuss the Quark model?

17. Discuss briefly low energy reaction kinematics?

18. Discuss the working of Proton synchrotron?

19. Write the working of Photographic plate? (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 electrostatic generator?

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

MODEL QUESTION PAPER - 2

Name…….
Reg. No…….

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

(CBCSS-UG)
Core Course – Applied Physics:
APH6B12 – NUCLEAR PHYSICS AND PARTICLE PHYSICS

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. Why the nuclei are so small compared to the atom?

2. What is mean by binding energy of the atoms?

3. What are the applications of nuclear physics?

4. Mention any two conservation laws in radioactive decay?

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 and neutrinos.

7. List the four families of elementary particles.

8. What do you mean by delayed neutrons?

9. What is mean by particle acceleration

10. Briefly given the working of Cosmotron.

11. What are the advantages of GM Counter?

12. What is the limitation of Bubble Chamber? (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 decay processes.

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 in stars?

16. Discuss briefly three different types of fission reactors.

17. Write a short note on elementary particle interactions and decays.

18. Discuss the working principle of Van de Graff electro statics generator.

19. Discuss the working of Ionization chamber. (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 energy formula.

21. Explain Radioisotope production in nuclear reactions. Discuss the main features of nuclear fusion reactors ($1 \times 10 = 10$ marks)

MODEL QUESTION PAPER - 1

Name…….
Reg. No…….

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

(CBCSS-UG)
Core Course – Applied Physics:

APH 6B13 – RELATIVISTIC MECHANICS 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. State the postulates of special relativity

2. What are Galilean transformations?

3. Explain length contraction.

4. What is the concept of simultaneity in relativistic mechanics?

5. Describe the relativistic Doppler Effect.

6. State and explain the principle of equivalence.

7. Explain the concept of dark matter.

8. What is meant by the Chandrasekhar limit?

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

10. Write on the internal structure of the Sun.

11. State and explain Hubble's law.

12. What are pulsars? (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 time dilation

14. Briefly describe the Hertzsprung – Russell diagram

15. Describe the classification of galaxies

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 classical result.

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

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

SECTION C – Essay type

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

20. Obtain the Lorentz transformation equations.

21. Describe the various mechanisms possible in the death of star. ($1 \times 10 = 10$ marks)

MODEL QUESTION PAPER - 2

Name…….
Reg. No…….

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

(CBCSS-UG)

Core Course – Applied Physics:

APH6B13 – RELATIVISTIC MECHANICS 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. Write down and explain the Lorentz transformation equations.
2. What is time dilation?
3. Explain relativistic addition of velocities.
4. Why the speed of light is considered the ultimate speed?
5. Explain the variation of mass with velocity.
6. Write down two experimental tests of the general theory of relativity.
7. What are neutron stars?
8. What is meant by Cosmic Microwave Background Radiation?
9. Explain the terms (a) apparent magnitude (b) absolute magnitude.
10. Write on the proton – proton chain reaction.
11. What is the relation between stellar parallax and distance?
12. Describe gravitational lensing. (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 energy relation.

14. Briefly describe (a) globular clusters (b) planetary nebulae.

15. Describe Cepheid variables and their period – luminosity relation.

16. Explain the twin paradox.

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 before decaying?

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 two particles?

19. Obtain the relation between relativistic momentum and energy. (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 – Russell diagram. ($1 \times 10 = 10$ marks)

MODEL QUESTION PAPER - 1

Name…….
Reg. No…….

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

(CBCSS-UG)
Core Course – Applied Physics:

APH6B14 (EL1) – OP-AMP AND DIGITAL INTEGRATED CIRCUITS

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. Draw the ideal voltage transfer curve of the 741 op amp.
2. Define CMRR of op amp. What is the CMRR of an ideal op amp?
3. Give an estimate value of the open loop gain of the 741 op amp. How can the gain be reduced for linear applications?
4. What is virtual ground?
5. What is the function of pins 1 and 5 of the 741 op amp?
6. What is fan out?
7. Draw the output voltage window of standard TTL circuits.
8. What happens if a terminal of a TTL input circuit is left open?
9. Give the power dissipation & time delay of (i) Standard TTL, (ii) Low power Schottky TTL circuits.
10. Write equations of input resistance & output resistance with feedback of an inverting amplifier using op amp.
11. Give the device number for (i) standard TTL NAND gate, (ii) Low power Schottky NOR gate.
12. What is voltage follower? (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 of an inverting amplifier using op amp 741 IC.

