File Ref.No.25479/GA - IV - J2/2013/CU

UNIVERSITY OF CALICUT

Abstract

BSc programme in Applied Physics (LRP)-CUCBCSS UG 2014-Scheme and Syllabus- Approved-Implemented-w.e.f 2014 Admissions-Orders issued

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G & A - IV - J

U.O.No. 6907/2014/Admn Dated, Calicut University.P.O, 17.07.2014

Read:-1. U.O. No. 3797/2013/CU, dated 07.09.2013 (CBCSS UG Modified Regulations) (File.ref.no. 13752/GA IV J SO/2013/CU).

2. U.O. No. 5180/2014/Admn, dated 29.05.2014 (CBCSS UG Revised Regulations) (File.ref.no. 13752/GA IV J SO/2013/CU).

3. Item no. 1 of the minutes of the meeting of the Board of Studies in Physics UG held on 20.06.2014.

4. Item no. 34 of the minutes of the meeting of the Faculty of Science held on 27.06.2014.

5.Orders of the VC on 14.07.2014, in the file no, 18602/GA IV /J1/2013/CU.

ORDER

The Modified Regulations of Choice Based Credit Semester System for UG Curriculum w.e.f 2014 was implemented under the University of Calicut vide paper read as (1).

The Revised CUCBCSS UG Regulations has been implemented w.e.f 2014 admission, for all UG programme under CUCBCSS in the University, vide paper read as (2).

The Board of Studies in Physics UG approved the new syllabus for B.Sc. Physics Core Course, **B.Sc. Applied Physics** and Complimentary Course according to the new system, which is to be implemented w.e.f 2014 admissions vide paper read as (3).

The Faculty of Science has also approved the minutes of the Board vide paper read as (4).

The Hon'ble Vice Chancellor, considering the exigency, exercising the powers of the Academic Council has approved the items regarding syllabus implementation in the minutes of the concerned Boards of Studies mentioned in the minutes of the Faculty of Science, subject to ratification by the Academic Council, vide paper read as (5).

Sanction has, therefore, been accorded for implementing the Scheme and Syllabus of **BSc. programme in Applied Physics** under CUCBCSS UG 2014, in the University, w.e.f 2014 Admissions.

Orders are issued accordingly.

(The syllabus is available in the website: universityofcalicut.info)

Muhammed S
Deputy Registrar

To

1. All Affiliated Colleges/SDE/Dept.s/Institutions under University of Calicut.
2. The Controller of Examinations, University of Calicut.
3. The Director SDE, University of Calicut.

Forwarded / By Order

Section Officer

B.Sc. PROGRAMME IN APPLIED PHYSICS WITH MODEL QUESTION PAPERS

(B.Sc. in language reduced pattern)

(KKTM GOVT.COLLEGE, PULLUT

& CARMEL COLLEGE, MALA)

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

For the purpose of selecting general courses in this programme, B.Sc. Applied Physics can be included in group 3 of the language reduced pattern subjects along with Computer science, Electronics, Multimedia and instrumentation (page 4 of CUCBCSS UG regulations 2014 vide ref C U.O. No. 5180/2014/Admn dated 29-05-2014)

B.Sc. DEGREE PROGRAMME (APPLIED PHYSICS CORE)

COURSE STRUCTURE

Semester	Course Code	Course Title	Total hours	Hours/ Week	Credits
I	A 01	Common Course I – English	72	4	4
	A 02	Common Course II – English	90	5	3
	A 07	Common Course III – Language other than English	72	4	4
	AP1 B01	Core course I - Methodology of Science and Physics	36	2	2
		Core Course V-Practical I	36	2	*
		1st Complementary Course I - Mathematics	72	4	3
		2nd Complementary Course I	36	2	2
		2nd Complementary Course Practical I	36	2	*
		Total	450	**25**	**18**
II	A 03	Common Course IV – English	72	4	4
	A 04	Common Course V – English	90	5	3
	A 08	Common Course VI – Language other than English	72	4	4
	AP2 B02	Core Course II - Properties of Matter, Waves and Acoustics	36	2	2
		Core Course V – Practical I	36	2	*
		1st Complementary Course II - Mathematics	72	4	3
		2nd Complementary Course II	36	2	2
		2nd Complementary Course Practical II	36	2	*
		Total	450	**25**	**18**
III		General Course I -engaged by core	72	4	4
		General Course II –engaged by core	72	4	4
	AP3 B03	Core Course III – Mechanics	54	3	3
		Core Course V– Practical I	36	2	*
		Core Course VI- Practical II	36	2	*
		1st Complementary Course III – Mathematics	90	5	3
		2nd Complementary Course III	54	3	2

		2nd Complementary Course Practical III	36	2	*
		Total	450	**25**	**16**
IV		General Course III- engaged by core	72	4	4
		General Course IV- engaged by core	72	4	4
	AP4 B04	Core Course IV - Electrodynamics I	54	3	3
	AP4 B05(P)	Core Course V- Practical I	36	2	5
	AP4 B06(P)	Core course VI - Practical II	36	2	5
		1st Complementary Course IV– Mathematics	90	5	3
		2nd Complementary Course IV	54	3	2
		2nd Complementary Course Practical IV	36	2	4
		Total	450	**25**	**30**
V	AP5 B07	Core Course VII - Electrodynamics II	54	3	3
	AP5 B08	Core Course VIII - Quantum Mechanics	54	3	3
	AP5 B09	Core Course IX - Physical Optics and Modern Optics	54	3	3
	AP5 B10	Core Course X-Electronics (Analog and Digital)	72	4	3
		Open Course – (*course from other streams*)	54	2	2
		Core Course Practical XVII - Practical III	72	4	*
		Core Course Practical XVIII- Practical IV	72	4	*
		Project	36	**2**	*
		Total	450	**25**	**14**
VI	AP6 B11	Core Course XI - Thermal and statistical physics	72	4	3
	AP6 B12	Core Course XII Solid State Physics, Spectroscopy and Laser physics	54	3	3
	AP6 B13	Core Course XIII - Nuclear Physics, Particle Physics and Astrophysics	72	4	3
	AP6 B14(E)	Core Course XIV (Elective)	72	4	3
	AP6 B15(P)	Core Course Practical XV – Practical III	72	**4**	**5**
	AP6 B16(P)A/B	Core Course Practical XVI – Practical IV	72	**4**	**5**
	AP6 B17(Pr)	Course XVII Project & Tour report	36	**2**	2
		Total	450	**25**	**24**
Total Credits					**120**

