UNIVERSITY OF KERALA

REVISED SYLLABI FOR

FIRST DEGREE PROGRAMME IN

PHYSICS

UNDER

CHOICE BASED-CREDIT & SEMESTER-

SYSTEM (CBCSS)

(2018 admission onwards)

AIM AND OBJECTIVES OF THE PROGRAMME

In this programme, we aim to provide a solid foundation in all aspects of Physics and to show a broad spectrum of modern trends in physics and to develop experimental, computational and mathematical skills of students. The syllabi are framed in such a way that it bridges the gap between the plus two and post graduate levels of physics by providing more or less complete and logical framework in almost all areas of basic Physics.

The programme also aims to

(i) Provide education in physics of the highest quality at the undergraduate level and generate graduates of the calibre sought by industries and public service as well as academic teachers and researchers of the future.

(ii) Attract outstanding students from all backgrounds.

(iii) Provide an intellectually stimulating environment in which the students have the opportunity to develop their skills and enthusiasms to the best of their potential.

(iv) Maintain the highest academic standards in undergraduate teaching.

(v) Impart the skills required to gather information from resources and use them.

(vi) Equip the students in methodology related to Physics.

Objectives

By the end of the first year (2nd semester), the students should have,

(i) Attained a common level in basic mechanics and properties of matter and laid a secure foundation in mathematics for their future courses.

(ii) Developed their experimental and data analysis skills through a wide range of experiments in the practical laboratories.

By the end of the fourth semester, the students should have

(ii) Been introduced to powerful tools for tackling a wide range of topics in Thermodynamics, Electrodynamics, Classical Mechanics and Relativistic Mechanics.

(iii) Become familiar with additional relevant mathematical techniques.

(iv) Further developed their experimental skills through a series of experiments which also illustrate major themes of the lecture courses.

By the end of the sixth semester, the students should have

(ii) Covered a range of topics in almost all areas of physics including Quantum Physics, Solid State Physics, Computational Physics, Electronics etc.

(iii) Had experience of independent work such as projects, seminars etc.

(iv) Developed their understanding of core Physics.

I. General Structure for the First-Degree Programme in Physics

Sem. No.	Course title	Instructional hours/week		Credit	UE duration	Evaluation		Total credits
		L	P		(hours)	IA. %	UE %	
I	EN1111 English Lang I	5		4	3	20	80	16
	1111 Addl Lang I	4		3	,,			
	EN1121 Found. Course I	4		2	,,			
	PY1141 Core Course I	2		2	,,			
	Core pract. I	-	2	-	-			
	MM1131.1 Compl. Course I	2	2	3	3			
	Compl. Course II (CH1131.1/ST1131.2/EL1131)	2	2	2	,,			
II	EN1211 Eng Lang. II	5		4	3	20	80	17
	EN1212 Eng Lang. III	4		3	,,			
	1211 Addl Lang. II	4		3	,,			
	PY1241 Core Course II	2		2	,,			
	Core pract. I		2					
	MM1231.1 Compl. Course III	2	2	3	,,			
	Compl. Course IV (CH1231.1/ST1231.2/EL1231)	2	2	2	,,			
III	EN1311 Eng Lang. IV	5		4	3	20	80	18
	1311 Addl Lang. III	5		4	,,			
	PY1341 Core Course II	3	-	3	,,			
	Core Pract I	-	2	-	-			
	MM1331.1 Compl. Course V	5	2	4	3			
	Compl. Course VI (CH1331.1/ST1331.2/EL1331)	3	2	3	,,			

IV	EN1411 Eng. Lang. V	5		4	3			25
	1411Addl Lang. IV	5		4	,,			
	PY1441Core Course III	3		3	,,			
	PY 1442 Core (Pract I) IV	-	2	3	,,			
	MM1431.1 Compl. Course VII	5	-	4	3			
	Compl. Course VIII	3	-	3	,,			
	(CH1431.1/ST1431.2/EL1431)							
	Compl. (Practical) IX	-	2	4	,,			
	(CH1432.1/ST1432.2/ EL1432)							
V	PY1541 Core Course V	4	-	4	3			18
	PY1542 Core Course VI	4	-	4	,,			
	PY1543 Core Course VII	4	-	4	,,			
	PY1544 Core Course VIII	4	-	4	,,			
	Core (Practical II)	-	4	-	-			
	Open Course (PY1551.1/PY1551.2/ PY1551.3/PY1551.4/ PY1551.5)	3	-	2	3			
	Project	-	2	-	-			
VI	PY1641 Core Course IX	4	-	4	3			26
	PY1642 Core Course X	4	-	4	,,			
	PY1643 Core Course XI	4	-	4	,,			
	PY1644 Core Course XII	4	-	3	,,			
	PY1645 Core (Pract II) XIII	-	2	2	,,			
	PY1646 Core (Pract III) XIV	-	2	3	,,			
	Elective Course (PY1661.1/PY1661.2/ PY1661.3/PY1661.4/PY1661.5)	3	-	2	,,			
	PY1647 Project and Research Institute/Science Museum visit	-	2	4	-			
		TOTAL CREDITS						**120**

UE- University Examination, IA- Internal Assessment

II. Course structure:(1a). ***Core Courses (theory)***

Sem.	Title of paper	Number of hrs/ week	Number of credits	Total hrs/ sem.	UE Duration (hrs)
1	PY1141 – Basic mechanics & Properties of matter	2	2	36	3
2	PY1241- Heat& Thermodynamics	2	2	36	3
3	PY1341–Electrodynamics	3	3	54	3
4	PY1441- Classical &Relativistic Mechanics	3	3	54	3
	PY1541– Quantum Mechanics	4	4	72	3
5	PY1542–Statistical Mechanics, Research Methodology and Disaster Management	4	4	72	3
	PY1543–Electronics	4	4	72	3
	PY1544–Atomic & Molecular Physics	4	4	72	3
	PY1551– Open course	3	2	54	3
6	PY1641-Solid State Physics	4	4	72	3
	PY1642–Nuclear &Particle Physics	4	4	72	3
	PY1643- Classical & Modern Optics	4	4	72	3
	PY1644-Digital Electronics & Computer Science	4	3	72	3
	PY1661– Elective Course	3	2	54	3

(1b). Course structure for practical and project work for the core course:

Sem	Title of Paper	Duration of Exam (hrs.)	Number of Credits	Weightage		Allotted hours	
				IA	UE	Per week	Per year
4	**PY1442- Basic Physics Lab 1**	3	3	1	3	S1---2 S2---2 S3---2 S4—2	144
6	**PY1645-Advanced Physics Lab 2**	3	2	1	3	S5---2 S6—2	72
	PY1646-Advanced Physics Lab 3	3	3	1	3	S5---2 S6—2	72
	PY-1647-Project	-	4	-	4	S5-2 S6-2	72

2(a). Complementary Courses (General structure)

Semester	Theory			Practical	
	Number of hrs/week	Number of credits	Total hrs/sem.	number of hrs/week	Number of credits
1	2	2	36	2	-
2	2	2	36	2	-
3	3	3	54	2	-
4	3	3	54	2	4

2(b). COMPLEMENTARY COURSES (Theory and Practical)

1. Physics for Mathematics B. Sc. Programme

Sem.	Title of the course	No. of hrs/ week	No. of credits	Total credits	Total hrs/sem.	UE Duration
1	PY1131.1-Mechanics& Properties of Matter	2	2	2	36	3
	Practical	2	-		36	-
2	PY1231.1-Thermal Physics and Statistical Mechanics	2	2	2	36	3
	Practical	2	-		36	-
3	PY1331.1-Optics, Magnetism& Electricity	3	3	3	54	3
	Practical	2	-		36	-
4	PY1431-Modern Physics & Electronics	3	3	7	54	3
	PY1432-Practical	2	4		36	3

2. Physics for Chemistry B. Sc. Programmes

Sem.	Title of the course	No. of hrs/week	No. of credits	Total credits	Total hrs/sem.	UE duration (hrs)
1	PY1131.2-Rotational dynamics& Properties of Matter	2	2	2	36	3
	Practical	2	-	-	36	-
2	PY1231.2- Thermal Physics	2	2	2	36	3
	Practical	2	-	-	36	-
3	PY1331.2- Optics, Magnetism & Electricity	3	3	3	54	3
	Practical	2	-	-	36	-
4	PY1431.2-Atomic Physics, Quantum mechanics & Electronics	3	3	3	54	3
	PY1432- Practical	2	4		36	3

3. Physics for Statistics B. Sc. Programme

Sem.	Title of the course	No. of hrs/ week	No. of credits	Total Credits	Total hrs / sem	UE duration
1	PY1131.3- Mechanics& Properties of Matter	2	2	2	36	3
	Practical	2	-	-	36	-
2	PY1231.3- Thermal Physics & Statistical Mechanics	2	2	2	36	3
	Practical	2	-	-	36	-
3	PY1331.3- Optics, Magnetism& Electricity	3	3	3	54	3
	Practical	2	-	-	36	-
4	PY1431.3- Modern Physics& Electronics	3	3	7	54	3
	PY1432 Practical	2	4			3

4. Physics for Geology B. Sc. Programme

Sem.	Title of the course	No. of hrs/ week	No. of credits	Total Credits	Total hrs / sem.	UE duration
1	PY1131.4- Mechanics& Properties of Matter	2	2	2	36	3
	Practical	2	-	-	36	-
2	PY1231.4- Thermal Physics & Physics of the Earth	2	2	2	36	3
	Practical	2	-	-	36	-
3	PY1331.4- Optics &Electrodynamics	3	3	3	54	3
	Practical	2	-	-	36	-
4	PY1431.4- Modern Physics, Electronics& Crystallography	3	3	7	54	3
	PY1432 Practical	2	4			3

5. Physics for Home Science B. Sc. Programme

Sem.	Title of the course	No. of hrs/ week	No. of credits	Total Credits	Total hrs / sem.	UE duration
1	PY1131.5- Mechanics& Properties Matter	2	2	2	36	3
	Practical	2	-	-	36	-
2	PY1231.5- Thermal Physics	2	2	2	36	3
	Practical	2	-	-	36	-
3	PY1331.5- Optics &Electricity	3	3	3	54	3
	Practical	2	-	-	36	-
4	PY1431.5- Atomic Physics &Electronics	3	3	7	54	3
	PY1432 Practical	2	4			3

6. Electronics for Physics B. Sc. Programme

Sem	Title of the course	No. of hrs/ week	No. of credits	Total credits	Total hrs /Sem	UE duration
1	EL1131- Electronics I	2	2	2	36	3
	Practical	2	-	-	36	-
2	EL1231- Electronics II	2	2	2	36	3
	Practical	2	-	-	36	-
3	EL1331- Electronics III	3	3	3	54	3
	Practical	2	-	-	-	-
4	EL1431- Electronics IV	3	3	7	54	3
	EL1432- Practical	2	4		36	3

7. Physics for Polymer Chemistry B. Sc. Programme

Sem	Title of the course	No. of hrs/ week	No. of credits	Total credits	Total hrs /Sem	UE duration
1	PY1131.7–Mechanics and Fluid dynamics	2	2	2	36	3
	Practical	2	-	-	36	-
2	PY1231.7- Thermal Physics	2	2	2	36	3
	Practical	2	-	-	36	-
3	PY1331.7- Modern Optics and Electricity	3	3	3	54	3
	Practical	2	-	-	-	-
4	PY1331.7- Atomic Physics & Electronics	3	3	7	54	3
	PY1432- Practical	2	4		36	3

III. QUESTION PAPER PATTERN

For all semesters

1. The examination has duration of 3 hours
2. Each question paper has four parts A, B, C & D.
3. Part A contains 10 questions and the candidate has to answer all questions. Each question carries 1mark. The answer may be in the forms-one word/one sentence
4. Part B contains 12 short answer questions. Out of these 12 questions, the candidate has to answer 8 questions. Each question carries 2marks.
5. Part C contains 9 questions of which the candidate has to answer 6 of them.

   Each question carries 4 marks.
6. Part D contains 4 long answer questions (essays) of which the candidate has to answer 2 questions. Each question carries 15 marks.
7. The total weightage for the entire questions to be answered is 80 marks.

QUESTION PAPER PATTERN FOR EXAMINATION		
Question No	Type of Question	Marks
Part A : 1-10	10 One word/One sentence	10
Part B : 11-22	8 out of 12; Short answer	16
Part C : 23-31	6 out of 9; Short essay/problem	24
Part D : 32-35	2 out of 4; Essay	30
		Total=80 marks

V. OPEN/ELECTIVE COURSES

During the programme the students have to undergo two open/elective courses. The students attached to the Physics department can opt one course from the Physics department (Elective course) and the other from any one of the other departments (Open course). The student has to do the open course during the fifth semester and the elective course during the sixth semester. As a beginning, the department will choose one open course for the fifth semester and one elective course for the sixth semester depending on the faculty and infrastructure available.

(a). Open Courses.

i) Bio-Physics ii) Astronomy & Astrophysics iii) Applied Physics iv) Environmental Physics v) Energy Physics

(b). Elective Courses.

i) Photonics ii) Nano science iii) Computer hardware and networking iv) Instrumentation v) Space Science

VI. IMPLEMENTATION OF PROJECT WORK AND STUDY TOUR (RESEARCH INSTITUTE/SCIENCE MUSEUM VISIT)

As part of study the candidate has to do a project work. The aim of the project work is to bring out the talents of students and to introduce research methodology. The work may be chosen from any branch of Physics, which may be experimental, theoretical or computational. Emphasis should be given for originality of approach. The project shall be done individually or as a group of maximum 5 students. The projects are to be identified during the 4^{th} semester with the help of the supervising teacher. The report of the project (of about 30-40 pages) in duplicate shall be submitted to the department by the end of the 6^{th} semester well before the commencement of the examination. The reports are to be produced before the external examiners appointed by the University for valuation.

STUDY TOUR

Students are directed to visit one research institute /science museum preferably within the state of Kerala. Scientifically prepared hand-written study tour report must be submitted by each student for ESE on the day of the examination of project evaluation.

VII. CONTINUOUS EVALUATION

There will be continuous evaluation (CE) based on continuous assessment and end semester examination (ESE) for each course. CE carries 20 marks based on specific components such as attendance, tests, assignments, seminars etc. and ESE 80 marks. Out of the 20marks in internal assessment, 5marks shall be given to attendance, 10 marks to test papers, 5marks to seminar / assignments (minimum one test & one assignment). The components of the internal evaluation for theory and practical and their marks are given below.

(a). Theory

No	**Component**	**marks**
1	Attendance	5
2	Assignment	5
3	Test paper	10
	Total	20

The continuous evaluation (CE) shall be based on periodic written tests, assignments, viva/ seminar and attendance in respect of theory courses. **Written Tests**: Each test paper may have duration of minimum 3 hours. For each course there shall be a minimum of one written test during a semester. **Assignments**: Each student is required to submit one assignment for a theory course. Seminar / Viva: For each theory course, performance of a student shall also be assessed by conducting a viva – voce examination or seminar presentation based on topics in that course.

(b). Continuous Evaluation CE (Practical)

No	Component	Marks
1	Attendance	5
2	Skill & Punctuality	5
3	Laboratory record	5
4	Test (internal exam)	5
Total		20

Lab skill is to be assessed based on the performance of the student in practical classes. Minimum one practical test paper and an internal viva – voce examination based on the experiments done in the lab are to be conducted in each practical course. The laboratory record should contain an index and a certificate page. Separate records are to be used for each practical course. **A candidate shall be permitted to attend an end semester practical examination only if he / she submit a certified record with a minimum of 10 experiments**. This is to be endorsed by the examiners.

The **evaluation of certified record** shall be according to the scheme given below.

No of experiments recorded	Marks
18	10
16	9
14	8
12	7
10	6

(c) The allotment of marks for attendance shall be as follows.

	% of attendance	Marks
Attendance	Attendance less than 50%	0
	51%-60%	1
	61%-70%	2
	71%-80%	3
	81%-90%	4
	91%-100%	5

(d) Tests, Assignments and Seminars

For each course there shall be at least two class tests during a semester. Marks for the test in continuous evaluation shall be awarded on the basis of the marks secured

for the better of the two tests. Valued answer scripts shall be made available to the students for perusal within 10 working days from the date of the test.

Each student shall be required to do one assignment and one seminar for each course. Valued assignments shall be returned to the students. The seminars shall be organized by the teacher in charge and the same shall be assessed by a group of teachers including the teacher in charge of that course.

VIII. END SEMESTER EXAMINATION (ESE)

The external theory examinations of all semesters shall be conducted by the University. There will be no supplementary examinations. For reappearance/ improvement, as per university rules, the students can appear along with the next batch.

IX. EVALUATION OF PROJECT AND TOUR REPORT

The evaluation of the project shall be done by two external examiners according to the scheme given above. Each candidate shall be evaluated separately. There shall be a maximum of 12 candidates per session with two sessions per day. However, there shall be no continuous evaluation for the project.

The **evaluation of project** shall be according to the scheme given below.