14. With the help of a diagram explain the TTL NAND gate.

15. Describe the square wave generator using op amp.

16. Using an op amp, design a circuit with input voltages having values V_1, V_2 & V_3 such that the output is given by the expression: $V_O = 3V_1-4V_2+7V_3$. Given $R_f = 1K\Omega$.

17. Design an op amp ideal integrator which integrates sine wave signals from frequency 100 Hz to 10 KHz.

18. Design a low pass filter with cut off frequency 1KHz and pass band gain of 2.

19. Explain a CMOS inverter. (Ceiling – 30)

SECTION C – Essay type

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

20. With the help of a circuit diagram, explain instrumentation amplifier. How can this amplifier be used to measure temperature?

21. Explain the TTL parameters. Differentiate between standard TTL, low power TTL, high power TTL & Schottky TTL circuits in terms of propagation delay, power consumption & input & output profiles. ($1 \times 10 = 10$ marks)

MODEL QUESTION PAPER - 2

Name…….
Reg. No…….

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION ……, 20……
(CBCSS-UG)

Core Course – Applied Physics:

APH6B14 (EL1) – OP-AMP AND DIGITAL INTEGRATED CIRCUITS

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. Draw the pin diagram of the 741 op amp.
2. Define CMRR of op amp. What is the CMRR of an ideal op amp?
3. Give an estimate value of the open loop gain of the 741 opamp. How can the gain be reduced for linear applications?
4. What is virtual ground?
5. What is the function of pins 1 and 5 of the 741 op amp?
6. What is fan out?
7. Draw the input voltage window of Low power TTL circuits.
8. What happens if a terminal of a CMOS input circuit is left open?
9. Give the power dissipation & time delay of (i) High power TTL, (ii) Schottky TTL circuits.
10. Write equations of input resistance & output resistance with feedback of an inverting amplifier using op amp.
11. Give the device number for (i) standard CMOS NOR gate, (ii) Low power Schottky NOT gate.
12. Draw the equivalent circuit of a 741 op amp. (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 of a differentiator using op amp 741 IC.

14. With the help of a diagram do not explain the CMOS NOR gate.

15. Describe the triangular wave generator using op amp.

16. For an inverting amplifier, R_1=470Ω, R_F=4.7kΩ. An input voltage of 10mV is applied. Find the exact value of output voltage.

17. Design an opamp ideal differentiator which integrates sine wave signals from frequency 10 Hz to 10KHz.

18. Design a high pass filter with cut off frequency 1KHz and pass band gain of 2.

19. Explain open collector configuration. Why should the outputs of two TTL circuits never be connected together? (Ceiling – 30)

SECTION C – Essay type

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

20. With the help of a circuit diagram, explain first order low pass & high pass filters. How these filters are converted to 2^{nd} order filters?

21. Explain the TTL NAND and NOR gates. Draw the output & input profiles of standard TTL circuits. ($1 \times 10 = 10$ marks)

MODEL QUESTION PAPER - 1

Name…….
Reg. No…….