Tour report may be evaluated with Practical IV

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	General course I- engaged by core	4	100
	General course II-engaged by core	4	100
	Core Course III: Mechanics	3	100
	Complementary course: Mathematics	3	100
	Complementary course: II	2	80
	Total	**16**	**480**
IV	General course III- engaged by core	4	100
	General course IV- engaged by core	4	100
	Core Course IV: Electrodynamics-1	3	100
	Core Course V: Practical 1	5	125
	Core Course VI: Practical II	5	125
	Complementary course: Mathematics	3	100
	Complementary course: II	2	80
	Complementary course: II Practical	4	80
	Total	**30**	**810**
V	Core Course VII: Electrodynamics II	3	100
	Core Course VIII :Quantum Mechanics	3	100
	Core Course IX: Physical Optics and Modern Optics	3	100
	Core Course X: Electronics (Analog and Digital)	3	100
	Open course	2	50
	Total	**14**	**450**
VI	Core Course XI: Thermal and Statistical Physics	3	100
	Core Course XII: Solid State Physics ,Spectroscopy and Laser	3	100
	Core Course XII: Nuclear Physics ,Particle Physics and Astrophysics	3	100
	Core Course XIV: Elective	3	100
	Core Course XV: Practical III	5	125
	Core Course XVI: Practical IV	5	125
	Core Course XVII: Project and Tour report	2	50
	Total	**24**	**700**

COURSE STRUCTURE APPLIED PHYSICS

Credit Distribution

Semester	*Common course*		*General course*	*Core course*	*Complementary course*		*Open course*	*Total*
	English	*Additional Language*			*Mathematics*	*Computer Appl.*		
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*+5*	3	2+4*	-	30
V	-	-		3+3+3+3	-	-	2	14
VI	-	-		3+3+3+3+5*+5*+2**	-	-	-	24
Total	**14**	**8**	**16**	**56**	**12**	**12**	**2**	**120**

*Practical **Project

Tour Report to be evaluated with Practical Paper IV

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	400
2	Additional Language	200
3	General course – engaged by core	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	AP1B01	Core Course I: Methodology of Science and Physics	2	36	2	100
II	AP2B02	Core Course II: Properties of matter waves and Acoustics	2	36	2	100
III	AP3B03	Core Course III: Mechanics	3	54	3	100
	-	Core Course V : Practical-I	2	36	-*	-
		Core Course VI : Practical-II	2	36	-*	-
IV	AP4B04	Core Course IV: Electrodynamics-I	3	54	3	100
	AP4B05(P)	Core Course V : Practical-I	2	36	5	125
	AP4B06(P)	Core Course VI : Practical-II	2	36	5	125
V	AP5B07	Core Course VII: Electrodynamics-II	3	54	3	100
	AP5B08	Core Course VIII: Quantum Mechanics	3	54	3	100
	AP5B09	Core Course IX: Physical Optics and Modern Optics	3	54	3	100
	AP5B10	Core Course X: Electronics (Analog and digital)	4	72	3	100
		Core Course XIV: Practical II	4	72	-**	-
		Core Course XV: Practical III	4	72	-**	-
		Core Course XVI: Project Work	2	36	-**	-
VI	AP6B11	Core Course XI: Thermal and Statistical physics	4	72	3	100
	AP6B12	Core Course XII Solid State Physics, Spectroscopy and Laser	3	54	3	100
	AP6B13	Core Course XIII: : Nuclear Physics, Particle Physics and Astrophysics	4	72	3	100
	AP6B14(E1)	Core Course XIV: Elective*** — 1. Opamps and digital integrated circuits	4	72	3	100
	AP6B14(E2)	2. Microprocessor and microcomputer systems				
	AP6B14(E3)	3. Communication systems				
	AP66B15(P)	Core Course XV: Practical -II	4	72	5**	125
	AP6B16(P)A/ B	Core Course XVI: Practical-III	4	72	5**	125
	AP66B17(Pr)	Core Course XVII: Project Work &Tour Report	2	36	2**	50
				Total	**56**	**1750**

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

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

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

CORE COURSE THEORY: EVALUATION SCHEME

The evaluation scheme for each course contains two parts: *viz.,* internal evaluation and external evaluation. Maximum marks from each unit 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	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. University examinations will be conducted at the end of each semester.

Table 1: Pattern of Question Paper

Duration	*Pattern*	*Total number of questions*	*Number of questions to be answered*	*Marks for each question*	*Marks*
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 log book and the written report must be submitted at the end of the project**.

Table 1: Internal Evaluation

Sl. No	*Criteria*	*Marks*
1	Punctuality &Log book	2
2	Skill in doing project work/data	2
3	Scheme Organization of Project Report	3
4	Viva-Voce	3
	Total Marks	10

Table 2: External Evaluation

Individual presentation is compulsory and individual Log book should be submitted

Sl. No	*Criteria*	*Marks*
1	Content and relevance of the project, Methedology, Reference, Bibliography	6
2	Project Presentation, Quality of analysis, statistical tools, findings, recommendations	9
3	Project Report (written copy) and Log Book	5
4	Viva-voce	10
	Total Marks	30

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 Practical Paper IV for evaluation

Distribution of marks EXTERNAL

No		External (10)
1	Hand written Report	5
2	Outcome/Analysis	3
3	Photos (five photos)	2
	Total	10

Practical Evaluation (Core)

Internal		**External**		
Items	**Marks**	**Items**	**Marks**	**Marks for Programming**
Record	5	Record with 20 expts Max.one mark for each expt	20	20
Regularity in getting the expts done	5	Formulae, Theory, Principle/ Programme	20	15
Attendance	5	Adjustments& setting / Algorithm	15	15
Test 1	5	Tabulation, Observation and performance/ Execution	25	30
Test 2	5	Calculation, result, graph, unit/ Result	15	15
		Viva	5	5
Total	**25**	**Total**	**100**	**100**

CORE COURSE – XIII (ELECTIVE) :		
1	AP6 B14 (E1)	OPAMPS AND DIGITAL INTEGRATED CIRCUITS
2	AP6 B14 (E2)	MICROPROCESSOR AND MICROCOMPUTER SYSTEMS
3	AP6 B14 (E3)	COMMUNICATION SYSTEMS

OPEN COURSES OFFERED BY PHYSICS DEPARMENT (For students from other streams)		
1	PH5 D01(1)	NON CONVENTIONAL ENERGY SOURCES
2	PH5 D01(2)	AMATEUR ASTRONOMY AND ASTROPHYSICS
3	PH5 D01(3)	ELEMENTARY MEDICAL PHYSICS

OPEN COURSE: EVALUATION SCHEME

The evaluation scheme contains two parts: *viz.,* internal evaluation and external evaluation. Maximum marks from each unit is 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/Problems	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*
2 Hours	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

Core Course I

AP1 B01: METHODOLOGY OF SCIENCE AND PHYSICS– 36 hours (Credit - 2)

(Importance must be given to Part C)

Part A: Methodology And Perspectives Of Sciences 10Hours Max marks 27

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.