Component	Marks
Originality of approach	15
Relevance of the topic	10
Involvement	10
Viva-voce	15
Presentation of report	20
Research Institute/Science museum visit and Report	**30**

Evaluation of Tour report

The evaluation of tour report shall be according to the scheme given below

Component	**Marks**
Presentation of the report	10
Certified report	20

X. EVALUATION OF PRACTICAL EXAMINATION

The practical examinations for the core subject shall be conducted by the University at the end of semesters 4 and 6 with a common time table and questions set by the University. Similarly, the practical examination for the complementary course shall be conducted by the University at the end of the 4th semester. The examiners shall

be selected from a panel of experts prepared by the University. **For each examination centre there shall be two external examiners and one internal examiner who is not in charge of the practical at that centre.** The mark sheet duly certified by the head of the institution should be sent to the University before the commencement of the end semester examinations.

The evaluation scheme for the end semester practical examinations shall be as follows.

Component	Marks
Formula, circuit, graph, brief procedure	20
Setting and experimental skill	15
Observations and tabulations	15
Substitution, calculation, result with correct unit	20
Certified record with 18 experiments	10
Total	80

For electronics experiments, the scheme shall be as follows.

Component	Marks
Formula, circuit, graph, brief procedure	20
Observations, skill and tabulations	25
Substitution, calculation, result with correct unit	25
Certified record with 18 experiments	10
Total	80

For computer experiments, the following scheme shall be followed.

Component	Marks
Writing the programme	30
Execution of the programme	20
Output/Result	20

Certified record with 18 experiments	10
Total	80

PY1141: BASIC MECHANICS & PROPERTIES OF MATTER

(36 HOURS-2 CREDITS)

MECHANICS (22 hrs)

Unit 1- Dynamics of Rigid Bodies (7 hrs)

Equations of motion for rotating rigid bodies- angular momentum and Moment of Inertia (MI)- Theorems on MI- calculation of MI of bodies of regular shapes- uniform rod, ring, disc, annular ring, solid cylinder, hollow cylinder and solid sphere- KE of rotating and rolling bodies- torque- Determination of MI of a fly wheel (theory, experiment and applications).

Unit 2- Conservation of energy (3 hrs)

Energy Conservation law- Work – power- Kinetic Energy – Work Energy theorem- Conservative Forces - potential energy- Conservation of energy for a particle– energy function- .

Unit 3-Oscillations (12 hrs)

Simple harmonic motion – Energy of harmonic oscillators-simple pendulum-mass on a spring-oscillation of two particles connected by a spring- compound bar pendulum - interchange ability of suspension and oscillation-four points collinear with C.G about which the time period is the same-conditions for maximum and minimum periods - Determination of g using symmetric bar pendulum. Mechanical and electromagnetic wave motion- General equation of a wave motion-expression for a plane progressive harmonic wave- energy density for a plane progressive wave

PROPERTIES OF MATTER (14hrs)

Unit 4- Elasticity (8 hrs)

Modulus of elasticity (revision)Relations connecting the three elastic moduli- Poisson's ratio- bending of beams- bending moment-cantilever-centrally loaded beams and uniformly bent beams-I section girders-torsion of a cylinder-expression for torsional couple -work done in twisting a wire-torsion pendulum-.

Unit 5– Surface Tension (3 hrs)

Surface tension-molecular explanation of ST.-angle of contact (revision)shapes of drops -expression for excess of pressure on a curved liquid surface -variation of ST. with temperature.

Unit 6 – Fluid Dynamics (3 hrs)

Streamline and turbulent flow-equation of continuity-Bernoulli's theorem-venturimeter-viscosity-Newton's law- Stoke's formula.

Books for Study:

1. Mechanics: H. S. Hans and S. P Puri TMH, 2nd Edn.

2. Mechanics: J.C. Upadhyaya and S. Ram Prasad Chand Publications, 2017

3. Elements of Properties of Matter: D.S. Mathur, S. Chand Publications,2008

4. Fundamentals of Physics: Halliday and Resnick, Wiley India Pvt. Ltd.,2006

Books for Reference:

1. Properties of matter: Brijlal and Subramaniam, S.Chand & Co.,2004

2. Principles of Physics: P.V.Naik, PHI,2010

Topics for assignments /discussion in the tutorial session (sample)

1. Physics-The fundamental science-historical development of mechanics-some implications of the principle of mechanics-The scope of mechanics.

2. Life of eminent physicists- Newton, Einstein, C.V.Raman, Edison.

3. Study of Young's modulus for different types of wood.

4. Study of variation of surface tension for different detergents.

5. Study of viscosity of different types of ink and to arrive at knowledge of its fluidity.

6. Wide applications of Bernoulli's equation.

7. Variation of surface tension with temperature by Jaeger's method

PY1241 –HEAT AND THERMODYNAMICS

(36 HOURS-2 CREDITS)

Unit 1- Transference of heat (8 hrs)

Thermal conductivity - determination by Lee's Disc method for bad conductor radial flow of heat, cylindrical flow, thermal conductivity of rubber, Weidman-Franz law- Radiation of heat, Stefan's law, determination of Stefan's constant, solar constant, determination of solar temperature

Unit 2- Thermodynamics (18 hrs)

Zeroth Law & First law of Thermodynamics, differential form-Thermodynamic Processes-Expression for work done in isothermal and adiabatic processes. Application of first law to specific heat and latent heat Reversible and irreversible process Second law of thermodynamics- Clausius and Kelvin statements-Carnot engine- Principle of refrigerator- working and efficiency, Otto engine and Diesel engine – working and efficiency.

Unit 3- Entropy (10 hrs)

Definition of entropy, change of entropy in reversible and irreversible cycle, Clausius inequality and second law of thermodynamics, entropy and available energy, Entropy, probability and disorder Nernst theorem and third law of thermodynamics phase transition, phase diagram, first order and second order phase transition (qualitative idea) Clausius-Clepeyron Equation

Books for Study:

1. Thermal and Statistical Mechanics: S.K. Roy, New Age International
2. Heat and Thermodynamics: D. S. Mathur, S. Chand &Co
3. Heat Thermodynamics and Statistical Physics: Brijlal & Subramaniam, S. Chand &Co
4. Thermal Physics, Statistical Physics and SolidState Physics: C. J. Babu, Calicut University Press
5. Engineering Thermodynamics: P. K. Nag, McGraw-Hill, 5th Edn.

Books for Reference:

1. Heat and Thermodynamics: Zemansky, McGraw-Hill
2 Heat and Thermodynamics: Rose C McCarthy, The Rosen Publishing Group, Inc.NY,2005
3 Thermodynamics, Kinetic Theory and Statistical Thermodynamics: F. W. Sears and G. L. Salinger, Addison-Wesley Publishing Company, 3rdEdn.

PY 1341 ELECTRODYNAMICS

(54 HOURS-3CREDITS)

Unit 1-Electrostatic Field (10hrs)

Electric field: introduction, Coulomb's law, Electric field, continuous distribution(Revision) , Divergence and curl of electrostatic fields; Field lines, flux applications of gauss's law, Curl of E, Electric potential: Introduction to potential, Comments on potential, Poisson's and Laplace's equations, potential of a localized charge distribution, Electrostatic boundary , Work and Energy in Electrostatics: The work done to move a charge, the energy of a point charge distribution, The energy of a continuous charge distribution.

Unit 2-Electrostatic fields in matter (10 hrs)

Polarization: Dielectrics, induced dipoles, Polarization, The field of a polarized object: Bound charges, physical interpretation of bound charges and the field inside a dielectric Electric displacement: Gauss's law in the presence dielectrics, Boundary conditions.

Unit 3-Magnetostatics (7hrs)

Introduction- The Biot- Savart law, Ampere's force law (revision), Magnetic torque, Magnetic flux and gauss's law for magnetic fields, magnetic vector potential, Magnetic intensity and Ampere's circuital law, magnetic materials.

Unit 4-Electromagnetic Induction (7hrs)

Electromotive force: Ohm's law Electromagnetic Induction Faraday's law, the induced electric field, Maxwell's equations, Magnetic charge,

Unit 5-Electromagnetic waves (6hrs)

Waves in one dimension: The wave equation Electromagnetic waves in vacuum: The wave equation for E and B, Monochromatic plane waves, Energy and momentum in electromagnetic waves.

Unit 6-Transient currents (7hrs)

Growth and decay of current in LR and CR Circuits-Measurement of high resistance by leakage-Charging and discharging of a capacitor through LCR circuit.

Unit 7-Alternating current (7 hrs)

AC through series LCR (acceptor circuit) and parallel LCR circuit (rejecter circuit)- Q- factor, Power in AC-power factor.

Books for Study:

1. Electrodynamics: David J Griffith, PHI, 3rd Edn.
2. Electricity and Magnetism: Murugesan, S. Chand & Co.
3. Electricity and Magnetism: K. K. Tiwari, S. Chand & Co.
4. Principles of electromagnetics: N.O. Matthew Sadiku and S. V. Kulkarni Oxford University Press, 6th Edn.

Books for Reference:

1. Electricity and Magnetism: Muneer H. Nayfeh & Norton K. Bressel, John Wiley & Sons
2. Electricity and Magnetism: E. M. Purcell, Berkley Physics course, Vol.2,

MGH
3. Electricity and Magnetism: J. H. Fewkes & John Yarwood, University Tutorial Press
4. Classical Electrodynamics: Walter Greiner, Springer International Edn.
5. Electromagnetic waves and radiating systems: Jordan & Balmain, PHI
6. Electromagnetics: B. B. Laud, Wiley Eastern Ltd., 2nd Edn.
7. Introduction to electrodynamics: Reitz & Milford, Addison Wesley
8. Electromagnetic theory fundamentals: Bhag Guru and Huseyin Hizirogulu, Cambridge University Press, 2nd Edn.
9. Electricity and Magnetism: D. C. Tayal, Himalaya Publishing Co.

Topics for discussion in Tutorial session/Assignments (sample)

1. Comment on how electrostatic energy is stored in a field
2. Discuss the electrostatic properties of conductors
3. What is meant by electrostatic shielding? In what way it helps us?
4. Discuss the peculiarities of electric displacement D and electric field E. How they are incorporated in Maxwell's Equations
5. Discuss the properties of linear dielectrics. What differentiates a dielectric to be linear or not?
6. Discuss applications of Ampere's circuital law
7. Compare electrostatics and magnetostatics
8. Why magnetic forces cannot do work
9. Discuss about cyclotron motion & cycloid motion
10. Discuss whether there exists any stand-off between ohm's law and Newton's second law
11. A battery has an *emf*. Can this *emf*. be a 'force'? How will you interpret electromotive force?
12. Discuss the role of motional *emf* in power generation
13. Discuss the orthogonality of E, B and propagation vector k
14. A wave function can have a sinusoidal representation. Solve the wave equation for this function and discuss the various terms related to a wave such as amplitude, frequency, phase, wave number.
15. Complex representation of wave function has good advantage. Why? Discuss the linearity of wave function. (use complex notation)
16. Discuss AC through LC, LR and CR circuits
17. Show that sharpness of resonance is equal to Q- factor
18. What is a choke coil? Discuss the advantage of using a choke coil instead of a resistor

PY1441CLASSICAL AND RELATIVISTIC MECHANICS
(54 HOURS-3CREDITS)

Unit 1 - Particle Dynamics (5 hrs)

Mechanics of a particle – equation of motion of a particle – Motion of a charged particle in electromagnetic field – mechanics of a system of particles

Unit 2-Conservation laws (6 hrs)

linear uniformities of space and conservation of linear momentum – rotational invariance of space and law of conservation of angular momentum – homogeneity of flow of time and conservation of energy

Unit 3- Motion in central force field (10 hrs)

Equivalent one body problem – motion in central force field – general features of motion – motion in an inverse square law force field – equation of the orbit – Kepler's laws of planetary motion and their deduction

Unit 4 - Collisions (6 hrs)

Conservation laws- Conservation of momentum- laboratory and centre of mass systems- kinetic energies in the lab and CM systems-Cross-section of elastic scattering

Unit 5 Lagrangian Dynamics (9hrs)

Constraints-generalized coordinates- principle of virtual work-D' Alembert's principle, Lagrange's equation from D'Alembert's principle-applications of Lagrange's equation in simple pendulum, Atwood's machine and compound pendulum, Comparison of Lagrangian approach with Newtonian approach

Unit 6 Hamiltonian Dynamics (5hrs)

Generalized momentum and cyclic coordinates- Hamiltonian function H-conservation of energy- Hamilton's equation - examples of Hamiltonian dynamics-one dimensional harmonic oscillator

Unit 7 Frames of Reference, Galilean transformation and Special theory of relativity (13hrs)

Inertial frames of reference- Galilean transformation- non- inertial frames

Origin and significance of special theory of relativity-search for universal frame of reference-Michelson-Morley experiment- postulates of special theory of relativity-consequences-Lorentz transformation equations- kinematical consequences of Lorentz transformations-length contraction-time dilation-twin paradox-transformation of velocity- variation of mass with velocity- mass energy equivalence

Books for Study:

1. Classical Mechanics: J. C. Upadhyaya, Himalaya Publishing
2. Mechanics: H. S. Hans and S. P. Puri, Tata-McGraw Hill
3. Classical Mechanics: G. Aruldhas, PHI Learning Pvt Ltd., 2008
4. Introduction to classical mechanics: R. G. Thakwale and P. S. Puranik, Tata-

McGraw Hill.
5. Classical Mechanics: Vimal Kumar Jain, Ane Books Pvt. Ltd., 2009

Books for Reference:

1. Classical Mechanics: Goldstein.
2. Modern Physics: Ronald Gautreau, Shaum's outlines series,1999
3. Classical Mechanics-Systems of Particles & Hamiltonian Dynamics: Walter Greiner, Springer,2nd Edn.
4. Classical Mechanics: N.C Rana and P. S. Joag, TMH Education Pvt. Ltd., 2015
5. Modern Physics: R. Murugersan, S. Chand &Co., Reprint, 2008

PY1541- QUANTUM MECHANICS
(72 HOURS-4 CREDITS)

Unit 1 – The Emergence of Quantum Mechanics (18 hrs)

Limitations of classical physics, Black body radiation curve-Optical spectra –- photoelectric effect -specific heat of solids -Plank's quantum hypothesis, Einstein's theory of photoelectric effect -Compton effect- Quantum theory of specific heat of solids, -Bohr model- hydrogen atom-Bohr postulates-The correspondence principle.

Unit 2-Wave Mechanics (22 hrs)

Wave nature of particles-electron diffraction- standing wave of electron in the orbit uncertainty principle -uncertainty relation among canonically conjugate pairs-application- non-existence of electrons in the nucleus-ground state energy of hydrogen atom- width of spectral lines-Properties of wave function-Conditions for Physical Acceptability of Wave Function, Normalization and orthogonality condition. Superposition Principle-wave packets, relation between - Particle velocity- group velocity and phase velocity- Probability Interpretation of Wave Function -Statistical Interpretation of Wave function - probability current density in one dimension-Expectation value- Time dependent Schrodinger equation,-Time independent Schrodinger equation - stationary states.

Unit 3-One Dimensional Energy Eigen Value Problems (14hrs)

Free particle Schrodinger equation–square-well potential with infinite walls- Square well potential with finite walls, square potential barrier– The Harmonic oscillator-(Schrodinger method)-

Unit 4- General Formalism of Quantum Mechanics (18hrs)

Linear vector space, Linear operator, Eigen values and Eigen functions-, Hermitian operator, Postulates of Quantum Mechanics-Equation of motion-Schrodinger representation- Momentum representation

Books for Study:

1. Quantum Mechanics: G. Aruldhas, PHI, 2nd Edn., 2002
2. A Text book of Quantum Mechanics: P.M. Mathews & K. Venkatesan- McGraw Hill, 2nd Edn., 2010
3. Quantum Mechanics: Robert Eisberg and Robert Resnick, Wiley, 2nd Edn. 2002
4. Quantum Mechanics: Leonard I. Schiff, TMH, 3rd Edn., 2010
5. Concepts of Modern Physics: Arthur Beiser, TMH, 6th Edn.

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Books for Reference:

1. Quantum Mechanics: Eugen Merzbacher, John Wiley and Sons Inc.,2004
2. Introduction to Quantum Mechanics: David J. Griffith, Pearson Education, 2nd Ed. 2005
3. Quantum Mechanics: Walter Greiner, Springer,4thEdn., 2001
4. Quantum Mechanics: Bruce Cameron Reed, Jones and Bartlett, 2008.
5. Quantum Mechanics for Scientists & Engineers: D.A. B. Miller, Cambridge University Press, 2008
6. Shaum's outline series

PY1542: STATISTICAL PHYSICS, RESEARCH METHODOLOGY AND DISASTER MANAGEMENT
(72 HOURS- 4 CREDITS)

Unit 1- Statistical Physics (18 hrs)

Statistical probability, Macro and Micro states, Phase space, Statistical ensemble, Postulate of equal probability, Maxwell Boltzmann distribution, Velocity distribution. Indistinguishability of identical particles, Bose Einstein and Fermi Dirac distribution function, comparison of three statistics

Unit 2 - Research Methodology (18 hrs)

Research - Objectives and motivation in research – different types of research- research approaches- Significance of research- Research methods and methodology – Research and scientific method- Various steps in a research process- importance of literature survey- criteria of good research.

