VIMALA COLLEGE (AUTONOMOUS)

(NAAC Re-accredited(3rd Cycle): A Grade, CGPA-3.50)

College with potential for Excellence

(Affiliated to University of Calicut)

B.Sc. DEGREE PROGRAMME

IN

PHYSICS

(Choice Based Credit and Semester System -VCCBCSS)

SCHEME FOR
CORE, COMPLEMENTARY AND OPEN COURSES

(2017 ADMISSION ONWARDS)

VIMALA COLLEGE
ENGINEERING COLLEGE P O, THRISSUR
KERALA- 680009
INDIA

Board of Studies : Physics & Computer Science

Vimala College,Thrissur

Chairperson

Dr.Sr.Ritty J.Nedumpara
Associate Professor and HOD of Physics
Vimala College, Thrissur Mob.9497073225

University Nominee:

Dr.Rajesh R
Dept of Computer Science Mob.9446265997
Sree Narayana Gurukulam College of Engineering
Kolencherry

Members from the Department

Dr.Malini.K.A
Assistant Professor of Physics,
Vimala College ,Thrissur Mob.9495220673

Dr.Mini Krishna K
Assistant Professor of Physics,
Vimala College ,Thrissur Mob.9495381789

Sr.Ani Davis K
Assistant Professor of Computer Science,
Vimala College ,Thrissur Mob.9496135711

Subject Experts

Dr.V.P.Joseph
Associate Professor
Dept of Physics
Christ College,Irinjalakuda Mob.9447877760

Dr.Sonia Sunny
Associate Professor
Dept of Computer Science
Prajothi Nikethan, Puthukkad Ph.04802659599

Representative from Industry:

Sri,Christo George Kattokkaren,
Chairman& Managing Director
Hykon India.Ltd, Thrissur Mob.9846032117

Meritorious Alumnae

Dr.Reena Mary A.P
Assistant Professor,Dept of Physics ,
Govt.Victoria College, Palghat Mob.9495840114

AIMS AND OBJECTIVES OF B Sc PHYSICS PROGRAMME

Science has an important role in development of technology and they can be considered as two sides of the same coin. Hence development of science has a significant role in society. Proper science education is necessary to impart scientific temper to the society. All science undergraduate programmes are designed to instil scientific knowledge among the students. The syllabi for UG science programmes are prepared with a view to equipping the students with the potential to contribute to academic and professional environments. The curriculum is restructured, by universities giving emphasis to various aspects such as the creativity of students, knowledge of current developments in the discipline, awareness of environmental impacts due to the development of science and technology, and the skills essential for handling equipment and instruments in laboratories and industries..

UG programme in Physics is also designed to provide sound knowledge and understanding of physics to undergraduate students. It is aimed to provide education in physics of the highest quality and to generate a solid foundation in all aspects of physics. The programme is framed so as to bridges the gap between the plus two and post graduate levels of physics. It is providing a more complete and logical framework in almost all areas of basic physics. The syllabi of UG Physics programme is also aimed to show a broad spectrum of modern trends in physics and to develop experimental, computational and mathematical skills of students. The syllabi will help students in understanding links of Physics to other disciplines. The programme will also help to impart the skills required to gather information from resources, use them and to equip the students in methodology related to physics.

The broad objective of the curriculum is to enable students to

- understand basic facts and modern concepts in physics so as to develop interest in the study of physics as a discipline.
- acquire the knowledge of terms, facts, concepts, processes techniques, principles and applications of the subject
- To develop problem solving skills

- appreciate the discipline of Physics
- create inquisitiveness towards advanced physics and developments therein
- approach science with enhanced curiosity, creativity and reasoned scepticism

By the end of the first year (2nd semester), the students should have attained a common level in basic mechanics, properties of matter, a secure foundation in mathematics and other relevant subjects to complement the core for their future courses and developed their experimental and data analysis skills through a wide range of experiments through practical at laboratories. By the end of the second year (fourth semester), the students should have been introduced to the core concepts of mechanics and electrodynamics in addition to powerful mathematical tools for tackling a wide range of topics to be covered in the next semesters. They should have been familiar with additional relevant mathematical techniques and other relevant subjects to complement the core and developed their experimental skills through a series of experiments which also illustrate major themes of the lecture courses.

By the end of the third year (sixth semester), the students should have covered a range of topics in almost all areas of physics including Optics, quantum physics, solid state physics, computational physics, electronics Thermodynamics, Statistical Mechanics, Electronics.etc. and had experience of independent work such as projects; seminars etc. They should have been developed their understanding of core Physics.

At the end of the programme, the students will be able to identify, formulate and solve the complex problems in various fields of Physics, communicate effectively in oral and written form. They will also learn to read, understand and interpret physical information. They will also learn to appreciate the development of science particularly physics. They will also Succeed in obtaining employment appropriate to their interests, education and will become valuable individual.

Chairman

B.Sc Physics Board of Studies

B.Sc. DEGREE PROGRAMME - PHYSICS CORE
COURSE SRTUCTURE

Semester	Course Code	Course Title	Total hours	Hours /week	Credit
I	VEG1A 01	Common Course I – English	72	4	4
	VEG1A 02	Common Course II – English	90	5	3
	VML1A 01 VHD1A 01 VSK1A 01	Common Course III – Language other than English	72	4	4
	VPH1 B01	Methodology of Science and Physics	36	2	2
		Core Practical I	36	2	*
	VMT1C01	1st Complementary Course I Mathematics	72	4	3
	VCH1C01	2nd Complementary Course I	36	2	2
		2nd Complementary Course Practical I	36	2	*
		Total	**450**	**25**	**18**
II	VEG2A 03	Common Course IV – English	72	4	4
	VEG2A 04	Common Course V – English	90	5	3
	VML2A 02 VHD2A 02 VSK2A 02	Common Course VI – Language other than English	72	4	4
	VPH2 B02	Core Course II - Properties of Matter, Waves and Acoustics	36	2	2
		Core Course Practical I	36	2	*

	VMT2C02	1st Complementary Course I Mathematics	72	4	3
	VCH2C02	2nd Complementary Course I	36	2	2
		2nd Complementary Course Practical II	36	2	*
		Total	**450**	**25**	**18**
III	VEG3A05	Common Course VI – English	90	5	4
	VML3A03 VHD3A 03 VSK3A 03	Common Course VIII - Language other than English	90	5	4
	VPH3 B03	Core Course III – Mechanics	54	3	3
		Core Course Practical III Practical I	36	2	*
	VMT3C03	1st Complementary Course III – Mathematics	90	5	3
	VCH3C03	2nd Complementary Course III	54	3	2
		2nd Complementary Course Practical III	36	2	*
		Total	**450**	**25**	**16**
IV	VEG4 A06	Common Course IX – English	90	5	4
	VML4 A04 VHD4A 04 VSK4A 04	Common Course X - Language other than English	90	5	4
	VPH4 B04	Core Course IV – Electrodynamics I	54	3	3
	VPH4 BPL1	Core Course Practical IV	36	2	5

		Practical I			
	VMT4C04	1st Complementary Course IV – Mathematics	90	5	3
	VCH4C04	2nd Complementary Course IV	54	3	2
	VCH4CPL	2nd Complementary Course Practical IV	36	2	4
		Total	**450**	**25**	**25**
V	VPH5 B05	Core Course V -Electrodynamics II	54	3	3
	VPH5 B06	Core Course VI -Quantum Mechanics	54	3	3
	VPH5 B07	Core Course VII Physical Optics and Modern Optics	54	3	3
	VPH5 B08	Core Course VIII Electronics (Analogue and Digital	54	4	3
	VPH5D01	Open Course – (*course from other streams*)	54	2	3
		Core Course Practical V Practical II	72	4	*
		Core Course Practical V Practical II	72	4	*
		Project (including study tour)	36	2	*
		Total	**450**	**25**	**15**
VI	VPH6 B09	Core Course IX -Thermal and Statistical Physics	72	4	4
	VPH6 B10	Core Course X - Solid State Physics, Spectroscopy and Laser physics	72	4	4
	VPH6 B11	Core Course XI - Nuclear Physics, Particle Physics and Astrophysics	72	4	4

	VPH6 E01	Core Course XII -(Elective)	54	3	3
	VPH6 BPL2	Core Course Practical VII – Practical II	72	4	5
	VPH6 BPL3	Core Course Practical VIII – Practical III	72	4	5
	VPH6BPR	Project (including study tour& general Seminar)	36	2	3
		Total	**450**	**25**	**28**
		Total Credit			**120**

Note : **Tour report may be evaluated with Project Report**

CREDIT AND MARK DISTRIBUTION IN EACH SEMESTERS
Total Credits: 120; Total Marks: 3600

Semester	*Course*	*Credit*	*Marks*
I	Common course: English	4	100
	Common course: English	3	100
	Common course: Additional Language	4	100
	Core Course I: Methodology of Physics and Science	2	100
	Complementary course: Mathematics	3	100
	Complementary course: II	2	80
	Total	**18**	**580**
II	Common course: English	4	100
	Common course: English	3	100
	Common course: Additional Language	4	100
	Core Course II: Properties of matter ,Waves and Acoustics	2	100
	Complementary course: Mathematics	3	100
	Complementary course: II	2	80
	Total	**18**	**580**
III	Common course: English	4	100
	Common course: Additional Language	4	100
	Core Course III: Mechanics	3	100
	Complementary course: Mathematics	3	100
	Complementary course: II	2	80
	Total	**16**	**480**
IV	Common course: English	4	100
	Common course: Additional Language	4	100
	Core Course IV: Electrodynamics-1	3	100
	Core Course V: Physics Practical 1	5	150
	Complementary course: Mathematics	3	100
	Complementary course: II	2	80
	Complementary course: II Practical	4	80
	Total	**25**	**710**
V	Core Course VI: Electrodynamics II	3	100
	Core Course VII :Quantum Mechanics	3	100
	Core Course VIII: Physical Optics and Modern Optics	3	100
	Core Course IX: Electronics	4	100
	Open course	2	50
	Total	**15**	**450**

VI	Core Course X: Thermal and Statistical Physics	4	100
	Core Course XI: Solid State Physics ,Spectroscopy and Laser	4	100
	Core Course XII: Nuclear Physics ,Particle Physics and Astrophysics	4	100
	Core Course XIII: Elective	3	100
	Core Course XIV: Practical II	5	150
	Core Course XV: Practical III	5	150
	Core Course XVI: Project General Seminar & Tour report (10+15)	3	75 25
	Total	**28**	**800**
	Grand Total	**120**	**3600**

COURSE STRUCTURE PHYSICS(CORE)

Credit Distribution

Semester	*Common course*		*Core Course*	*Complementary course*		*Open course*	*Total*
	English	*Additional Language*		*Mathematics*	*Chemistry*		
I	4+3	4	2	3	2	-	18
II	4+3	4	2	3	2	-	18
III	4	4	3	3	2	-	16
IV	4	4	3+5*	3	2+4*	-	25
V	-	-	3+3+3+4	-	-	2	15
VI	-	-	4+4+4+3+5* +5** +3**	-	-	-	28
Total	**22**	**16**	**56**	**12**	**12**	**2**	**120**

* Practical ** Project

3 credits of Project include Project, Study Tour and General Seminar. Tour Report to be evaluated with Project Report. General Seminar is evaluated internally.

Mark Distribution and Indirect Grading System

Mark system is followed instead of direct grading for each question. 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 7 point scale is followed. Each course is evaluated by assigning marks with a letter grade (A^+, A, B, C, D, E or F) to that course by the method of indirect grading.

Mark Distribution

Sl. No.	*Course*	*Marks*
1	English	600
2	Additional Language	400
3	Core course: Physics	1750
4	Complementary course I: Mathematics	400
5	Complementary course II: Chemistry	400
6	Open Course	50
	Total Marks	**3600**

Seven point Indirect Grading System

% of Marks	*Grade*	*Interpretation*	*Grade Point Average*	*Range of Grade points*	*Class*
90 and above	A^+	Outstanding	6	5.5 - 6	First Class with distinction
80 to below 90	A	Excellent	5	4.5 – 5.49	
70 to below 80	B	Very good	4	3.5 – 4.49	First Class
60 to below 70	C	Good	3	2.5 – 3.49	
50 to below 60	D	Satisfactory	2	1.5 – 2.49	Second Class
40 to below 50	E	Pass/Adequate	1	0.5 – 1.49	Pass
Below 40	F	Failure	0	0 – 0.49	Fail

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

Semester	*Code No*	*Course Title*	*Hrs/ Week*	*Total Hrs*	*Credit*	*Marks*
I	VPH1B01	Core Course I: Methodology of Science and Physics	2	36	2	100
	-	Core Course V : Practical-I	2	36	-*	-
II	VPH2B02	Core Course II: Properties of matter waves and Acoustics	2	36	2	100
	-	Core Course V : Practical-I	2	36	-*	-
III	VPH3B03	Core Course III: Mechanics	3	54	3	100
	-	Core Course V : Practical-I	2	36	-*	-
IV	VPH4B04	Core Course IV: Electrodynamics-I	3	54	3	100
	VPH4BPL1	Core Course V : Practical-I	2	36	5	150
	VPH5B05	Core Course VI: Electrodynamics-II	3	54	3	100
	VPH5B06	Core Course VII: Quantum Mechanics	3	54	3	100

	VPH5B07	Core Course VIII: Physical Optics and Modern Optics	3	54	3	100
V	VPH5B08	Core Course IX: Electronics	4	72	4	100
		Core Course XIV: Practical II	4	72	-**	-
		Core Course XV: Practical III	4	72	-**	-
		Core Course XVI: Project Work	2	36	-**	-
	VPH6B09	Core Course X: Thermal and statistical Physics	4	72	4	100
	VPH6B10	Core Course XI: Solid State Physics, Spectroscopy and Laser	4	72	4	100
	VPH6B11	Core Course XII: Nuclear Physics, Particle Physics and Astrophysics	4	72	4	100
	VPH6E01	Core Course XIII:Core Course Elective	3	54	3	100
	VPH6BPL2	Core Course XIV: Practical –II	4	72	5**	150
	VPH6BPL3	Core Course XV: Practical-III	4	72	5**	150
	VPH6BPR	Core Course XVI: Project Work Tour Report & General Seminar	2	36	3**	75 25
				Total	**56**	**1750**

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

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

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 is prescribed in the syllabus.

1. INTERNAL EVALUATION

20% of the total marks in each course are for internal evaluation.

Table 1: Components of Evaluation

Sl. No.	*Components*	*Marks*
1	Attendance	5
2	Test papers: I & II	5 + 5
3	Assignment	2
4	Seminar/ Viva	3
	Total Marks	20

Table 2: Percentage of Attendance and Eligible Marks

% of attendance	*Marks*
Above 90%	5
85-89%	4
80-84%	3
76-79%	2
75%	1

Table 3: Pattern of Test Papers

Duration	*Pattern*	*Total number of questions*	*Number of questions to be answered*	*Marks for each question*	*Marks*
1.5 Hours	One word	4	4	1	4
	Short answer	5	4	2	8
	Paragraph	5	4	3	12
	Problem	4	2	3	6
	Essay	2	1	10	10
				*Total Marks**	40

*90% and above = 5, 80 to below 90% = 4.5, 70 to below 80% = 4, 60 to below 70% = 3.5, 50 to below 60% = 3, 40 to below 50% = 2, 35 to below 40% = 1, below 35% = 0

2. EXTERNAL EVALUATION

External evaluation carries 80% marks. It 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*
3 Hours	One word or one phrase or true or false	10	10	1	10
	Short answer(one or two Sentence)	7	7	2	14
	Paragraph/half page	7	5	4	20
	Problems	7	4	4	16
	Essay	4	2	10	20
				Total Marks	80

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 recognised lab or organisation.
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 written 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 report must be submitted at the end of the project**.

Table 1: Internal Evaluation

Sl. No	*Criteria*	*Marks*
1	Punctuality &Log book	3
2	Skill in doing project work/data	3
3	Scheme Organisation of Project Report	4
4	Viva-Voce	5
	Total Marks	15

Table 2: External Evaluation

Individual presentation is compulsory .

Sl. No	*Criteria*	*Marks*
1	Content and relevance of the project, Methedology, Reference, Bibliography	12
2	Project Presentation, Quality of analysis, statistical tools, findings, Recommendations	18
3	Project Report	10
4	Viva-voce	20
	Total Marks	60

GENERAL SEMINAR

General Seminar is introduced for the V semester Students. Each students can a take general seminar on any current topics or new developments in Physics. It is evaluated internally and Ten marks are allotted for that.

STUDY TOUR

Minimum two days visit to National research Institutes, Laboratories and places of Scientific importance .Study tour report has to be submitted with photos and analysis along with project report.