Science as a human activity, scientific temper, empiricism, vocabulary of science, science disciplines.

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: Methodology and Perspectives of Physics 9Hours Max marks 27

What does physics deal with? - brief history of physics during the last century-the inconsistency between experiments and theories-

Birth of new science concepts -Quantum concepts-Black body radiation, Photoelectric effect, X-rays, De Broglie waves, Sections 2.2, 2.3, 2.5, 3.1, of Arthur Beisser) ***(All topics in this part require qualitative study only, derivations are not required. Detailed study not required)***

Relativity-Special relativity, Time dilation, Length contraction, Twin paradox (Sections 1.1, 1.2, 1.4, 1.5 of Arthur Beisser)

Laser- Concepts of ordinary and monochromatic light, Coherent and incoherent light, Spontaneous and stimulated emission, Metastable state, pumping and population inversion.(Basic ideas only Section 4.9 of Arthur Beisser) ***(All topics in this part require qualitative study only, derivations are not required. Practical Laser not required. Detailed study not required.)***

Design of an experiment , experimentation , Observation, data collection:

Interaction between physics and technology.

References:

1. Concepts of Modern physics- Arthur Beisser
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

Part C – Mathematical Methods in Physics 17 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.

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 – BD Guptha

4. Mechanics-J.C .Upadhyaya

Semester -2

Core course –II - 36 hours (Credit – 2)

AP2 B02: PROPERTIES OF MATTER, WAVES & ACOUSTICS

Unit-1: Properties of Matter 9 Hours Max 27 marks

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 52 marks

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

(Sections: 9.1 to 9.4, 9.7, 9.10 to 9.11, 10.1 to 10.4 to 10.6 of Mechanics by J.C Upadhyaya)

Unit-3 Waves 8 hours Max 27marks

Wave Motion, General Equation of Wave Motion, Plane Progressive Harmonic Wave, Energy Density for a Plane Progressive Wave, Intensity of a Wave, Transverse Waves in Stretched Strings, Modes of Transverse Vibrations of Strings, Longitudinal Waves in Rods and Gases, Fourier's Theorem, Wave Velocity and Group Velocity

(Sections:11.1 to 11.9 , 11.12 to 11.13 of Mechanics by J.C Upadhyaya)

Unit-4 Acoustics 5 hours Max 20marks

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 to 5.3, 5.7 to 5.10, 5.12 to 5.15 of Properties of Matter and Acoustics by R.Murugeshan & Kiruthiga Sivaprasath)

Text books for Study

1. Elements of Properties of Matter by D.S. Mathur 2008
2. Mechanics by J.C Upadhyaya 2003
3. Properties of Matter and Acoustics by R.Murugeshan & Kiruthiga Sivaprasath 2005

Reference

1. Mechanics -- D.S. Mathur
2. Text book of Sound –Brij Lal& Subramanian
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- Universities Press
6. Introduction to Mechanics – Mahendra K Verma – Universities Press

Semester-3

Core Course – III - 54 hours (Credit –3)

AP3 B03: MECHANICS

UNIT-1

1. Frames of reference **8 hours** **Max 20 marks**

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 15marks**

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 22marks**

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 22 marks**

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 20marks**

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 27marks**

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
3. Berkeley Physics course Vol 1
4. Feynman Lectures on Physics Vol 1
5. Elements of Mechanics – K Rama Reddy, S Raghavan & D V N Sarma- Universities Press
6. Introduction to Mechanics – Mahendra K Verma – Universities Press
7. Classical Mechanics-Aruldas

Semester-4

Core Course – IV 54 hours (Credit – 3)

AP4 B04: ELECTRODYNAMICS – I

UNIT I

1. Electrostatics 20 hours Max 37marks

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

(Sections 2.1 to 2.5 of Introduction to Electrodynamics by David J Griffiths)

2. Special Techniques for Calculating Potentials 6 hours Max 15 marks

Laplace's equation in One Dimension, Two Dimensions and Three Dimensions, Uniqueness theorems - Method of images, The classic image problem, induced surface charge, force and energy. (Sections 3.1 to 3.2.3 of Introduction to Electrodynamics by David J Griffiths)

UNIT II

3 . Electric fields in matter 8 hours Max 22 marks

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)

UNIT III

4 . Magnetostatics **12 hours** **Max32 marks**

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)

5. Magnetostatic fields in matter **8 hours** **Max 20 marks**

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)

Textbook for study

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

References

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 – VII 54 hrs (Credit – 3)

AP5 B07: ELECTRODYNAMICS-II

UNIT I (27 hours)

1. Electrodynamics **15 hours** **Max 32 marks**

Electromagnetic induction - Faraday's law, induced electric field, inductance, energy in magnetic fields – Maxwell's equations, Electrodynamics before Maxwell, Maxwell's modification of Ampere's law, Maxwell's equations and magnetic charges, Maxwell's equations inside matter, Boundary conditions.

(Sections 7.2 to 7.3 of Introduction to Electrodynamics by David J Griffiths)

2. Electromagnetic waves **12 hours** **Max 27 marks**

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 (27 hours)

3. Transient currents **7 hours** **Max 20 marks**

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 27marks**

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 **8 hours** **Max 20marks**

Kirchhoff's laws, Voltage sign and current direction, Solution of simultaneous equations using determinants, 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**

References

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
5. Electrical Circuit analysis –K Sureshkumar,NIT

Semester-5

Core Course – VIII 54 hrs (Credit – 3)

AP5 B08: QUANTUM MECHANICS

UNIT 1 (24 hrs)

1. Particle Properties of Waves **8 hours** **Max marks 20**

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

2. Wave Properties Of Particles **10 hours** **Max marks 22**

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** **Max marks 15**

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** **Max marks 37**

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** **Max marks 32**

Schrodinger equation for the hydrogen atom, separation of variables, quantum numbers, principal quantum number, orbital quantum number, magnetic quantum number, electron probability density, radiative transitions, selection rules, Zeeman effect, electron spin, exclusion principle, Stern-Gerlach experiment.