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

(CBCSS-UG)

Core Course – Applied Physics:
APH6B14 (EL2) – MICROPROCESSOR AND MICROCOMPUTER SYSTEM

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 multiplexing?
2. Add the binary nos. 10101110 and 01110101. Verify your answer by using binary to decimal conversion
3. Discuss why the interrupt controller is required? Discuss the interrupt controller 8259?
4. What is meant by ALU
5. What do you mean by opcode and operand?
6. What is a Timing diagram?
7. Explain implicit addressing mode
8. What is stalk
9. What do mean by BCD
10. Convert $(11001)_2$ to decimal
11. Convert $(A54C)_{16}$ to binary
12. Explain hardware and firmware. 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 different addressing modes of Intel 8085

14. Give the functions of following8085signals:-a) IO/Mb)WR

15. Distinguish between IC,MC and T states

16. Draw and explain the timing diagram for opcode fetch

17. Show the bit position of flag register if the flags are S=1, Z=0, AC=1, P=0, CY=0.

18. Convert $(11011011.11011)_2$ to decimal and hexadecimal numbers

19. Distinguish between unconditional jump and conditional jump instructions (Ceiling – 30)

SECTION C – Essay type

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

20. Explain Intel 8085 with a neat block diagram.

21. Explain arithmetic and data transfer group of instructions. ($1 \times 10 = 10$ marks)

MODEL QUESTION PAPER - 2

Name…….
Reg. No…….

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

(CBCSS-UG)
Core Course – Applied Physics:

APH6B14 (EL2) – MICROPROCESSOR AND MICROCOMPUTER SYSTEM

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 the function of temporary registers of the 8085processor?

2. Define the term word length of a computer.

3. Distinguish between hardware and software

4. What is Register addressing mode?

5. Define instruction cycle

6. What is meant by signed magnitude in digital systems?

7. Give two examples for data transfer group of instructions

8. Give any two logical instructions and explain their meaning.

9. Give a note about HOLD & HLDA instructions

10. What is the purpose of the instruction DAA?

11. Write a short note on stack. What is called LIFO?

12. What is interfacing? (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 program status word?

14. What is multiplexing?

15. Explain how PUSH and POP instructions are executed.

16. What is meant by immediate addressing mode of 8085?

17. Describe the bus structure of 8085processor

18. Explain the arithmetic group of instructions of Intel 8085 with examples

19. Discuss the conversion of decimal fraction to binary fraction. Convert 0.7 into its four bit binary equivalent (Ceiling – 30)

SECTION C – Essay type

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

20. Briefly describe the general purpose and special purpose registers of Intel8085

21. Define timing diagram. Sketch and explain the timing diagram for memory read operation ($1 \times 10 = 10$ marks)

Applied Physics Open Courses
SEMESTER 5

MODEL QUESTION PAPER - 1

Name…….
Reg. No…….

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

(CBCSS-UG)
Open Course – Applied Physics:

APH5D01 (1) - **NON CONVENTIONAL ENERGY SOURCES**

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. Define solar constant.

2. What is the working principle of a pyranometer?

3. Explain the principle behind the working of a solar cooker.

4. What is the use of a solar green house?

5. What are the factors that determine the output from a wind energy converter?

6. Write any four disadvantages of wind energy.

7. What are the basic components of a tidal power plant?

8. List any two advantages of geothermal energy.

9. What do you mean by biomass?

10. Give one example each for a primary and a secondary battery.

11. What do you mean by energy efficiency of a battery?

12. Write four applications of a fuel cell. (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 solar furnace.

14. What do you mean by photovoltaic effect? List three advantages of photovoltaic power conversion system.

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 hydrothermal sources.

18. What is the origin of source of energy in waves? Discuss a method for converting wave energy into mechanical energy.

19. Discuss the source of geothermal energy. (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 schematic diagram. What are the merits of a solar water heater over a conventional water heater?

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 energy conversion system. ($1 \times 10 = 10$ marks)

MODEL QUESTION PAPER - 2

Name…….
Reg. No…….

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION ……, 20……
(CBCSS-UG)

Open Course – Applied Physics:

APH5D01(1) - **NON CONVENTIONAL ENERGY SOURCES**

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. Distinguish between direct and diffuse components of solar radiation.
2. What are the instruments used for measuring solar radiation and sun shine?
3. List four merits of a solar cooker.
4. List any four advantages of a solar furnace.
5. What are the causes for local winds?
6. Give four advantages of wind energy utilization.
7. What are the four sources of energy available from oceans?
8. What are the essential parts of a tidal power plant?
9. What are the environmental benefits of use of biomass?
10. What is an electrochemical cell?
11. What are the main uses of a storage battery?
12. Write down the problems associated with storage of hydrogen fuel in motor vehicles.