Distribution of Marks for Study Tour and General seminar

Internal		**External**	
Item	**Marks**	**Item**	**Marks**
General Seminar	10	Report	10
		Outcome/Analysis	3
		Photos	2
Total	10	Total	15
Grand Total	**25**		

Practical Evaluation –Core Course

Internal		**External**		
Items	**Marks**	**Items**	**Marks**	**Marks for Python Programming**
Record	6	Record with 20 expts Max.one mark for each expt	20	20
Regularity in getting the expts done	6	Formulae, Theory, Principle/ Programme	30	20
Attendance	6	Adjustments& setting / Algorithm	20	20
Test 1	6	Tabulation, Observation and performance/ Execution	30	40
Test 2	6	Calculation, result, graph,	15	15

		unit/ Result		
		Viva	5	5
Total	**30**	**Total**	**120**	**120**

OPEN COURSES OFFERED BY PHYSICS DEPARMENT
(For students from other streams)

VPH5 D01 : NON CONVENTIONAL ENERGY SOURCES
VPH5 D02: AMATEUR ASTRONOMY AND ASTROPHYSICS

VPH5 D03: ELEMENTARY MEDICAL PHYSICS

PHYSICS COMPLEMENTARY COURSE STRUCTURE
Total Credits: 12 (Internal: 20%; External: 80%)

Semester	*Code No*	*Course Title*	*Hrs/ Week*	*Total Hrs*	*Credit*	*Marks*
I	VPH1C01	Complementary Course I: Properties of matter and Thermodynamics	2	36	2	80
	-	Complementary Course V: PHYSICS Practical	2	36	-*	-
II	VPH2C02	Complementary Course II: Mechanics, Relativity, Waves and Oscillations	2	36	2	80
	-	Complementary Course V: PHYSICS Practical	2	36	-*	-
III	VPH3C03	Complementary Course III: Optics ,Laser, Electronics and Communication	3	54	2	80
	-	Complementary Course V: PHYSICS Practical	2	36	-*	-
IV	VPH4C04	Complementary Course IV: Electricity ,Magnetism and Nuclear Physics	3	54	2	80
	VPH4CPL	Complementary Course V: Physics Practical	2	36	4*	80
				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 is 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*
1	Attendance	4
2	Test papers: I & II	4 + 4
3	Assignment	2
4	Viva-Voce	2
	Total Marks	16

Table 2: Percentage of Attendance and Eligible Marks

% of attendance	*Marks*
Above 90%	4
85-89%	3.2
80-84%	2.4
76-79%	1.6
75%	0.8

Table 3: Pattern of Test Papers

Duration	*Pattern*	*Total number of questions*	*Number of questions to be answered*	*Marks for each question*	*Marks*
1.5 Hours	One word	4	4	1	4
	Short answer	4	4	2	8
	Paragraph/half page	4	2	3	6
	problems	4	2	3	6
	Essay	2	1	8	8
				*Total Marks**	32

*90% and above = 4, 80 to below 90% = 3.5, 70 to below 80% = 3, 60 to below 70% = 2.5, 50 to below 60% = 2, 35 to below 50% = 1, below 35% = 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*
3 Hours	One word/one phrase/true or false	10	10	1	10
	Short answer-one or two sentences	7	7	2	14
	Paragraph/Half page	5	3	4	12
	Problems	5	3	4	12
	Essay-within two pages	4	2	8	16
				Total Marks	64

Practical Evaluation (Complimentary)

Internal		External	
Record	4	Record with 20 expts Max. ½ mark for one expt	10
Regularity	3	Formulae, Theory, Principle	12
Attendance	3	Adjustments, setting	12
Test I	3	Tabulation & Observation	16
Test II	3	Calculation, graph, result, unit	10
		Viva	4
Total	**16**	**Total**	**64**

OPEN COURSE STRUCTURE

(FOR STUDENTS OTHER THAN B.Sc. Physics)
Total Credits: 2 (Internal 20%; External 80%)

Semester	Code	Course Title	Hours/week	Total Hours	Marks
V	VPH5D01	Non conventional Energy Sources	2	36	50
	VPH5D02	Amateur Astronomy And Astrophysics			
	VPH5D03	Elementary 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*
1	Attendance	2.5
2	Test papers: I & II	2.5 + 2.5
3	Assignment / Viva	2.5
	Total Marks	10

Table 2: Percentage of Attendance and Eligible Marks

% of attendance	*Marks*
Above 90%	2.5
85-89%	2
80-84%	1.5
76-79%	1
75%	0.5

Table 3: Pattern of Test Papers (Internal)

Duration	*Pattern*	*Total number of questions*	*Number of questions to be answered*	*Marks for each question*	*Marks*
1 Hour	One word	4	4	1	4
	Short answer	2	1	2	2
	Paragraph	4	2	3	6
	Essay	2	1	8	8
				Total Marks	20

*Marks: 80% and above = 2.5, 60 to below 80% = 2, 50 to below 60% = 1.5, 40 to below 50% = 1, 35 to below 40% = 0.5, below 35% = 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*
	One word/One Phrase/True or false	6	6	1	6
	Short answer- one or two sentence	5	5	2	10
	Paragraph- half page	6	4	4	16
	Essay- within two pages	3	1	8	8
				Total Marks	40

Semester-1

Core Course –1 - 36 hours (Credit – 2)

VPH1 B01: METHODOLOGY OF SCIENCE AND PHYSICS– 36 hours (Credit - 2)

(Importance must be given to Part C)

Part A: Methodology And Perspectives of Sciences: 7 Hours Max marks 18

Unit I – Science and Science Studies

Types of knowledge: Practical, Theoretical, and Scientific knowledge, Information.
What is Science; what is not science; laws of science. Basis for scientific laws and factual truths.Revolution in science and Technology.

Unit II – Methods and tools of science

Hypothesis: Theories and laws in science. Observations, Evidences and proofs.
Posing a question; Formulation of hypothesis; Hypothetico-deductive model, Inductive model. Significance of verification (Proving), Corroboration and falsification (disproving), Auxiliary hypothesis, Ad-hoc hypothesis.
Revision of scientific theories and laws, Importance of models, Simulations and virtual testing, Mathematical methods vs. scientific methods. Significance of Peer Review.

Reference Books:

1. Gieryn, T F. Cultural Boundaries of Science., Univ. of Chicago Press, 1999
2. Collins H. and T Pinch., The Golem: What Everyone Should Know About Science., Cambridge Uni. Press, 1993
3. Hewitt, Paul G, Suzanne Lyons, John A. Suchocki & Jennifer Yeh, Conceptual Integrated Science. Addison-Wesley, 2007
4. Newton R G. The Truth of Science: New Delhi, 2nd edition
5. Bass, Joel E and et. al. Methods for Teaching Science as Inquiry, Allyn & Bacon, 2009

Part B: Developments of New Frontiers of Physics: 9 Hours Max marks 30

Brief history of Physics during the last century- Birth of new science concepts - Classical Mechanics, Quantum Mechanics concepts, Blackbody radiation, Special theory of relativity, General theory of relativity, Astronomy and cosmology, Our galaxy, galaxy types, Radio sources and quasars, Large scale structure of Universe, Radiation backgrounds, History of universe – Future of Universe. ***(All topics in this part require qualitative study only, derivations are not required. Detailed study not required)***

References:

1. Concepts of Modern Physics- Arthur Beisser(6th edition)
2. A brief history and Philosophy of Physics - Alan J. Slavin- http:/ www.trentu. Ca/ academic / history- 895 .html
3. The inspiring History of Physics in the Last One Hundred Years : Retrospect and prospect Prof. Dr-lng . Lu Yongxiang http :// www.twas .org.cn/twas/proLu.asp
4.Introduction to cosmology. J V Narlikar Cambridge University press (Sections1.1 to 1.6 ,1.8-1.9)
5. Modern Physics – R. Murugeshan (17th revised edition)

Part C – Mathematical Methods in Physics :20 Hours -Max marks 72

Vector Analysis: – Vector Operations - Vector Algebra – Component form – How vectors transform, Applications of vectors in Physics.
Differential Calculus: – The operator ▽- Gradient, Divergence, Curl – Physical interpretation - Product rules of ▽- Second derivatives.

Integral Calculus: – Line integral, surface integral and volume integral - Fundamental theorem of Gradients – Gauss's Divergence Theorem (Statement only)– The fundamental theorem of curl – Stoke's theorem(Statement only). Divergence less and curlless fields. Curvilinear co-ordinates: – Spherical polar coordinates – cylindrical coordinates (Basic ideas).
Matrices: – Basic ideas of matrices – addition, subtraction, scalar multiplication, Transpose of a matrix, conjugate of a matrix, diagonal matrix - Representation of vectors as column matrix – Determinants – Cramer's rule – Eigen Values and Eigen Vectors - Hermitian Matrix,Unitary Matrix. (Mathematical Physics - Satya Prakash, Sultan Chand &Sons, New Delhi)

References:

1. Introduction to Electrodynamics – David J . Griffiths, Prentice Hall India Pvt. Ltd., Chapter – 1
2. Mathematical Physics - Satya Prakash, Sultan Chand &Sons, New Delhi
3. Mathematical Physics – B D Guptha
4. Mechanics-J.C .Upadhyaya

Semester -2
Core course –II - 36 hours (Credit – 2)
VPH2 B02: PROPERTIES OF MATTER, WAVES & ACOUSTICS

Unit-1: Properties of Matter :8 Hours Max marks 26

Elasticity: Basic ideas, Work Done per Unit Volume, Relations between elastic constants, Poisson's Ratio, Limiting Values of Poisson's Ratio, Twisting Couple on a Cylinder (or a Wire), Torsion pendulum, Determination of Rigidity Modulus, Bending of Beams, Bending Moment, Cantilever Loaded at Free End, Depression of a Beam Supported at the Ends and Loaded at the Centre (weight of the beam neglected), Determination of Y by Bending of a Beam, I form of Girders.
(Sections: 8.1 to 8.18, 8.22 to8.23, 8.26 to 8.27, 8.29 to 8.30, 8.33 to 8.34 Elements of Properties of Matter by D.S. Mathur)

Unit-2 Harmonic Oscillator :14 hours Max marks 49

Periodic Motion, Simple Harmonic Motion and Harmonic Oscillator, Energy of a Harmonic Oscillator, Examples of Harmonic Oscillator, Anharmonic Oscillator, Composition of Two Simple Harmonic Motions of Equal Periods in a Straight Line, Composition of Two Rectangular Simple Harmonic Motions of Equal Periods: Lissajous Figures, Damping Force, Damped Harmonic Oscillator, Examples of Damped Harmonic Oscillator, Power Dissipation, Quality Factor, Forced Harmonic Oscillator- concept of resonance. (Sections 9.1 to 9.7, sections 9.10 to 9.14, sections 10.1 to 10.7 Mechanics by J.C Upadhyaya)

Unit-3 Waves :9 hours Max marks 28

Wave Motion, General Equation of Wave Motion, Plane Progressive Harmonic Wave, Energy Density for a Plane Progressive Wave, Intensity of a Wave, Transverse Waves in Stretched Strings, Modes of Transverse Vibrations of Strings, Longitudinal Waves in Rods and Gases. (Sections 11.1 to 11.9 Mechanics by J.C Upadhyaya)
Fourier series – Evaluation of coefficients, even and odd functions. (Mathematical Physics - Satya Prakash, Sultan Chand &Sons, New Delhi 8.1, 8.2, 8.9.1, 8.9.2) (Sections 11.2 Mechanics by J.C Upadhyaya).

Unit-4 Acoustics :5 hours Max marks 17

Intensity of Sound- Decibel and Bel, Loudness of Sound, Noise Pollution, Ultrasonics: Production of Ultrasonic Waves- Piezo Electric Crystal Method, Determination of Velocity of Ultrasonic Waves in a Liquid - Acoustic Grating , Application of Ultrasonic Waves, Reverberation, Sabine's Formula (Derivation not required), Absorption Coefficient, Acoustics of Buildings.

Sections: 4.10 to 4.13, 5.1 -5.3, 5.7 -5.10, 5.12 to 5.15 of Properties of Matter and Acoustics by R.Murugeshan & Kiruthiga Sivaprasath)

Reference

1. Mechanics -- D.S. Mathur
2. Text book of Sound –Brij Lal& Subramaniam
3. Text book of Sound –Khanna .D.R. & Bedi.R.S.
4. Berkeley Physics course Vol 3 on Waves
5. Elements of Mechanics – K Rama Reddy, S Raghavan & D V N Sarma- Unit press
6. Introduction to Mechanics – Mahendra K Verma – Universities Press

Semester-3
Core Course – III - 54 hours (Credit – 3)
VPH3 B03: MECHANICS

UNIT-1

1. Frames of reference: 8 hours Max marks 20

Laws of Mechanics, Inertial frames of reference, Galilean transformation equations, Hypothesis of Galilean invariance, Conservation of Momentum, Non inertial frames and fictitious forces, Rotating frames of reference, Centrifugal force and Coriolis force, Foucault's pendulum (Section 2.1 to 2.11of Mechanics by J C Upadhyaya)

2. Conservation of Energy :6 hours Max marks 15

Conservation laws, Conservative forces, Conservation of energy for a particle: Energy function, Potential energy curve, Non conservative forces
(Section 5.1to 5.7, 5.10, 5.11of Mechanics by J C Upadhyaya)

3. Linear and Angular Momentum :9 hours Max marks 22

Conservation of linear momentum, Centre of mass, ,Centre of mass frame of reference, Collision of two particles ,Deflection of a moving particle by a particle at rest, Rockets, Angular momentum and torque, Motion under central force, Areal velocity, Conservation of angular momentum with examples
(Section 6.1 to 6.4 ,6.6 to 6.9 of Mechanics by J C Upadhyaya)

4. Potentials and Fields :9 hours Max marks 22

Central force, Inverse square law force, Potential energy of a system of masses, Gravitational field and potential, Escape velocity, Keplar's laws, Newton's deductions from Keplar's laws
(Section 7.1 to 7.4, 7.6to7.9, 7.18, 7.19 of Mechanics by J C Upadhyaya)

UNIT-2

5 Lagrangian formulations of Classical Mechanics :9 hours Max marks 20

Constraints, Generalized co-ordinates, Principle of virtual work, D'Alembert's principle, Lagrange's equations, Kinetic energy in generalized co-ordinates, Generalized momentum, Cyclic co-ordinates, Conservation laws and symmetry properties-Hamiltonian of a system (Classical Mechanics by Takwale and Puranik 8:1-7)

UNIT-3

6. Special Theory of Relativity :13 hours Max marks 27

1. Electromagnetism and Galilean transformation, Michelson Morley experiment, Ether hypothesis, Postulates of Special Theory of Relativity, Lorentz transformation equations, Velocity transformation, Length contraction, Time dilation, Simultaneity, Mass in relativity, Mass and energy ,Space time diagram, Geometrical interpretation of Lorentz transformation, Principle of covariance, Four-vectors in Mechanics
2. Classical Mechanics by Takwale and Puranik(14:1-9)

Text books for study

1. Mechanics by J C Upadhyaya 2003 edition
2. Classical Mechanics by Takwale and Puranik
3. Classical Mechanics by Hans and Puri
4. Classical Mechanics by J C Upadhyaya

References

1. Mechanics by D.S.Mathur
2. Classical Mechanics by Goldstein

Semester-4

Core Course – IV 54 hours (Credit – 3)

VPH4 B04: ELECTRODYNAMICS – I

UNIT I

1. Electrostatics :21 hours

Electrostatic field – Coulomb's law, Electric field, Continuous charge distributions - Divergence and curl of electrostatic field, Field lines and Gauss law, The divergence of **E**, Applications of Gauss law, Curl of **E** - Electric potential – Comments on potential, Poisson's equation and Laplace's equation, The potential of a localized charge distribution, Electrostatic boundary conditions – Work and energy in electrostatics, The work done in moving a charge, The energy of point charge distribution, The Energy of a continuous charge distribution, Comments on Electrostatic energy – Conductors, Basic properties of conductors, Induced charges, The Surface charge on a conductor, The force on surface charge, Capacitors, Special Techniques-The method of images
(Sections 2.1 to 2.5,3.2 of Introduction to Electrodynamics by David J Griffiths)

2. 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, Energy in dielectric systems, Forces on dielectrics, Polarizability and susceptibility.
(Sections 4.1 to 4.4.1, 4.4.3, 4.4.4 of Introduction to Electrodynamics by David J Griffiths)

3 . 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 by David J Griffiths)

4. Magnetostatic fields in matter :8 hours

Magnetisation – Diamagnets, Paramagnets and Ferromagnets, Torques and forces on magnetic dipoles, Effect of a magnetic field on atomic orbits, Magnetization – Field of a magnetised object, Bound Currents, Physical interpretation, Magnetic field inside matter – Auxiliary field **H**, Ampere's law in magnetised materials, Boundary conditions – Linear and nonlinear media, Magnetic susceptibility and permeability, Ferromagnetism.
(Sections 6.1 to 6.4 of Introduction to Electrodynamics by David J Griffiths)

5.**Electromagnetic Induction :5 hours:**

Electromotive Force-Ohm's law, Electromotive Force, Motional emf, Electromagnetic Induction-Faraday's Law, The induced electric field, Inductance, Energy in magnetic fields.
(Sections 7.1 to 7.2.4 of Introduction to Electrodynamics by David J Griffiths)

Textbook for study

Introduction to Electrodynamics by David J Griffiths, 3rd Ed.