(Sections 6.1 to 6.10 & 7.1, 7.2 of Modern Physics by Beiser]

Textbooks for study

Concepts of Modern Physics 6th Edition-By Arthur Beiser

References

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. Quantum Mechanics – Trilochan Pradhan – Universities Press
7. Advanced Physics Second Edition – Keith Gibbs – Cambridge University Press
8. Introduction to Vector spaces in Physics - K A I L Wijewardena Gamalath – Foundation Books
9. Quatum Mechanics –Iswarsingh Thyagi
10. Feynman Lectures

Semester-5

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

AP5 B09 PHYSICAL OPTICS AND MODERN OPTICS

UNIT I (5 hours) Max marks 15

1.Fermat's Principle, verification of laws of reflection and refraction. **2 hours**

(Sections 2.1-2.6 (Brijlal, Subramaniyam, & Avadhanulu Section 2.1-2.2 Ajoy Ghatak)

Matrix methods **3 hours**

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)

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 intrference patterns, intensity distribution .Fresnel's two mirror arrangement, Fresnel's Biprism, Determination of λ and $d\lambda$ of Sodium Light (Sections:14.1-14.4,14.6-14.9 (Brijlal, Subramaniyam, & Avadhanulu, Sections 12.1-12.9 Ajoy Ghatak)

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

Interference by a plane film illuminated by a plane wave, cosine law, non reflecting films (the subsections excluded), interference by a film with two nonparallel reflecting surfaces, colours of thin films, Newton's rings, The Michelson interferometer, white light fringes (Sections 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 Diffaraction 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. (Ajoy Ghatak)

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. Ajoy Ghatak)

UNIT IV **8 hours** **Max marks 15**

6. Polarization

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

Laurentz half shade polarimeter (Sections 20.9,20.17-20.20,20.24 Brijlal, Subramaniyam, & Avadhanulu and Ajoy Ghatak)

UNIT V **6 hours** **Max marks 10**

7. Holography

Principles of holography, Theory of construction and reconstruction, of Hologram, Applications of Holography. (Sections 23.1-23.6 Brijlal, Subramaniyam, & Avadhanulu, Sections 18.1-18.4. Ajoy Ghatak)

UNIT VI **8 hours** **Max marks 15**

8. Fiber Optics

Optical fibre, Numerical aperture, step index fiber, pulse dispersion, graded index fibre, fiber optic communication system, fiber optic sensors. (Sections 24.1-24.3,24.5,24.6-24.7,24.11 Ajoy Ghatak, corresponding sections from 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
8. 8 Optics – Hetch and A RGanesan

Semester-5

Core Course –X 72 hours (Credit – 3)

AP5 B10: ELECTRONICS (ANALOG & DIGITAL)

UNIT I

1. Semiconductor rectifiers and DC Power supplies 8 hours. Max marks 15

Preliminaries of rectification, Bridge rectifier, Efficiency, Nature of rectified output, Ripple factor, different types of filter circuits, voltage multipliers, Zener diode voltage stabilization (sections 6.13-6.15, 6.17 - 6.27 V.K Mehta)

2. Transistors: 14 hours Max marks 27

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, single stage transistor amplifier circuit, load line analysis, DC and AC equivalent circuits. (Section 8.7 - 8.10, 8.12-8.22, 9.2-9.8, 9.11-9.12, 10.4-10.5, 10.7-10.9 V K Mehta)

3. Multistage Transistor amplifier 4 hours Max marks 10

R.C coupled amplifier- frequency response, and gain in decibels, Transformer coupled Amplifiers,Direct Coupled Amplifier,Comparison.

(Section 11.1-11.8, VK Mehta)

4. Feedback Circuits and Oscillators 8 hours Max marks 12

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

Sections (13.1-13.5, 14.1 - 14.13, 14.15-14.20 VK Mehta)

UNIT II

5. Digital Communication 5 hours Max marks 12

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 VK Mehta)

6. Special Devices and Opamp 12 hours Max marks 18

LED, basic idea of UJT, FET, MOSFET, OP-amp-basic operation, application, inverting, Non-inverting, summing amplifiers, Differentiator integrator.

(Sections 7.2-7.4, 19.2-19.14, 19.14, 19.27-19.30, 21.11-21.14, 25.1, 25.16, 25.15-25.17,25.23-25.26, 25.32, 25.34-25.35, 25.37 VK Mehta)

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 Binary arithmetic, Compliments and its algebra. (Aditya P Mathur - 2.2 to 2.8).

8. Logic gates and circuits **13hrs.** **Max marks 20**

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

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

Text books for study

1. Principles of electronics - VK Mehta - 2008 edition (S. Chand)
2. Introduction to Micro Procesors - 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
7. Electronic Principles and applications-A B Bhattacharya
8. Electronics-Classical and Modern-KAR

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.

PH5 D01(1): NON CONVENTIONAL ENERGY SOURCES (36 Hours Credit – 2)
(Problems not required)

UNIT I .

Solar energy : 10 Hrs Max marks 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: 8Hrs Max marks 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 marks 20

Geothermal sources, geo-pressured resources, advantages and disadvantages of geothermal
energy over other energy forms, application of geothermal energy. introduction to bio mass
Method of obtaining energy from biomass.
(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: 8 Hrs Max marks 14

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.

Semester 5

OPEN COURSE –I

((Problems not required)

PH5 D01 (2): AMATEUR ASTRONOMY AND ASTROPHYSICS(36 Hours Credit – 2)

Unit-1 **(12 hours) Max marks 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 marks 14**

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

Unit-3 **(8 hours) Max marks 16**

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

Unit-4 **(8 hours) Max marks 16**

The stars Unit of distance-Astronomical units--parsec-light year-Magnitudes of stars-apparent magnitudeabsolute magnitude-Three categories of stars-Main sequence stars-Dwarfs-Giants-star formation lifecycle 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

Semester 5

OPEN COURSE –I

((Problems not required)

PH5 D01 (3): ELEMENTARY MEDICAL PHYSICS (36 HOURS)

UNIT-1-NUCLEAR MEDICINE PHYSICS (12 Hours) Max marks 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 marks 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 marks 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 Instrumentation", Tata McGraw-Hill,New Delhi, 1997.)