(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 neat diagram.

14. What are the essential parts of a photovoltaic system? What are the basic processes involves in a solar cell.

15. Draw the schematic diagram of a horizontal axis wind mill indicating the essential parts.

16. Write briefly about liquid and gaseous biofuels.

17. Write briefly on geothermal sources of energy.

18. List any four limitations of tidal power generation.

19. List the advantages and disadvantages of a fuel cell. (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 × 10 = 10 marks)

MODEL QUESTION PAPER - 1

Name…….
Reg. No…….

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

(CBCSS-UG)

Open Course – Applied Physics:

APH5D01(2) - **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 longitude and latitude.

2. What is meant by perihelion?

3. What is Kuiper belt?

4. Define the astronomical unit of distance.

5. What is meant by equinox?

6. State and explain Hubble's law.

7. What is Cosmic Microwave Background Radiation?

8. Describe neutron stars.

9. What are the advantages of reflecting telescopes?

10. Describe the formation of seasons on Earth.

11. What is meant by supernova?

12. Discuss the main features of the planet 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 lunar eclipses.

14. Explain the proton – proton chain reaction.

15. Briefly explain (a) white dwarf (b) comet.

16. Explain the parallax method of distance measurement.

17. Explain the important regions of the HR diagram.

18. Derive the relation between absolute luminosity and apparent luminosity.

19. Discuss elliptical and spiral galaxies. (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 the sun.

21. Describe the theory of planetary formation in the solar system. ($1 \times 10 = 10$ marks)

MODEL QUESTION PAPER - 2

Name…….

Reg. No…….

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

(CBCSS-UG)

Open Course – Applied Physics:

APH5D01(2) - **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 term solstice

2. What is meant by perigee and apogee?

3. What is Asteroid belt?

4. Define and explain absolute luminosity of a star

5. What are Cepheid variables?

6. Explain quasars

7. Compare astronomy and astrology

8. What is meant by the term black hole?

9. What are the different types of telescopes?

10. Describe the corona of the sun

11. What is meant by solar flare?

12. Discuss the main features of the planet Saturn. (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 Chandrasekhar limit

14. What is the main energy production mechanism in stars?

15. Briefly explain (a) photosphere (b) chromospheres

16. Explain how the scientific method is applied in Astronomy

17. Describe the main features of the Big Bang theory

18. Derive the Pogson's relation

19. Discuss the classification of galaxies. (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 of stars

21. Explain the Hertzsprung – Russell diagram and describe its major regions

(1 × 10 = 10 marks)

MODEL QUESTION PAPER - 1

Name…….

Reg. No…….

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

(CBCSS-UG)

Open Course – Applied Physics:

APH5D01(3) - ELEMENTARY MEDICAL PHYSICS

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 an electromyograph.
2. Write the value of Planck's constant.
3. What are ions?
4. Give an example of non-ionizing radiation.
5. What is REM/
6. What are evoked potentials?
7. What is ' CT' in medical imaging .
8. What are tracers in diagnostic applications?
9. What is radioactivity?
10. Who discovered X-rays.
11. What is the unit of frequency of sound waves?
12. What are ultrasonic waves? (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 of them.

14. Compare photoelectric effect and Compton Effect.

15. What is piezoelectric effect?

16. Write a note on conventional sources of radiation.

17. Discuss cardiac cycle and arrhythmias.

18. Discuss the units of radiations. What is radiation protection?

19. Write the properties of X-ray. What is X-ray attenuation in imaging? (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 nuclear medicines..

21. Discuss the generation and detection of ultrasound. ($1 \times 10 = 10$ marks)

MODEL QUESTION PAPER - 2

Name…….

Reg. No…….