Books for reference

1. Electricity and magnetism by Arthur F Kip
2. Physics Vol. II by Resnick and Halliday
3.Electricity and Magnetism- Berkley series
4.Electricity and Magnetism-Hugh D Young and Roger A Freedman

Semester-5

Core Course – V 54 hrs (Credit – 3)

VPH5 B05: ELECTRODYNAMICS-II

UNIT I (25 hours)

1)Electrodynamics :13 hours **Max marks 32**

Maxwell's equations, Electrodynamics before Maxwell, Maxwell's modification of Ampere's law, Maxwell's equations and magnetic charges, Maxwell's equations inside matter, Boundary conditions, Relativistic Electrodynamics-Magnetism as a relativistic phenomenon. (Sections 7.3,12.3.1 of Introduction to Electrodynamics by David J Griffiths)

2) Electromagnetic waves : 12 hours **Max marks 27**

Waves in one dimension, The wave equation, sinusoidal waves, boundary conditions : reflection and transmission, Polarization – Electromagnetic waves in vacuum , Wave equation for **E** and **B**, monochromatic plane waves in vacuum, energy and momentum of E.M. waves, Poynting vector - Electromagnetic waves in matter, Propagation through linear media, reflection and transmission at normal incidence. (Sections 9.1 to 9.3.2 of Introduction to Electrodynamics by David J Griffiths)

UNIT II (29 hours)

3) Transient currents :7 hours **Max marks 20**

Growth and decay of current in LR and CR circuits – measurement of high resistance by leakage – growth of charge and discharge of a capacitor through LCR circuit – theory of BG – experiment to determine charge sensitiveness of BG using a standard condenser and HMS. (Sections 12.1 to 12.6, 10.10 to 10.13 and section 11.14 of Electricity and magnetism by R. Murugeshan)

4) AC circuits :12 hours **Max marks 27** AC through L, C, R, LC, CR, LR and LCR – resonance and resonant circuits – repulsion between coil

and conductor – j operators, application to AC circuits – AC bridges – Anderson and Rayleigh bridge. (Sections 22.1, 22.2, 22.3, 22.6, 22.7, 22.10, 22.11, 22.13, 22.18 to 22.22.1, 22.23 of Electricity and Magnetism by D.N. Vasudeva and sections 11.5 to 11.6 of Electricity and Magnetism by R. Murugeshan)

5) Network theorems : 10 hours **Max marks 20**

Kirchhoff's laws, Voltage sign and current direction, Solution of simultaneous equations using determinants, Maxwells Loop Current method, Nodal analysis with current sources,Source conversion, Superposition theorem, Ideal equivalent circuits, Thevenin's theorem, Thevenizing a given circuit, Norton's theorem, Maximum power transfer theorem. (Sections 2.2, 2.3, 2.4, 2.5, 2.6, 2.14, 2.15, 2.16, 2.17, 2.18, 2.19 and 2.30 from Electrical technology by Theraja)

Textbooks for study

1. Introduction to Electrodynamics by David J Griffiths, 3rd ed.
2. Electricity and Magnetism by R.Murugeshan (Third revised edition)
3. Electrical technology by Theraja

Books for reference

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

Semester-5
Core Course – VI 54 hrs (Credit – 3)
VPH5 B06: QUANTUM MECHANICS

UNIT 1 (24 hrs)

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

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

2. Wave Properties of Particles:10 hours

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

3. Atomic Structure : 6 hours

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

UNIT 2 (30 hrs)

4. Wave Mechanics :16 hours

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

5. Hydrogen Atom :14 hours

Schrodinger equation for the hydrogen atom, separation of variables, quantum numbers, principal quantum number, orbital quantum number, magnetic quantum number,
radiative transitions, selection rules, Zeeman effect, electron spin, Pauli's exclusion principle (Sections 6.1 to 6.10 & 7.1, 7.2 of Modern Physics by Beiser]

TEXT

Concepts of Modern Physics 6th Edition-By Arthur Beiser

REFERENCE:

1. Modern Physics(II Edn.)-Kenneth Krane
2. Quantum Physics of Atom, Molecules, Solids, Nuclei & Particles By R.Eisberg & R. Resnick (John Wiley)
3. Quantum Mechanics By G. Aruldhas
4. Berkeley Physics Course: Quantum Physics By Wichmann
5. University Physics – Zemansky
6. . Advanced Physics Second Edition – Keith Gibbs – Cambridge University Press
7. Feynman Lectures

Semester-5

Core Course – VII - 54 Hours (Credit – 3)

VPH5 B07: PHYSICAL OPTICS AND MODERN OPTICS

UNIT I (5 hours) **Max marks 15**

1. Fermat's Principle, verification of laws of reflection and refraction. (Sections 2.1-2.6 Optics by Brijlal, Subramaniyam, &Avadhanulu, Section 2.1-2.2 Optics by AjoyGhatak) **2 hours**

Matrix methods - Refraction and translation, translation matrix, refraction matrix, system matrix, position of the image plane, magnification, system matrix for thick lens, system matrix for thin lens. (Sections 7.1-7.9 (Brijlal, Subramaniyam, &Avadhanulu) 3 **hours**

UNIT II (14 hours)

2. Interference by division of wavefront **6 hours Max marks 17**

Superposition of two sinusoidal waves, Interference, coherence, conditions for interference, the interference patterns, intensity distribution. Fresnel's two mirror arrangement, Fresnel's Biprism, Lloyd's mirror (Sections: 14.1-14.4, 14.6-14.9 (Brijlal, Subramaniyam, &Avadhanulu, Sections 12.1-12.9 AjoyGhatak)

3. Interference by division of amplitude **8 hours Max marks 22**

Interference by a plane film illuminated by a plane wave, cosine law, nonreflecting 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 13.1-13.3,13.4,13.813.9-13.11Ajoy Ghatak, Sections 2.1-2.6 (Brijlal,Subramaniyam, &Avadhanulu)

UNIT III- (13 hours)

4. Fraunhofer Diffraction **9 hours Max marks 22**

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 16.1-16.7. (AjoyGhatak).

5. Fresnel Diffraction **4 hours Max marks 10**

Preliminaries, Fresnel half period zones, explanation of rectilinear propagation of light, zone plate, diffraction at straight edge (Sections 17.1-17.4. AjoyGhatak)

UNIT IV

6. Polarization **8 hours Max marks 15**

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, Laurent's half shade polarimeter (Sections 20.9,20.17-20.20,20.24 Brijlal, Subramaniyam, &Avadhanulu and AjoyGhatak)

UNIT V

7. Fiber Optics **8 hours Max marks 15**

Optical fibre, Numerical aperture, step index fiber, pulse dispersion, graded index fibre, fiber optic communication system, fiber optic sensors. (Sections 24.1-24.3,24.5,24.6- 24.7,24.11AjoyGhatak, corresponding sections from Brijlal, Subramaniyam, &Avadhanulu)

UNIT VI

8. Nonlinear Optics **6 hours Max marks 10**

Introduction, wave propagation in an anisotropic crystal, nonlinear polarization, second harmonic generation, phase matching, sum and difference frequency generation light. (Relevant sections from 'Optics" by Brijlal, Subramaniyam, &Avadhanulu)

References

1. Optics by Ajoy Ghatak
2. Optics by Subramaniam, Brijlal&Avadhanulu – New edition
3. Optics by Mathur
4. Nonlinear Optics- B.B.Laud
5. Laser Fundamentals- Silfast
6. Wave Optics and its Applications – Rajpal S Sirohi – Orient Longman
7. Optical Communications – M Mukunda Rao – Universities Press

Semester-5

Core Course – VIII 72 Hours (Credit – 4)

VPH5 B08: ELECTRONICS (ANALOG & DIGITAL)

UNIT I

1. Semiconductor rectifiers and DC Power supplies :10 hours. Max marks 16

Crystal diode rectifier, Half wave rectifier, Full wave Rectifiers Centre tap and Bridge rectifier, Efficiency, Nature of rectified output, Ripple factor, different types of filter circuits, voltage multipliers, Zener diode voltage stabilization. Switched Mode Power Supplies (sections 6.7-6.15 6, 6.17 - 6.27 Principles of electronics V.K Mehta 2008 edition SMPS -section : 9.13 K A Navas .Introduction to electronics engineering)

2. Transistors: 12 hours Max marks 20

Different transistor amplifier configurations:- C-B, C-E, C-C, 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 (Section 8.7- 8.10, 8.12-8.22, 9.1-9.8, 9.11-9.12, Principles of electronics Mehta 2008 edition V K Mehta)

3. Transistor Amplifiers: 8 hours Max marks 14

Single stage transistor amplifier circuit, load line analysis, DC and AC equivalent circuits. ***R.C*** coupled amplifier- frequency response, and gain in decibels. Hybrid parameters, h-parameters of a transistor .Nomenclature for transistor h parameters (h-parameter qualitative only)
(10.4-10.5, 10.6-10.9 11.1-11.5 ,24.1, 24.5 , 24.6 Principles of electronics V K Mehta 2008 edition)

4. Feedback Circuits and Oscillators :8 hours Max marks 14

Basic principles of feedback, negative feedback and its advantages, positive feedbackcircuits Oscillatory Circuits-LC, RC oscillators, tuned collector oscillator, Hartley, Colpitt's, phase shift and crystal oscillators - their expressions for frequency.
Sections (13.1-13.5, 14.1 - 14.13, 14.15-14.20 Principles of electronics VK Mehta 2008 edition)

UNIT II

5. Digital Communication :6 hours Max marks 10

Transmission and reception of radio waves, types of modulation, AM, FM their comparison advantages, demodulation, pulse code modulation(qualitative idea only) (Sections: 16.1-16.10, 16.11-16.18, 16.22 Principles of electronics VK Mehta 2008 edition)

6. Special Devices and Opamp :12 hours Max marks 20

LED, Photodiode, Solar cells, basic idea of UJT, FET, MOSFET, OP-amp-basic operation, application, inverting, Non-inverting, summing amplifiers, Photo diode, Solar cell (Sections 7.2-7.4, 19.1-19.14, 19.27-19.31, 21.11-21.15, 25.1-25.3, 25.15-25.17,25.23-25.26, 25.32,) Principles of electronics VK Mehta 2008 edition) 7.7-7.9 Principles of electronics VK Mehta 2008 edition.

7. Number system :8 hours Max marks 12

Positional number system, binary number system, Binary - Decimal conversions, Representation of positive integer, negative number representation, Floating point Arithmetic, Binary arithmetic, Compliments and its algebra, ,Character representation (Aditya P Mathur - 2.2 to 2.8). Other number systems and conversions (Sections Malvino 5.3 to 5.9)

8. Logic gates and circuits :8 hours Max marks 14

Fundamental gates, Universal gates, De Morgan's theorem, Exclusive OR gate, Boolean relations, Sum of product simplification ,product of Sum simplification Half adder, Full adder, RS Flip Flop, JK Flip flop, JK Master Slave Flipflop
(Sections Malvino - 2.1 to 2.2, 3.1 to 3.2, 3.7, 6.7, 8.1 to 8.5, 8.8)

Text Books

1. Principles of electronics - VK Mehta - 2008 edition (S. Chand)
2. Introduction to Micro Processor - Aditya P Mathur (Tata McGarw Hill)
3. Digital principles and applications - Leach and Malvino (Tata McGraw Hill)

References

1. Digital Computer Fundamentals (Thomas.C. Bartee)
2. Electronics principles - Malvino
3. Physics of Semiconductor Devices- Second Edition – Dilip K Roy – Universities Press
4. Digital Fundamentals –Thomas L Floyd
5. Digital Technology-Principles and Practice-Virendrakumar
6. The Art of Electronics-Paul Herowitz & Winfield Hill

Semester-6

Core Course – IX - 72 hrs (Credit – 4)

VPH6 B09: THERMAL AND STATISTICAL PHYSICS

Unit- I

1. Thermodynamic system- Thermal equilibrium-zeroth law-concept of heat and temperature-thermodynamic equilibrium- quasistatic process -extensive and intensive variables-thermodynamic process (cyclic and non cyclic)-indicator diagram- workdone in isothermal, adiabatic, isobaric and isochoric –cyclic processes- concept of path and point functions-internal energy- first law of thermodynamics-relation between P,T,V,in adiabatic process-slope of adiabatic and isothermal process -application of first law to heat capacities-(relation between Cp and Cv) and latent heat– adiabatic and isothermal elasticity of a gas.(**18 Hrs)**

2. Reversible and irreversible processes , Conditions for reversibility-second law of thermodynamics-heat engine, Carnot engine, derivation for expression for efficiency, efficiency, Carnot's refrigerator-thermodynamical scale of temperature- Carnot's theorem and its proof.- application of second law(Clausius-Clapyron equation)- Internal combustion engine-Otto engine & Diesel engine –Expression for efficiency with derivation. (11 **Hrs)**

3.Entropy and adiabatics- definition of entropy-Change of entropy in a Carnot cycle- Change of entropy in an reversible cycle (Claussius theorem) -Change of entropy in an irreversible cycle (Claussius inequality)- Change in entropy of a perfect gas during a process-Change in entropy in a irreversible process-change in entropy due to free expansion-Change in entropy due to spontaneous cooling by conduction, radiation….etc, - Principle of increase of entropy-Entropy and available energy-Entropy and disorder-Nernst heat theorem-entropy temperature diagrams**(12 hours**).

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

4. Thermodynamic functions-Enthalpy, Helmhlotz function, Gibbs function-Maxwell's thermodynamic relations-TdS relations-application of Maxwell's thermodynamical relations-variation of intrinsic energy with volume--Joule-Kelvin coefficient-.Claussius-Clapeyron equation from Maxwell's thermodynamic relations- change of phase.(**10 Hrs)**

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

UNIT II

5. Statistical distributions-Concepts of Phase space-Maxwell-Boltzmann statistics (no derivation)-Distribution of molecular energies in an ideal gas-Average molecular energy- Equipartition theorem-Maxwell-Boltzmann speed distribution law-Expressions for RMS speed, most probable speed and mean speed. (10 **Hrs)**

(Chapter 9.1, 9.2 and 9.3-Concepts of Modern Physics-Arthur Beiser)

6. Bose Einstein and Fermi Dirac distribution laws (no derivations)- Application of BE distribution law to black body radiation-Planck's radiation law-Stefan's law-Wien's displacement law-Fermi energy-Expression for Fermi energy of electron system-electron energy distribution- average electron energy at absolute zero-Degeneracy pressure and its astrophysical significance. (**11 Hrs**)

(Relevant topics from Chapter 9, Concepts of Modern Physics – Arthur Beiser)

References:

1. Heat and Thermodynamics-DS Mathur (V Edn.)
2. Statistical Mechanics – An Elementary Outline – Avijit Lahiri – Universities Press
3. Physics- Resnick and Halliday
4. Heat and Thermodynamics-Zemansky
5. Thermodynamics – Y V C Rao – Universities Press
6. Advanced Physics Second Edition – Keith Gibbs – Cambridge University Press
7. Thermodynamics and statistical mechanics-Brijlal Subramanium

Semester-6

Core Course – X 72 hrs (Credit – 4)

VPH6 B10 : SOLID STATE PHYSICS, SPECTROSCOPY AND LASER PHYSICS

UNIT –1 SOLID STATE PHYSICS

1.Crystal Physics :15 Hrs

Lattice Point & Space Lattice-Basis and crystal structure, unit cells and lattice Parameters, Unit cells v/s primitive cells, Crystal systems, crystal symmetry. The 23 symmetry elements in a cubical crystal, rotation axis and inversion. Symmetry elements, Bravais space lattices-metallic crystal structure , sodium chloride, diamond, zinc sulphide, hexagonal and closed packed structure, directions, planes and Miller indices, atomic and geometric factor (Section 4.1 to 4.8, 4.11 to 4.15-4.18 - Solid State Physics by S.O. Pillai**)**

2. X-ray Diffraction: 5 Hrs

Bragg's law – Braggs X-ray spectrometer-Rotating Crystal method, powder diffraction method Section 5.7 to 5.11- Solid State Physics by S.O. Pilla

3. Super conductivity: 8 Hrs

A survey of superconductivity- Mechanism of Superconductors-Effects of Magnetic Field-Meissner Effect-isotope Effect-Energy Gap -Coherence Length- Josephson effect- BCS Theory (Qualitative idea only) -Application of Superconductivity, Type I and Type II superconductors. (Section 8.1 -8.10, 8.13,8.17,8.18,8.23,8.24 of Solid State Physics - S.O. Pillai)

UNIT-2 MOLECULAR SPECTROSCOPY

4 . Basic Elements of Spectroscopy: 5 Hrs

Quantum of Energy-Regions of Spectrum-Representation of Spectrum-Basic Elements of Practical Spectroscopy-Signal to Noise Ratio-Resolving Power-Width & Intensity of Spectral Transitions (Section 1.2-1.8 of Fundamentals of Molecular Spectroscopy by Banwell & Elaine Mcash**)**

5. Microwave Spectroscopy :10 Hrs

Classification of Molecules-Interaction of Radiation with Rotating Molecules- Rotational Spectrum of Rigid Diatomic Molecule-Example of CO-Selection Rule- Intensity-Spectrum of non –rigid Rotator-Example of HF- Spectrum of symmetric Top molecule- Example of Methyl chloride-Instrumentation for Microwave Spectroscopy- Information derived from Rotational Spectrum.