Reference books:

1 Medical Physics by Glasser O, Vol 1,2,3 Year Book Publisher Inc Chicago

2 Leslie Cromwell, "Biomedical Instrumentation and measurement", Prentice hall of India, New Delhi, 1999.

3 John G. Webster, “Medical Instrumentation Application and Design”, John Wiley and sons, New York, 1998.

4 Khandpur R.S, “Handbook of Biomedical Instrumentation”, Tata McGraw-Hill, New Delhi, 1997.

5 Joseph J.carr and John M. Brown, “introduction to Biomedical equipment technology”, John Wiley and sons, New York, 1997.

6 W.R.Hendee & E.R.Ritenour, Medical Imaging Physics (3rd eds), Mosbey Year-Book,
Inc., 1992.

7. Hendee & E.R.Ritenour, Medical Physics.

Semester-6

Core Course –XI - 72 hrs (Credit – 3)

AP6 B11: THERMAL AND STATISTICAL PHYSICS

Unit- I

Module 1. . 18 hours Max marks 32

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 ofpath 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 C_p and C_v) and latent heat– adiabatic and isothermal elasticity of a gas)

Module 2. 11 **Hours Max marks 20**

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

Module 3. 14 hours Max marks 22

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

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

Module 4. 10 hours Max marks 15

Thermodynamic functions-Enthalpy, Helmhlotz function, Gibbs function-Maxwell's thermodynamic relations-TdS relations-application of Maxwell's thermodynamical

relations-1.variation of intrinsic energy with volume-2.Joule-Kelvin coefficient-3.Claussius-Clapeyron equation from Maxwell's thermodynamic relations- changes of phase. (Relevant topics from Ch. 10-Heat and Thermodynamics by D S Mathur- Revised fifth edition)

UNIT II

Module 5. **8 hours** **Max marks 15**

Statistical distributions-Maxwell-Boltzmann statistics (no derivation)-Distribution of molecular energies in an ideal gas-Average molecular energy- Equi partition theorem-Maxwell-Boltzmann speed distribution law-Expressions for rms speed, most probable speed and mean speed. (Chapter 9.1, 9.2 and 9.3-Concepts of Modern Physics-Arthur Beiser)

Module 6. **11 hours** **Max marks 22**

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. (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
8. Heat and Thermodynamics- A Manna

Semester-6

Core Course – XII 72 hrs (Credit – 3)

AP6 B12 : SOLID STATE PHYSICS, SPECTROSCOPY AND LASER PHYSICS

UNIT –1 SOLID STATE PHYSICS

1.Crystal Physics **12 hours** **Max marks 27**

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. (Section 4.1 to 4.8, 4.11 to 4.15 and 4.18 - Solid State Physics by S.O. Pillai)

2. X-ray Diffraction: **5 hours** **Max marks 10**

Bragg's law – Braggs X-ray spectrometer-Rotating Crystal method

Section 5.7 to 5.11- Solid State Physics by S.O. Pillai

3. Super conductivity: **8 hours** **Max marks 12**

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 to 8.5 & 8.10 of Solid State Physics - S.O. Pillai)

UNIT-2 MOLECULAR SPECTROSCOPY

4 . Basic Elements of Spectroscopy **5 hours** **Max marks 10**

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 to 1.8 of Fundamentals of Molecular Spectroscopy by Banwell & Elaine Mcash)

5. Microwave Spectroscopy **8 hours** **Max marks 15**

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-Enformation derived from Rotational Spectrum. (Section 6-Rotation of Molecules, Section 6.1 to 6.6, 6.9, 6.13, 6.14 of Molecular Structure & Spectroscopy by G Aruldhas & Chapter 2 - Fundamentals of Molecular Spectroscopy by Banwell & Elaine M Mccash

6. Infra Red Spectroscopy: 9 hours Max marks 15

Vibrational Energy of an Anharmonic Oscillator-Diatomic Molecule (Morse Curve)-IR Spectra-Spectral Transitions & Selection Rules-Example of HCL-Vibration-Rotation Spectra of Diatomic 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 hours Max narks 15

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 12 hours Max marks 22

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)

Text Books for Study :

1. Solid State Physics by S O Pillai
2. Fundamentals of Molecular Spectroscopy by Banwell & Elaine M Mccash
3. Molecular Structure & Spectroscopy by G Aruldhas

References

1. Solid Sate Physics by M A Wahab
2. Introduction to Molecular Spectroscopy by G M Barrow
3. Raman Spectroscopy by Long D A
4. Modern Physics by R Murugeshan
5. Optical Communications – M Mukunda Rao – Universities Press
6. Principles of Condensed Matter Physics – P M Chaikin & T C Lubensky – Cambridge University Press

Semester-6

Core Course – XIII 72 hrs (Credit – 3)

AP6 B13 : NUCLEAR PHYSICS, PARTICLE PHYSICS & ASTROPHYSICS

UNIT: 1 (35 hrs)

1. Nuclear Structure 12 **hours** **Max marks 20**

Nuclear composition – nuclear electrons – discovery of neutron, Nuclear properties – nuclear radii –spin and magnetic moment - nuclear magnetic resonance, Stable nuclei, Binding energy, Liquid drop model -semi empirical binding energy formula- mass parabolas, Shell model, Meson theory of nuclear forces – discovery of pion.