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

(CBCSS-UG)

Open Course – Physics: Applied Physics:

APH5D01(3) - ELEMENTARY MEDICAL PHYSICS

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. State the three forms of radioactive emissions.
2. Define the curie.
3. What is Photo-electric effect?
4. What is Comption Scattering?
5. What is an electroencephalogram (EEG).
6. What is an electromyogram (EMG)?
7. What is ‘bradycardia’?
8. What are X-rays?
9. What are ultrasonic waves?
10. What is Planck’s constant?
11. What is the difference between an atom and an ion?
12. What is PET? (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 cardiac cycle.

14. Explain the term 'the blood pressure is 120/80 mm Hg '.

15. How are X-rays produced?

16. What is fluoroscopy?

17. Discuss the artifacts on the ECG trace.

18. Write a summary of the history of medical imaging.

19. Discuss X-ray attenuation in X-ray imaging. (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. ($1 \times 10 = 10$ marks)

B. Sc Applied Physics Complementary
SEMESTER 1 & 2

MODEL QUESTION PAPER 1

Name…….

Reg. No…….

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

(CBCSS-UG)

Complementary Course – Applied Physics:

APH1C01 – GENERAL AND APPLIED PHYSICS

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 Poisson's ratio? What are its limits?

2. What are I- Form girders?

3. What is velocity gradient?

4. What is critical velocity?

5. What are current and current density?

6. Write four properties of paramagnetic substances.

7. Write the different regions of electromagnetic spectrum.

8. What is interference?

9. What are coherent sources?

10. Write the properties of laser.

11. What is a torsion pendulum?

12. What are matter waves? (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 principle of potentiometer.

14. Obtain an expression for magnetic moment of a magnet kept in Tan-A position in a deflection magnetometer.

15. Obtain an expression for the resultant amplitude due to superposition of two sinusoidal waves.

16. What is tunnel effect? Explain scanning tunneling microscope.

17. Explain spontaneous and stimulated emissions.

18. A steel wire of 1mm radius is bent to form a circle of 10cm radius. What is the bending moment and the maximum stress if $Y = 2X10^{11}\ N/m^2$

19. 19. A liquid is flowing through a 25cm long tube of 1mm internal diameter due to a pressure of 10cms of mercury. Calculate the volume of liquid flowing out in one minute.

(Ceiling – 30)

SECTION C – Essay type

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

20. Derive Bragg's law for X-ray diffraction. Explain Bragg's spectrometer.

21. Explain acceptance angle and numerical aperture. Obtain an expression for numerical aperture for an optical fibre. ($1 \times 10 = 10$ marks)

MODEL QUESTION PAPER 2

Name…….

Reg. No…….

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

(CBCSS-UG)

Complementary Course – Applied Physics:

APH1C01 – GENERAL AND APPLIED PHYSICS

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 Young's modulus.

2. Is rubber or steel more elastic? Why?

3. What is meant by streamline flow?

4. State and explain Ohm's law?

5. How a deflection magnetometer is arranged in Tan A position?

6. Explain Bragg's law.

7. Explain superposition principle in interference of light.

8. Write four application of laser?

9. What is a graded index fiber?

10. What is population inversion?

11. Write four properties if ferromagnetic substance.

12. Explain matter waves? (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 an expression for period of a torsion pendulum.

14. Obtain an expression for numerical aperture of an optical fibre.

15. Explain working of an electron microscope.

16. Describe Bragg's spectrometer.

17. Obtain an expression for bending moment.

18. Two waves having intensities in the ratio 1:9. Find the ratio of the intensity at minima to that at maxima.

19. What is wavelength of the wave associated with an electron having kinetic energy 100 ev.

(Ceiling – 30)

SECTION C – Essay type

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

20. Explain the principle of a potentiometer. Describe the experiment to determine unknown resistance using potentiometer.

21. Derive Poiseuille's formulae for steady flow of a liquid through a narrow tube.

($1 \times 10 = 10$ marks)

MODEL QUESTION PAPER - 1

Name…….

Reg. No…….

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

(CBCSS-UG)

Complementary Course – Applied Physics:

APH2C02 – BASIC ELECTRONIC DEVICES AND CIRCUITS

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 knee and breakdown voltage of a p-n junction diode?