6. Infra Red Spectroscopy: 9 Hrs

Vibrational Energy of an Anharmonic Oscillator-Diatomic Molecule (Morse Curve)-IR Spectra-Spectral Transitions & Selection Rules-Example of HCL-Vibration- Rotation Spectra of iatomic Molecule-Born Oppenheimer Approximation-Instrmentation for Infra Red Spectroscopy. (Section 7 to 7.5, 7.15, 7.16 of Molecular Structures & Spectroscopy by G Aruldhas &
Chapter 3 of Fundamentals of Molecular Spectroscopy by Banwell & Elaine M Mccash)

7. Raman Spectroscopy :10 Hrs

Raman Effect, Elements of Quantum theory & Applications-Pure Rotational Raman Spectrum-Examples of Oxygen and carbon-dioxide-Rotational Raman spectrum of symmetric Top molecule-Example of chloroform.Vibrational Raman spectrum of Symmetric Top Molecule-Example of Chloroform.
(Molecular Structures & Spectroscopy by G Aruldhas & Chapter 4 of Fundamentals of

Molecular Spectroscopy by Banwell & Elaine M Mccash)

8. Laser Physics :10 Hrs

Induced Absorption- Spontaneous Emission & Stimulated Emission-Einstein Coefficients Principle of Laser-Population inversion-Pumping-Properties of Laser-Types of Laser- Principle & working of Ruby laser, Helium Neon Laser & Semiconductor Laser- -Yag Lasers (Qualitative ideas only). Application of Lasers

(Chapter 12 Masers & Lasers, Solid State Physics by S.O. Pillai, Lasers –Theory & Applications by K Thyagarajan & Ajoy Ghatak)

Semester-6

Core Course – XI 72 hrs (Credit – 4)

VPH6 B11 : NUCLEAR PHYSICS, PARTICLE PHYSICS & ASTROPHYSICS

UNIT: 1 (35 hrs):

1. Nuclear Structure 12 H**ours**

Nuclear composition, Nuclear properties –nuclear radii –spin and magnetic moment - nuclear magnetic resonance, electric moment, Stable nuclei,Binding energy, Liquid drop model -semi empirical binding energy formula Shell model, Meson theory of nuclear forces – discovery of pion. (Text Books: 11.1 to 11.7 Concepts of Modern Physics – Arthur Beiser (6th Edition), Nuclear Physics – Irving Kaplan (17.8)

2. Nuclear Transformations : **16 Hours**

Elementary ideas of radio activity- Alpha decay-tunnel theory of alpha decay, Beta decay-positron emission-electron capture-inverse beta decay and the discovery of neutrino-the solar neutrino mystery, Gamma decay- fundamental ideas of nuclear isomerism and internal conversion, The concept of interaction cross section-neutron capture cross section of cadmium-slow neutron cross sections-reaction rate-nuclear reactions-center of mass frame of reference and Q value of a nuclear reaction, Nuclear fission, Nuclear reactors-breeder reactors, Nuclear fusion-nuclear fusion in stars-proton-proton cycle-carbon nitrogen cycle-formation of heavier elements, Fusion reactors-confinement methods.

(Text Book: 12.1 to 12.12 & Appendix of Chapter 12, Concepts of Modern Physics – Arthur Beiser (6 th Edition)

3. Nuclear Detectors and Counters: 7 Hours

Interactions of radiation with matter – fundamental ideas, Gas filled counters- ionization Chamber, G.M. counter, Semi conductor detectors and scintillation counters, Photomultiplier tube (Qualitative study only. Maximum Weightage: 2) (Text Book: 17 to 17.6 Atomic and Nuclear Physics-An Introduction: T.A. Littlefield and N. Thorley)

UNIT: 2 (37 hrs)

4. Cosmic Rays: 4 H**ours**

Nature of Cosmic rays, the origin of cosmic rays, geomagnetic effects, Cosmic ray showers (Text Book: 25.1 to 25.6 Atomic and Nuclear Physics-An Introduction: T.A. Littlefield and N. Thorley)

5. Particle Physics: 13 Hours

Leptons –electron and positron-neutrinos and anti-neutrinos-other leptons, Elementary particle quantum numbers-baryon number- lepton number strangeness-isospin-electric charge-hyper

charge-basic ideas on symmetries and conservation laws, Quarks -color and flavor, Fundamental interactions-field bosons-basic ideas of quantum chromo dynamics-Higg's boson,
(Text Books: 13.2 to 13.8 Concepts of Modern Physics-Arthur Beiser (5th Edition)

6. Particle Accelerators :6 hours

Classification of accelerators-electrostatic accelerators-cyclic accelerators, the linear accelerator, the cyclotron, the betatron, the electron synchrotron .
(Text Books: 18.4 to 18.8 Atomic and Nuclear Physics- An Introduction: T.A. Littlefield and N. Thorley, 21.3 to 21.5 Nuclear Physics-Irving Kaplan)

7. Astrophysics :14 hours

Astronomy and Astrophysics , Importance of of Astronomy, Methods of Astronomy and Astrophysics, The scientific methods, scope of Astronomy.(Text Book Chapter 1.A.D.Abayankar)
Stellar magnitudes, Absolute magnitude, Bolometric Magnitude , Different magnitude standards, radiometric magnitude, colour index of a star, Luminosities of stars, Units of stellar distances Stellar positions (Text Book: 3.1 to 3.9 An introduction to Astro Physics-Baidyanath Basu)

Spectral classification of stars, Havard system of Spectral Classification, The Hertzsprung-Russel Diagram, Stellar evolution, White dwarfs, Electrons in a white dwarf star, Chandrasekhar limit, Neutron stars, Black holes, Supernova explosion
(Text book Modern Physics – R. Murugeshan (17^{th} revised edition -78.1 to 78.11)

Suggested Reference Materials (Books and Materials:)

1. Nuclear Physics: D.G. Tayal
2. Atomic Physics: J.B. Rajam
3. Atomic Physics: John Yarwood
4. Introduction to Astrophysics: H L Duorah & Kalpana Duorah

Semester-6
Core Course – XII (ELECTIVE)
VPH6 E01 - Computational Physics (54 hrs – 3 credits)

UNIT I.

Introduction to Python Programming: 20 Hrs Max marks 47

Concept of high level language, steps involved in the development of a Program – Compilers and Interpreters - Introduction to Python language, Advantages of Python in comparison with other Languages - Different methods of using python: Using python as a calculator, Writing python programs and execution - Inputs and Outputs - Variables, operators, expressions and statements -- Strings, Lists, list functions (len, append, insert, del, remove, reverse, sort, +, *, max, min, count, in, not in, sum), sets, set functions(set, add, remove, in, not in, union, intersection, symmetric difference)-Tuples and Dictionaries, Conditionals, Iteration and looping - Functions and Modules - File input and file output, Pickling.

UNIT II. 22 Hrs Max marks 47

Numerical Methods in physics *(Programs are to be discussed in Python)*

General introduction to numerical methods, Comparison between analytical and numerical techniques - Curve Fitting: Principle of least squares, fitting a straight line - Interpolation: Finite difference operator, Newton's forward difference interpolation

formula, Solution of algebraic equations: The Bisection method ,Newton-Raphson method – Numerical differentiation and integration: Difference table, Trapezoidal and Simpson's (1/3) method- Solution of differential equations :Runge Kutta method (Second order) -Taylor's Series : Sin(x) and Cos(x).
(* New addition to the syllabus)

UNIT III

Introduction to Computational approach in physics 12 Hrs Max marks 32

(Programs are to be discussed in Python)

One Dimensional Motion: Falling Objects: Introduction – Formulation: from Analytical methods to Numerical Methods - Euler Method, Freely falling body, Fall of a body in viscous medium - Simulation of free fall and numerical integration, Two dimensional motion: Projectile motion (by Euler method)-Motion under an attractive Inverse Square- law force Accuracy considerations .(elementary ideas)*(Graphics not required, data may be presented in table form)*

References:

(For Python any book can be used as reference. Moreover a number of open articles are available freely in internet. Python is included in default in all GNU/Linux platforms and It is freely downloadable for Windows platform as well. However use of GNU/Linux may be encouraged).

1. www.python.org
2. Python Essential Reference, David M. Beazley, Pearson Education
3. Core Python Programming, Wesley J Chun, Pearson Education
4. Python Tutorial Release 2.6.1 by Guido van Rossum, Fred L. Drake, Jr., editor. This Tutorial can be obtained from website (http://www.altaway.com/resources/python/tutorial.pdf)
5. How to Think Like a Computer Scientist: Learning with Python, Allen Downey , Jeffrey Elkner , Chris Meyers, http://www.greenteapress.com/thinkpython/thinkpython.pdf
6. Numerical Methods in Engineering and Science, Dr. B S Grewal, Khanna Publishers, Newdelhi (or any other book)
7. Numerical methods for scientists and engineers, K. Sankara Rao, PHI
8. Introductory methods of numerical analysis, S.S.Shastry , (Prentice Hall of India,1983)
9. Computational Physics, V.K.Mittal, R.C.Verma & S.C.Gupta-Published by Ane Books,4821,Pawana Bhawan,first floor,24 Ansari Road,Darya Ganj,New Delhi-110 002

(For theory part and algorithms. Programs must be discussed in Python)

ELECTIVE-II 54 hrs (Credit – 3)

VPH6 E02: NANO SCIENCE AND TECHNOLOGY

Module 1: Introduction : 6 Hrs Max marks 15

Length scales in Physics- nanometer- Nanostructures: Zero, One Two and Three dimensional nanostructures (Chapter 3, Text 2)

Band Structure and Density of State at nanoscale: Energy Bands, Density of States at low dimensional structures. (Chapter 3, Text 1)

Module 2:

Electrical transport in nanostructure: 10 Hrs Max mark 26

Electrical conduction in metals, The free electron model. Conduction in insulators/ionic crystals -

Electron transport in semiconductors - Various conduction mechanisms in 3D (bulk), 2D(thin film) and low dimensional systems: Thermionic emission, field enhanced thermionic emission (Schottky effect), Field assisted thermionic emission from traps (Poole-Frenkel effect), Arrhenius type activated conduction, Variable range, Hopping conduction, Polaron conduction. (Chapter 4, Text 1)

Module 3:

Introductory Quantum Mechanics for Nanoscience: 13 Hrs Max mark 28

Size effects in small systems, Quantum behaviors of nanometric world: Applications of Schrödinger equation – infinite potential well, potential step, potential box; trapped particle in 3D (nanodot), electron trapped in 2D plane (nanosheet), electrons moving in 1D (nanowire, nanorod, nanobelt), Excitons, Quantum confinement effect in nanomaterials (Chapter 5, Text 1)

Module 4:

Growth techniques of nanomaterials (Elementary ideas only): **9 Hrs Max mark 20**

Top down vs bottom up techniques, Lithographic process, Non Lithographic techniques: Plasma arc discharge, sputtering. Evaporation: Thermal evaporation, Electron beam evaporation. Chemical Vapour Deposition (CVD). Pulsed Laser Deposition, Molecular Beam Epitaxy, Sol-Gel Technique, Electro-deposition., Ball-milling. (Chapter 6, Text 1)

(6.1,6.2.6.3,6.4.1,6.4.2,6.4.2.1,6.4.3,6.4.3.1.6.4.3.2,6.4.4,6.4.5,6.4.6,6.4.7,6.4.8,6.4.9)

Module 5:

Characterisation tools of nanomaterials: 10 Hrs Max mark 22

Scanning Probe Microscopy(SPM) : Basic Principles of SPM techniques, The details of STM, Tunneling current, local barrier height, local density of states. Some applications of STM. (Section 7.1.1 – 7.1.3.3, 7.1.3.5, Text 1), General concepts of AFM (Section 7.2.1 – 7.2.4 , Text1), Electron microscopy (7.3.1-7.3.6, Text -1).

Module 6:

Applications of nanotechnology: (Elementary ideas only) **6 Hrs Max mark 15**

Buckminster fullerene, Carbon nanotube, nano diamomd, BN Nanotune, Nanoelectronics - single electron transistor (no derivation), Molecular machine, Nanobiomatrics (Chapter 8, Text 1).Applications of nanomaterials in energy, medicine and environment (Text 2)

Text books:

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

References:

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

ELECTIVE-III 54 hrs (Credit – 3)

VPH6 E03: MATERIALS SCIENCE

Unit I

Introduction: 15 Hrs Max Mark 32

What is material science, Classification of materials-metals, ceramics, polymers, composites, Advanced materials, smart materials.(Section 1.1 to 1.6 of Callister's Material science Text Bonds in Materials

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

Crystals

Crystalline and Non Crystalline materials –Single crystals, polycrystals, Anisotropy, metallic crystal structures, atomic packing factors of FCC, BCC, Hexagonal close packed crystal structure, Density computations, Linear and planar densities, polymorphism and allotropy, non crystalline solids.(Section 3.8 to 3.11, 4.2 to 4.9)

Unit II

Imperfections in Solids :12 Hrs Max mark 32

Point defects, Vacancies and self interstitials, substitutional impurities, atomic point defects-Schottky defect, Frenkel defect, Dislocations-edge and screw dislocations, burgers vector, Interfacial defects-External surfaces, Grain boundaries, twin boundaries, stacking faults, Bulk and volume defects.(Section 5.2 to 5.8)

Diffusion in solids -

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

Unit III

Ceramics and its properties:15 Hrs Max mark 32

Glasses, Glass ceramics, properties, refractories - fire clay and silica refractories, Abrasives, cements, advanced ceramics-optical fibers, ceramic ball bearings, piezo electric ceramics, stress-strain behaviour of ceramics, flexural strength and elastic behaviour.(Section 12.1 to 12.8, 12.11

Polymers and its properties

Different forms of Carbon-Diamond, Graphite, Fullerenes, Carbon nano tubes. (Qualitative aspects only)(Section 4.17,)

Hydro carbon molecules, polymer molecules, homo polymers and copolymers, molecular weight calculation, linear polymers, branched polymers, cross linked polymers, network polymers, thermo setting and thermo plastic polymers, stress -strain behaviour and viscoelastic deformation of polymers.(Section 13.1 to 13.9, 14.2, 14.3, 14.4)

Unit IV

Material Analysis Techniques :12 Hrs Max mark 30

Single crystal and powder diffraction techniques with diffractometer, Laue's technique and rotating crystal method, Microscopic techniques-Optical microscopy, electron microscopy, transmission electron microscopy, scanning electron microscopy, Scanning probe microscopy,

construction and working of each device, Grain size determination technique. (Section 4.20, 5.12, 5.13)

Book for study –

Material Science and Engineering by William D. Callister, Adapted by R. Balasubramanyam (IIT Kanpur), Published by Wiley India Pvt Ltd (Price - 550.00)(Reprint 2011)

Book for reference

1. Materials science and engineering- V Edn- V Raghavan(PHI)
2. Material science by S.L.Kakani & Amit Kakani, 2nd edition 2010, reprint 2011
3. Material Science & Engineering, R.K. Rajput (Jain Book Agency)
4. Material Science and Engineering, I. P . Singh, & Subhash Chander (Jain Book Agency)

Semester 5
OPEN COURSE –I
(For students from other streams)

Objective

To develop scientific temper and attitude in students from other streams.

Scope of the course

Since the course does not require a solid base in **physics only qualitative & elementary ideas of the subject** are expected from the students.

VPH5 D01: NON CONVENTIONAL ENERGY SOURCES (36 Hours Credit – 2)
(Problems not required)

UNIT I .

Solar energy : 10 Hrs **Max mark 20**

Solar constants, Solar radiation measurements, solar energy collector, Physical principle of the conversion of solar radiation in to heat, ,solar cookers, solar distillation, solar furnaces, solar greenhouses, solar electric power generation(no need of mathematical equations) (2:1,2;2,2:5,3:1,-3:3,3:7,3:8,5:6,5:8,5:10-12 Non conventional sources of Energy by G D Rai,Khanna publishers)

UNIT II.

Wind energy: 7Hrs **Max mark 14**

Basic principle of wind energy conversion, basic components of wind energy conversion system, wind energy collectors. application of wind energy. (6:1,6:2.1,6:5,6:7,6:8.1,6:8.2,6:8.4,6:13 Non conventional sources of Energy by G D Rai,Khanna publishers)

UNIT III.

Geothermal energy and energy from biomass: 10 Hrs **Max mark 18**

Geothermal sources, geo-pressured resources, advantages and disadvantages of geothermal energy over other energy forms, application of geothermal energy. introduction to biomass Method of obtaining energy from biomass. (8:1,8:4,8:6,8:12,8:13,7:1,7:23 Non conventional sources of Energy by G D Rai, Khanna publishers)

UNIT IV .

Energy from Oceans and Chemical energy resources: 9 Hrs **Max mark 16**

Ocean thermal electric conversion. Energy from tides, Basic principle of tidal power, advantages and limitation of tidal power generation. advantages and disadvantages of wave energy wave energy conversion devices. batteries, advantages of battery for bulk energy storage (9:1,9:2.1-9:2.4,9:3.1,9:3.2,9:3.9,9:4.2,9:4.4,10:3.1-10;3.3,10:3.7 Non conventional Sources of Energy by G D Rai, Khanna publishers)

Text books:

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 by G.D. Rai, 1995.

References

1. Energy Technology by S. Rao and Dr. B.B. Parulekar, 1997, 2nd edition
2. Power Technology by A. K. Wahil. 1993.
3.Non conventional energy resources, S. hasan Saeed, D. K. Sarma

OPEN COURSE –II

(Problems not required)

VPH5 D02: AMATEUR ASTRONOMY AND ASTROPHYSICS (36 Hours Credit – 2)

Unit-1 (12 hours) **Max mark 22**

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 (8 hours) **Max mark 14**

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 (8 hours) **Max mark 16**

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 (8 hours) **Max mark 16**

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-Chandra sekher limit- Novae-Binary stars - neutron star-black holes. Expanding universe-Bigbang theory

References Books:

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

OPEN COURSE –III

(Problems not required)

VPH5 D03: ELEMENTARY MEDICAL PHYSICS (36 HOURS)

UNIT-1-NUCLEAR MEDICINE PHYSICS (12 Hours) Max mark 24

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, and 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.

Books for study

1. W.R.Hendee & E.R.Ritenour, Medical Imaging Physics (4th edn) Wiley New York,
2. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill,New Delhi, 1997.)