(Text Books: 11.1 to 11.7 Concepts of Modern Physics – Arthur Beiser (5^{th} Edition), Nuclear Physics – Irving Kaplan (17.8)

2. Nuclear Transformations : **16 hours** **Max marks 27**

Elementary ideas of radio activity- Alpha decay-tunnel theory of alpha decay-derivation for the formula for decay constant-Beta decay-negatron emission-positron emission-electron capture-inverse beta decay and the discovery of neutrino, Gamma decay-fundamental ideas of nuclear isomerism and internal conversion, The concept of interaction cross section--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 (5^{th} Edition)

3. Nuclear Detectors And Counters: **7 Hours** **Max marks 15**

Interactions of radiation with matter – fundamental ideas, Gas filled counters- ionization chamber – proportional counter – G.M. counter, Cloud chamber, Bubble chamber, Semi conductor detectors and scintillation counters (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 **hours** **Max Marks 10**

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: 15 hours Max marks 24

Leptons –electron and positron-neutrinos and anti-neutrinos-other leptons, Hadrons-resonance particles, 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 (Text Books: 13.2 to 13.6 Concepts of Modern Physics-Arthur Beiser (5^{th} Edition)

6. Particle Accelerators 8 hours Max marks 15

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 and astronomy 10 hours Max marks 15

Stellar magnitudes an sequences, Absolute magnitude, The bolometric magnitude - Different magnitude standards, The colour index of a star, Luminosities of stars, Stellar parallax and the units of stellar distances, Stellar positions: The celestial co-ordinates. A Qualitative study on stellar positions and constellations

(Text Book: 3.1 to 3.9 An introduction to Astro Physics-Baidyanath Basu)

References

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
5. Mayer – Jensen Shell Model and Magic Numbers: R Velusamy, Dec 2007
6. The Enigma of Cosmic Rays: Biman Nath, Resonance – Feb 2004, March 2004
7. Black body radiation: G.S. Ranganath, Resonance – Feb. 2008.
8. Advanced Physics Second Edition – Keith Gibbs – Cambridge University Press

Semester -6
Core Course –XIV (ELECTIVE) (72 hours) (credit 3)

AP6 B14 (E1) – OP-AMP AND DIGITAL INTEGRATED CIRCUITS

Unit 1(24 hours) **Max Marks 42**

1.Opamp parameters, ideal opamp, open loop opamp configuration-differential amplifier, Inverting amplifier, non inverting amplifier, equivalent circuit of an opamp, ideal voltage transfer curve (section 3.1 to 3.6 of ref.1)

2.Opamp linear application-dc amplifier, ac amplifier, summing amplifier, scaling amplifier, averaging amplifier, instrumentation amplifier, integrator, differentiator (sec 7.2 to 7.6,7.12,7.13 ofref.1)

Unit 2 (24 hours) **Max Marks 42**

3.Active filters-low pass, high pass, band reject, all pass filter(sec 8.1 to 8.10 of ref.1)

4.Wave form generators-square wave, triangular, saw tooth, voltage controlled oscillator (sec 8.15 to 8.18 of ref 1)

5.Comparators-basic comparator types, characteristics, applications, zero crossing detector, Schimitt trigger, voltage limiters (sec 9.1 to 9.8 of ref 1)

Unit 4 (24 hours) **Max Marks 42**

3.Digital ICs-logic families, TTL circuits, TTL types, TTL parameters, TTL gates, external drives for TTL loads, comparison of positive and negative logic (sec 6.1,6.10 of ref 2)

4.CMOS Circuits-CMOS gate, characteristics, TTL to CMOS &CMOS to TTL interface (sec 7.1 to 7.6 of ref 2)

5.Applications of digital ICs-multiplexing displays, frequency counter, time measurements (sec 14.1 to 14.3 of ref 2)

Text book

1.Opamps and linear integrated circuits-E.A.Gayakwad,Prentice Hall,India

2.Digital principles and applications-Malvino and Leach 4th edn TMH

Additional references

1.Operational amplifiers and applications-Subirkumar Sarkar,S.Chand&Co

2.Digital fundementals-Thomas L Floyd, Merril publishing Co gh, US

Semester -6

Core Course –XIV (ELECTIVE) (72 hours) (Credit 3)

AP6B14 (E2)-Microprocessor and Microcomputer Systems

UNIT-I (36 hours)

1.Microcomputer fundamentals Max Marks 42

Introduction, simplified microcomputer architecture-word length of a computer or microprocessor hardware and firmware-CPU-memory-cache memory-flash memory-microcomputer bus architecture memory addressing capacity of CPU-operating system- artificial intelligence-array processors-vector processor. (section1.1,1.7,1.8,1.9,1.10,1.16,1.23,1.24 of fundamentals of microprocessors and microcomputers by B.RAM.)

2 Number system and digital electronics Max marks 30

Decimal number system-binary-conversion of binary to decimal-binary addition and subtraction –BCD-hexadecimal number system-1's compliment-2's compliment-conversion-logic gates –tristate logic gates-buffer-encoders-decoders.)(section 2.1 to 2.11,2.15, 2.23,2.24 of fundamentals of microprocessors and microcomputers by B.RAM.)

UNIT-II (36 hours)

3 Microprocessor Architecture **Max marks 54**

Introduction-Intel 8085 ALU-timing and control unit –registers-flags-stack-data and address bus –pin configuration –Intel 8085 instruction –opcode –operand-instruction cycle- machine cycle-timing diagram (sections 3.1 to 3.3 B.RAM)

4 Instruction set of Intel 8085 Data transfer group- arithmetic group-logical-branch control-I/O and machine control-addressing modes (sections 4.1 to 4.6 of B.RAM.) (Max marks 30)

Text Book

Fundamentals of microprocessors and microcomputers - B.RAM.

References

Microprocessor Architecture Programming and Application with 8085-Ramesh S Gaonkar

Digital principles and application –Malvino and Leach.

Semester-6

Core Course – XVI (Elective) (72 hours) (Credit 3)

AP6 B14 (E3): Communication systems

Unit 1 **24 hours** **Max Marks 42**

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

Unit 2 **24 hours** **Max marks 42**

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

Unit 3 **24 hours** **Max Marks 42**

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

Text books

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

Additional reference

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

B.Sc PROGRAMME IN PHYSICS (CORE)
PRACTICALS

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

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

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

NUMBER OF QUESTIONS IN THE QUESTION PAPER SHALL BE

PAPER -1&II EIGHT (8) PAPER- III &IV SIX (6)

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

AP4 B05 (P) Practical-I (Credit 5)

1st,2nd & 3rd SEMESTER EXPTS

(Any Ten from Each Part)

Part A

1. Young's modulus-non uniform bending-using pin and microscope-(load-extension graph).
2. Young's modulus-Uniform bending-using optic lever
3. Young's modulus-Angle between the tangents
4. Surface Tension-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 moments
15. Searle's vibration magnetometer-moment & ratio of moments
16. Box type vibration magnetometer-m & B_h
17. Melde's string arrangement-Frequency, relative density of liquid and solid (both modes)
18. Mirror galvanometer-figure of merit
19. Potentiometer-measurement of resistance
20. Potentiometer-calibration of ammeter
21. Ballistic Galvanometer- BG constant using HMS-then find B_h.
22. B.G.-Comparison of capacities Desauty's method.
23. Spectrometer- i-d curve
24. Verification of Thevenin's theorem.