Thesis/ Report writing - preliminary section (Title page, declaration of author, certificate of supervisor, table of contents, list of tables and figures, preface acknowledgement), Main Text (abstract, introduction, experimental section, results and discussion), Conclusions, references, scope for future study.

Unit 3 - Error Analysis (12 hrs)

Significant figures- Basic ideas of error measurement, uncertainties of

measurement, importance of estimating errors, dominant errors, random errors, systematic errors, rejection of spurious measurements.

Estimating and reporting of errors, errors with reading scales, absolute and relative errors, and standard deviation, Variance in measurements, error bars and graphical representation.

Unit 4 – **Disaster Management (24hrs)**

Global natural disasters: Natural hazards and natural disasters, Recent major disasters and their relief efforts, Impact of global climate change and major natural disasters, Human adaptability of natural disasters, Fragile natural eco-environment, Disaster reduction activity, achievements, challenges and future development

Earth quake disaster and their and their effects, Advancement in research of earthquake disaster, earthquake and tsunami warnings, earthquake disaster prevention, earthquake disaster mitigation

Health emergencies and diseases: environmental health and diseases, disasters and emergencies, steps in disaster management, pre-disaster activity, role of water supply, need for protecting large scale water supply schemes, assessment of damaged and available and water resources, water quality testing- Personal hygiene, control of communicable diseases and prevention of epidemics, measures for controlling communicable diseases and epidemics.

Radiation emergencies, health consequence of radiation, measures to prevent sudden health emergencies due to radiation

Books for Study:

1. Thermal and Statistical Mechanics: S. K. Roy –New Age International-2001
2. Elements of Statistical Mechanics: Kamal Singh and S. P. Singh- S. Chand & Co,1999
3. Thermal Physics, Statistical Physics and Solid-State Physics: C. J. Babu, Calicut University Press
4. Introduction to Statistical Mechanics: S. K. Sinha, Alpha Science International Ltd. 2005
5. Statistical Mechanics: B. K. Agarwal- New Age International 2007
6. Research Methodology: C. R. Kothari, New Age International Publishers.
7. Natural disaster mitigation – a scientific and practical approach: Science Press, Beijing, 2009
8. Environmental health in emergencies and disasters: A practical guide, B.Wisner & J.Adams (Eds.), WHO, Geneva, 2002 ISBN 92-4 154541-0.
9. Introduction to Disaster Management: SatishModh, Macmillan, 2010

Books for Reference:

1. Statistical Mechanics: S. Rajagopal
2. Introduction to Statistical Physics: Kerson Huang -CRC Press, 2001
3. Statistical Mechanics: Norman Davison, Courier Corporation, 2013
4. Disaster Management: Harsh K Gupta, Universities Press, 2003

PY1543-ELECTRONICS
(72 HOURS-4 CREDITS)

Unit 1. Circuit Theory (4 hours)

Kirchhoff's law- Ideal voltage and current sources- Thevenin's and Norton's theorem, Maximum power transfer theorem

Unit 2. Diode Circuits(14 hours)

Extrinsic semiconductors-n- type and – p-type semiconductors-PN junction-PN junction under forward and reverse biased conditions-r m s value and peak inverse voltage- diode characteristics-ac and dc resistances- half wave and full wave rectifiers- (average dc value of current, ripple factor and efficiency)- different types of filters(shunt capacitor, LC and RC)- break down mechanism in diodes- Zener diode- voltage regulator-

Unit 3.Transistors(16 hours)

Theory of BJT operation- CB,CE and CC characteristics-alpha, beta and gamma – relation between transistor currents- biasing circuits(CE configuration)- stability factors-selection of operating point-ac and dc load lines-Q point-collector feedback; base resistor and potential divider methods- BJT amplifiers- input and output impedances-graphical analysis of CE amplifier(frequency response, band width and gain in dB)- emitter follower.

Unit 4. Power amplifiers: (5 hours)

Amplifier classes and efficiency - class A operation - transformer coupled class A amplifier - class B amplifier - push pull amplifier - basic ideas of class C operation - distortion in amplifiers.

Unit 5. Feedback & Oscillator circuits (8 hours)

Feedback principles – negative feedback - advantages of negative feedback - positive feedback - principle of sinusoidal feedback- oscillation - Barkhausen criterion for oscillations - RC phase shift, Hartley Oscillator, Colpitt's, Oscillator (derivations not required).

Unit 6. Modulation (5 hours)

Fundamentals of modulation - AM, FM - frequency spectrum of AM - power in AM - demodulation of AM signal - frequency spectrum for FM

Unit 7. Special devices: (8 hours)

JFET- Basic construction - Theory of operation - Static characteristics - Drain characteristics- Advantages - MOSFET – Depletion enhancement MOSFET – Construction – Static characteristics. Uni-junction Transistor - Construction-operation.

Unit 8. Operational amplifiers (IC741) (12 hours)

Introduction – Schematic symbol and pin configuration - circuit configuration and block diagram representation – differential amplifier-ideal OP amp. - CMRR – differential mode and common mode – virtual ground principle – parameters of OP amp. - inverting amplifier – non-inverting amplifier –summing- differentiator-integrator amplifiers.

Books for Study:

1. Basic electronics: Devices, circuits and IT fundamentals: Santiram Kal, PHI, 2009
2. Basic Electronics-Solid State: B. L. Theraja, S. Chand Ltd., 2005
3. Principles of Electronics: V. K. Mehta, S. Chand Ltd.,2005
4. A first course in Electronics: Anwar A. Khan, Kanchan K. Dey,PHI, 2006
5. Communication Electronics:Jose Robin and Ubald Raj, Indira Publications, 2002

Books for Reference:

1. Electronic Devices and Circuits: Theodore F. Bogart Jr., Universal book stall
2. Electronic devices and Circuit theory: Robert Boylestad & Louis Nashelski,PHI,5th Edn.
3. Electronic fundamentals & applications: John D Ryder, PHI, 4thEdn.
4. Electronic Communications: Dennis Roddy, John Coolen, Pearson, 4thEdn.
5. The art of electronics: Paul Horowitz and Winfield Hill 2nd Edn. Cambridge University Press, 2006

Topics for assignments/discussion in the tutorial session (sample)

1. Electronic projects using flip flops.
2. Electronic projects using logic gates.
3. Electronic projects using IC 741 OP amp.
4. Electronic projects using timer 555.
5. Electronic projects using IC 311.
6. Constant voltage power supplies.
7. Constant current sources.
8. Oscillators of different frequencies.
9. Low range frequency generators.
10. High range frequency generators.
11. Voltage regulated dc power supplies with variable output.
12. Voltage regulated dual power supplies with variable output.
13. Instrument for the measurement of capacitance.
14. Instrument for the measurement of dielectric constant of a liquid/ solid.
15. Effect of temperature on electronic components.

PY1544-ATOMIC & MOLECULAR PHYSICS

(72 HOURS-4 CREDITS)

Unit 1- Vector Atom Model (10hrs)

Bohr's theory, correspondence principle Somerfield's atom model and explanation of fine structure of H line in Balmer series of hydrogen atom.Limitation of Sommerfeld atom model Vector atom model-Various quantum numbers associated with vector atom model-, L.S and j.j couplings –application of spatial quantization-Pauli's exclusion principle - magnetic dipole moment of electron due to orbital and spin motion - Spin-Orbit coupling.

Unit 2- Atomic Spectra (14hrs)

Optical spectra-Spectral terms and notations - selection rules - intensity rule and interval rule - fine structure of sodium D lines – hyperfine structure-alkali spectra - Zeeman effect - Larmor's theorem – quantum mechanical explanation of normal Zeeman effect. Anomalous Zeeman effect –Paschen-Back effect-Stark effect.

Unit 3- X-ray Diffraction (8 hrs)

X-rays- Discovery- properties -scattering -Measurement of X-ray wavelengths by ruled gratings-X-ray Spectra- continuous and characteristics X- ray spectrum-Origin of continuous Spectrum -Origin of characteristic X-rays-X-ray energy level diagram. -Absorption of X-rays-Applications of X-rays

Unit 4- Molecular spectra (28 hrs)

Electromagnetic spectra-molecular energies-classification of molecules-rotational spectra of diatomic molecules-rotational energy levels-selection rules-rotational spectrum-isotope effect- bond length and atomic mass

Diatomic vibrational spectra-vibrational energy levels-selection rule-vibrational transitions-Rotation-Vibration transitions-IR spectrometer

Raman scattering- classical description of Raman scattering, quantum theory of Raman scattering- -vibrational Raman spectra-diatomic molecules-polyatomic molecules-rotational Raman spectra Raman spectrometer

Electronic spectra sequences and progressions-Frank-Condon principle-

Unit 5- Resonance Spectroscopy (12 hrs)

NMR principle-Resonance condition-NMR spectrometer-chemical shift-indirect spin-spin Interaction- applications of NMR spectroscopy-

ESR principle- Resonance condition –ESR spectrometer- hyperfine interaction –

applications of ESR spectroscopy
Mossbauer spectroscopy- principle -isomer shift

Books for Study:

1. Modern Physics: G. Aruldhas and P. Rajagopal, PHI, New Delhi, 2005
2. Modern Physics: R. Murugesan, S. Chand& Co., Reprint, 2008
3. Atomic and Nuclear Physics: N. Subramaniam & Brijlal, S. Chand& Co.
4. Atomic Physics: J. B. Rajam, S. Chand&Co.
5. Concepts of Modern Physics: A. Beiser, TMH, New Delhi, 6^{th}Edn.

Books for Reference:

1. Fundamentals of Molecular Spectroscopy: Banwell, TMH
2.Spectroscopy: Walker & Straw, Chapman & Hill.
3.Molecular Spectroscopy: G. Aruldhas, PHI, 2004
4.Atomic and Nuclear Physics: Dr.V. W. Kulkarni-Himalaya Publishing House

PY 1551-OPEN COURSES
(54 HOURS-2CREDITS) FOR EACH COURSE

PY1551.1. BIO PHYSICS
(54 HOURS-2CREDITS)

Unit 1 (18 hrs)

Bio mechanics- biophysics and fluid flow—Gas transport—physics of audition Physics of vision (chapter 1 to 5 of Reference 3)

Unit 2 Cellular – Molecular biophysics (18 hrs)

Cell -components-proteins-nucleic acids—physics of bio-membranes - Thermodynamics of bio systems (Chapter 6 to 9 of reference 3)

Unit 3 (18 hrs)

Radiation biophysics

Bio–electronics and Bio Instrumentation (chapter 17 of reference 1) Bio–informatics - (chapter 6 of reference 1) Demonstration of biophysics experiments (reference 3)

Books for Study:

1. Essentials of Biophysics: P. Narayanan, 2nd Edn. New Age publishers
2. A text book of biophysics: R. N. Roy, New central book agency Kolkata.
3. Elementary bio physics, P. K. Srivastava, Narosa publishing house, New Delhi
4. Introduction to Biophysics, Pranab kumar Banerjee, S. Chand&co, New Delhi
5. Biological Science, Green, Stout& Taylor, Cambridge university press

PY 1551.2 ASTRONOMY AND ASTROPHYSICS
(54 HOURS-2CREDITS)

Unit 1: Introduction to Astronomy (10 hours)

What is Astronomy – Branches of Astronomy - The celestial sphere and stellar magnitudes: constellations, stellar magnitudes, apparent magnitudes – The celestial coordinate system – Precession of Earth's axis.

Unit 2: History of Modern Astronomy (14 hours)

Ptolemy's model of Universe – Copernican and Galilean contributions – Laws of planetary motion: Tycho Brahe's observations, Kepler's laws – Newton and his law of Universal law of Gravity – Einstein's special and general theories of relativity (*topics in this unit are intended as brief qualitative introductions only*)

Unit 3: The Solar system (15 hours)

Formation of solar system: Nebular hypothesis – The Sun: Physical properties – Internal structure – Solar atmosphere - Sun spots – Solar wind, prominences and flares – Physical characteristics of planets in solar system – Earth's motion and

Seasons - Lunar and Solar eclipses – Brief familiarisation of solar system objects: Satellites, Asteroid belt, Kuiper belt, Comets and Meteorites.

Unit 5: Outer Universe (15 hours)

Properties of stars: luminosity, colour and surface temperature – Spectral types of stars – Hertzsprung-Russel diagram – Evolution of a Sun-like star – Fate of high-mass stars: Supernova, Neutron stars and Black holes (*qualitative description only*) – Brief familiarization of Milky Way galaxy, Types of galaxies according to shape.

Sources for Study:

1. https://www.space.com/16014-astronomy.html
2. Introduction to Astronomy and Cosmology – Ian Morison (Wiley)
3. https://theplanets.org/solar-system/

Books for Reference:

1. Planet Earth, Cesare Emiliani, Cambridge University Press
2. Astrophysics - K. D. Abhayankar, University Press
3. Introduction to Astrophysics – BaidyanadhBasu

PY 1551.3- APPLIED PHYSICS

(54 hours-2credits)

Unit 1.ELECTRIC AND ELECTRONIC EQUIPMENT (14 hrs)

Electric motor-principles of working, Microwave oven-principle-technical specifications-applications-advantages, public address system-Block diagram representation- function of each unit-CD player and drives-DVD player and drives-Telephonic communication(Cable and cellular)-principles (qualitative study using block diagram) -Cell phone-SIM card-technical specifications-Radio –History of radio revolution-different types of radios-Television-working(qualitative)-Touch screens & ATM (Automatic Telling machine)

Unit 2- X-RAY AND ITS APPLICATIONS (11 hrs)

Discovery of X-rays, Gas filled tube, Coolidge X-ray tube, Properties of X-ray, X-ray spectra-continues and characteristic spectra, C T Scan-basic principle-applications and advantages –MRI Scan-Principle, applications and advantages.

Unit 3- LASERS (13 hrs)

Introduction-Interaction of light with matter, Absorption, spontaneous emission, stimulated emission, Light amplification, population inversion, metastable states-Components of Laser-Principal pumping Schemes-Role of resonant cavity- Ruby laser, He-Ne Laser-Applications.

Unit 4- HOLOGRAPHY (6 hrs)

Introduction, principle of holography, recording of the hologram, Reconstruction of the image-applications

Unit-5-FIBRE OPTIC COMMUNICATION (10 hrs)

Introduction, optical fibre, Necessity of cladding, optical fibre system, Total internal reflection- propagation of light through an optical fibre, critical angle of propagation, Modes of propagation- Types of rays-classification of optical fibres-Applications

References

1. Audio and Video Systems: R. G. Gupta, Technical Education Series.
2. Mobile Satellite Communication Network: (Ch. 1 &2),Ray E Sherrif&Y. Funttu, Wiley India Edu.
3. Television Engineering & Video System: R. G. Gupta, TMH.
4. Electrical Technology: B.L. Theraja (Vol 1& 2)
5. A Text book of Optics: N. Subrahmanyam Brijlal, M. N. Avadhanulu, S. Chand & Company Pvt. Ltd
6. Modern Physics: R. Murugesan &Kiruthiga Siva Prasath, S. Chand & Company Pvt. Ltd
7. Atomic and Nuclear Physics: V. W. Kulkarni, Himalaya Publishing House

PY1551.4. ENVIRONMENTAL PHYSICS
(54 HOURS-2CREDITS)

Unit 1 Essentials of Environmental physics (18 hrs)

Structure and thermodynamics of the atmosphere; composition of air; Greenhouse effect; Transport of matter; energy and momentum in nature; Stratification and stability of the atmosphere; Laws of motion; Hydrostatic equilibrium; General circulation of the tropics; Elements of weather and climate in India.

Unit 2 Environmental pollution and Degradation (18 hrs)

Factors governing air, water and noise pollution; Air and water quality standards; Waste disposal; Heat island effect; Land and sea breeze; Puffs and Plumes; Gaseous and particulate matter; Wet and dry deposition; Dispersal mechanism of air and water pollutants; Mixing height and turbulence; Gaussian plume models; Dispersion models; Environmental degradation; Thermal and radioactive pollution; Nuclear radiation; Health hazards and safety.

Unit 3 Environmental Changes and remote sensing (18 hrs)

Energy sources and combustion processes; Renewable sources of energy; Solar energy, Wind energy, Bio energy, hydro power; fuel cells; and nuclear energy;Forestry and bio-energy; Deforestation; Degradation of soils; Agriculture and land use changes; Changing composition of local and global environment; Remote sensing techniques.