UNIT – 2. MEDICAL INSTRUMENTATION- (12 Hours) Max mark 22

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, Electroencephalography(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

Books for study

1. John G. Webster, "Medical Instrumentation Application and Design", John Wiley and sons, New York, 1998.,
2. Khandpur R.S,Handbook of Biomedical Instrumentation,Tata McGraw-Hill,New Delhi, 1997

UNIT-3-MEDICAL IMAGING TECHNIQUES (12 Hours) Max mark 22

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 for study

1. John G. Webster, "Medical Instrumentation Application and Design", John Wiley and sons, New York, 1998.,
2. Khandpur R.S,Handbook of Biomedical Instrumentatio 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.
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(3rd eds) Mosbe Year-Book, Inc., 1992.
7. Hendee & E.R.Ritenour, Medical Physics.

B.Sc PROGRAMME IN PHYSICS (CORE)
PRACTICALS

The external practical examination will be conducted at the end of 4th & 6th semesters. Fair record has to be submitted for the external examination. **Total number of experiments to be done for each practical paper is twenty and the minimum number of experiments for appearing the external examination is 15.**

A student has to submit a certified record with a minimum of **75%** of the experiments, listed in the syllabus to attend the practical External Examination. Equal weightage must be given to all sections. The principle or the logic and the relevant expressions of the experiment must be shown at the time of examination (Activity oriented).

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 3rd and 4th cycles. If there are a total of 3 cycles for a practical course, a test paper each can be included in the 2nd and 3rd cycles. A model examination can also be conducted after completion of all cycles. Internal grade for test papers can be awarded based on the best two performances.

VPH4 BPL1: Practical I (Credit – 5)
1st, 2nd, 3rd & 4th SEMESTER EXPTS
(Any 10 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-capillary 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 magnet
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. Ballistic galvanometer-figure of merit
19. Potentiometer-measurement of resistance and resistivity

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.

VPH6BPL2 - Practical II (Credit – 5)
5th & 6th SEMESTER EXPERIMENTS (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 andextra-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 –thermal conductivity
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.
16. Conversion of Galvanometer to ammeter
17. BG Absolute Capacity
18. BG-High resistance by leakage method
19. Planck's constant using LED's (3no.s)
20. To determine the specific heat capacity of a liquid by the Newton's law of cooling.
21. Frequency of AC using sonometer
22. Verification of Stefan's law.
23. To determine the sensitiveness of the given galvanometer in millivolt/scale division and to use it to measure the emf of a thermocouple.
24. To study the variation of magnetic flux density in ion rod/ring with the magnetising field and to draw the hysteresis loop and hence to determine the energy dissipated per unit volume per cycle.
25. Determination of the dielectric constant using charging and discharging of a capacitor.
26. Spectrometer-Determination of refractive index of liquid by using hollow prism.
27. Determination of temperature coefficient of resistance of thermistor.

VPH6 BPL3– Practical III (Credit – 5)
5th & 6th SEM EXPTS (Minimum 15 from Unit: I and 5 from Unit: II)

Unit: I

1. Construction of Half wave rectifier and full wave Bridge rectifiers. Calculate the ripple factor.
2. Characteristics of Zener diode and construction of Voltage regulator.

3. Transistor characteristics and transfer characteristics in Common Emitter Configuration-current again
4. CE Transistor Amplifier-Frequency response.
5. Clipping & Clamping circuits
6. Negative feedback amplifier
7. Colpitt's Oscillator
8. Phase shift oscillator
9. Operational Amplifier –inverting, noninverting, Voltage follower
10. Construct a single transistor voltage regulator
11. Realisation of gates using diodes (AND, OR) & transistors (NOT), verification using IC's
12. Voltage multiplier (doubler, tripler)
13. AstableMultivibrator using transistors.
14. Flip-Flop circuits –RS and JK using IC's
15. Verification of De-Morgan's Theorem using basic gates.
16. Half adder using NAND gates
17. Construct a full wave centre tapped rectifier using semiconductor diodes and find its ripple factor. Construct a low voltage power pack using this arrangement.
18. To draw the static characteristics of a semiconductor diode/LED and hence to determine its forward dc resistance.
19.Construction of RC filter circuit –Low pass, High pass
20.Construction of dual regulated power supply

Unit: II Numerical Methods Using Python:

Note:-Basic ideas of Python Programming (theory) should be introduced during Lab hours before starting the Practicals.

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

COMPLEMENTARY COURSES IN PHYSICS
(For B.Sc Programme In Mathematics, Chemistry Etc.)

Aim & Objectives.

The syllabus is drafted to generate new concepts with practical thinking and multidimensional applicability of Physics in other science programmes so as to empower students who have undergone grading system of education at under graduate level. It is restructured in order to correlate the concepts of Physics with other core programmes and also to generate exhaustive interest in Physics course through series of activities like problem solving, active participation in laboratory programme, smart class room lectures etc.

At the time of external practical examination, a student has to produce certified record with a minimum of **75%** of the experiments, listed in the syllabus. The maximum marks for record is Ten for twenty experiments. ½ mark will be deducted per experiment if the number is less than twenty.

SEMESTER -1
VPH1 C01: Properties of matter & Thermodynamics

(Hrs/ Week =2 , Hrs / Sem =36, Credit =2)

1. **Elasticity: 9 Hours Max 26 marks**

Elastic modulii. (Elementary ideas)- Dependence of Young's modulus on temperature (posing one practical application)- Work done per unit volume- Poisson's ratio (Engineering application and theoretical limits)- relation between various elastic constants- Twisting couple on a cylinder- Torsion pendulum-Determination of rigidity modulus of a wire- Bending of beams-bending moment- I-form girders- Cantilever loaded at the free end.

2. **Surface Tension & viscosity :9 Hours Max marks 26**

Surface tension (Elementary ideas)-Excess pressure inside a liquid drop and bubble (Effect of electrostatic pressure on a bubble-change in radius)-Work done in blowing the bubble (problem based on the formation of bigger drop by a number of smaller drops)- Variation of surface tension with temperature, impurities, contamination- Effect of evaporation and condensation.

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

3. **Thermo dynamics :18 Hours Max marks 48**

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

Entropy-Change of entropy in a carnot's cycle, reversible cycle , irreversible cycle ,principle of increase of entropy- Entropy and available energy- entropy and disorder

Thermo dynamic functions- concept of enthalpy- Helmholtz function- Gibb's function-Maxwell's thermodynamic relations- Clausius-Clapyron equation-Effect of pressure on melting point and boiling point.

(Heat , Thermodynamics and statistical mechanics- Brijlal, Dr. Subrahmanyam, P.S. Hemne (revised Edition 2010) Sections : 4.4, 4.7, 4.10.1, 4.10.3, 4.10.4, 4.10.5, 4.10.7, 4.11, 4.12, 4.13, 4.14, 4.15, 4.20, 4.21, 4.22, 4.23, 4.24,,4.26, 4.27, 4.28, 4.29, 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.8, 6.3, 6.4.7, 6.5, 6.6, 6.7
Text for study: Properties of matter –J.C.Upadhaya
Heat and thermodynamics-Brijlal and Subramanium

Books for reference

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

SEMESTER - 2
VPH2 C02: Mechanics, Relativity, Waves & Oscillations

(Hrs/ Week =2 , Hrs / Sem =36, Credit =2)

1. **Frames of reference** : **4 Hours Max marks 15**

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

2. **Conservation of Energy and Momentum :10 Hours Max marks 27**

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

3. **Relativity :6 Hours Max marks 18**

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

4**. Oscillation and waves :10 Hours Max marks 26**

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

5**. Quantum mechanics :6 Hours Max marks 14**

Postulates of quantum mechanics-Wave function-Schrodinger equation (Time dependent & steady state form)-eigen values and eigen functions-electron microscope and scanning tunnelling microscope (Qualitative study)
Text for Study:Mechanics-J C Upadhaya
Modern Physics-Arthur Bieser

Books for reference-

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

SEMESTER - 3

VPH3 C03: Optics , Laser , Electronics & communication

(Hrs/ Week =3 , Hrs / Sem =54, Credit =2)

1.**Fermat's Principle : 2Hrs Max marks 8**

Laws of reflection and refraction- verification by Fermat's principle

2.Interference :10 Hrs Max Marks 20

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

3.Diffraction :8 Hrs Max marks 16

Fresnels and Fraunhoffer class of diffraction

Fraunhofer single slit diffraction pattern- Intensity distribution- plane diffraction Grating-resolving power and dispersive power. Experiment with grating

4. Polarisation :8 Hrs Max marks 16

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

5. Electronics :14 Hrs Max marks 24

Half wave, Full wave and bridge rectifier circuits- Efficiency & ripple factor- Filter circuits (capacitor filter and π filters) – Zener diode characteristics- Voltage stabilization

Transistors- CB, CE, CC Configurations- characteristics- Current amplification factors relation connecting α , β and γ. Basic principle of feedback- L C & RC oscillators- Colpit's & Hartley oscillators.Logic gates- Universal gates- De- Morgan's theorem – Exclusive OR and Exclusive NOR Gate,

Basic principles of integrated circuits.

6. Laser physics :6 Hrs Max marks 8

Induced absorption- spontaneous emission and stimulated emission- population inversion- Principle of Laser-Types of laser- Ruby laser, Helium Neon laser- semi conductor laser (qualitative study)

7. Principle of Communication :6 Hrs Max marks 8

Transmission and reception of signals- modulation and demodulation- Types of modulation-AM, FM,PM.(Elementary only)

Text for study: Optics-Brijlal&Subramanian

Principles of Electronics-VK Mehta

Books for reference

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

SEMESTER - 4

VPH4 C04: Electricity, Magnetism and Nuclear physics

(Hrs/ Week =3 , Hrs / Sem =54, Credit =2)

1. Electrostatics :12 Hrs Max marks 22

Coulomb's law between charges- Electric field- field lines- Electric potential-Gauss lawapplication to find field due to plane sheets of charge- Electrostatic shielding (pose practical application) –Dielectrics- capacitors

2. Current electricity : 8 Hrs Max marks 16

Drift velocity of charges- electric resistance- super conductivity (basic ideas)- Potentiometer – determination of resistance- Carey Fosters bridge- temperature coefficient of resistance.

3. Magnetism :10 Hrs Max marks 20

Earths magnetism- magnetic elements- Dia magnets-paramagnets and Ferro magnetsmagnetic moment-Deflection magnetometer-Tan A & Tan B - Searle's vibration magnetometer- Tangent galvanometer- Hysteresis

4. Nuclear physics: 14 Hrs Max marks 24

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

5. Cosmic rays and Elementary particles :10 Hrs, Max marks 18

Cosmic rays (primary and secondary)- cosmic ray showers-latitude effect- longitude effect-Elementary particles- Classification- Leptons- Hadrons- quarks- Higgs boson- L H C.

Text for study:Electricity and Magnetism-Murukesan

Nuclear Physics-D.C.Tayal

Books for reference

1. Introduction to Electro dynamics-David J Griffith
2. Electricity and Magnetism – Arthur F kip
3. Concepts of Modern physics – Arthur Beiser
4. Nuclear physics – Irvin Kaplan
5. Nuclear physics - D.C.Tayal

Lab Programme for Complementary courses

Lab examination will be conducted at the end of 4 th semester. Total number of experiments to be done is twenty and the minimum number of experiments for appearing the external examination is 15.

Basic theory of the experiment must be shown at the time of Examination

VPH4 CPL: Complimentary Course-II (Practical)
Hours per week-2, Hours per semester-36,Credit-0
Semester-1

(Any FIVE)

1. Density of a rectangular glass plate – use of vernier caliper, screw gauge and weighing balance
2. Liquid lens- Refractive index of liquid and glass
3. Torsion pendulum- Rigidity modulus
4. Spectrometer- Refractive index of the material of prism

5 Deflection Magnetometer- Moment of a magnet (Tan-A position)
6 Potentiometer-Measurement of resistance and resistivity

Semester-2

(Any FIVE)

1 Young's modulus – Uniform bending –using optic lever
2. Static torsion – Rigidity modulus
3. Spectrometer- Grating- Normal incidence
4. Melde's string- Frequency of fork (Transverse and Longitudinal mode)
5. Half wave rectifier and Full wave rectifier
6. Field along the axis of a circular coil

Semester-3

(Any FIVE)

1.Young's modulus- Pin and microscope (Non- Uniform bending)
2. Characteristics of Diode and Zener diode
3.Viscosity of liquid- Capillary flow- Variable pressure head method
4. Air wedge-angle of the wedge, radius of a thin wire
5 Carey Fosters bridge- Resistivity of the material of wire
6 Surface Tension-Capillary rise method- Radius by microscope.

Semester-4

VPH4 C05(PL): Complimentary Course-II (Practical)

(Any FIVE)

1. Young's modulus of a cantilever- Mirror and telescope method
2. Potentiometer-Calibration of low range voltmeter
3. Moment of inertia of fly wheel
4. Logic gates – Verification of truth table
5. Searle's vibration magnetometer – Comparison of moments
6. Newton's rings- Wavelength of sodium light

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

FIRST SEMESTER B.Sc. DEGREE EXAMINATION, OCTOBER 2016

(CBCSS-UG)

Core Course-Physics

VPH1B01-METHODOLOGY OF SCIENCE AND PHYSICS

Time:3 Hours Maximum: 80Marks

Part A (Objective Type)

Answer all questions.

Each question carries 1 mark.

1. Knowledge obtained by deductive reasoning is called ----------
2. Author of Principia Mathematica is----------
3. Who introduced the word Physics to science first?
4. ----------is referred to as language of science .
5. A vector divided by its magnitude is ----------vector.
6. Vectors A and B are such that [A+B]= [A-B] then the angle between the vectors is---------
7. Two forces 6N and 2N are acting at an angle 60 degrees. Angle made by the resultant with the greater force is----------

State whether the statement is true or false (8-10)

8. Finding the speed of a car is science.
9. A Scientific Theory is extensible.
10. If Curl F =0, then F is rotational.

(10 x 1 = 10 marks)

Part B (Short answer type)

Answer all questions.

Each question carries 2 marks.

11. What are auxiliary hypothesis and adhoc hypothesis?
12. What is meant by pseudo science?
13. What is a black body?
14. Give three properties of null vector.
15. What is the geometrical meaning of gradient?
16. Define transpose of a matrix
17. State and explain Stokes theorem

(7 x 2 = 14 marks)

Part C (Paragraph type)

Answer any five questions.

Each question carries 4 marks.

18. What are the assumptions made by Newton to develop Mechanics?

19. . What is De Broglies hypothesis?
20. Discuss the importance of peer review.
21. Give the elemental displacement in cylindrical coordinates
22. What is Hermitian matrix. Show that A is Hermitian, =
23. Using spherical polar coordinates find the volume of a sphere of radius R.
24. Prove that the given vectors A=1+4j+3k and B =4i=2j-4k are perpendicular to each other.

(5 x 4 = 20 marks)

Part D (Problems)

Answer any four questions.

Each question carries 4 marks.

25. The threshold wavelength for photo electric emission in tungsten is 230nm.What is the wavelength of light that must be used in order to eject electron with energy of 1.5 eV.
26. Find the area of a parallelogram whose sides A and B are in metres. A=i+j+k and B=3i+2k
27. If F= 2xz2i-yzj+3xz3k, find the Curl of Curl of F at the point (1,1,1)
28. If A=4i-3j+2k and B=2i-4j+3k and C=4i-8j-2k find (AXB)XC
29. A particle acted upon by a force F=6i+j-3k is displaced from a point i+2j+3k to a point 5i+4j+k.Find the work done by the force.
30. Calculate the Laplacian of the following function Ø= x2+2xy+3z+4
31. Show that matrix A is orthogonal. A=$\begin{matrix} 4 & 2 \\ 3 & 6 \end{matrix}$

(4 x 4 = 16 marks)

Part E (Essay Type)

Answer any two questions.

Each question carries 10 marks.

32. What is hypothesis? Discuss the various aspects and steps in formulation of hypothesis scientific method.
33. Write an essay on the development of Quantum Mechanics
34. Solve the equations using Cramer's rule.
    2x-y+2z=2, x+10y-3z=5, -x+y+z=-3
35. What are Eigen values and Eigenvectors. Find the Eigen values and Eigen vectors of
    A=$\begin{matrix} 2 & 1 \\ -1 & 4 \end{matrix}$

(2 x 10 = 20 marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

SECOND SEMESTER B.Sc. DEGREE EXAMINATION

(CBCSS-UG)

Core Course-Physics

VPH2B02- Properties of Matter, Waves and Acoustics

Time:3 Hours Maximum: 80Marks

Part A (Objective Type)

Answer all questions.

Each question carries 1 mark.

1. The motion of a particle is given by $x = a\sin(\omega t) + b\csc(\omega t)$. The amplitude of resultant motion is.....
2. Write down the expression for the frequency of oscillation of a damped harmonic oscillator?
3. What is a harmonic oscillator?
4. What is relaxation time ?
5. Write down the expression for total energy of a harmonic oscillator.
6. The length of a wire is doubled ,then its Young's modulus .....

a) remains unchanged **b)** becomes double **c)** becomes half **d)** none of these

7. Give the theoretical limits of Poissons ratio
8. The length of metal is l_1 when the tension is T_1 and l_2 when the tension in it is T_2 .The original length of the wire is

a) $\frac{l_1+l_2}{2}$ **b)** $\sqrt{l_1+l_2}$ **c)** $\frac{l_1T_2+l_2T_1}{T_2+T_1}$ **d)** $\frac{l_1T_2-l_2T_1}{T_2-T_1}$

9. State Hookes law of elasticity
10. Give the expression for work done in twisting a cylinder or wire

(10 x 1 = 10 marks)

Part B (Short answer type)

Answer all questions.