AP4 B06 (P) - Practical II (Credit – 5)

3rd & 4th SEM EXPTS. (Any 20)

1. Spectrometer- i_1-i_2 curve
2. Spectrometer-Cauchy's constants
3. Spectrometer-Diffraction Grating-Normal incidence
4. Laser-wavelength using transmission grating
5. Diffraction Grating-minimum deviation
6. Spectrometer-Quartz prism-Refractive indices of quartz for the ordinary and extra-ordinary rays

7. Newton's rings-wavelength of sodium light
8. Air wedge-angle of the wedge, radius of a thin wire
9. Lee's Disc –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 and calibrating using Potentiometer.
16. Conversion of Galvanometer to ammeter and calibrating using Potentiometer.
17. BG -Absolute Capacity
18. BG-High resistance by leakage method
19. BG- Mutual inductance
20. Planck's constant using LED's (3no.s)
21. Polarimeter-Specific rotation of sugar solution.
22. Searls and Box vibration magnetometers- m & Bh..
23. Numerical aperture of an optical fibre by semiconductor laser
24. Frequency of AC using sonometer

AP6 B15 (P) Practical III (Credit – 5)

5^{th} & 6^{th} SEM EXPTS (Minimum Fifteen from Unit : I and Five from Unit : II)

Unit : I

1. Construction of full wave, Centre tapped and Bridge rectifiers
2. Characteristics of Zener diode and construction of Voltage regulator.
3. Transistor characteristics and transfer characteristics in Common Base Configuration- current again
4. Transistor characteristics and transfer characteristics in Common Emitter Configuration- current again
5. CE Transistor Amplifier-Frequency response.
6. Full adder with NAND gates- construction and varification
7. Negative feed back amplifier
8. LC Oscillator (Hartley or Colpitt's)

9. Phase shift oscillator
10. Operational Amplifier –inverting, non inverting, Voltage follower
11. LCR circuits-Resonance using CRO
12. Construction of gates using diodes(AND, OR) & transistors (NOT) and verification by measuring voltages
13. Voltage multiplier (doubler, tripler)
14. Multivibrator using transistors.
15. Flip-Flop circuits –RS and JK using IC's
16. Verification of De-Morgan's Theorem using basic gates.
17. Half adder using NAND gates and decade counter (7490 IC)

C-Programming

18. Solution of equations by iteration method

19. Work done and Angular momentum

20. Projectile motion-List the height, horizontal range, range and time of flight (Plot graph in graph sheet).

21. LCR Circuit

22. Taylor series - Sin θ, Cos θ

23. Decimal to binary and Binary to decimal

24. Motion of a rocket- velocity at different instances

25. Mean & standard deviation

AP6 B16 (P)A Practical IV

5^{th} & 6^{th} SEMESTER EXPTS (Any 20)

(FOR KKTM GOVT. COLLEGE)

1.Network Theorems-Verification

2. Wein Bridge Oscillator using Op-Amp

3.Emitter follower

4.Astable multivibrator using 555 IC

5.Opamp Adder

6.Opamp Differentiator-study of wave forms

7.Opamp Integrator-study of wave forms

8.Opamp-Square wave generator

9.Opamp-Triangular wave generator

10.First order low pass filter using Opamp

11.First order high pass filter using Opamp

12.Crystal Oscillator

13.Clocked J-K Flip-Flop-to familiarise IC 7476

14.Four Bit Binary Adder-to familiarise IC 7483

15.For Bit Magnitude Comparator-to familiarise IC 7485

16.To implement 4:1 Multiplexer using IC 7400,7408,7432

17.To implement 1:4 De Multiplexer using IC 7400,7408

18.To implement BCD to Decimal Decoder using IC 7445

19.To implement Four Bit Binary Counter using IC 7493

20.To implement Four Bit Decade Counter using IC 7490

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

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

23.Monostable multivibrator using 555 IC

24.Seven segment display-To setup a static display system to display decimal numbers

AP6 B016 (P)B Practical IV

5th & 6th SEMESTER EXPTS (Any 20)

(for Carmel College)

UNIT I-Electronics

1. Voltage Multiplier

2. Wein Bridge Oscillator using Op-Amp

3. Diode Clipper

4. Saw Tooth Generator

5. Verification of Network Theorems

6. Low voltage Power Pack

7. Differentiator and Integrator circuit using Op-Amp

8. Astable Multivibrator using IC 555

9. Low Pass Filter

10. High Pass Filter

UNIT II- Microprocessor

11. Subtraction of 8 bit

12. Addition of two consecutive numbers

13. Addition of 8 bit No-sum16 bit

14. Decimal Addition of two 8 bit Numbers

15. addition of 8 bits

16. Data Transfer Operations

17. Larger of 2 numbers

18. Largest number in an array

19. Smallest number in an array

20. Even or Odd

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

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

MODEL QUESTION PAPERS

Reg. No……

(A) CORE COURSE (1)

Name……....

FOURTH SEMESTER B.Sc.DEGREE EXAMINATION MAY 2016
(CCSS)
PHYSICS CORE
PH4B07- ELECTRODYNAMICS - I

Time: 3 hours Total Marks : 80

Symbols used in this question paper have their usual meanings

SECTION A

(Answer in a word or phrase)

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 magnetoststic 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 equipotential surface.
10. When an dielectric is placed in a parallel plate capacitor its capacitance decreases.

10x1= 10

SECTION B

(Answer in a short paragraph- three or four sentences)

Answer any seven 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. What are paramagnetic and diamagnetic substances?
16. Show that surface current density is the product of charge density and velocity of charges?
17. Distinguish between linear and non linear dielectrics?.
18. How magnetic dipoles are generated in specimen placed in a magnetic field?
19. What is the physical significance of auxiliary field H?
20. What is Retentivity in Hysterisis?

7x2= 14

SECTION C

(Answer in a paragraph of about half a page to one page)

Answer any three questions. Each question carries 4 marks

21. Derive an expression for the electric field intensity at a point in between two infinite plane

sheet of charge?
22.What are bound currents? Explain them?
23.Mention about three special techniques for calculating potentials?
24 What is the significance of Laplaces equation ?
25 Discuss about the comparison of magnetostatics and electrostatics.