Books for Study:

1. The Physics of Monsoon: R. N. Kesavamoorthy and N. Sankar Rao, Allied Publications
2. The Physics of Atmosphere: J. T. Houghton, CambridgeUniversity

3. Renewal Energy Resources: J. T Widell and J Weir, ELBS 1988
4. Numerical Weather Prediction: G. J. Haltiner and R. T. Williams, John Wiley

PY1551.5. ENERGY PHYSICS

(54 HOURS-2CREDITS)

Unit I (7 hrs)

Various forms of energy – renewable and conventional energy systems –comparison – coal, oil and natural gas – availability – applications – merits and demerits.

Unit 2 (10 hrs)

Solar energy - Solar radiation measurements, solar energy collector, principle of the conversion of solar radiation in to heat, Solar energy storage, solar heaters, space cooling, solar ponds, solar cookers, solar distillation, solar furnaces, solar green houses, merits and demerits of solar energy.

Unit 3 (9 hrs)

Wind energy: Basic principle of wind energy conversion, basic components of wind energy conversion system (WECS), wind energy collectors. application of wind energy.

Unit 4 (9 hrs)

Biomass energy, classification, photosynthesis, biomass conversion process, Gober gas plants, wood gasification, ethanol from wood, merits and demerits of biomass as energy source

Unit 5 (9 hrs)

Energy from Oceans and Chemical energy resources: Ocean thermal energy Conversion, energy from waves and tides – basic ideas, nature, applications, merits and demerits.

Unit 6 (10 hrs)

Patterns of energy consumption in domestic, industrial, transportation and agricultural sectors –energy crisis and possible solutions – energy options for the developing countries – energy storage-primary and secondary cells – fuel cells (basics) – impact due to non-conventional energy sources – global warming

Books for Study:

1. Non–Conventional Energy Resources: G. D. Rai, Khanna Publishers, 2008.
2. Solar energy: G.D. Rai, 5th edition, 1995.
3. Solar Energy Fundamentals and application: H.P. Garg and J. Prakash, Tata McGraw - Hill Publishing company Ltd., 1997.

Books for Reference:

1. Energy Technology: S. Rao and B.B. Parulekar, 1997, 2nd Edn.
2. Power Plant Technology: A. K. Wahil. 1993.
3. Solar energy: S. P. Sukhatme, Tata McGraw- Hill Publishing company Ltd.,1997.

PY 1641 SOLID STATE PHYSICS
(72 HOURS -4 CREDITS)

Unit 1 Crystal Structure (18hrs)

Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors Lattice with a Basis – Unit Cell-Elements of symmetry-Types of Lattices -two and three dimensional- Miller Indices-Reciprocal Lattice.-.Brillouin Zones Diffraction of X-rays by Crystals. Bragg's Law X- ray diffraction techniques-Inter atomic forces. Types of bonding

Unit 2 Conduction in Metals- Free electron model (12 hrs) Introduction-conduction electrons-free electron gas-electrical conductivity-electrical resistivity versus temperature-heat capacity of conduction electrons -Fermi surface -electrical conductivity-effects of the Fermi surface-thermal conductivity in metals-Hall effect and magneto resistance -AC conductivity and optical properties-failure of free electron model.

Unit 3 Band theory (10 hrs)

Bloch theorem- Kronig Penny Model-Band Gaps- Conductors-Semiconductors and insulators- P and N type Semiconductors- Conductivity of Semiconductors-mobility- Hall Effect- Hall coefficient

Unit 4 Dielectric Properties of Materials (12 hrs)

Polarization- Local Electric Field at an Atom- Depolarization Field- Electric Susceptibility- Polarizability- Clausius Mosotti Equation- Classical Theory of Electric Polarizability- Normal and Anomalous Dispersion- Cauchy and Sellmeier relations- Langevin-Debye equation- Complex Dielectric Constant- Optical Phenomena- Application: Plasma Oscillations- Plasma Frequency- Plasmons

Unit 5 Magnetic Properties of Matter (12hrs) Dia, Para, Ferri and Ferromagnetic Materials- Classical Langevin Theory of Dia and Paramagnetic Domains- Quantum Mechanical Treatment of Para magnetism- Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains- Discussion of B-H Curve. Hysteresis and Energy Loss

Unit 6 Superconductivity (8 hrs)

Critical Temperature-Critical magnetic field-Meissner effect- Type I and type II Superconductors- London's Equation and Penetration Depth- Isotope effect-.BCS theory- Tunnelling and Josephson Effect (Qualitative study)

Books for Study:

1. Elements of Solid-State Physics: J. P. Srivastava, 2nd Edn., 2006, Prentice-Hall of India
2. Elementary Solid-State Physics: M. Ali Omar, Pearson India, 1999

3. Solid State Physics: M. A. Wahab, Narosa Publication, 2011
4. Elements of Solid-State Physics: J.P. Srivastava, 2nd Edn., Prentice-Hall of India, 2006

Books for Reference:

1. Introduction to Solid State Physics: Charles Kittel, 8th Edn., Wiley India Pvt. Ltd., 2004
2. Introduction to Solids: Leonid V. Azaroff, Tata Mc-Graw Hill, 2004
3. Solid State Physics: Neil W. Ashcroft and N. David Mermin, Cengage Learning, 1976
4. Solid State Physics: Rita John, McGraw Hill, 2014
5. Solid-State Physics: H. Ibach and H Luth, Springer, 2009

PY 1642 NUCLEAR AND PARTICLE PHYSICS
(72 HOURS-4 CREDITS)

Unit 1 General Properties of Nuclei (14hrs)

Constituents of nucleus and their Intrinsic properties-quantitative facts about size- mass- charge density (matter energy), binding energy- average binding energy and its variation with mass number- main features of binding energy versus mass number curve- nuclear stability- angular momentum- parity- magnetic moment- electric quadrupole moments- Nuclear forces-meson theory.

Unit 2 Nuclear Models (11 hrs)

Liquid drop model -semi empirical mass formula and significance of various terms, condition of nuclear stability. Shell model-evidence for nuclear shell structure, nuclear magic numbers, basic assumptions of shell model, Collective model.

Unit 3 Radioactivity (12 hrs)

Alpha decay-basics of α-decay processes, theory of α-emission, Gamow's theory, Geiger Nuttal law, α -decay- energy kinematics for α- decay, positron emission, electron capture, neutrino hypothesis, Gamma decay: Gamma ray emission & kinematics, internal conversion.

Unit 4 Nuclear Reactions (9 hrs)

Types of Reactions, Conservation Laws, kinematics of reactions, Q-value- reaction rate- reaction cross section- reaction mechanism-Concept of compound nucleus

Unit 5 Particle Detectors & Accelerators (6 hrs)

GM counter-scintillation counter- Linear accelerator- Cyclotron- Synchrotron-betatron

Unit 6 Nuclear fission and fusion (12 hrs)

Nuclear fission-energy released in fission-Bohr and Wheeler's theory-chain reaction -multiplication factor-critical size-atom bomb-nuclear reactors-breeder reactors-uses of nuclear reactors. Nuclear fusion-sources of stellar energy-thermonuclear reactions-hydrogen bomb-controlled thermo-nuclear reactions-magnetic bottle-Tokamak- inertial confinement-nuclear power in India

Unit 7 Particle physics: (8 hrs)

Particle interactions- basic features- types of particles and its families Symmetries and Conservation Laws-baryon number- Lepton number- Isospin-Strangeness and charm- concept of quark model- Cerenkov radiation.

Books for Study

1. Modern Physics: R. Murugesan, S. Chand & Co., Reprint, 2008
2. Modern Physics: G. Aruldhas and P. Rajagopal, PHI, New Delhi, 2005.
3. Nuclear Physics: D. C. Tayal, Himalaya Publishing House, 4th Edn.
4. Concepts of Modern Physics: A. Beiser, Tata McGraw-Hill, New Delhi, 6th Edn.
5. Atomic and Nuclear Physics: N. Subramaniam and Brijlal, S.Chand & Co.
6. Atomic Physics: J. B. Rajam, S.Chand & Co.
7. Introduction to Elementary Particles: D. Griffith, John Wiley & Sons
8. Nuclear Physics: S. N. Ghoshal, S. Chand & Co.

Books for Reference:

1. Concepts of nuclear physics: Bernard L. Cohen, Tata Mcgraw Hill, 1998
2. Nuclear Physics: Kaplan, Narosa publications
3. Introductory nuclear Physics: Kenneth S. Krane, Wiley India Pvt. Ltd., 2008
4. Introduction to the physics of nuclei & particles: R. A. Dunlap, Thomson Asia, 2004
5. Quarks and Leptons: F. Halzen and A. D. Martin, Wiley India, New Delhi
6. Basic ideas and concepts in Nuclear Physics- An Introductory Approach: K. Heyde, Institute of Physics Publishing, 2004
7. Radiation detection and measurement: G. F. Knoll, John Wiley & Sons, 2000
8. Theoretical Nuclear Physics: J. M. Blatt & V. F. Weisskopf, Dover Pub. Inc., 1991

PY1643- CLASSICAL AND MODERN OPTICS
(72 HRS-4 CREDITS)

Unit 1 Interference of light (14 hrs)

The principle of superposition - coherent sources – Double slit interference (theory of interference fringes and band width) - Interference by division of wave front and amplitude – Fresnel's biprism-interference in thin films-classification of fringes-wedge shaped films-testing of optical flatness-Newton's rings(reflected system)-refractive index of a liquid-
Michelson interferometer – determination of wavelength

Unit 2 Diffraction (14 hrs)

Fresnel diffraction: - Half-period zones - explanation of rectilinear propagation of light– diffraction at a straight edge-zone plate. Fraunhofer diffraction: - Diffraction at a single slit, double slits – plane transmission grating - Rayleigh's criterion for resolution - resolving power of diffraction grating.

Unit 3 Polarisation (12 hrs)

Plane polarized light -polarization by reflection – Brewster's law - pile of plates -
Malus law - Double refraction - Huygens explanation for double refraction in uniaxial Crystals - Nicol prism - Nicol prism as a polarizer and analyzer – Theory- production and analysis of plane, circularly and elliptically polarized light - quarter and half wave plates.

Unit 4 Laser (14 hrs)

Basic principle of laser operation Einstein coefficient, light propagation through medium and condition for light amplification population inversion by pumping and cavity threshold condition, line shape function- optical resonators (qualitative) Q factor various laser systems – Ruby laser - He-NE laser, Dye laser, semiconductor laser, (working principle only) Application of lasers- characteristics of laser beams -spatial coherence - Temporal coherence and spectral energy density Nonlinear optics : Nonlinear Polarization –second harmonic generation – phase matching

Unit 5 Fibre Optics (10 hrs)

Introduction, optical fibre, the numerical aperture, coherent bundle, pulse dispersion in step index fibre, graded index fibre, single mode fibre, multimode fibre, Fibre optic sensors (Qualitative), fibre optic communication (qualitative), Advantages of fibre optic communication system.

Unit 6 Holography: (8 hrs)

Principle of holography, recording of holograms, reconstruction of images (Theory not needed), application of holography, different types of holograms, transmission and reflection types.

Books for Study:

1. Text Book of Optics: Subramaniam, Brijlal &Avadhanulu, 23rd Edn., 2006
2. Optics: Ajoy Ghatak, TMH, 2005

3. Optics and spectroscopy: R. Murugesan and K Sivaprasad, S. Chand & Co., 2010
4. Lasers Principles, Types and applications: K. R. Nambiar, New Age International Pvt. Ltd. 2006
5. Optics: Eugene Hecht, Addison-Wesley 2002

Books for Reference:

1. Fundamentals of Optics: Jenkins and White, MCH
2. Modern Classical Optics: Geoffrey Brooker, Oxford University Press, 2003
3.Fundamentals of Optics-Geometrical Physical and Quantum:D. R. Khanna and H. R. Gulati, R. Chand,1984
4.Lasers &Non-Linear Optics: B. B. Laud, New Age International Pvt. Ltd., 2011
5.Electronic Communications: Dennis Roddy & John Coolen, Pearson, 1995

Topics for assignments/discussion in the tutorial session (sample)

1. Michelson's interferometer-Standardization of metre.
2. Diffraction at a rectangular aperture and circular aperture
3. Optical activity-Fresnel's theory of optical rotation.
4. Resolving power of prism and telescope
5. Constant deviation spectrometer.
6. Laurent's half shade polarimeter.
7. Laser applications.
8. Study of Fraunhofer lines using spectrometer. .
9. Determination of refractive index of liquid by Newton's rings method.
10. Comparison of radii of curvature by Newton's rings method.

PY1644 DIGITAL ELECTRONICS AND COMPUTER SCIENCE (72HRS-4 CREDITS)

Unit-1 (22hrs)

Number systems :-Decimal number system-binary number system-conversion 2of binary number to decimal and decimal number to binary-binary addition and subtraction-21's complement-2's complement-binary subtraction using 2's complement-signed arithmetic operation-conversion of real numbers-conversion of decimal fraction to binary fraction-binary coded decimal -hexadecimal number system-conversion of hexadecimal number to decimal, decimal to hexadecimal, binary to hexadecimal and hexadecimal to binary-real or floating point representation of numbers-ASCII code.

Boolean algebra and logic gates: - Logic gates AND, OR, NOT, NAND, NOR

And Ex-OR gate-realization of other logic functions using NAND / NOR gates-tri state logic gate-Boolean laws- Demorgan's theorem-Simplification of Boolean equations using Boolean laws. Karnaugh map

Arithmetic circuits:-Half adder-full adder-controlled inverter-binary adder- subtractor.
Sequential circuits:- Flip-Flop, S-R Flip Flop, J-K Flip-flop, Master slave JK Flip- Flop

Unit2 (11hrs)

Basics of computers:-Hardware- input and output units- memory unit-ALU-control unit–basic operational concepts-Software – operating systems

The memory systems:- Basic concepts-semiconductor RAM- internal organization memory chips- static memories-asynchronous and synchronous DRAM-structure of large memories–ROM,PROM,EPROM, EEPROM–flash memory-speed size and cost-Basic concepts of cache memory and virtual memories. Secondary storage-magnetic hard disks-optical disks-magnetic tape systems

Unit-3: Programming in C++ (25 hrs)

Features of c++ - basic structure of c++ program – library files-header files – preprocessor directives- inbuilt functions- output using cout- input with cin - constants and variables – data types – declaration of variables – integer variables, character variables, floating point types, type bool - assigning values to variables–manipulators-operators and expressions–arithmetic operators, relational operators, logical operators, short hand operators-control statements-for loops , while loop, do…while loop- if statement, if……else, else….if constructions, switch statement- break, continue, go to statements-user defined functions-function definition, function declaration, function header and body, function call and execution, passing arguments to functions, returning values from functions, overloaded functions, inline functions, default arguments, scope rule for functions- storage classes-Arrays-array elements, array initialization, multidimensional arrays, passing arrays to functions-strings-basics of structures and pointers in c++, classes and objects (introduction only)-basic file operations-serial and sequential files, reading and writing -simple examples of c++ programs for solving problems in physics-compilation and execution of data.

Unit 4: Introduction to microprocessors (14 hrs)

Microprocessors and microcontrollers (definition only)-intel 8085-8 bit microprocessor-pin disruption - 8085 instructions - addressing modes(definition only)- interrupts (definition only) -assembly language - simple programs- addition, subtraction.

Books for study:

1. Fundamentals of Microprocessors and Microcomputers: B. Ram,Dhanpat Rai Publications
2. Digital principles and Applications: Malvino and Leach.TMH, New Delhi, 4th Edn.
3. Fundamentals of Computers: V. Rajaram, PHI, New Delhi, 4th Edn.
4. A first course in Computers: S. Saxena, Vikas Publishing House Pvt. Ltd.,
5. Programming in C++: D. Ravichandran, Tata Mc Graw Hill, 2011

6. Object oriented programming in C++:Robert Lfore, Galgotia publications Pvt Ltd., 3rd Edn., 2004
7. The C++ programming language: Bjome Stroustrup, 4th Edn. Addison Wesley
8. Object oriented programming with C++: E. Balaguruswami, 5th Edn., Tata Mc Graw Hill
9. Programming in C++: M.T. Somasekharan, PHI Pvt. Publishing,2005
10. Numerical Methods with computer programs in C++:P. Ghosh, PHI Learning Pvt. Ltd.
11. The 8085 microprocessors:K. Udayakumar and B. S. Umasankar, Dorling Kindersley (India) Pvt. Ltd.,2008
12. Microprocessor 8085,8086:Abhishek Yadav, University Science Press, New Delhi 2008
13. Microprocessor-Architecture, Programming and applications with 8085:R. S. Gaonkar

Books for Reference: -

1. Introduction to digital electronics: NIIT, PHI.
2.A first course in Computers: Sanjay Saxena, Vikas publishing house Pvt. Ltd.