2. What is meant by ripple factor?

3. Name the different types of passive filters.

4. Describe the different types of transistor configurations?

5. Write any two advantages of voltage divider biasing method?

6. Write the expressions for current amplification factors α and β.

7. Describe the concept of phase reversal in CE configuration.

8. What is class B power amplifier?

9. What do you mean by pinch off voltage in JFET?

10. Write the expressions for ac drain resistance and trans-conductance in JFET

11. Differentiate between positive and negative feedback?

12. What do you mean by Barkhausen criteria? (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 of a π filter.

14. Describe the working of a photodiode.

15. Derive the relationship between current amplification factors α, β and γ.

16. Describe the different coupling methods used in multi stage amplifiers

17. Explain the working of a colpitt's oscillator.

18. Explain the working of a JFET and draw the output characteristics

19. An ac supply of 230 V is applied to a half wave rectifier circuit through a transformer of turn ratio 10:1. Find the (i) output dc voltage (ii) peak inverse voltage. Assume the diode to be ideal. (Ceiling – 30)

SECTION C – Essay type

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

20. Derive the expression for ripple factor for a half wave rectifier.

21. Explain the working of a CE amplifier. Also discuss about the frequency response curve. ($1 \times 10 = 10$ marks)

MODEL QUESTION PAPER - 2

Name…….

Reg. No…….

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

(CBCSS-UG)

Complementary Course – Applied Physics:

APH2C02 – BASIC ELECTRONIC DEVICES AND CIRCUITS

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 intrinsic and extrinsic semiconductor?

2. Mention any two advantages of full wave rectifier over half wave rectifier?

3. What is peak inverse voltage (PIV)?

4. What is a transistor and why it is called so?

5. Describe Q-point in transistor output characteristic curve?

6. Describe the term stability factor

7. Differentiate between voltage and power amplifiers

8. What is class C power amplifier?

9. What is I_{DSS} in JFET?

10. What is MOSFET?

11. What are the advantages of negative feedback?

12. What is emitter follower? (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 how zener diode can be used as voltage regulator

14. Explain the working of an LED. Mention its advantages

15. Describe in detail the different biasing methods

16. Draw the input and output characteristics of CE transistor configuration

17. Explain the working of a phase shift oscillator

18. Describe in detail dc and ac load lines

19. A half wave rectifier is used to supply 50 V dc to a resistive load of 800Ω. The diode has a resistance of 25Ω. Calculate ac voltage required. (Ceiling – 30)

SECTION C – Essay type

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

20. Derive the expression for efficiency of a full wave rectifier.

21. What is piezo electric effect? Explain how crystal oscillators work. (1 × 10 = 10 marks)

B. Sc Applied Physics Complementary
SEMESTER 3 & 4

MODEL QUESTION PAPER - 1

Name…….

Reg. No…….

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

(CBCSS-UG)

Complementary Course – Applied Physics:

APH3C03 – DIGITAL INTEGRATED CIRCUITS

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 are Boolean relations and their duals?

2. Differentiate between bipolar and MOS families of logic circuits

3. Explain the working of an X-OR gate

4. Describe the working of a full-adder

5. What is a multiplexer?

6. What is an encoder?

7. Explain the use of parity generators

8. What is meant by toggling?

9. What is meant by fan-in and fan-out?

10. What is merged transistor logic?

11. Explain the term propagation delay in logic circuits

12. What is Schottky TTL? (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 and prove De-Morgan's theorems.

14. Explain the working of a TTL inverter.

15. Describe the working of a D-flip-flop.

16. Explain the working of a serial-in serial-out shift register.

17. Explain the working of an asynchronous counter.

18. Explain how TTL to CMOS interfacing can be done?

19. Using Boolean relation prove $A.B + \bar{A}.B + \bar{A}.\bar{B} = \bar{A} + B$. (Ceiling – 30)

SECTION C – Essay type

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

20. Explain the working of TTL NAND & NOR gates.

21. Explain the working of a JK Master Slave flip-flop. (1 × 10 = 10 marks)

MODEL QUESTION PAPER - 2

Name…….