3x4= 12

SECTION D

(Problems- write all relevant formulas. All important steps carry separate marks)

Answer any four questions. Each question carries 6 marks

26hat is the velocity and kinetic energy of a proton which undergoes in circular path of radius 1 metre under a magnetic field of 10^{-2} Tesla ?
27. E = xy i + 2yz j + 3xz k. Check whether it is an admissible electric field or not.
28. An electron travels with a velocity of $2x10^8$ m/s perpendicular to a uniform magnetic field 0.15 T. Determine the force on the electron.
29. 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.
30 A parallel plate capacitor having capacitance C_0 is filled with insulating material of doelectric constant K. What is the new capacitance
31 Find average potential over a spherical surface of radius R due to a point charge q located inside the sphere?

4x6= 24

SECTION E

(Essays - Answer in about two pages)

Answer any two questions. Each question carries 10 marks.

32 Derive the expression for energy and force in a dielectric system subjected to an electric field?
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?

2x10 = 20

CORE COURSE (2)

PH5 B08 - PHYSICAL OPTICS AND MODERN OPTICS

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION (CCSS)

PH5 B08 - PHYSICAL OPTICS AND MODERN OPTICS

Time: 3 hours Total Marks: 80

Symbols used in this question paper have their usual meanings

SECTION A

(Answer all questions in a word or phrase) 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.

(10x1= 10)

SECTION B

(Answer all questions in two or three sentences) 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.

(7x2= 14)

SECTION C

(Answer any five questions in a paragraph of about half a page to one page)
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 straight edge.
22. Distinguish between holography and photography.
23. Briefly explain how hologram is constructed.
24. Explain three types of pulse dispersions in optical fibres.

(5x4= 20)

SECTION D

(Problems- write all relevant formulas. All important steps carry separate marks)
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 circularily polarized light. Given μ_o=1.65, μ_e = 1.48 and wavelength of light is 589 nm.
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.

(4x4= 16)

SECTION E

(Essays - Answer any two questions in about two pages)

. 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.

(2x10 = 20)

(B) OPEN COURSE

Vth SEM . NON CONVENTINAL ENERGY SOURCES

Marks 40 **Time 2hours**

Section A -One word answer- Answer all 6x1=6

1 .----------radiations are absorbed by Ozone
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.

Section B -Short answer - (In one or two sentences) Answer all 5 5x2=10

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.What are the sources of geothermal energy?

Section C -Paragraph Answer -Answer any 4 4x4=16

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

Section D - Essay -Answer any one 1x8=8

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. Discuss the methods to get energy from Bio mass .

CORE COURSE -1

MODEL QUESTION PAPER

PH1B01-METHEDOLOGY OF SCIENCE AND PHYSICS

Max marks 100 Time 3 Hours

Section A(Answer all questions) 1x10=10

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.

Section B Answer all (Write in two or three sentences.) Two marks each. 7x2=14

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

Section C . Write in one paragraph (Write any five) 5x4=20

18 What are the assumptions made by Newton to develop Mechanics?
19. What is DeBroglies 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, $=\begin{bmatrix} 1 & i & 0 \\ -i & 0-2i & \\ 0 & 2i & 0 \end{bmatrix}$
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.

Section D.(Solve any four problems.) 4x4=16

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 an 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= $2xz^2$i-yzj+$3xz^3$k, 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= x^2+2xy+3z+4
31. Show that matrix A is orthogonal. A=$\begin{pmatrix} coso & -sino \\ sino & coso \end{pmatrix}$

Section E (Write any two) 2x10=20

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=$\begin{pmatrix} 2 & 1 \\ -1 & 4 \end{pmatrix}$

FIFTH SEMESTER B.Sc .DEGREE EXAMINATION
(CCSS)
PH5 B09: ELECTRONICS (ANALOG & DIGITAL)

Time: 3 hours Total Marks : 80

Symbols used in this question paper have their usual meanings

SECTION A
(Answer in a word or phrase)
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 ---------

Questions 6 to 10 : Write True or False.

6. If the doping level of a crystal diode is increased, the breakdown voltage decreases.
7. CC configuration is used for getting high voltage gain.
8. The input to an XOR gate are 1 , 0, 1. Then the output will be zero.
9. Two's complement of 10111 is 01000.
10 The decimal equivalent of octal number 110 is 73.

10x1=10 Marks

SECTION B

(Answer in Two or three sentences)

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.

7x2= 14Marks

SECTION C

(Answer in a paragraph of about half a page to one page)

Answer any three 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 basic integrator circuits using opamp.
24. Explain how voltage stabilization is ensured in a zener voltage regulator.

5x4= 20 Marks

SECTION D

(Problems- write all relevant formulas. All important steps carry separate marks)

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 R_B of 100kΩ. If V_{CC} =20V, R_C =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 I_{DSS} = 10mA and V_{GS}(off) = -6V, find the value of V_{GS} and V_p
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

4x4= 16 Marks

SECTION E
(Essays - Answer in about two pages)
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 feed back. Derive an expression for gain in a negative voltage feedback amplifier.
What are the advantages of negative feed back?
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.

2x10 = 20Marks

MODEL QUESTION PAPER

Reg. No……
Name……....

SIXTH SEMESTER B.Sc.DEGREE EXAMINATION (CCSS) PHYSICS CORE PH6 B11 : SOLID STATE PHYSICS, SPECTROSCOPY AND LASER PHYSICS

Time: 3 hours Total Marks : 80

Symbols used in this question paper have their usual meanings

SECTION A
(Answer in a word or phrase)
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

(10x1= 10 marks)

SECTION B

(Answer in a short paragraph- three or four sentences)

Answer any 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

(7x2= 14 marks)

SECTION C

(Answer in a paragraph of about half a page to one page)

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

(5x4= 20 marks)

SECTION D

(Problems- write all relevant formulas. All important steps carry separate marks)

Answer any four questions. Each question carries 6 marks

25. Shoe 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^{-I}. Calculate B and hence bond length in CO molecule. Given Avogardro No is 6.022×10^{23}.
27. 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.
28. 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.
29. A substance shows a Raman line at 4567 A^{θ} when exciting line $4358A^{0}$ is used. Deduce the positions of stokes and anti stokes lines for same substance when exciting line $4047A^{o}$ is used.

30. 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

(4x4= 16 marks)

SECTION E

(Essays - Answer in about two pages)

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

(2x10 = 20 marks)