PRACTICAL

PY1442- Basic Physics Lab 1
(Minimum 18 experiments to be done)

1. Fly Wheel - Moment of Inertia
2. Compound Bar Pendulum – Symmetric
3. Compound Bar Pendulum – Asymmetric
4. Uniform Bending---Y---Pin and Microscope
5. Uniform bending—Y- optic lever method
6. Non-uniform bending-Y-Optic lever& telescope
7. Rigidity modulus –Static torsion
8. Torsion pendulum I- By Torsional oscillations
9. Torsion pendulum I- By Equal masses
11. Kater’s pendulum-Acceleration due to gravity
12. Melde’s string-----Frequency of fork
13. Phase transition-determination of M.P of wax.
14. Determination of thermal conductivity of rubber
15. Lee’s disc-determination of thermal conductivity of a bad conductor
16. Viscosity-Continuous flow method using constant pressure head.
17. Viscosity-Variable pressure head arrangement
18. Surface tension-Capillary rise
19. Sonometer-frequency of A.C
20. Kundt’s tube-determination of velocity of sound.
21. Determination of m and Bh using deflection and vibration magnetomers.

22. Potentiometer-Resistivity.
23. Comparison of least counts of measuring instruments.
24. Evaluation of errors in simple experiments.

References

1.Yarwood and Wittle; Experimental Physics for Students, Chapman &Hall Publishers.
2. An advanced course in practical physics, Chathopadhyaya, Rakshit and Saha, New central agency, Kolkata.
3. A text book of practical physics, S. Viswanathan& Co., Chennai.
4. Advanced Practical Physics, B. L. Worsnop and H. T. Flint, Khosla Publishers, Delhi.

PY1645-Advanced Physics Lab 2

(Minimum 18 experiments to be done)

1. Spectrometer-A, D and n of a solid prism.
2. Spectrometer –Dispersive power and Cauchy's constants
3. Spectrometer Grating—Normal incidence- N & wavelength
4. Spectrometer-i-d curve
5. Spectrometer- Hollow prism
6. Liquid lens-refractive index of liquid and lens
7. Newton's Rings—Reflected system
8. Air wedge-diameter of a wire
9. Potentiometer-Resistivity.
10. Potentiometer-Calibration of ammeter
11. Potentiometer –Reduction factor of T.G
12. Potentiometer –Calibration of low range voltmeter
13. Potentiometer – Calibration of high range voltmeter
14. Thermo emf-measurement of emf using digital multimeter.
15. Carey Foster's bridge-Resistivity
16. Carey Foster's bridge-Temperature coefficient of resistance.
17. Mirror galvanometer-figure of merit.
18. BG- Absolute capacity of a condenser
19. Conversion of galvanometer into ammeter and calibration using digital Multimeter
20. Conversion of galvanometer into voltmeter and calibration using digital Voltmeter.
21. Circular coil-Calibration of ammeter.
22. Study of network theorems-Thevenin's & Norton's theorems and maximum power transfer theorem.
23. Circular coil-Study of earth's magnetic field using compass box.
24. Absolute determination of m and Bh using box type and Searle's type vibration magnetometers.
25. Searle's vibration magnetometer-comparison of magnetic moments.

References

1. Yarwood and Wittle; Experimental Physics for Students, Chapman &Hall Publishers.
2. An advanced course in practical physics, Chathopadhyaya, Rakshit and Saha, New central agency, Kolkata.
3. A text book of practical physics, S. Viswanathan& Co., Chennai.

4. Advanced Practical Physics, B. L. Worsnop and H. T. Flint, Khosla Publishers, Delhi.

PY1646—Advanced Physics Lab 3
(Minimum 18 experiments to be done – 4 from Computer Science)

ELECTRONICS

1. PN junction Diode (Ge & Si) characteristics-To draw the characteristic curves of a PN junction diode and to determine its ac and dc forward resistances.

2. Full wave (centre tapped) rectifier-To construct a full wave rectifier using junction diode and to calculate the ripple factor with and without shunt filter (10 readings for R_L 100 to 5000).

3. Full wave (centre tapped) rectifier-To construct a full wave rectifier using junction diode and to study effect of L,C, and LC filters on the ripple factor (for different R_L).

4. Bridge rectifier-To construct a bridge rectifier using junction diodes and to calculate the ripple factor with and without shunt filter (10 readings for R_L 100 to 5000).

5. Bridge rectifier- Dual power supply-To construct a dual power supply using bridge rectifier and measure the output voltages for different pair of identical load resistors.

6. Zener diode characteristics-To draw the I-V characteristic of a Zener diode and to find the break down voltage and the dynamic resistance of the diode.

7. Zener diode as a voltage regulator-To construct a voltage regulator using Zener diode and to study the output voltage variation (i) for different RL and (ii) for different input voltage with same R_L.

8. Transistor characteristics-CE-To draw the characteristic curves of a transistor in the CE configuration and determine the current gain, input impedance and output impedance.

9. Transistor characteristics-CB-To draw the characteristic curves of a transistor in the CB configuration and determine the current gain, input impedance and output impedance.

10. Single stage CE amplifier-To construct a single stage CE transistor amplifier and study its frequency response.

11. OP amp. IC741- Inverting amplifier-To construct an inverting amplifier using IC741 and determine its voltage gain.

12. OP amp. IC741- Non-inverting amplifier - To construct a non-inverting amplifier using IC741 and determine its voltage gain

13. OP amp. IC741- Differentiator-To construct an OP amp. Differentiator, determine its voltage gain and study the output response to pulse and square wave.

14. OP amp. IC741- Integrator-To construct an OP amp. Integrator, determine its voltage gain and study the output response to pulse and square wave.

15. Phase shift oscillator-To construct a phase shift oscillator using transistor and measure the frequency of the output waveform.

16. Logic gates- OR and AND-To verify the truth tables of OR and AND gates using diodes.

17. Logic gate- NOT-To verify the truth tables of NOT gate using a transistor.

18. Network theorems (Superposition, Thevenin's & Norton's theorems) - To verify the (i) Superposition, (ii) Thevenin's & (iii) Norton's theorems

19. RC-Filter circuits (Low pass) - To construct an RC –low pass filter circuit and to find the upper cut off frequency

20. RC-Filter circuits (High pass)-To construct an RC –high pass filter circuit and to find the lower cut off frequency.

Computer Science (C++ Programs)

1. Program to find the roots of a quadratic equation (both real and imaginary root)
2. Program to find the dot product and cross product of vectors
3. Program to plot the functions Sin x, Tan x and e^x
4. Program to find the matrix addition, multiplication, trace, transpose and inverse.
5. Program to convert hexadecimal to decimal number, decimal to hexadecimal number, binary to hexadecimal numbers and hexadecimal to binary numbers
6. Program to find the result of binary addition and subtraction.
7. Program to find the moment of inertia of regular bodies about various axes of rotation.
8. Program to find the velocity of a rolling body (without sliding) at any point in an inclined plane
9. Program to study the motion of a spherical body in a viscous fluid
10. Program to study the motion of projectile in central force field
11. Program to study the planetary motion and Kepler's law
12. Monte Carlo simulation

References:

1. Basic electronics and linear circuits; N.N. Bhargava, D.C. Kulshreshtha, S.C.Gupta
2. OP- Amps and linear integrated circuits; Ramakant A. Gayakwad
3. Basic electronics; Santiram Kal
4. Basic electronics; B. L. Theraja
5. Principles of electronics; V. K. Mehta
6. A first course in Electronic s; Anwar A. Khan, Kanchan K. Dey

PY1661. ELECTIVE COURSES
(54 HOURS-2CREDITS) FOR EACH COURSE

PY1661.1 ELECTRONIC INSTRUMENTATION
(54 HOURS-2CREDITS)

Unit 1 (14 hrs)

Basic concepts of measurements- Instruments for measuring basic parameters-ammeter-voltmeters-multi meter- digital voltmeter-accuracy and resolution of DVM

Unit 2 – Oscilloscopes (14 hrs)

Cathode ray tubes- CRT circuits- vertical deflection system- delay line- horizontal deflection system-multiple trace- oscilloscope probes and transducer- storage oscilloscopes.

Unit 3 – Transducers (10 hrs)

Basic principles- classification of transducers- Passive and Active transducers- strain gauges-temperature measurements- thermistors-photosensitive devices.

Unit 5 – Signal Generation and Analysis (16 hrs)

Sine wave generator- frequency synthesizer- sweep generator- astable Multi vibrator- laboratory pulse generator- function generator- wave analysers- harmonic distortion analyzer- wave meter-spectrum analyzer (qualitative idea only)

Books for Study:

1. Modern Electronic Instrumentation and Measurement Techniques: Albert D. Helfrick & William D. Cooper, PHI, Ltd.
2. Electronic Instrumentation:Kalsi H. S, 2nd Edn, TMH Publishers.
3. Instrumentation-Devices and Systems: C. S. Rangan, G. R. Sarma, V. S. V. Mani, TMH Publishers.
4. Electronic Instruments and Instrumentation Technology: M. M. S.Anand, PHI Ltd.

Books for Reference:

1. Sensors and Transducers: D. Patranabis, Wheeler Publishing Co. Ltd.
2. Industrial Electronics and Control: S. K. Bhattacharya & S. Chatterjee, TMH Publishers.
3. Electronic measurement and Instrumentation: K. B. Klaassen, Cambridge University Press.
4. Measurement Systems-Applications and Design: Ernest O. Doebelin& Dhanesh N. Manik, 5th Edn.TMH Publishers.
5. Principles of Measurement systems: John P.Bentley,Longman, Pearson Education Publishers. 3rd Edn.

PY1661.2. SPACE SCIENCE
(54 HOURS-2CREDITS)

Unit 1. Universe (12 hrs) [Book3]

Large Scale Structure of the Universe: Astronomy and Cosmology, Our Galaxy, Galaxy types, Radio sources, Quasars, Structures on the largest scale, Coordinates and catalogues of astronomical objects, Expansion of the Universe

Unit 2. The evolution of Stars (9hrs) [Book4]

Introduction, Classification of Stars: The Harvard classification, Hertzsprung –Russel diagram, Stellar evolution, White dwarfs, Electrons in a white dwarf star, Chandrasekhar limit, Neutron stars, Black holes, Supernova explosion, Photon diffusion time, Gravitational potential energy of a star, Internal temperature of a star, Internal pressure of a star.

Unit 3. The active Sun (10 hrs) [Book2]

Introduction, Sunspots and Solar storms, Sunspots and Solar activity, Cosmic rays of Solar origin, The Solar wind, Solar corona and the origin of the solar wind, Disturbed Solar wind.

Unit 4. The earth's Atmosphere (15 hrs) [Book 1]

Introduction, Nomenclature and temperature profile, Temperature distribution in the troposphere, Temperature of stratosphere, temperature of mesosphere and thermosphere, Temperature variability, The pressure profile, Scale height, Density variation. The Ionosphere: Effect on scale height, Ionospheric electric fields, Ionization profile, Layer of charge, Ionospheric hydrogen and Helium.

Unit 5. Magnetosphere (8 hrs) [Book 2]

Introduction, The magnetic field of Earth, Earth's variable magnetic field, Solar activity and Earth's magnetic weather, solar wind interaction, The Chapman-Ferraro closed magnetosphere, Dungey's open magnetosphere, Structure of the magnetosphere: Magneto tail and Plasma sheet, Plasma sphere, Earth's radiation belts.

Books for Study

1. Introduction to Space Science – Robert C Hymes (1971), John Wiley & Sons Inc.
2. Earth's Proximal Space- Chanchal Uberoi (2000), Universities Press (India)
3. Introduction to Cosmology- J. V. Narlikar (1993), Cambridge University Press
4. Modern Physics- R. Murugeshan, Kiruthika Sivaprasath (2007), S. Chand& Company Ltd.

Books for reference

1. Space Physics and Space Astronomy – Michael D Pappagiannis (1972), Gordon and Breach Science Publishers Ltd.
2. Introductory Course on Space Science and Earth's environment-Degaonkar (Gujarat University, 1978)
3. Introduction to Ionosphere and magnetosphere- Ratcliffe (CUP, 1972)
4. The Physics of Atmospheres-Houghton (Cambridge University Press)
5. Introduction to Ionospheric Physics-Henry Rishbeth&Owen K. Garriot (Academic Press, 1969)
6. Space Science –Louise K. Harra& Keith O. Mason(Imperial College Press,London, 2004)

7. Introduction to Space Physics- Kivelson and Russel
8. Introduction to Astrophysics – BaidyanadhBasu
9.Astrophysics - K. D. Abhayankar (University Press)

PY1661.3. PHOTONICS

(54 HOURS-2CREDITS)

Unit 1 (5 hrs)

Photons in semiconductors-semiconductors-energy band and charge carriers-direct and indirect gap semiconductors –Different type of semi conducting materials—generation, recombination and injection-electron hole injection homo andhetero junctions-quantum wells, quantum dots and quantum wires.

Unit 2 (6 hrs)

Semiconductor photon sources -light emitting diodes-injection electroluminescence-in thermal equilibrium –in the presence of carrier injection- LED characteristics- internal photon flux-output photon flux and efficiency-responsivity- spectral distribution- materials- response time-device structures (Basics).

Unit 3 (10 hrs)

Semiconductor laser amplifiers-gain-amplifier band width-optical pumping-electrical current pumping-hetero structures -semiconductor injection lasers-amplification-feedback and oscillators-laser amplification-resonator losses -gain condition-Laser Threshold-Power-internal photon flux-output photon flux

Unit 4 (10 hrs)

Semiconductor photon detectors-The external photo effect-photo electron emission-The internal photo effect-properties of semiconductor photo detectors--quantum efficiency-responsivity devices with gain-response time-photoconductors-gain-spectral response- p-n photo diodes-PIN photo diodes-hetero structure photo diode- Schottky barrier photodiodes - array detectors-avalanche photodiodes (basics)-

Unit 5 (8 hrs)

Electro optics, Pockels and Kerr effects- electro optic modulators and switches phase modulators–dynamic wave retarders- intensity Modulators- scanners- directional couplers-spatial light modulators-

Unit 6 (7 hrs)

Non linear optics-second order non-linear optics - electro-optic effect-three wave mixing- third order non-linear optics- self phase modulation-optical Kerr effect-self focusing. .

Unit 7 (8 hrs)

Photonic switching and computing-photonic switches-switches-opto mechanical, electro optic, acousto-optic and magneto optic switches-all optical switches-optical computing-digital optical computing-analog optical processing

Book for Study:

1. Fundamentals of Photonics: BFA Saleh and M. C. Teich, John Wiley &Sons, Inc.

Books for Reference:

1. Semiconductor optoelectronic devices: Pallab Bhattacharya, Prentice Hall of India.
2. Optics and Photonics- An introduction: F. Graham Smith and Terry A. King, John Wiley & Sons, Inc.
3. Lasers and Nonlinear Optics: B. B. Laud, New Age International Pvt Ltd.

PY 1661.4: NANO SCIENCE AND TECHNOLOGY
(54 HOURS-2CREDITS)

Unit1 Introduction: (6 Hrs)

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

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

Unit 2: Electrical Transport in Nanostructure: (15 hours)

Electrical conduction in metals, The free electron model. Conduction in insulators/ionic crystals - Electron transport in semiconductors - Various conduction mechanisms in 3D (bulk), 2D(thin film) and low dimensional systems: Thermionic emission, field enhanced thermionic emission (Schottky effect).(Chapter 4, Text 1)

Unit 3: Introductory Quantum Mechanics for Nanoscience: (8 hrs)

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

Unit 4: Growth Techniques of Nanomaterials (Elementary ideas only): (9 hrs)

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

Unit 5: Characterization tools of nanomaterials: (Qualitative ideas only) (10 hrs)

Atomic Structures -Grain size determination – XRD (Debye Scherrer equation), Microscopy – Scanning Electron Microscope (SEM), Tunnelling Electron Microscope (TEM), Scanning Probe Microscope (SPM), Scanning Tunnelling Microscope (STM), Atomic Force Microscope (AFM). (Text -1).

Unit 6: Applications of nanotechnology: (Elementary ideas only) (6 hrs)

Buckminster fullerene, Carbon nanotube, nano diamond, BN Nanotube, Nanoelectronics - single electron transistor (no derivation), Molecular machine, Nano biometrics (Chapter 8, Text 1)

Applications of nanotechnology: (Elementary ideas only) Potential applications, expected benefits from nanotechnologies, can nanotechnology help in addressing various challenges? Energy and Energy Efficiency, new energy producers, Medicine, security, Other Applications (Text book-2, Chapter 5, 6, 7 &8, Nanotechnology: Technology Revolution of 21st Century, Rakesh Rathi, S Chand & Company, New Delhi.).