Each question carries 2 marks.

11. Find the position of SHM at which kinetic energy and potential energy are equal.
12. Show that the space averages of kinetic energy and potential energy are not eqal
13. Show that in the presence of damping the velocity of a damped harmonic oscillator decreases exponentially
14. Represent graphically the variation of KE , PE and total energy with displacement of a particle executing SHM
15. Which is more elastic steel or rubber? Why?
16. Derive the expression for work done in deforming a body in the case of shearing strain.
17. For a given material Y is 2.4 times than of n. Find its poisson's ratio.

(7 x 2 = 14 marks)

Part C (Paragraph type)

Answer any five questions.

Each question carries 4 marks.

18. Derive expression for time period of a simple pendulum.
19. What is a Helmholtz resonator. Derive expression for its time period.
20. Explain in detail what is meant by anharmonic oscillations
21. Derive expressions for Young modulus ,bulk modulus and rigidity modulus
22. Show that adiabatic elasticity is γ times pressure.
23. Explain Stress Strain graph
24. Derive the relation between various elastic constants

(5 x 4 = 20 marks)

Part D (Problems)

Answer any four questions.

Each question carries 4 marks.

25. A simple harmonic oscillator of period 3s and amplitude 1.5m has a total energy of 1J. What is its mass? How much time will it take to reach half way through the amplitude after crossing the mean position?
26. A simple pendulum has a period of 2s. After 100 complete oscillations its amplitude has been reduced to 1/10. Find the damping constant.
27. Find the velocity and acceleration after 0.3s from the extreme position of a body moving with SH M with an amplitude 0.8m and period of oscillation of 1.6s.
28. At what displacement the kinetic energy is equal to ¼ of the potential energy of a particle executing SHM.
29. Show that a small and uniform volume strain *v* is equivalent to three linear strains in three perpendicular directions.
30. When a rubber is stretched it is observed that change in its volume is partially negligible in comparison to the change in its shape. Find the value of Poisson's ratio for rubber.
31. Two cylindrical shafts have the same length and mass are made of the same material. One solid, while the other which is hollow has an external radius twice the internal radius. Compare their torsional rigidities.

(4 x 4 = 16 marks)

Part E (Essay Type)

Answer any two questions.

Each question carries 10 marks.

32. Set up the differential equation for a damped harmonic oscillator and solve it. Discuss the three cases of damping.
33. Explain the composition of two rectangular SHMs of equal periods and different phases and amplitudes in detail.
34. Deduce an expression for the couple per unit twist of a uniform cylinder.
35. Derive an expression for the time period of a torsion pendulum and explain how it is used to find the rigidity modulus of the material of a wire.

(2 x 10 = 20 marks)

Model Question Paper
VIMALA COLLEGE (AUTONOMOUS), THRISSUR
THIRD SEMESTER B.Sc. DEGREE EXAMINATION
(CBCSS-UG)
Core Course-Physics
VPH3 B03 - MECHANICS

Time:3 Hours Maximum: 80Marks

Part A (Objective Type)
Answer all questions.
Each question carries 1 mark.

1. Coriolis force is a .....
2. What is Energy Function ?
3. ……frame is known as Zero momentum frame.
4. Constraints in the case of gas molecules in a cubical vessel is an example of…… .
5. What are non conservative forces
6. Kinetic energy required to project a body of mass from earth to infinity is….
7. The constraints that do not do any work are called ----
8. The work done around any closed path in a conservative force field is-----
9. Define centre of mass
10. Expression for the period of oscillation plane of a Foucaults pendulum is……..

(10 x 1 = 10 marks)

Part B (Short answer type)
Answer all questions.
Each question carries 2 marks.

11. Show that length is invariant under Galilean Transformation
12. Explain with examples the concept of fictitious forces.
13. State and explain work energy theorem
14. Two masses m1 and m2 have position vectors r1 and r2. Find the position vector of the centre of the mass.
15. A light body and a heavy body in translational motion have equal KE. Which of them has greater momentum.
16. What is meant by inverse square law force? Give examples.
17. Define configuration space

(7 x 2 = 14 marks)

Part C (Paragraph type)
Answer any five questions.
Each question carries 4 marks.

18. Explain the principle of virtual work.
19. Discuss potential energy curve in detail.
20. Explain the hypothesis of Galilean invariance.
21. Check whether that the following force is conservative. $F=(y^2-x^2)i+2xyj$
22. Distinguish between elastic and inelastic collisions. Obtain an expression for the coefficient of restitution.
23. Derive the expression for the centre of mass of a solid hemisphere
24. What are constraints. Classify them with examples

(5 x 4 = 20 marks)

Part D (Problems)

Answer any four questions.

Each question carries 4 marks.

25. Derive the expression for the centre of mass of a right circular cone.
26. A rocket is fired vertically from rest burns its fuel in 30sec,If the exhaust velocity of the gases relative to the rocket is 3000m/s. What must be the mass ratio M0/M for a final velocity of 8×10^3m/s.
27. Four bodies of masses 5Kg,8Kg,10Kg and 2Kg are placed at points (3,0,3),(-3,2,2),(3,-2,4) and (2,2,2).Find the position of centre of mass of the system.
28. A stone is dropped with zero velocity from the top of a100m high tower at the equator. Calculate the horizontal displacement of the stone due to earths rotation.
29. A particle experience a force associated with a potential energy $U=3x^2-x^3$. Find the position of the stable and unstable equilibrium.
30. A mass m is raised to a height nR, where R is the radius of the earth and n is an integer. calculate the change in potential energy.
31. If the force $F=2x^2yi+3xyj$ displaces in the X-Y plane from (0,0) to (1,4) along the curve the $y=4x^2$. Find the work done.

(4 x 4 = 16 marks)

Part E (Essay Type)

Answer any two questions.

Each question carries 10 marks.

32. Explain the principle of rocket. Derive expression for the final velocity of rocket.
33. What do you mean by fictitious force? Discuss the fictitious forces acting on a particle moving in a rotating frame.
34. What is meant by gravitational self energy of a system ? Derive the expression for gravitational self energy of a uniform solid sphere.
35. Derive Lagranges equations from De Alemberts Principle.

(2 x 10 = 20 marks)

Model Question Paper
VIMALA COLLEGE (AUTONOMOUS), THRISSUR
FOURTH SEMESTER B.Sc. DEGREE EXAMINATION
(CBCSS-UG)
Core Course-Physics
VPH4 B04- ELECTRODYNAMICS - I

Time:3 Hours Maximum: 80Marks

Part A (Objective Type)
Answer all questions.
Each question carries 1 mark.

1. Write down the expression of volume current density J?
2. What will happen to the domains in a ferromagnetic substance in a external magnetic field?
3. What is the relationship between electric potential and electric field?
4. A charge q is placed at the centre of a cube of side L. What is the electric flux linked with the cubical surface?
5. Write down the divergence and curl of Magnetic fields?

Questions 6 to 10 : Write True or False.

6. The Electric field developed between two oppositely charged parallel plates is uniform.
7. In magneto statics boundary conditions, normal components of fields are discontinuous.
8. The concept of magnetic vector potential A is introduced on the basis of Lenz's law.
9. No work is done in moving a charge from one point to another on equi potential surface.
10. When a dielectric is placed in a parallel plate capacitor its capacitance decreases.

(10 x 1 = 10 marks)

Part B (Short answer type)
Answer all questions.
Each question carries 2 marks.

11. State and explain Coulomb's law
12. Define electric field at a point. Give its two units..
13. What are Polar molecules ?
14. State the first Uniqueness theorem?
15. Show that surface current density is the product of charge density and velocity of charges?
16. Write down the differential form of Ampere's circuital theorem from the integral form.
17. How magnetic dipoles are generated in specimen placed in a magnetic field?

(7 x 2 = 14 marks)

Part C (Paragraph type)
Answer any five questions.
Each question carries 4 marks.

18. What are paramagnetic and diamagnetic substances?

19. Derive an expression for the electric field intensity at a point in between two infinite plane sheet of charge?
20. What are bound currents? Explain them?
21. Explain cyclotron motion?
22. Derive Amper's law in magnetized materials
23. Discuss about the comparison of magnetostatics and electrostatics.
24. Derive Poissons equation and obtain Laplace equation.

(5 x 4 = 20 marks)

Part D (Problems)

Answer any four questions.

Each question carries 4 marks.

25. Find the electric field at a distance z above the centre of a flat circular disc of radius R, which carries uniform surface charge σ.
26. E = xyi + 2yz j + 3xz k. Check whether it is an admissible electric field or not.
27. An electron travels with a velocity of 2x108 m/s perpendicular to a uniform magnetic field 0.15 T. Determine the force on the electron.
28. A potential difference 100 V is applied to a 1 microfarad and 2 microfarad capacitors are connected parallel. Find charge and potential across each other.
29. A point charge 10 -7 is situated at the centre of a cube of side1m. Calculate the electric flux through the surface.
30. A power line carries a current of 90 Ampere in East – West direction. What is the magnitude and direction of the magnetic field due to the current 1.5 m below the line?
31 Find out he magnetic flux density B of a square wire loop of side 10 cm carrying a current 1 A in the clockwise direction

(4 x 4 = 16 marks)

Part E (Essay Type)

Answer any two questions.

Each question carries 10 marks.

32. Derive equations for div and curl of B due to a volume distribution of current..
33. Applying Gauss's law find the electric field due to a uniformly charged spherical Insulator at a point (a) outside (b) on the surface and (c) inside. Plot the variation graphically.
34. What is the effect of magnetic field on atoms?
35. Derive an expression for the magnetic field due to a straight conductor carrying steady current using Biot – Savart law?

(2 x 10 = 20 marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION

(CBCSS-UG)

Core Course-Physics

VPH5 B05- ELECTRODYNAMICS-II

Time: 3 Hours Maximum: 80Marks

Part A (Objective Type)

Answer all questions.

Each question carries 1 mark.

1. The dimension of L/R is
2. The physical meaning of $\nabla.B = 0$ is
   a) nonexistence of magnetic monopoles b) no source is required to produce magnetic field
   c) both a and b d) none
3. In an AC circuit with C and R the current lags behind the voltage by……
4. At half power frequency of a resonance curve, the current is…….times the maximum current.
5. The direction of propagation of electromagnetic wave is given by:
   a) Vector E b) Vector M c) Vector (ExB) d)None
6. The normal components of **E** are continuous across a boundary. True or False?
7. The dimension of $(\mu_o \in_o)^{-1/2}$ is …….
8. . ……is the unit of current sensitivity
9. Give the expression for displacement current.
10. Give the expression for the general wave equation.

(10 x 1 = 10 marks)

Part B (Short answer type)

Answer all questions.

Each question carries 2 marks.

11. Explain the functioning of a choke coil.
12. What is the time constant of a LR circuit.
13. Explain the significance of j operator.
14. State superposition theorem
15. Write down Maxwell's equations in free space.
16. Mention the significance of the continuity equation.
17. What is meant by polarization of a plane electromagnetic wave.

(7 x 2 = 14 marks)

Part C (Paragraph type)

Answer any five questions.

Each question carries 4 marks.

18. State Poynting's theorem.
19. Derive the wave equations governing electromagnetic fields in free space.
20. Give the method for Thevenizing a given circuit.
21. Calculate the energy per unit volume stored in an electromagnetic field.
22. Why and how Maxwell modified Ampere's law
23. Write down the boundary condition for normal components of E and B.
24. What is meant by admittance in ac circuits.

(5 x 4 = 20 marks)

Part D (Problems)

Answer any four questions.

Each question carries 4 marks.

25. An alternating emf of 200V, 50Hz is applied to a capacitor in series with a 20V,5w lamp. Find the capacitance.
26. Discuss resonance Parallel LC circuit with a small resistance for the inductor coil.
27. Show that maximum power is transferred to the load when the load resistance is equal to the internal resistance.
28. Find the velocity of electromagnetic wave in a lossless medium having a relative permittivity of 5 and relative permeability unity.
29. A solenoid 50 cm long and 10 cm in diameter is wound with 1500 turns. Find the inductance and the energy stored in the magnetic field when a current of 4 A flows in the coil.
30. Write down conditions for critical damping, over damping and damped oscillation in the case of an LCR circuit.
31. Show that the energy flux for a travelling wave in free space is simply the energy density times the velocity of the wave.

(4 x 4 = 16 marks)

Part E (Essay Type)

Answer any two questions.

Each question carries 10 marks.

32. Describe with theory how you will determine self inductance of a coil by Andersons method.
33. Derive the boundary conditions that the field vectors obey at the interface between two different media.
34. Derive Maxwell's equations inside a polarised matter
35. Discuss the LCR series circuit in detail

(2 x 10 = 20 marks)

Model Question Paper
VIMALA COLLEGE (AUTONOMOUS), THRISSUR
FIFTH SEMESTER B.Sc. DEGREE EXAMINATION
(CBCSS-UG)
Core Course-Physics
VPH5 B06 QUANTUM MCHANICS

Time: 3 Hours Maximum: 80Marks

Part A (Objective Type)
Answer all questions.
Each question carries 1 mark.

1. De Broglie wavelength in terms of momentum is .....
2. In pair production a photon splits in to .....
3. Photoelectric effect explains the .....nature of light
4. Uncertainity principle in terms of time and energy is.....
5. radius of orbit is proportional to ... power of principal quantum number.
6. Balmer series liesin the ..... part of the electromagnetic spectrum.
7. Meta stable state has the life time of about.....
8. Probability density is.....
9. Zero point energy of a harmonic oscillator is.....
10. Energy of hydrogen in terms of radius is.....

(10 x 1 = 10 marks)

Part B (Short answer type)
Answer all questions.
Each question carries 2 marks.

11. Explain Compton effect
12. Differentiate between phase and group velocity
13. What is meant by uncertainity principle?
14. What is Ruby LASER
15. Write a note on expectation value
16. What are the different quantum numbers
17. Explain tunnel effect

(7 x 2 = 14 marks)

Part C (Paragraph type)
Answer any five questions.
Each question carries 4 marks.

18. Explain quantum theory of blackbody radiation

19. Define pair production with examples
20. Why the energy of a particle trapped in a box is quantized?
21. Briefly explain the atomic spectra
22. Derive time dependant schrodinger equation
23. Explain Zeeman effect
24. Mention about linearity and superposition principle of waves

(5 x 4 = 20 marks)

Part D (Problems)

Answer any four questions.

Each question carries 4 marks.

25. Find the shortest wavelength present in the radiation from an X Ray machine whose accelerating potential is 50,000V
26. What is the frequency of an X Ray photon whose momentum is $1.1*10^{-23}$ Kg.m/s.
27. A typical atomic nuclei is about $5.0*10^{-15}$m i radius. Use the uncertainity principle to place a lower limit on the energy an electron must have if it is to be part of a nucleus
28. A positroim atom is a system taht consists of a positron and a electron that orbit each other. Compare the wavelengths of the spectral lies of positronium with those of ordinary hydrogen.
29. A particle limited to the x axis has the wavefunction ψ= ax between x=0 and x=1; ψ=0 elsewhere. a) Find the probability that the particle can be found between x=0.45 and x=0.55. b) Find the expectation value of the particle's position
30. Find the energy of a 700nm photon.
31. Derive the uncertainty principles

(4 x 4 = 16 marks)

Part E (Essay Type)

Answer any two questions.

Each question carries 10 marks.

32. Obtain the wave function and energy levels of a trapped particle in a box.
33. Obtain and Show that the energy levels of a harmonic oscillator are equally spaced.
34. Applying the separation of variable method, obtain the differential equation of hydrogen atom
35. Explain the splitting of atomic lines in the presence of a magnetic field

(2 x 10 = 20 marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION

(CBCSS-UG)

Core Course-Physics

VPH5 B07 - PHYSICAL OPTICS AND MODERN OPTICS

Time: 3 Hours Maximum: 80Marks

Part A (Objective Type)

Answer all questions.

Each question carries 1 mark.

1. When white light is used in biprism experiment, centre of fringe system is…….
2. What is the ratio of the amplitudes if the ratio of the intensities is 4:1?
3. What will happen to the fringe width if the biprism experiment is conducted in water instead of air?
4. Colours of thin film is due to …… .
5. The central point in Newton's ring seen in reflected light appears …….. .

Questions 6 to 10 : Write True or False.

6. The optical path length can never be less than geometrical path
7. For negative crystal μ_e is less than μ_o.
8. Refractive index of core is less than that of cladding.
9. Total internal reflection occurs when light ray travels from rarer to denser medium.
10. Optical fibres are immune to external interferences.

(10 x 1 = 10 marks)

Part B (Short answer type)

Answer all questions.

Each question carries 2 marks.

11 What are the necessary conditions for producing sustained interference?

12 Draw the diagram of Fresnel's two mirror arrangement

13 What is Rayleigh's criterion for resolution?

14 Compare zone plate with convex lens.

15 Give two applications of Holography.

16 What is the difference between step index fibre and graded index fibre.

17 What is acceptance angle? Write down the expression for it.

(7 x 2 = 14 marks)

Part C (Paragraph type)

Answer any five questions.

Each question carries 4 marks.

18 Using Fermat's principle prove the second law of reflection.

19 Explain how the distance between the two virtual slits in the biprism experiment is determined?
20 Deduce an equation for the resolving power of a grating
21 Explain with necessary graph the intensity distribution due to diffraction at a straightedge.
22 Distinguish between holography and photography.
23 Briefly explain how hologram is constructed.
24 Explain three types of pulse dispersions in optical fibres.