Reg. No…….

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

(CBCSS-UG)

Complementary Course – Applied Physics:

APH3C03 – DIGITAL INTEGRATED CIRCUITS

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. Why universal gates are called so?

2. Differentiate 7400 and 5400 series of digital IC's

3. Explain the working of an X-NOR gate

4. Describe the working of a half-adder

5. What is a de-multiplexer?

6. What is a decoder?

7. What are synchronous and asynchronous logic inputs?

8. What is called racing?

9. What is BiCMOS?

10. Differentiate between active and passive pull up

11. Explain the term figure of merit

12. Briefly describe saturated and non-saturated bipolar logic families? (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 Karnaugh map and explain its deduction process.

14. Explain the working of a CMOS inverter.

15. Describe the working of an edge triggered flip-flop.

16. Explain the working of a parallel-in parallel-out shift register.

17. Explain the working of a synchronous counter.

18. Explain how CMOS toTTL interfacing can be done?

19. Using Boolean relation prove $A + \bar{A}.B + A.\bar{B} = A + B$. (Ceiling – 30)

SECTION C – Essay type

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

20. Explain the working of CMOS NAND & NOR gates

21. Explain the working of a Digital to Analog Converter (DAC) (1 × 10 = 10 marks)

MODEL QUESTION PAPER - 1

Name…….

Reg. No…….

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

(CBCSS-UG)

Complementary Course – Applied Physics:

APH4C04 – OP-AMP AND APPLICATIONS

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 an op-amp?

2. What is meant by input offset voltage?

3. What is common mode rejection ratio (CMRR)?

4. What do you mean by unity gain bandwidth?

5. Mention two advantages of closed loop op-amp configurations over open loop?

6. What are the advantages of active filters over passive filters?

7. Differentiate between narrow and wide band pass filters

8. What is meant by Roll-off rate?

9. What are inverting and non-inverting inputs of an op-amp?

10. What is meant by precision type op-amp?

11. In op-amp 741SC, what does S stands for?

12. What is swamping resistor? (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 follower and its uses.

14. Explain the working of a summing amplifier.

15. Describe the working of an integrator.

16. Explain the working of Schmitt trigger.

17. Explain the working of a band-pass filter.

18. Describe in detail about zero crossing detectors.

19. Design a phase shift oscillator for a frequency of 200 Hz. (Ceiling – 30)

SECTION C – Essay type

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

20. Derive the expression for gain with feedback for an op-amp inverting amplifier.

21. Explain the working of a square wave oscillator. Also explain the conversion of this into triangular wave generator. ($1 \times 10 = 10$ marks)

MODEL QUESTION PAPER - 2

Name…….

Reg. No…….

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

(CBCSS-UG)

Complementary Course – Applied Physics:

APH4C04 – OP-AMP AND APPLICATIONS

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 differential amplifier?

2. What is meant by supply voltage rejection ratio (SVRR)?

3. What is slew rate?

4. What are the features of an ideal op-amp?

5. Describe the concept of virtual ground

6. What is meant by Butterworth response?

7. For what purpose all pass filters are used in electronic circuits?

8. What are comparators?

9. What is offset minimizing resistor?

10. Differentiate between commercial and military grade op-amps

11. Explain the use of emitter follower in multistage amplifier

12. Explain the concept of constant current source? (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 different types of differential amplifiers.

14. Explain the working of an averaging amplifier.

15. Describe the working of a differentiator.

16. Explain the working of a second order high-pass Butterworth filter..

17. Explain the working of a band-reject filter.

18. What are voltage limiters? Explain.

19. Design a second order low-pass filter at a high cut off frequency of 1 KHz. (Ceiling – 30)

SECTION C – Essay type

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

20. Derive the expression for gain with feedback for an op-amp non-inverting amplifier.

21. Differentiate sinusoidal and non-sinusoidal oscillators and explain the working of a sine wave oscillator. ($1 \times 10 = 10$ marks)