Books for study

1. Introduction to Nanoscience & Nanotechnology by K. K. Chattopadhyay and A. N. Banerjee, PHI Learning and Private Limited
2. Nanotechnology, Rakesh Rathi, S Chand & Company, New Delhi
3. NANO: The Essentials, T. Pradeep, McGraw Hill Education (India) Private Limited

Books for References:

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

PY1661.5. COMPUTER HARDWARE & NETWORKING
(54 HOURS-2CREDITS)

Unit 1 (3 hrs)

P.C. Architecture Functional block diagram of a computer- Processors Introduction to Microprocessor- CISC, RISC processors Type of Processors and their specification- (Intel: Celeron, Pentium family-PII, PIII, PIV, dual core, core 2duo - AMD-K5,K6 series

Unit 2 (10 hrs)

Motherboards: Motherboard components Types, Form factor, Different components of Motherboard (BIOS, CMOS, BICMOS, RAM, CMOS Battery, I/O slots, I/O connectors), Riser architecture, Main Memory (SIMM, DIMM, RIMM), extended/expanded/cache memories. Chipsets (Intel & AMD)-ROM, DRAM, SDRAM, CDRAM, RDRAM, WRAM. Bus standards: Types of Buses (PC, ISA, MCA, AGP, PCI, USB, IEEE FireWire) Add on Cards Different latest

Add on Cards (TV Tuner Card, DVR card, Video Capture, Internal Modem, Sound Card)

Unit 3 (9 hrs)

Drivers:

1. Floppy Disk Drive- Floppy Drive Components (overview only)

2. Hard Disk Drive (HDD)

Types, Capacity, Hard Disk Components (Media, Read/Write Head, Spindle Motor Head Actuator), Connector, Jumper setting, trouble shooting in HDD. Hard Disk Controller (HDC) – Block diagram,

Working, Interfacing (IDE, SCSI, ATA and SATA series) Configuration of HDD- Installation, Formatting, File Format (FAT, NTFS) Pen drive, i-pods

3.Optical Disk Drive

Types (ROM, R/W, DVD ROM, DVD R/W), Capacity, Difference between CD &DVD (capacity, format)-trouble shooting.

Unit 4 (5 hrs)

Peripherals. Keyboard and Mouse- operation

Types of VDU (CRT, LCD, and TFT), Resolution, and Dot pitch -Printers – Types (dot matrix, inkjet, laser) Scanner- operation. Power conditioning Device:SMPS- Block diagram, operation-UPS- Types (online, off line, Hybrid)-trouble shooting in all these devices.

Unit 5(4 hrs)

Viruses & Vaccines-Virus- Introduction, infection methods,Types of viruses, Different symptoms of virus attack, precautions.Vaccine- Method of vaccine, Different types of Antivirus used in PC, Firewalls

Unit 6(7 hrs)

Networking essentials

Introduction-Need for networking-Network Topology-OSI Model-Types of networks (LAN, WAN, MAN)

Protocols-LAN Protocols- Classification, Examples, Ethernet networking-WAN Protocols- PPP, X.25, PPTP, L2TP, ISDN

Unit 7(8 hrs)

LAN Connectivity Devices- NIC, Repeater, Hub, Switch, Bridge. Internet Connectivity Device-Routers, Gateways, CSU/DSU-TCP/IP Protocol Suite-What is TCP/IP, Importance, OSI vs TCP/IP

Unit 8(6 hrs)

IP Addressing-Overview, Address classes, Network ID, Host ID and Subnet Mask, Addressing guidelines, Reserved IP Address, Subnetting and Super netting(overview)

Unit 9(2 hrs)

Emerging Technologies-Wireless Technology - Bluetooth, WAP-Mobile Technology- GSM, CDMA, GPRS

Books for Study:

1. D. Balasubramanian, “Computer Installation & Servicing”, Tata McGraw Hill.
2. Rom Gilster, Black book, “PC Upgrading and Repairing”, Dream tech, New Delhi.
3. Street Smart, James Pyler, “PC Upgrading and Repairing”, Wiley Publishing, Inc.
4. Stephen.J.Bigelow,”Bigelow’s Troubleshooting, Maintenance & Repairing PCs”,Tata McGraw Hill
5. Craig Zacker, “The Complete Reference- Networking”, Tata McGraw Hill
6. Douglowe, “Networking All in One Desk Reference”-3rd Edn, Wiley India Pvt Ltd

Books for Reference:

1. Mark Minasi, “The Complete PC Upgrade & Maintenance Guide” BPB Publication
2. C.A. Schmidt, “The Complete Computer Upgrade & Repair Book”, Dreamtech
3. Craig Zacker, John Rourke, “The Complete Reference- PC Hardware”Tata McGraw Hill
4. Scott Mueller, “Upgrading & Repairing PC’s”, Pearson Education
5. Vishnu Priya Sing & Meenakshi Singh, “Computer Hardware Course”, Computech
6. ManaharLotia, Pradeep Nair, PayalLotia, “Modern Computer Hardware Course”,BPB Publication.
7. Richard Mc Mohan, “Introduction to Networking”, Tata McGraw Hill.

Internet Resources:

www.edugrid.ac.in/webfolder/courses/cn/cn_resourses.htm
www.howstuffwork.com
www.e-tutes.com
www.learnthat.com
www.intel.com
www.amd.com
http://en.wikipedia.org

II Complementary Courses

Semester 1 (Mathematics Main)
PY1131.1 – Mechanics and Properties of matter (36 hours)

Unit I (28 hours)

Dynamics of rigid bodies (7 hours)

Theorems of MI with proof-Calculation of MI of bodies of regular shapes rectangular lamina, uniform bar of rectangular cross section, annular disc, circular disc, solid sphere-K.E of a rotating body. Determination of MI of a fly wheel (theory and experiment).

Oscillations and waves (13 hours)

Examples of SHM oscillator-compound pendulum-determination of g -torsion pendulum-oscillations of two particles connected by a spring-vibration state of a diatomic molecule

Wave motion-general equation of wave motion-plane progressive harmonic wave - energy density of a plane progressive wave -intensity of wave and spherical waves-

Mechanics of solids (8 hours)

Bending of beams-bending moment-cantilever-beam supported at its ends and loaded in the middle-uniform bending-experimental determination of Y using the above principles with pin and microscope-twisting couple on a cylinder-angle of twist and angle of shear-torsional rigidity**.**

Unit II (8 hours)

Surface Tension (5 hours)

Excess of pressure on a curved surface-force between two plates separated by a thin layer of liquid-experiment with theory to find surface tension and its temperature dependence by Jaeger' method-equilibrium of a liquid drop over solid and liquid surfaces

Viscosity (3 hours)

Flow of liquid through a capillary tube-derivation of Poiseuille's formula -limitations-Ostwald's viscometer-variation of viscosity with temperature

Books for Study

1. Mechanics: J.C.Upadhyaya, Ram Prasad & Sons
2. Oscillations & Waves: K. Rama Reddy, S. Badami& V. Balasubramaniam (University Press)

Semester 2 (Mathematics Main)
PY1231.1 – Thermal Physics and statistical mechanics (36 hours)

Unit I Transmission of Heat (14 hours)

Thermal conductivity and thermometric conductivity-Lee's disc experiment-Weidmann and Franz law (statement only)-energy distribution in the spectrum of black body and results-Wien's displacement law-Rayleigh-Jeans law-their failure and Planck's hypothesis-Planck's law-comparison-solar constant-its determination-temperature of sun.

Unit II Thermodynamics (9 hours)

Isothermal and adiabatic processes-work done-isothermal and adiabatic elasticity Heat engines-Carnot's cycle -derivation of efficiency-petrol and diesel engine cycles-efficiency in these two cases-second laws of thermodynamics-Kelvin and Clausius statements.

Unit III Entropy (9 hours)

Concept of entropy-change of entropy in reversible and irreversible cycles-principle of increase of entropy-entropy and disorder-entropy and available energy-T-S diagram for Carnot's cycle-second law in terms of entropy-calculation of entropy when ice is converted into steam.

Unit 4- Statistical Mechanics (4hours)

Statistical probability-Macro and Microstates- Phase space-statistical ensemble-postulates of equal probability-Maxwell Boltzmann Distribution- velocity distribution

Books for Study

1. Heat & Thermodynamics: N.Subramaniam & Brijlal, S.Chand & Co
2. Heat & Thermodynamics: W. Zemansky, McGraw Hill
3. Heat & Thermodynamics: C. L. Arora

Semester 3 (Mathematics Main)

PY1331.1 – Optics, Magnetism and Electricity (54 hours)

Unit I (34 hours)

Interference (12 hours)

Analytical treatment of interference-theory of interference fringes and bandwidth-Interference in thin films-reflected system-colour of thin films-fringes of equal inclination and equal thickness - Newton's rings-reflected system-measurement of wavelength and refractive index of liquid

Diffraction (14 hours)

Phenomenon of diffraction-classification-Fresnel and Fraunhofer.Fresnel's theory of approximate rectilinear propagation of light-Fresnel diffraction at a straight edge and circular aperture Fraunhofer diffraction at a single slit, two slits and N slits. Plane transmission grating-determination of wavelength

Laser and Fibre Optics (8 hours)

Principle of operation of laser-population inversion-optical pumping-ruby laser applications of lasers Light propagation in optical fibres-step index fibre-graded index fibre-applications

Unit II (20 hours)

Magnetism (10 hours)

Magnetic properties of matter-definition and relation between magnetic vectors B, H and M. Magnetic susceptibility and permeability.Magneticproperties-diamagnetism-paramagnetism-ferromagnetism-antiferromagnetism Electron theory of magnetism-explanation of ferromagnetism

Electricity (10 hours)

EMF induced in a coil rotating in a magnetic field-peak, mean, rms and effective values of A.C. Ac circuits-AC through RC, LC, LR and LCR series circuits-resonance-sharpness of resonance-power factor and choke coil-transformers.

Books for Study

1.A text book of optics – Brijlal & Subramaniam

2.Electricity and Magnetism – Murugesan, S. Chand& Co Ltd.

Semester 4 (Mathematics Main)

PY1431.1ModernPhysics and Electronics (54hours)

Unit 1 (30 hours)

Modern Physics (20 hours)

Basic features of Bohr atom model-Bohr's correspondence principle -vector atom model-various quantum numbers-magnetic moment of orbital electrons -electron spin-Spin-Orbit coupling-Pauli's exclusion principle-

Atomic nucleus-basic properties of nucleus-charge, mass, spin, magnetic moment-binding energy and packing fraction-nuclear forces-salient features-radioactivity-radioactive decay-decay laws-decay constant-half life and mean life-radioactive equilibrium-secular and transient equilibrium-measurement of radioactivity.

Quantum Mechanics (10 hours)

Inadequacies of classical physics-experimental evidences- quantum theory-Planck's hypothesis-foundation of quantum mechanics-wave function and probability density-Schrödinger equation-time dependent and time independent-particle in a potential box

Unit2 (24 hours)

Electronics (16hour)

Current-voltage characteristics of a diode-forward and reverse bias-breakdown mechanism of p - n junction diode-Zener diode and its characteristics-half wave and full wave rectifiers-bridge rectifier-ripple factor, efficiency.

Construction and operation of a bipolar junction transistor-transistor configurations current components-transistor characteristics-DC load line-Q point-AC load line transistor biasing-need for biasing-bias stabilization-biasing circuits- voltage divider bias. amplifier-basic features of an amplifier-gain, -frequency response and band width

Digital Electronics (8 hours)

Number systems and codes-decimal numbers-binary arithmetic -1's and 2's compliment-decimal to binary conversion-octal numbers-hexadecimal numbers-binary coded decimal-digital codes-logic gates-NOT, OR, AND, NOR and NAND gates. Boolean algebra-Boolean operations -logic expressions-laws of Boolean algebra-De Morgan's theorem-Boolean expression for gate network-simplification of Boolean expression

Books for Study:

1. Modern Physics – Murugesan, S. Chand& Co. Ltd.
2. Principles of Electronics – V. K. Mehta.

Semester 1 (Chemistry Main)
PY1131.2 – Rotational dynamics and Properties of matter (36 hours)

Unit I (28 hours)

Dynamics of rigid bodies (7 hours)

Theorems of MI with proof -Calculation of MI of bodies of regular shapes- rectangular lamina, uniform bar of rectangular cross section, annular disc, circular disc, solid cylinder, solid sphere-KE of a rotating body-Determination of MI of a flywheel (Theory and Experiment)

Oscillations and waves (13 hours)

Examples of S.H oscillator-compound pendulum-determination of g-torsion pendulum-oscillations of two particles connected by a spring-vibration state of a diatomic molecule-

Wave motion-general equation of wave motion-plane progressive harmonic wave - energy density of a plane progressive wave -intensity of wave and spherical waves-

Mechanics of solids (8 hours)

Bending of beams-bending moment-cantilever-beam supported at its ends-and loaded in the middle-uniform bending-experimental determination of Y using the above principles with pin and microscope-twisting couple on a cylinder-angle of twist and angle of shear-torsional rigidity.

Unit II (8hours)

Surface Tension (5 hours)

Excess of pressure on a curved surface-force between two plates separated by a thin layer of liquid-experiment with theory to find surface tension and its temperature dependence by Jaeger' method-equilibrium of a liquid drop over solid and liquid surfaces

Viscosity (3 hours)

Flow of liquid through a capillary tube-derivation of Poiseuille's formula -limitations-Ostwald's viscometer-variation of viscosity with temperature

Books for Reference:

1. Mechanics: J. C. Upadhyaya, Ram Prasad & Sons
2. Oscillations &Waves: K. Rama Reddy, S. B. Badami & V. Balasubramaniam (University Press)

Semester 2 (Chemistry Main)
PY1231.2 – Thermal Physics (36 hours)

Unit I – Diffusion (4 hours)

Graham's law of diffusion in liquids-Fick's law-analogy between liquid diffusion and heat conduction-methods of estimating concentrations-determination of coefficient of diffusivity

Unit II Transmission of Heat (14hours)

Thermal conductivity and thermometric conductivity – Lee's Disc experiment- Weidmann and Franz law (statement only) -Radiation of heat-black body radiation-Kirchhoff's laws of heat radiation-absorptive power-emissive power-Stefan's law (no derivation) -energy distribution in the spectrum of black body and results-Wien's displacement law - Rayleigh-Jeans law-their failure and Planck's hypothesis -Planck's law-comparison-solar constant-temperature of sun

Unit III – Thermodynamics (9 hours)

Isothermal and adiabatic processes-work done-isothermal and adiabatic elasticity Heat engines-Carnot's cycle -derivation of efficiency-petrol and diesel engine cycles-efficiency in these two cases-second laws of thermodynamics-Kelvin and Clausius statements.

Unit IV – Entropy (9 hours)

Concept of entropy-change of entropy in reversible and irreversible cycles-principle of increase of entropy-entropy and disorder-entropy and available energy-T-S diagram for Carnot's cycle-second law in terms of entropy-calculation of entropy when ice is converted into steam.

References

1. The general Properties of matter: F. H. Newman&V. H. L. Searle
2. Heat & Thermodynamics: N. Subramaniam & Brijlal, S.Chand& Co
3. Heat & Thermodynamics: W. Zemansky, McGraw Hill
4. Heat & Thermodynamics: C. L. Arora.

Semester 3 (Chemistry Main)
PY1331.2 – Optics, Magnetism and Electricity (54 hours)

Unit I (34 hours)

Interference (11 hours)

Analytical treatment of interference-theory of interference fringes and bandwidth- Interference in thin films-reflected system-colour of thin films-fringes of equal inclination and equal thickness Newton's rings-reflected system-measurement of wavelength and refractive index of a liquid.

Diffraction (11 hours)

Phenomenon of diffraction-classification-Fresnel and Fraunhofer- Fresnel's theory of approximate rectilinear propagation of light-Fresnel diffraction at a straight edge

Fraunhofer diffraction at a single slit, two slits and N slits. Plane transmission grating-determination of wavelength.

Polarisation (6 hours)

Experiments showing the transverse nature of light-plane polarized light-polarization by reflection-Brewster's law-double refraction-Nicol prism-propagation of light in uni-axial crystals-positive and negative crystals-principal refractive indices-half wave plate and quarter wave plate-elliptically and circularly polarized light-optical activity.

Laser and Fibre Optics (6 hours)

Principle of operation of laser-population inversion-optical pumping-ruby laser applications of lasers. Light propagation in optical fibres-step index fibre-graded index fibre-applications.

Unit II (20 hours)

Magnetism (10 hours)

Magnetic properties of matter-definition and relation between magnetic vectors B, H and M. Magnetic susceptibility and permeability. Magnetic properties-diamagnetismparamagnetism-ferromagnetism-antiferromagnetism. Electron theory of magnetism-explanation of ferromagnetism

Electricity (10 hours)

EMF induced in a coil rotating in a magnetic field-peak, mean, rms and effective values of A.C. Ac circuits-AC through RC, LC, LR and LCR series circuits-resonance-sharpness of resonance-power factor and choke coil-transformers.

References

1. A text book of optics – Brijlal & Subramaniam
2. Electricity and Magnetism – R. Murugesan, S. Chand& Co Ltd.

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Semester 4 (Chemistry Main)

PY1431.2 – Atomic Physics, Quantum Mechanics and Electronics (54 hours)

Unit I Atomic physics (12 hours)

Basic features of Bohr atom model-Bohr's correspondence principle -vector atom model-various quantum numbers-magnetic moment of orbital electrons -electron spin-Spin-Orbit coupling-Pauli's exclusion principle-periodic table

Unit II Superconductivity (8 hours)

Properties of superconductors-zero electrical resistance- Meissner effect- electrical magnetic field-Type I and Type II superconductors-isotope effect-high temperature ceramic superconductors-applications of superconductors.