(5 x 4 = 20 marks)

Part D (Problems)

Answer any four questions.

Each question carries 4 marks.

25 Fresnel's biprism of refractive index 1.5 has an angle of 1_0.If the biprism is kept at a distance of 0.3 m from the slit illuminated by a light of wave length 600nm.,Find the band width. Given the distance between biprism and screen is 0.7m.
26 A beam of monochromatic light of wavelength582nm falls normally on a glass wedge with the wedge angle of 20 seconds of an arc. If the refractive index of glass is 1.5, find the number of dark fringes per cm of the wedge length.
27 In a Newton's rings experiment the diameter of the 15_{th} ring was found to be 0.59cm and that of the 5_{th} ring was 0.336 cm. If the radius of the Plano-convex lens is 100 cm, calculate the wave length of the light used.
28 A parallel beam of light of wave length 546 nm is incident at an angle of 30^0 on a plane transmission grating which has 6000 lines per cm. Find the highest order spectrum that can be observed.
29 What is the radius of the first half-period zone in a zone plate behaving like a convex lens of focal length 60 cm for light of wavelength 600 nm.
30 Calculate least thickness of a calcite plate which would convert plane polarized light into circularly polarized light. Given μ_o=1.65, μ_e= 1.48 and wavelength of light is 589nm.
31 The numerical aperture of an optical fibre is 0.5 and the core refractive index is 1.54. Find the refractive index of the cladding.

(4 x 4 = 16 marks)

Part E (Essay Type)

Answer any two questions.

Each question carries 10 marks.

32 Derive the system matrix for a thick lens and hence arrive at lens maker's formula.
33 Describe Michelson's interferometer .How will you determine the wave length of monochromatic light with the help of Michelson's interferometer?
34 Discuss Fraunhofer diffraction due to a double slit. Derive an expression for the intensity distribution and explain maxima and minima?
35 What is specific rotation? Deduce an equation for specific rotation. Describe Laurent's half shade polarimeter to find the specific rotation of sugar solution.

(2 x 10 = 20 marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION

(CBCSS-UG)

Core Course-Physics

VPH5 B08: ELECTRONICS (ANALOG & DIGITAL)

Time:3 Hours Maximum: 80Marks

Part A (Objective Type)

Answer all questions.

Each question carries 1 mark.

1. What is the maximum efficiency of a full wave rectifier?
2. A zener diode is used as a ----------
3. There is a phase difference of ----------between the input and output voltages of a CE amplifier..
4. For highest power gain which transistor configuration is to be used?
5. The binary equivalent of a hexadecimal number EF is ---------
6. If the doping level of a crystal diode is increased, the breakdown voltage ……..
7. CC configuration is used for getting high voltage gain. State true or false
8. The input to an XOR gate are 1 , 0, 1. Then the output will be……..
9. Two's complement of 10111 is …….
10. The decimal equivalent of octal number 110 is ……..

(10 x 1 = 10 marks)

Part B (Short answer type)

Answer all questions.

Each question carries 2 marks.

11. What is positional number system?
12. What is the importance of modulation factor in communication system?
13. Define α of a transistor and show that it is always less than unity.
14. Draw a full adder and its truth table.
15. Why do you prefer to express the gain in dB?
16. State and explain De Morgans theorem.
17. Subtract 4 from 8 using two's complement method in 8-bit format.

(7 x 2 = 14 marks)

Part C (Paragraph type)

Answer any five questions.

Each question carries 4 marks.

18. With a neat labelled diagram describe the working of a full wave bridge rectifier
19. Explain the following terms for a transistor CE amplifier a) Voltage gain b) Power gain
20. Discuss the importance of load line analysis in a transistor amplifier.
21. Draw the connection diagram of two stage RC coupled transistor amplifier and discuss the use of various capacitors in the circuit.

22. What do you understand by frequency modulation? Explain its advantages over amplitude modulation.
23. Explain the working of a summing amplifier using opamp.
24. Explain how voltage stabilization is ensured in a zener voltage regulator.

(5 x 4 = 20 marks)

Part D (Problems)

Answer any four questions.

Each question carries 4 marks.

25. A full wave bridge rectifier is connected to a 12V step down transformer. If the forward resistance of each diode is 4Ω and load resistance is 400Ω, find the dc load current and efficiency of the rectifier.
26. A transistor amplifier is biased with feedback resistor RB of 100kΩ. If VCC =20V, RC=1kΩ. and β=100 determine the operating points.
27. The absolute gain of an amplifier is 20. Find its decibel gain. When it is coupled to another amplifier the overall gain is 400. What is the overall gain in decibel.
28. Calculate the modulation index for an FM wave where the maximum frequency deviation is 50KHz and the modulating frequency is 5kHz.
29. A JFET has drain current of 5mA. If IDSS = 10mA and VGS(off) = -6V, find the value of VGS and Vp
30. A)Illustrate associative law of (i) addition and (ii)multiplication as applied to Boolean algebra.B)Also simplify the Boolean expression Y = (A+B+C) . (A+B)
31. Convert the the following decimal numbers into binary numbers

a) 133 b) 59.6855

(4 x 4 = 16 marks)

Part E (Essay Type)

Answer any two questions.

Each question carries 10 marks.

32. Discuss two biasing circuits used in CE amplifier configuration. Also explain how stabilization of operating point is achieved in each case and discuss the advantages and disadvantages of each circuit.
33. Explain negative feedback. Derive an expression for gain in a negative voltage feedback amplifier .What are the advantages of negative feedback?
34. Explain the principle, working and V-I characteristic of UJT. Discuss one practical application of UJT in detail.
35. With the help of diagrams explain the working of RS and JK flip-flops

(2 x 10 = 20 marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION

(CBCSS-UG)

Core Course-Physics

VPH6B09 THERMAL AND STATISTICAL PHYSICS

Time:3 Hours Maximum: 80Marks

Part A (Objective Type)

Answer all questions.

Each question carries 1 mark.

1. The mathematical form of Mayer's relation is**.....**
2. The refrigerator works on .....
3. The principle of heat engine is based on.....
4. The otto cycle was suggested by....
5. When ice melts, the entropy of the melted water .....
6. Phase transition of He I to He II is a transition of.....
7. The expression for Helmholz free energy is.....
8. According to classical physics the entropy of a syatem at absolute zero is .....
9. Who postulated zeroth law of thermodynamics?
10. The Clausius –Clapeyron eqn is the

(10 x 1 = 10 marks)

Part B (Short answer type)

Answer all questions.

Each question carries 2 marks.

11. What is meant by quasi static process
12. Define second law of thermodynamics
13. Explain entropy
14. Write a note on liquid helium
15. Draw T-S diagram of Carnot cycle
16. Explain equipartition theorem
17. Explain Wein's displacement law

(7 x 2 = 14 marks)

Part C (Paragraph type)

Answer any five questions.

Each question carries 4 marks.

18. Explain isothermal and adiabatic processes with examples.
19. Define Carnot's theorem

20. Describe entropy of an ideal gas.
21. Distinguish between first order and second order phase transitions
22. Write about the four thermodynamics functions
23. Write the differences between classical and quantum statistics
24. What is free expansion

(5 x 4 = 20 marks)

Part D (Problems)

Answer any four questions.

Each question carries 4 marks.

25. Calculate the work done in isothermal expansion
26. A Carnot reservoir has 30% efficiency, by how much hot reservoir alone can be raised in temperature to have 60% efficiency. B and hence bond length in CO molecule. Given Avogardro No is 6.022 X 10 ^{23}.
27. Obtain the Clausius Mossotti relationship using Maxwell's thermodyanical relation.
28. Prove that rms velocity is 9% greater than the average speed.
29. One mole of helium at 300K is adiabatically compressed so that its pressure increases to 10 times of its initial value. Find the final temperature attained. γ for helium is 1.67.
30. Calculate the change in entropy when 0.010kg of ice at 0 ^{0} C is converted in to water at the same temperature. Latent heat of ice is 336*10^{0} J/Kg.
31. How many photons are present in 1.00cm^{3} of radiation in thermal equilibrium at 1000K. What is their average energy.

(4 x 4 = 16 marks)

Part E (Essay Type)

Answer any two questions.

Each question carries 10 marks.

32. What is meant by adiabatic process? Derive an expression for it in terms of P and V
33. What is entropy-temperature diagram? Mention its uses. Obtain the expression for efficiency for Carnot engine using temperature entropy diagram of Carnot cycle
34. Discuss in detail the behaviour of the electrons in metals treating them as degenerate Fermi gas. Derive expressions for (i) Fermi energy and (ii) average electron energy at absolute zero.
35. Obtain the gas equation for an adiabatic process.

.

(2 x 10 = 20 marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION

(CBCSS-UG)

Core Course-Physics

VPH6B10 -SOLID STATE PHYSICS, SPECTROSCOPY AND LASER PHYSICS

Time:3 Hours Maximum: 80Marks

Part A (Objective Type)

Answer all questions.

Each question carries 1 mark.

1. The atomic packing factor for simple cubic structure is ---------
2. Write down the range of frequency of microwave radiations .
3. A super conductor exhibit complete Meissner effect is called ----------
4. Name the semiconducting material used in Semiconductor laser.
5. The commonly used source in microwave spectrometer is ----------
6. Name two molecules which shows infrared spectrum.
7. The lines on the low frequency side of Raman spectra are called ---------
8. The symmetry element in which a rotation followed by a translation is called -----
9. For a non –rigid rotator the spacing between the successive spectral lines decreases. (True or False)
10. Name two linear molecules

(10 x 1 = 10 marks)

Part B (Short answer type)

Answer all questions.

Each question carries 2 marks.

11. What is meant by coordination number. obtain the coordination number for fcc lattice
12. Explain how population of states affect the intensity of spectral lines
13. Distinguish between prolate and oblate type of molecules
14. What is zero point energy
15. Stokes or Antistokes, Which are more intense. Why
16. What is population inversion
17. Sketch the Schematic arrangement of an infrared spectrometer

(7 x 2 = 14 marks)

Part C (Paragraph type)

Answer any five questions.

Each question carries 4 marks.

18. What are miller indices? Explain the significance of miller indices.
19. Sketch the possible orthorhombic crystal systems.

20. Explain the BCS theory.
21. Distinguish between Type I and Type II super conductors.
22. Discuss the factors on which width of spectral lines depends.
23. Explain the breakdown of Born Oppenheimer approximation
24. Discuss the rotational Raman spectrum of symmetric top molecules

(5 x 4 = 20 marks)

Part D (Problems)

Answer any four questions.

Each question carries 4 marks.

25. Show that for a simple cubic lattice $d_{100} : d_{110} : d_{111} = 1; 1/\sqrt{2} : 1/\sqrt{3}$
26. The first line in the rotational spectrum of CO has a frequency of 3.8424 cm^{-1}. Calculate
27. B and hence bond length in CO molecule. Given Avogardro No is 6.022×10^{23}.
28. What is the average period of rotation of H Cl molecule if it is in the J=1 state. The inter nuclear distance of H Cl is 0.1274 nm. Given mass of Hydrogen and Chlorine atoms are 1.673×10^{-27} kg and 58.06×10^{-27} kg respectively.
29. The fundamental and first overtone of NO are centred at 1876 cm^{-1} and 3724 cm^{-1} respectively. Evaluate the equilibrium vibration frequency, the anharmonicity constant,zero point energy and force constant of the molecule. Mass of Nitrogen atom= 23.25×10^{-27}Kg. Mass of Oxygen atom = 26.56×10^{-27} Kg.
30. A substance shows a Raman line at 4567 A_0 when exciting line 4358A^0 is used. Deduce the positions of stokes and anti stokes lines for same substance when exciting line 4047A^0 is used. Critical temperature of mercury with isotopic mass 199.5 is 4.185 K. Calculate the critical temperature when atomic mass changes to 203.4.
31. Determine the coefficient of stimulated emission of radiation whose wavelength is 610 nm and the coefficient of spontaneous emission is 10^6 per second

(4 x 4 = 16 marks)

Part E (Essay Type)

Answer any two questions.

Each question carries 10 marks.

32. Explain Braggs Law and Braggs X-ray Spectrometer
33. Explain the rotational Spectrum of a linear diatomic molecule
34. Explain the theory and working of Ruby laser
35. Discuss the different Plains of symmetry of a cubic crystal

(2 x 10 = 20 marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION

(CBCSS-UG)

Core Course-Physics

VPH6 B11- NUCLEAR , PARTICLE PHYSICS AND ASTROPHYSICS

Time:3 Hours Maximum: 80Marks

Part A (Objective Type)

Answer all questions.

Each question carries 1 mark.

1. Neutrons were discovered by ……..
2. In betatron ……..causes acceleration of electrons
3. Nuclei with identical neutron numbers are called ……
4. Most of the cosmic rays particles have energy of ……..
5. The dimension of nuclear cross section is ……
6. Name a phosphor for gamma ray detection.
7. Which nuclear model can be used to explain nuclear fission?
8. Name the particle discovered in Large Hadron Collider Experiment at Geneva
9. The quark structure of Ω is ……..
10. What is the spin of photon?

(10 x 1 = 10 marks)

Part B (Short answer type)

Answer all questions.

Each question carries 2 marks.

11. Give two reasons for the non existence of electrons in the nucleus.
12. Find the density of 16 O nucleus. Given 1u= 1.66x 10^{-27}
13. Draw the binding energy curve for a nucleus. What conclusions can be drawn from it ?
14. What are the different types of b decay?
15. What is solar neutrino mystery?
16. What is a breeder reactor?
17. Deduce the relation between apparent and absolute stellar magnitudes.

i. (7 x 2 = 14 marks)

Part C (Paragraph type)

Answer any five questions.

Each question carries 4 marks.

18. What are the evidences for the occurrence of nuclear shells? What are the merits of shell model of nucleus?

19. State radioactive decay law. Determine the expression for half life period.
20. Explain the working of a G M Counter
21. Explain any two geo-magnetic effects of cosmic rays.
22. List four fundamental interactions and their properties .Explain the unification theory of interactions.
23. Explain the principle of ionization chamber
24. Write short note on stellar constellations.

(5 x 4 = 20 marks)

Part D (Problems)

Answer any four questions.

Each question carries 4 marks.

25. Find the energy difference of spin up and spin down states of proton in a magnetic field of 2 Tesla. What is the Lamor frequency of the proton in this field? Given μ_{pz}. =2.793 x 3.152x 10^{-8} eV/ T.
26. Find the binding energy per nucleon in $_{20}Ne^{10}$ and in $_{26}Fe^{56}$.
27. Derive the relation K .E_{α} = (A-4) /A for the Kinetic energy of alpha particles released in the decay of a nucleus of mass number A .
28. Show that Pion decay, muon decay and pair production conserve the lepton number.
29. Find the quark structure of pion, kaon, proton, neutron and omega.
30. In a linear accelerator proton accelerated thrice by a potential of 40 kV leaves a tube and enters an accelerating space of length 30 cm before entering next tube. Calculate the frequency of the r.f voltage
31. Derive the relation $m_2-m_1=-2.5 \log (l_2/l_1)$

(4 x 4 = 16 marks)

Part E (Essay Type)

Answer any two questions.

Each question carries 10 marks.

32. Explain the liquid drop model of nucleus. How does it lead to the semi empirical mass formula?
33. Derive an expression for decay constant in alpha decay.
34. Explain the construction and working of betatron.
35. Explain the classification of elementary particles with the associated quantum numbers. Give examples.

(2 x 10 = 20 marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

SIXTH SEMESTER B.Sc.DEGREE EXAMINATION

(CBCSS-UG)

Core Course-Physics

VPH6 E01 -COMPUTATIONAL PHYSICS

Time:3 Hours Maximum: 80Marks

Part A (Objective Type)

Answer all questions.

Each question carries 1 mark.

1. A method of determination of ' y' value corresponding to a given 'x' value within a range of data is called……
2. According to Euler's formula ,
   The new value of y = Old value of y + Slope× ……
3. In difference table $\Delta^2 Y_1 - \Delta^2 Y_0 =$
4. Simpson's rule is accurate only if, the number elements is ……
5. If we run the following Python code:

```
x=1
while x<=10:
 print x*2
x=x+1
```

   the output will not contain the number:
   (a) 10 (b) 8 (c) 21 (d) 20
6. Identify the statement that is not allowed in Python
   (a) x=a+b (b) x,y=1,2 (c) 3+x=x (d) x=a/c
7. Write an alternative expression for the Python statement: >>> n+=10
8. Which among the following is a valid python variable name?
   (a) Y@fy (b) del (c) as. (d) Y_fy
9. What is the result of the Python statement >>> print type(5+8j)?
10. Python can be used as a calculator in
    (a) script mode (b) Interactive mode (c) In Linux only (d) In windows only

(10x1=10 Marks)

Part B (Short answer type)

Answer all questions.

Each question carries 2 marks.

11. Explain the central differential operator.
12. What is an interpolation?
13. From the following table estimate the area bounded by the curve and the x-axis from x=0 to x=1

X	0	0.2	0.4	0.6	0.8	1.0
Y	2.00	2.04	2.16	1.36	1.64	3.00

14. Explain the principle of least square approximation method for curve fitting.
15. What is meant by dynamic data typing?
16. What is meant by slicing of a string? Write a line of code to demonstrate slicing.

17. What is the importance of finding solutions of algebraic equations in numerical method?

(7x2=14 marks)

Part C (Paragraph type)

Answer any five questions.

Each question carries 4 marks

18. How truncation error is produced?
19. Write the syntax for a function call.
20. Find $\sqrt[3]{14}$
21. Construct a difference table with the following data

X	-2	-1	0	1	2
Y	-7.3	-2.5	2.3	7.1	11.9

22. Evaluate the integral

$$\int_0^1 \frac{dx}{1+x^2}$$

23. Explain the Taylor series expansion for sinx and cosx. Develop a Python programme for it.
24. Write a program to obtain the numerical solution for the motion of a body falling in a viscous medium

(5x4=20 marks)

Part D (Problems)

Answer any four questions.

Each question carries 4 marks

25. Suppose the position of a point in two dimensional space is given to us in polar coordinates (r,θ). Write a Python program to ask the user to enter the values r and θ(in degrees) and to convert them to Cartesian coordinates x= rcosθ, y= rsinθ.
26. How do we create a list in Python? Generate a list of number of your choice and show how to add another number to the list ,find the total number of elements in the list and replace one number in the list with another number.
27. Derive Simpson's 1/3 rd rule for numerical integration.
28. What are the advantages of numerical methods over algebraic methods?
29. Explain 'TUPLE' in python.
30. Explain Euler's method for solving differential equations. What is the source of error in this method?
31. Explain Newton- Raphson's method for solving transcendental equations.

(4x4=16marks)

Part E (Essay Type)

Answer any two questions.

Each question carries 10 marks.

32. Explain the method of numerical integration for a given set of data. Develop a Python programme for it.
33. Explain the Runge-Kutta methods for the solution of first order differential equations. Develop a Python progamme for it.
34. (a) Explain control structures in Python with suitable examples.
    (b) Elucidate the difference between if….else and if….elif statements. Write a program to find a given number is even or odd
35. Explain the terms 'function' and 'modules'

(2x10=20 marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

FIRST SEMESTER B.Sc. DEGREE EXAMINATION, OCTOBER 2016

(CBCSS-UG)

Complimentary Course-Physics

VPH1C01-- PROPERTIES OF MATTER AND THERMODYNAMICS

Time: 3 hours Maximum: 64 marks

Part A (Objective type)

*Answer **all** questions*

Each question carries 1 mark

1. The first law of thermodynamics is the law of conservation of ……..
2. In the given process of an ideal gas, if dW = 0 and dQ < 0 then the temperature will……..……
3. Helmoltz free energy remains constant in a …….. process.
4. The efficiency of a Carnot engine operating between the steam point and the ice point is
   a) 100% b) 0 c) 27% d) 63%
5. The change in entropy in an isothermal process is given by……..
6. The strain produced in a stretched spring is …….
   a) linear strain b) volume strain c) shearing strain d) none of these
7. Write the relation connecting elastic constants Y, K and n.
8. Kerosene oil rises up in the wick of a lantern because of……
9. On charging the bubble, it's excess of pressure
   a) does not change b) increases c) decreases d) none of these
10. Critical radius of a drop is ……..

(10×1=10 marks)

Part B (Short answer type)

*Answer **all** questions*

Each question carries 2 marks

11. Write down Clausius-Clapeyron equation and explain each term.
12. State the difference between internal energy and enthalpy.
13. Relate entropy and available energy.
14. Distinguish between heat engine and entropy.
15. Explain surface energy. How is related to surface tension?
16. State and explain Eotvos law.
17. What are I-form girders? What are its advantages?

(7×2=14 marks)

Part C(Paragraph type)

*Answer any **three** questions*

Each question carries 4 marks

18. Derive the equation of state of an adiabatic process.
19. Find the change in entropy of a Carnot cycle in both reversible and irreversible processes.
20. Calculate the change in entropy in an isobaric and isochoric process.
21. Derive an expression for bending moment.
22. Explain the effect of surface tension on evaporation and condensation.

(3×4=12 marks)

Part D (Problems)

*Answer any **three** problems*

Each question carries 4 marks

23. A Carnot engine operates between the temperatures 227˚C and 127˚C. It absorbs 6.10×104 calories at higher temperature. Calculate the amount of heat converted into work.
24. The efficiency of a Carnot engine is 1/7 and the temperature of the source is 112˚C. To obtain an efficiency of 1/5, what should be the temperature of the sink?
25. Calculate the coefficient of performance of a Carnot refrigerator and a Carnot engine (heat pump) if they are operated between the reservoirs at 20˚C and 60˚C.
26. Compare the loads required to produce equal depression for two beams of same material, same lengh and same weight if one has a circular cross section and the other has a square cross section.
27. Calculate the energy needed to break a liquid drop of radius " R " and surface tension " T " into "n" equal small drops.

(3×4=12 marks)

Part E (Essay)

*Answer any **two** questions*

Each question carries 8 marks

28. Define the thermodynamic potentials and obtain the Maxwell's equation connecting them.
29. Derive Clausius- Clayperon equation and explain its effect on boiling and melting point of materials.
30. Explain the excess of pressure of the curved surface. Derive expression for the excess for the excess of pressure for (a) spherical liquid drop in air, (b) an air bubble formed in the liquid and (c) an air bubble formed by the liquid film in air.
31. Derive an expression for the depression at the free end of a uniformly loaded cantilever.

(8×2=16 marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

SECOND SEMESTER B.Sc. DEGREE EXAMINATION

(CBCSS-UG)

Complimentary Course-Physics

VPH2C02 -MECHANICS, RELATIVITY, WAVES AND OSCILLATIONS

Time: 3 hours Maximum marks: 64

Part A (Objective type)

*Answer **all** questions,Each question carries 1 mark*

1. The motion of a projectile as observed from another projectile is:
   a) Parabolic b) Elliptical c) Straight lined) Circular
2. If linear momentum of a body is increased by 50%. Its K E will increase by:
   a) 50% b) 100% c) 125% d) 150%
3. The centre of mass of a body lies:
   a) At geometric centre b) Always inside body
   c) Always outside body c) Within or outside body
4. The operator $\frac{d}{dx}$ operates on eigenfunction gives eigenvalue K, then corresponding eigenvector is:
   a) Kx b) cos Kx c) sin Kx d) e^x
5. Which of the following equations represent SHM?
   a) Asinwt+Bcoswt c)Asinwt+Bcos2wt c)$Asin^2wt$ d) e^{sinwt}
6. Aspring pendulum has period T. The spring is broken into two halves. One of that pieces is connected to same mass. The period of this pendulum will be:
   a) T b) $T/\sqrt{2}$ c) $T\sqrt{2}$ d) T/2
7. The equation of a progressive wave is Y=Asin(100πt-0.02z).The velocity of wave is:
   a) 500π b) 50π c) 50π d) 5π
8. A frame of reference which is moving with constant velocity with respect to a frame at rest is:
   a)Inertial b) Non – Inertial c) Rotating d) Absolute
9. When a body is moving:
   a) its mass increases b) its length increases
   c) its mass decreases d) none of the above
10. Angular momentum of a body under central force field is.....

(10×1=10 marks)

Part B (Short answer type)

*Answer **all** questions*

Each question carries 2 marks

11. Prove that force is negative gradient of potential.
12. What is meant by linear restoring force?

13. Define stable, unstable and neutral equilibrium using potential energy curve.
14. What is meant by inertial frame of reference? Give examples.
15. Explain energy function.
16. Under what condition Lorenz transformation reduces to Galilean transformation?
17. Show that curl of conservative forces vanishes.

(7×2=14 marks)

Part C(Paragraph type)

*Answer any **three** questions*

Each question carries 4 marks

18. Show that all the inertial frames in constant relative motion are equivalent.
19. Give the basic principle of STM.
20. Show that the speed of rocket is twice the exhaust speed if $M_0/M = e^2$
21. The mass of a particle is triple its rest mass. What is its speed?
22. An eigen function of the operator d^2/dx^2 is $\psi=e^{2x}$. Find the corresponding eigen value.

(3×4=12 marks)

Part D (Problems)

*Answer any **three** problems*

Each question carries 4 marks

23. A particle of mass 0.1 Kg is in a field of potential $U=5x^2$ +10 J/kg. Find the frequency of oscillations.
24. Two particles of masses 2kg and 10 kg with position vectors 3i+2j+k and i-j+k respectively. Find out the position vector of the centre of mass.
25. Prove that gravitational force is conservative.
26. The position vector of a particle of mass m under the influence of force is r = Asinwti+ Bcoswtj. Find out expression for the force.
27. Find the work done by a force $F=F_0+kx$ acting parallel to X-axis on an object which moves along the axis from x_1 to x_2.

(3×4=12 marks)

Part E(Essay)

*Answer any **two** questions*

Each question carries 8 marks

28. What are fundamental postulates of special theory of relativity? Obtain Lorentz transformation equation.
29. What is meant by wave function? Develop Schrodeinger's one dimensional time dependent equation.
30. Give the basic principles of rocket propulsion and get an expression for final velocity of rocket.
31. Explain Michleson's Morley experiment and the negative result obtained by them.

(8×2=16 marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

THIRD SEMESTER B.Sc.DEGREE EXAMINATION

(CBCSS-UG)

Complimentary Course-Physics

VPH3C03 -OPTICS, LASER ELECTRONICS & COMMUNICATION

Time: 3 hours Maximum: 64 marks

Part A (Objective type)

*Answer **all** questions*

Each question carries 1 mark

1. The secondary wavelet principle is introduced buy.....
2. In Fraunhoffer diffraction the source and screen are at ..... distance from the aperture.
3. Resolving power of a grating can be increased by increasing.....
4. The light coming from two consecutive zones in a zone plate differ by .....
5. For a positive crystal the velocity of ordinary ray is .....than Extra ordinary ray
6. Band gap energy of Silicon is.....
7. Maximum efficiency of a full wave rectifier is .....
8. In common base configuration I_{CBO} is due to the
   a) Majority carriers in the collector region b) Minority carriers in the emitter region
   c) Minority carriers in the collector base depletion region d) Majority carriers in the base emitter depletion region
9. Common base current gain is
   a) Of the order of 100 b) Nearly unity c) Much less than unity d)Very large
10. The ratio of change in amplitude of carrier wave to the amplitude of normal carrier wave is called .....

(10×1=10 marks)

Part B (Short answer type)

*Answer **all** questions*

Each question carries 2 marks

11. Differentiate between Fresnel and Fraunhofer diffraction
12. Explain Brewster's law
13. Give a short note on population inversion
14. What are the limitations of amplitude modulation?
15. Explain the mechanism of Zener break down.
16. What are ripples in the rectified output of a rectifier? What is the ripple factor of a half wave rectifier?
17. Explain the biasing of a rectifier.

(7×2=14 marks)

Part C (Paragraph type)

*Answer any **three** questions*

Each question carries 4 marks

18. Obtain the expression for resolving power of grating.
19. Write a brief note on Ruby Laser.
20. Write a note on different types of modulation techniques.
21. Explain briefly the concept of zone plate. Compare Zone plate with a convex lens.
22. Explain the action of a filter in a rectifier circuit with an example.

(3×4=12 marks)

Part D (Problems)

*Answer any **three** problems*

Each question carries 4 marks

23. How many orders will be visible if the wavelength of the incident radiation is 5000 A^o and the number of lines on the grating is 2620 per inch.
24. What will be the Brewster's angle for a glass slab (n=1.5) immersed in water (n=4/3) Light of wavelength 6000 A^0 is incident on a slit of width 0.3mm. The screen is placed 2m from the slit. Find the position of the first dark fringe and width of central bright fringe.
25. An AC voltage of peak value 20V is connected in series with a silicon diode and load resistance of 500 Ohm. If the forward resistance of the diode is 10 Ohm, find
    a) Peak current through the diode. b) Peak output voltage.
26. A crystal diode having internal resistance 20 Ohm is used for half-wave rectification. If the applied voltage V = 50 Sinωt and load resistance of 800Ω find
    a) DC power output and AC power input. b) Efficiency of rectification.

(3×4=12 marks)

Part E (Essay)

*Answer any **two** questions*

Each question carries 8 marks

27. Explain the formation of spectra by a plane diffraction grating. What are its characteristics.
28. What are the different types of LASERS? Describe the working of Ruby Laser with neat diagram
29. What is meant by rectification? Describe the construction and working of any one full wave rectifier with a neat diagram. Derive the expression for the efficiency of the full wave rectifier.
30. What are different transistor configurations? With the help of a neat diagram explain Common Base characteristics.

(8×2=16 marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

FOURTH SEMESTER B.Sc.DEGREE EXAMINATION

(CBCSS-UG)

Complimentary Course-Physics

VPH4C04 -ELECTRICITY, MAGNETISM AND NUCLEAR PHYSICS

Time: 3 hours Maximum marks : 64

Part A (Objective type)

*Answer **all** questions*

Each question carries 1 mark

1. The electric field in the space between a parallel plate air capacitor is E. If the distance between the plates is reduced to half its initial distance the electric field is
   a) E/2 b) 2E c) E d) 4E
2. The dielectric constant of a conductor is
   a) zero b) one c) infinite d) negative
3. A conducting wire is stretched to double its length. Its resistivity ……..
4. Two wires of same material and same area of cross section have their lengths in the ratio 2:1. When same p.d is applied across their ends, the currents are in ratio.
   a) 1:1 b) 2:1 c) 1:2 d) 1:4
5. The number of electrons passing through a conductor in 10s when a current of 1A flows through it is …….
6. At superconducting stat the material becomes …….(diamagnetic/paramagnetic)
7. Nuclear force is ……dependent and ..... independent.
8. The energy equivalence of mass defect is called…….
9. Primary cosmic rays mainly consists of ……
10. The average binding energy per nucleon of stable nucleus is ……

(10×1=10 marks)

Part B (Short answer type)

*Answer **all** questions*

Each question carries 2 marks

11. What is the cause of electrical resistance in metals?
12. Deduce Coulombs law from Gauss law.
13. What do you mean by electrostatic shielding?
14. What is Meissener effect?
15. Explain nuclear fusion?
16. Distinguish between alpha and beta decay?
17. State tangent law in magnetism.

(7×2=14 marks)

Part C (Paragraph type)

*Answer any **three** questions*

18. *Each question carries 4 marks* What is meant by cosmic ray showers?
19. Sketch the binding energy curve.
20. What is Larmor frequency?
21. Why naturally occurring uranium is not suitable for fission?
22. Explain the working of an atom bomb.

(3×4=12 marks)

Part D (Problems)

*Answer any **three** problems*

Each question carries 4 marks

23. Calculate the drift velocity of free electrons in copper from the following data: Current density J is 480 Acm^{-2}, Avogadros number is 6 x 10^{23} atoms/mole, density of copper d is 9 gm/cc, atomic weight is 64 gm/mole, electron charge is 1.6 x 10^{-19} C. Assume that there is one free electron per atom of copper.
24. A potentiometer wire of length 3m has a resistance of 20Ω. It is connected in series wit a resistance R and a cell of emf 4V. A source of emf 20mV is balanced against 60cm of potentiometer wire. Find the value R.
25. Two fixed point charges in the ratio 2:1 separated by a distance R. Where should a third charge be placed on the line joining these two charges so that the third charge remains in equilibrium?
26. Show that the curl of an electric field in a region is always zero.
27. Explain the principle of potentiometer.

(3×4=12 marks)

Part E (Essay)

*Answer any **two** questions*

Each question carries 8 marks

28. State and explain Gauss theorem in electrostatics. Apply this to find the electric field due to two parallel plane sheets of charge of equal and opposite charge densities.
29. Explain the theory of Carey Foster Bridge. How can we determine the temperature coefficient of resistance of a material using this bridge?
30. Define drift velocity of electrons in a conductor. Find out the relation between electric current and drift velocity in a conductor.
31. What is meant by elementary particles? Explain the classification of elementary particles.

(8×2=16 marks)

Model Question Paper
VIMALA COLLEGE (AUTONOMOUS), THRISSUR
FIFTH SEMESTER B.Sc. DEGREE EXAMINATION
(CBCSS-UG)
Open Course-Physics
VPH5D01- NON CONVENTINAL ENERGY SOURCES

Time: 2 hours Maximum: 40 Marks

Part A (One word questions)
*Answer **all** questions*
Each question carries 1 mark

1 .----------is the most commonly used material for making solar cell.

2. What type of energy is derived from heated ground water?

3. The temperature difference between upper and deeper layers of the ocean should be at least ----------degree to install an OTEC plant

4. The primary source behind the wind energy is --------energy

5. Molten Rock at a temperature 650 degree is called--------

6……type of rotor mill is used for high velocity wind.

(6x1=6marks)

Part B (Short answer type, in one or two sentences)
*Answer **all** questions*
Each question carries 2 marks

7. Define Solar constant

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

9. What are the two types of battery? Give examples

10. What are the different categories of geomass resources?

11. Explain the principle of hydrogen fuel cells.

(5x2=10 marks)

Part C (Paragraph question)

*Answer any **four** questions*

Each question carries 4 marks

12. What do you mean by solar green house? Explain.

13. Describe with neat diagram the working of open cycle OTEC
14. List the advantages and disadvantages of geothermal energy.
15. Discuss the advantages and disadvantages of wind energy converters
16. Explain any one of the solar collectors with the help of a neat diagram.
17. Explain the working of a wind mill with the help of a diagram

(4x4=16 marks)

Part D (Essay)

*Answer any **one** question*

Each question carries 8 marks

18. Describe the principle of working of solar furnace? What are the main applications? What are the advantages and limitations of solar furnace?
19. Explain how tidal power is used to generate electricity with one tidal energy conversion plant? Give its limits.
20. What are the main components of biogas? With a neat diagram, explain the working of a fixed dome type biogas plant.

(1x8=8 marks)