Unit III Quantum mechanics (14 hours)

Inadequacies of classical physics-experimental evidences-evidences for quantum theory-Planck's hypothesis-foundation of quantum mechanics-wave function and probability density-Schrodinger equation-time dependent and time independent-particle in a potential box

Unit IV. Spectroscopic Techniques(4hours)

EM Spectrum- UV, Visible, IR, Radio and microwave regions-principle of various spectrometers used in specific regions of EM spectrum-absorption spectroscopy, emission spectroscopy

Unit V. Electronics (12 hours)

Current-voltage characteristics of a diode -forward and reverse bias-breakdown mechanism of p -n junction diode-Zener diode and its characteristics-half wave and full wave rectifiers-bridge rectifier-ripple factor, efficiency.

Construction and operation of a bipolar junction transistor-transistor configurations current components-transistor characteristics-DC load line-Q point-AC load line transistor biasing-need for biasing-bias stabilization-biasing circuits-fixed bias, emitter feedback bias, voltage divider bias (qualitative study only). Transistor amplifier-basic features of an amplifier-gain, input and output resistances-frequency response and band width

Unit V. Digital Electronics (4hours)

Number systems and codes-decimal numbers-binary arithmetic -1's and 2's compliment-decimal to binary conversion-octal numbers-hexadecimal numbers-binary coded decimal-digital codes-logic gates-NOT, OR, AND, NOR and NAND gates.

References

1. Modern Physics –R. Murugesan, S. Chand& Co. Ltd.
2. Principles of Electronics – V. K.Mehta.

Semester 1 (Statistics Main)
PY1131.3 – Mechanics and Properties of matter (36 hours)

Unit I (28 hours)

Dynamics of rigid bodies (8 hours)

Theorems of MI with proof -Calculation of MI of bodies of regular shapes- rectangular lamina, uniform bar of rectangular cross section, annular disc, circular disc, solid sphere-KE of a rotating body Determination of MI of a fly wheel (theory and experiment)

Oscillations and waves (12 hours)

Examples of SHM oscillator-compound pendulum-determination of g-torsion pendulum-oscillations of two particles connected by a spring

Wave motion-general equation of wave motion-plane progressive harmonic wave energy density of a plane progressive wave-intensity of wave and spherical wave- transverse waves in stretched string-modes of transverse vibrations of string longitudinal waves in rods and in gases

Mechanics of solids (8 hours)

Bending of beams-bending moment-cantilever-beam supported at its ends-and loaded in the middle-uniform bending-experimental determination of Y using the above principles with pin and microscope-twisting couple on a cylinder-angle of twist and angle of shear-torsional rigidity.

Unit II (8 hours)

Surface Tension (5 hours)

Excess of pressure on a curved surface-force between two plates separated by a thin layer of liquid-experiment with theory to find surface tension and its temperature dependence by Jaeger' method-equilibrium of a liquid drop over solid and liquid surfaces

Viscosity (3 hours)

Flow of liquid through a capillary tube-derivation of Poiseuille's formula -limitations-Ostwald's viscometer-variation of viscosity with temperature

References

1. Mechanics: J. C. Upadhyaya, Ram Prasad & Sons
2. Oscillations & Waves: K. Rama Reddy, S. Badami &V. Balasubramaniam (University Press)

Semester 2 (Statistics Main)

PY1231.3 – Thermal Physics and statistical mechanics (36 hours)

Unit I – Transmission of Heat (8 hours)

Thermal conductivity and thermometric conductivity-Lee's disc experiment Weidmann and Franz law (statement only)-energy distribution in the spectrum of black body and results-Wien's displacement law**.**

Unit II – Thermodynamics (8 hours)

Isothermal and adiabatic processes-work done-isothermal and adiabatic elasticity Heat engines-Carnot's cycle-derivation of efficiency- second law of thermodynamics Kelvin and Clausius statements.

Unit III – Entropy (8 hours)

Concept of entropy-change of entropy in reversible and irreversible cycles-principle of increase of entropy-entropy and disorder-entropy and available energy-T-S diagram for Carnot's cycle-second law in terms of entropy-calculation of entropy when ice is converted into steam.

Unit IV – Statistical Mechanics (12 hours)

Concepts of phase-space-ensemble and statistical equilibrium-probability theorems in statistical thermodynamics-distribution laws-Maxwell-Boltzmann, Fermi -Dirac and Bose-Einstein distribution laws (no derivation)-comparison of three statistics- Molecular energies in an ideal gas-Quantum statistics-Rayleigh-Jeans formula Planck's radiation law-specific heat of solids-free electrons in metals-electron energy distribution.

References

1. Heat & Thermodynamics: N.Subramaniam& Brijlal, S.Chand & Co
2. Heat & Thermodynamics: W.Zemansky, McGraw Hill

3. Heat & Thermodynamics: C.L.Arora.
4. Concepts of modern physics: Arthur Beiser (TMH).
5. Statistical Mechanics: Sinha (TMH).
6. Theoretical Chemistry: Samuel Gladstone, New York, D Van Nostrand Co., Inc.
7. Heat: Saha and Srivasthava.

Semester 3 (Statistics Main)
PY1331.3 –Optics, Magnetism and Electricity (54 hours)

Unit I (34 hours)

Interference (12 hours)

Analytical treatment of interference-theory of interference fringes and bandwidth Interference in thin films-reflected system-colour of thin films-fringes of equal inclination and equal thickness.Newton's rings-reflected system-measurement of wavelength and refractive index of liquid

Diffraction (14 hours)

Phenomenon of diffraction-classification-Fresnel and FraunhoferFresnel's theory of approximate rectilinear propagation of light-Fresnel diffraction at a straight edge and circular aperture. Fraunhofer diffraction at a single slit, two slits and N slits. Plane transmission grating-determination of wavelength-Resolving power of grating

Laser and Fibre Optics (8 hours)

Principle of operation of laser-population inversion-optical pumping-ruby laser applications of lasers Light propagation in optical fibres-step index fibre-graded index fibre-applications.

Unit II (20 hours)

Magnetism (10 hours)

Magnetic properties of matter-definition and relation between magnetic vectors B, H and M Magnetic susceptibility and permeability Magnetic properties-diamagnetism-paramagnetism-ferromagnetism-antiferromagnetism Electron theory of magnetism-explanation of ferromagnetism.

Electricity (10 hours)

EMF induced in a coil rotating in a magnetic field-peak, mean, rms and effective values of A.C. Ac circuits-AC through RC, LC, LR and LCR series circuits-resonance-sharpness of resonance-power factor and choke coil-transformers.

References

1. A text book of optics – Brijlal & Subramaniam
2. Electricity and Magnetism – Murugesan, S.Chand& Co Ltd

Semester 4 (Statistics Main)
PY1431.3 – Modern Physics and Electronics (54 hours)

Unit I

Modern Physics (20 hours)

Basic features of Bohr atom model-Bohr's correspondence principle -vector atom model-various quantum numbers-magnetic moment of orbital electrons -electron spin-Spin-Orbit coupling-Pauli's exclusion principle-periodic table

Atomic nucleus-basic properties of nucleus-charge, mass, spin, magnetic moment-binding energy and packing fraction-nuclear forces-salient features-radioactivity-radioactive decay-decay laws-decay constant-half life and mean life-

Radioactive equilibrium-secular and transient equilibrium-measurement of radioactivity

Quantum mechanics (14 hours)

Inadequacies of classical physics-experimental evidences-evidences for quantum theory-Planck's hypothesis-foundation of quantum mechanics-wave function and probability density-Schrodinger equation-time dependent and time independent-particle in a potential box

Unit II (20 hours)

Electronics (12 hours)

Current-voltage characteristics of a diode -forward and reverse bias-breakdown mechanism of p -n junction diode-Zener diode and its characteristics-half wave and full wave rectifiers-bridge rectifier-ripple factor, efficiency

Construction and operation of a bipolar junction transistor-transistor configurations current components-transistor characteristics-DC load line-Q point-AC load line transistor biasing-need for biasing-bias stabilization-biasing circuits-fixed bias, emitter feed back bias, voltage divider bias (qualitative study only).

Transistor amplifier-basic features of an amplifier-gain, input and output resistances-frequency response and band width.

Digital Electronics (8 hours)

Number systems and codes-decimal numbers-binary arithmetic -1's and 2's compliment-decimal to binary conversion-octal numbers-hexadecimal numbers-binary coded decimal-digital codes-logic gates-NOT, OR, AND, NOR and NAND gates. Boolean algebra-Boolean operations -logic expressions-laws of Boolean algebra-DeMorgan's theorem-Boolean expression for gate network-simplification of Boolean expression

References

1. Modern Physics – Murugesan, S. Chand& Co. Ltd.
2. Principles of Electronics – V. K. Mehta.

Semester 1 (Geology Main)
PY1131.4 – Mechanics and Properties of matter (36 hours)

Unit I (29 hours)

Dynamics of rigid bodies (7 hours)

Theorems of M.I with proof -Calculation of M.I of bodies of regular shapes- rectangular lamina, uniform bar of rectangular cross section, annular disc, circular disc, solid cylinder, solid sphere-K.E of a rotating body- Determination of MI of a flywheel(Theory and Experiment).

.**Oscillations and waves (15 hours)**

Examples of S H oscillator- compound pendulum- determination of g-torsion pendulum-oscillations of two particles connected by a spring- vibrational state of diatomic molecule -damped and forced harmonic oscillators-damping force-damped harmonic oscillator -examples-power dissipation-Q factor. Wave motion-general equation of wave motion-plane progressive harmonic wave intensity of wave and spherical waves-waves in solids-longitudinal waves –transverse waves- torsional waves-common characteristics-reflection and transmission of waves- reflection and transmission of energy- flexural vibrations-applications of geophysicscharacteristics-reflection and transmission of waves-reflection and transmission of energy-flexural vibrations-applications in geophysics.

Mechanics of solids (7 hours)

Bending of beams-bending moment-cantilever-beam supported at its ends-and loaded in the middle-uniform bending-experimental determination of Y using the above principles with pin and microscope-twisting couple on a cylinder-angle of twist and angle of shear-torsional rigidity.

Unit II (7 hours)

Surface Tension (4 hours)

Excess of pressure on a curved surface-force between two plates separated by a thin layer of liquid-experiment with theory to find surface tension and its temperature dependence by Jaeger' method-equilibrium of a liquid drop over solid and liquid surfaces

Viscosity (3 hours)

Flow of liquid through a capillary tube-derivation of Poiseuille's formula -limitations-Ostwald's viscometer-variation of viscosity with temperature

References

1. Mechanics: J. C. Upadhyaya, Ram Prasad & Sons
2. Oscillations & Waves: K.Rama Reddy, S. B. Badami &V. Balasubramaniam (University Press)

Semester 2 (Geology Main)
PY1231.4 – Thermal Physics and Physics of the Earth (36 hours)

Unit I – Transmission of Heat (9 hours)

Thermal conductivity and thermometric conductivity-Lee's disc experiment Weidmann and Franz law (statement only)-energy distribution in the spectrum of black body and results-Wien's displacement law-Rayleigh-Jeans law-their failure and Planck's hypothesis-Planck's law - comparison-solar constant-temperature of sun.

Unit II – Thermodynamics (9 hours)

Isothermal and adiabatic process- work done -isothermal and adiabatic elasticity

Heat engines-Carnot's cycle -derivation of efficiency-petrol and diesel engine cycles-efficiency in these two cases-second laws of thermodynamics-Kelvin and Clausius statements-Carnot's theorem with proof

Unit III – Physics of the Earth (18 hours)

The solar system-origin of solar system-the dynamic earth-continental drift-earth's structure- earth's size and shape-gravitation-gravitational field and potential equipotential surfaces-gravitational field and potential due to a thin spherical shell and solid sphere-gravitational self-energy-gravity measurements-free fall method-rise and fall method-gravity anomalies. The tide-tidal effect of sun-earth quakes-causes seismic wave propagation-seismographs Atmospheric physics-atmospheric structure and composition-atmospheric pressure, density and temperature-measurement of air temperature-daily cycle of air temperature-atmospheric radiation-ionosphere-magnetosphere

References

1. Heat & Thermodynamics: N. Subramaniam & Brijlal, S.Chand& Co
2. Heat & Thermodynamics: W. Zemansky, McGraw Hill
3. Heat & Thermodynamics: C. L. Arora.
4. Fundamentals of Geophysics: William Lowrie, Cambridge University Press.
5. Applied Physics: G. Aruldhas et al, Rajam publishers, Tvpm.

Semester 3 (Geology Main)
PY1331.4 – Optics and Electrodynamics (54 hours)

Unit I (34 hours)

Interference (12 hours)

Analytical treatment of interference-theory of interference fringes and bandwidth Interference in thin films-reflected system-colour of thin films-fringes of equal inclination and equal thickness.Newton's rings-reflected system-measurement of wavelength and refractive index of liquid

Diffraction (14 hours)

Phenomenon of diffraction-classification-Fresnel and Fraunhofer Fresnel's theory of approximate rectilinear propagation of light-Fresnel diffraction at a straight edge and circular aperture Fraunhofer diffraction at a single slit, two slits and N slits. Plane transmission grating-determination of wavelength-Resolving power of grating

Polarisation (8 hours)

Experiments showing the transverse nature of light-plane polarized light-polarization by reflection-Brewster's law-double refraction-Nicol prism-propagation of light in uni-axial crystals-positive and negative crystals-principal refractive indices-half wave plate and quarter wave plate-elliptically and circularly polarized light-optical activity-Fresnel's theory and applications.

Unit II (20 hours)

Magnetism (12 hours)

Magnetic properties of matter-definition and relation between magnetic vectors B, H and M. Magnetic susceptibility and permeability Magnetic properties-diamagnetism-Para magnetism-ferromagnetism-anti-ferro magnetism. Electron theory of magnetism-Explanation of ferromagnetism

Earth's magnetism-dip- inclination -vertical components-magnetic maps -magnetographs -cause of earth's magnetism geomagnetic prospecting

Electricity (8 hours)

EMF induced in a coil rotating in a magnetic field-peak, mean, rms and effective values of A.C. Ac circuits-AC through RC, LC, LR and LCR series circuits-resonance-sharpness of resonance-power factor and choke coil-transformers.

Books for study:

1. A text book of optics – Brijlal & Subramaniam
2. Electricity and Magnetism – Murugesan, S.Chand& Co Ltd.

Semester 4 (Geology Main)

PY1431.4 – Modern Physics, Electronics and Crystallography(54hours)

Unit I

Modern Physics (20 hours)

Basic features of Bohr atom model-Bohr's correspondence principle -vector atom model-various quantum numbers-magnetic moment of orbital electrons -electron spin-Spin-Orbit coupling-Pauli's exclusion principle-periodic table

Atomic nucleus-basic properties of nucleus-charge, mass, spin, magnetic moment-binding energy and packing fraction-nuclear forces-salient features-radioactivity-radioactive decay-decay laws-decay constant-half life and mean life-radioactive equilibrium-secular and transient equilibrium-measurement of radioactivity-radio carbon dating-age of the earth-biological effects of radiation.

Crystallography (16 hours)

Crystal structure-crystal lattice and translation vectors-unit cell-symmetry operations point groups and space groups-types of lattices-lattice directions and planes interplanar spacing-simple crystal structures-close packed structures-structure of diamond-zinc blend structure-sodium chloride structure. X-ray crystallography-diffraction of x -rays-Bragg's law-x-ray diffraction methods rotating crystal method-powder diffraction method.

Unit II (18 hours)

Electronics (10 hours)

Current-voltage characteristics of a diode -forward and reverse bias-breakdown mechanism of p-n junction diode-Zener diode and its characteristics-half wave and full wave rectifiers-bridge rectifier-ripple factor, efficiency.

Construction and operation of a bipolar junction transistor-transistor configurations current components-transistor characteristics-DC load line-Q point-AC load line transistor biasing-need for biasing-bias stabilization-biasing circuits-fixed bias emitter feedback bias, voltage divider bias (qualitative study only).

Transistor amplifier-basic features of an amplifier-gain, input and output resistances-frequency response and band width-small signal CE amplifier-circuit and its operation

Digital Electronics (8 hours)

Number systems and codes-decimal numbers-binary arithmetic -1's and 2's compliment-decimal to binary conversion-octal numbers-hexadecimal numbers-binary coded decimal-digital codes-logic gates-NOT, OR, AND, NOR and NAND gates. Boolean algebra-Boolean operations -logic expressions-laws of Boolean algebra-DeMorgan's theorem-Boolean expression for gate network-simplification of Boolean expression

References

1. Modern Physics – Murugesan, S. Chand& Co. Ltd.
2. Principles of Electronics – V. K. Mehta.

Semester 1 (Home Science Main)

PY1131.5–Mechanics and Properties of matter (36 hours)

Unit I (26 hours)

Dynamics of rigid bodies (8 hours)

Theorems of M.I with proof -Calculation of M.I of bodies of regular shapes- rectangular lamina, uniform bar of rectangular cross section, annular disc, circular circular disc, solid cylinder, solid sphere-K.E of a rotating body-Determination of MI of fly wheel(Theory and experiment)

Oscillations and waves (12 hours)

Examples of S.H M oscillator- oscillations of two particles connected by a spring vibration state of a diatomic molecule Wave motion-general equation of wave motion-plane progressive

harmonic wave - energy density of a plane progressive wave-intensity of wave and spherical waves-

Mechanics of solids (6 hours)

Bending of beams-bending moment-cantilever-beam supported at its ends-and loaded in the middle-uniform bending-experimental determination of Y using the above principles with pin and microscope-twisting couple on a cylinder-angle of twist and angle of shear-

Unit II (10 hours)

Surface Tension (5hours)

Excess of pressure on a curved surface-force between two plates separated by a thin layer of liquid-experiment with theory to find surface tension and its temperature dependence by Jaeger's method-equilibrium of a liquid drop over solid and liquid surfaces

Viscosity (5 hours)

Flow of liquid through a capillary tube -derivation of Poiseuille's formula-limitations - variation of viscosity with temperature-Stoke's formula-determination of viscosity of a highly viscous liquid by Stoke's method.

References

1. Mechanics: J. C. Upadhyaya, Ram Prasad & Sons
2. Oscillations & Waves: K. Rama Reddy, S. Badami&V. Balasubramaniam (University Press)

Semester 2 (Home Science Main)
PY1231.5 – Thermal Physics (36 hours)

Unit I – Diffusion (4 hours)

Graham's law of diffusion in liquids-Fick's law-analogy between liquid diffusion and heat conduction-methods of estimating concentrations-determination of coefficient of diffusivity

Unit II – Transmission of Heat (14hours)

Thermal conductivity and thermometric conductivity-Lee's disc experiment- Weidmann and Franz law (statement only) -Radiation of heat-black body radiation - absorptive power-emissive power-Stefan's law (no derivation) -energy distribution in the spectrum of black body and results-Wien's displacement law -Rayleigh-Jeans law - their failure and Planck's hypothesis-Planck's law-comparison-solar constant temperature of sun.

Unit III – Thermodynamics (10 hours)

Isothermal and adiabatic processes-work done-isothermal and adiabatic elasticity Heat engines-Carnot's cycle -derivation of efficiency-petrol and diesel engine cycles-efficiency in these two cases-second law of thermodynamics-Kelvin and Clausius statements

Phase transition- first order and second order-liquid helium-super fluidity.

Unit IV – Entropy (8 hours)

Concept of entropy-change of entropy in reversible and irreversible cycles-principle of increase

of entropy-entropy and disorder-entropy and available energy-T-S diagram for Carnot's cycle-second law in terms of entropy-calculation of entropy when ice is converted into steam.

References

1. The general Properties of matter: F. H. Newman & V. H. L. Searle
2. Heat & Thermodynamics: N. Subramaniam& Brijlal, S.Chand & Co
3. Heat & Thermodynamics: W. Zemansky, McGraw Hill
4. Heat & Thermodynamics: C. L. Arora.

Semester 3 (Home Science Main)
PY1331.5 – Optics and Electricity (54 hours)

Unit I (34 hours)

Interference (12 hours)

Analytical treatment of interference-theory of interference fringes and bandwidth-Interference in thin films-reflected system-colour of thin films-fringes of equal inclination and equal thickness-Newton's rings-reflected system-measurement of wavelength and refractive index of liquid

Diffraction (14 hours)

Phenomenon of diffraction-classification-Fresnel and Fraunhofer- Fresnel's theory of approximate rectilinear propagation of light-Fresnel diffraction at a straight edge and circular aperture-Fraunhofer diffraction at a single slit, two slits and N slits. Plane transmission grating-determination of wavelength.

Laser and Fibre Optics (8 hours)

Principle of operation of laser-population inversion-optical pumping-ruby laser-applications of lasers

Light propagation in optical fibers-step index fibre-graded index fibre-applications.

Unit II (20 hours)

Electricity

EMF induced in a coil rotating in a magnetic field-peak, mean, rms and effective values of A.C. Ac circuits-AC through RC, LC, LR and LCR series circuits-resonance-sharpness of resonance-power factor and choke coil-transformers.

Electric motors- principles of working- Devices working with electric motors-Electric fan- wet grinder, Mixer grinder, Microwave oven – principle – technical specifications - applications – advantages,

References

1. A text book of optics – Brijlal & Subramaniam
2. . Electricity and Magnetism – R.Murugeshan, S.Chand & Co Ltd.
3. A text book of B.Sc subsidiary Physics – P.Vivekanandan.
4. Electrical Technology (Vol I & II), B.L.Theraja.

Semester 4 (Home Science Main)
PY1431.5 – Atomic Physics and Electronics (54 hours)

Unit I

Modern Physics (20 hours)

Basic features of Bohr atom model-Bohr's correspondence principle -vector atom model-various quantum numbers-magnetic moment of orbital electrons -electron spin-Spin-Orbit coupling-Pauli's exclusion principle-periodic table Atomic nucleus-basic properties of nucleus -charge, mass, spin magnetic moment- binding energy and packing fraction-nuclear forces-salient features-radioactivity radioactive decay-decay laws-decay constant-half life and mean life-radioactive equilibrium-secular and transient equilibrium-measurement of radioactivity-

Unit II Superconductivity (8 hours)

Properties of superconductors-zero electrical resistance-Meissner effect-critical magnetic field-Type I and Type II superconductors-isotope effect-high temperature ceramic superconductors-applications of superconductors.

Unit III Spectroscopic Techniques (8 hours)

EM spectrum-UV, Visible, IR, Radio and microwave regions-principle of various spectrometers used in specific regions of EM spectrum-absorption spectroscopy-emission spectroscopy-mass spectroscopy-qualitative ideas of ESR& NMR spectrometer

Unit IV (18 hours)

Electronics (10 hours)

Current-voltage characteristics of a diode-forward and reverse bias-breakdown mechanism of p -n junction diode-Zener diode and its characteristics-half wave and full wave rectifiers-bridge rectifier-ripple factor, efficiency. Construction and operation of a bipolar junction transistor-transistor configurations-current components-transistor characteristics-DC load line-Q point-AC load line-transistor biasing-need for biasing-bias stabilization-biasing circuits-fixed bias, emitter feedback bias, voltage divider bias (qualitative study only).

Transistor amplifier-basic features of an amplifier-gain, input and output resistances-frequency response and band width-small signal CE amplifier-circuit and its operation

Digital Electronics (8 hours)

Number systems and codes-decimal numbers-binary arithmetic -1's and 2's compliment-decimal to binary conversion-octal numbers-hexadecimal numbers-binary coded decimal-digital codes-logic gates-NOT, OR, AND, NOR and NAND gates Boolean algebra-Boolean operations -logic expressions-laws of Boolean algebra-DeMorgan's theorem-Boolean expression for gate network-simplification of Boolean expression.

References

1. Modern Physics – R. Murugeshan, S. Chand & Co. Ltd.
2. . Principles of Electronics – V .K. Mehta.

Complementary Electronics for Physics Main
Semester 1
EL 1131-ELECTRONICS I (36 HOURS)

Unit 1 Circuit Elements and Fundamentals (10 hours)

Ohm's Law, Linear and non-linear Resistors, Resistor types-Wire wound Resistors, Carbon composition Resistors, Carbon film Resistors, Metal film Resistors, Resistor Colour code, Resistive circuits, Series and Parallel Resistor circuits, Series aiding and Series opposing Voltages, Proportional Voltage formula, Proportional Current formula, Series Voltage Dividers, 'Open' and 'Short' in Series, Parallel and Series –Parallel Circuits.

Inductor, Inductor Types- Air core inductor, Iron-core Inductor, Ferrite-core Inductor, Self Inductance, Mutual Inductance, Coefficient of Coupling, Inductors in Series or Parallel without M, series combination with M, Stray Inductance, Reactance offered by a Coil.

Capacitors, Type of Capacitors- Fixed Capacitors, Variable Capacitors, Capacitance, Capacitors in Series and Parallel, Reactance offered by the Capacitor, Cells in Series and Parallel

Unit 2 Network Theorems (6 hours)

Kirchhoff's Law, Super position theorem, Ideal constant Voltage Source, Ideal constant Current Source, Thevenin's and Norton's Theorem, Maximum Power Transfer Theorem(Proof).

Unit 3 Magnetism and A.C (8 hours)

Magnetic Field, Type of Magnets, Magnetic Shielding, Magnetic Terms and Units, Ohm's Law in Magnetism, Transformer, Transformer working, Transformer Types, Transformer Impedance.

Type of alternating waveforms, Different values of sinusoidal voltage and current, Phase and Phase difference of A.C, Non-sinusoidal waveform, Harmonics, A.C through Resistor, Inductor, Capacitor, L-R, R-C and LCR circuits, Sharpness of resonance, Q-factor, Bandwidth, Tuning of radio, Parallel LCR.

Unit 4 Transient Current (6 hours)

Rise and fall of Current in pure Resistance, Time constant of an L-R Circuit, Inductive Kick, Time constant of an R-C Circuit, Charging and Discharging of capacitor, Decreasing Time Constant, Flasher, Pulse Response of an R-C Circuit, Effect of Long and Short Time Constants.

Unit 5 Introduction to semiconductors(6 hours)

Energy Band, Valance band, Conduction Band, Classification of materials based on energy bands, Type of semiconductors-Intrinsic and Extrinsic, hole formation and its movements, Type of Extrinsic semiconductors-P-type and N-type, Drift current in Intrinsic semiconductors.

Books of Study

1. Basic Electronics Solid State – B. L. Theraja, S. Chand & Co. Ltd.

2. Principles of Electronics – V. K. Mehta.

Semester 2

EL1231 - Electronics II (36 hours)

Unit I Tuning circuits and filters (3 hours)

Tuned circuit – operating characteristics of a tuning circuit – series resonance – tuned transformer – double tuned transformer – parallel resonance – coupled circuits- coefficient of coupling- filters- types of filter circuits (low pass, high pass, band pass and band stop filter)- uses of filters.

Unit 2 The P-N junction (5 hours)

The P-N junction – formation of depletion layer – junction or barrier voltage – effect of temperature on barrier voltage – forward biased pn junction – forward V-I characteristics – reverse biased P-N junction – reverse saturation current reverse V-I characteristics– junction breakdown – junction capacitance – equivalent circuit of a pn junction

The ideal diode – real diode – diode circuits with dc and ac voltage sources– diode fabrication – clippers and clampers

Unit 3 Special diodes (3 hours)

Zener diode – voltage regulation – peak clipper – meter protection – tunneling effect – tunnel diode – tunnel diode oscillator – varactor – PIN diode – Schottky diode – step recovery diode - thermistors

Unit 4 Optoelectronic devices (3 hours)

Introduction – light emitting diode(LED) – theory, construction and applications- photoemissive devices – photomultiplier tube – photovoltaic devices – bulk type photoconductive cells – photodiodes – P-N junction photodiode – PIN photodiode – avalanche photodiode.

Unit 5 Regulated Power Supplies (5 hours)

Unregulated and regulated power supply – steady and pulsating DC voltages – rectifiers – half wave, full wave and bridge rectifiers (working, form factor, PIV, ripple factor, efficiency)- filters- bleeder resistor – voltage regulation – zener diode shunt regulator – voltage dividers – complete power supply – voltage multipliers – half wave voltage doubler – full wave voltage doubler – troubleshooting power supplies – controlled rectification – silicon controlled rectification – SCR- pulse control of SCR – SCR controlled circuit.

Unit 6 Basic Transistor (3 hours)

BJT – transistor biasing and biasing rule – transistor currents – configurations (CB, CE and CC Configurations) – relation between transistor current gains – leakage current in a transistor – thermal runaway.

Unit 7 Transistor Characteristics and Approximations (5 hours)

Transistor static characteristics (input, output and current transfer characteristic) of CB,CEand CC configurations – different ways of drawing transistor circuits – beta rule –

importance of V_{CE} cut-off and saturation points – normal DC voltage transistor indications – transistor fault location – solving universal stabilization circuit – applying AC to a DC biased transistor – transistor AC/DC analysis.

Unit 8 Load Lines and DC Bias Circuits (5 hours)

DC load line – Q point and maximum undistorted output – need for biasing a transistor – factors affecting bias variations – stability factor – beta sensitivity- stability factor of CB and CE circuits – different methods of transistor biasing – base bias – base bias with emitter feedback - base bias with collector feedback - base bias with emitter and collector feedback – voltage divider bias – load line and output characteristics – ac load line.

Unit 9 Transistor Equivalent Circuits and Hybrid Parameters (4 hours)

DC equivalent circuit - AC equivalent circuit - CB and CE amplifier(DC and AC equivalent circuit) – effect of source resistance on voltage gain – h-parameters – h-parameter notations for transistors – h-parameters of an ideal transistor – h-parameters of ideal CB and CE transistors

Books of Study

1. Basic Electronics Solid State – B. L. Theraja, S. Chand & Co. Ltd.
2. Principles of Electronics – V. K. Mehta.

Semester 3

EL 1331 - ELECTRONICS III (54 Hours)

Unit 1 Single Stage Transistor Amplifiers (10 Hrs)

Amplifier Classifications - Common Base (CB), Common Emitter (CE) and Common Collector (CC) Amplifier : Gains and Characteristics - Comparison of Amplifier Configurations - Classification of Amplifiers Based on Biasing Conditions - Class A Amplifier - Transformer Coupled Class A Amplifier - Class B Amplifier - Class B Push Pull Amplifier - Cross Over Distortion - Complimentary Symmetry Push Pull Class B Amplifier - Class C Amplifier - Distortion in Amplifiers - Noise

Unit 2 Multi Stage Amplifiers (9 Hrs)

Amplifier Coupling - RC Coupled Two Stage Amplifier - Impedance Coupled Two Stage Amplifier - Transformer Coupled Two Stage Amplifier - Direct Coupled Two Stage Amplifier Using Similar Transistors - Direct Coupled Two Stage Amplifier Using Complimentary Symmetry of Two Transistors - Darlington Pair - Differential Amplifier.

Unit 3 Decibels and Frequency Response (3 Hrs)

Decibel System - Frequency Response - Cut off Frequencies - Alpha and Beta Cut off Frequencies - Gain Bandwidth Product.

Unit 4 Feedback Amplifiers (4 Hrs)

Feedback Principle - Types of Feedback - Negative Feedback and its Properties - Forms of Negative Feedback.

Unit 5 Field Effect Transistors (7 Hrs)

FET - JFET: Structure, Theory of Operation and Characteristics - JFET Parameters - MOSFET - DE MOSFET and E only MOSFET: Working and Characteristics - FET Applications.

Unit 6 Breakdown Devices (6 Hrs)

Unijunction Transistor (UJT) - UJT Relaxation Oscillator - Silicon Controlled Rectifier (SCR) - Triac - Diac - Silicon Controlled Switch.

Unit 7 Sinusoidal Oscillators (8 Hrs)

Difference between Amplifier and Oscillator - Classification of Oscillators - Types of Sinusoidal Oscillations - Oscillatory Circuit and its Frequency - Essentials of Transistor LC Oscillator - Barkhausen Criterion for Oscillator - Tuned Base Oscillator - Tuned Collector Oscillator - Hartley Oscillator - Colpitt's Oscillator - Clapp Oscillator - Phase Shift Oscillator - Wien Bridge Oscillator - Crystal Controlled Oscillators.

Unit 8 Nonsinusoidal Oscillators (7 Hrs)

Nonsinusoidal Waveforms - Classification of Nonsinusoidal Oscillators - UJT Sawtooth Generator - Multivibrators - Astable Multivibrator - Monostable Multivibrator - Bistable Multivibrator - Schmitt Trigger - Transistor Blocking Oscillator.

Books of Study

1. Basic Electronics Solid State – B. L. Theraja, S. Chand & Co. Ltd.
2. Principles of Electronics – V. K. Mehta.

Semester 4
EL1431 - Electronics IV (54 hours)

Unit 1 Modulation and Demodulation (9 Hrs)

Radio frequency spectrum – need for modulation – modulation- methods of modulation – amplitude modulation(AM) - percent modulation – upper and lower side frequencies – mathematical analysis of modulated carrier wave – power relations in AM wave –forms of amplitude modulation – methods of amplitude modulation - methods of amplitude modulation – modulating amplifier circuit - Frequency Modulation (FM) – frequency deviation and carrier swing – modulation index, deviation ratio and percent modulation –FM sidebands – modulation index and number of sidebands – Demodulation – essentials for am detection –diode detector for AM signals – transistor detector for AM signals –FM detection – frequency conversion – super heterodyne AM and FM receivers – comparison between AM and FM.

Unit 2 Integrated Circuits (7 Hrs)

Integrated circuit – advantages and drawbacks – scale of integration – classification of ICs by structure and function – linear integrated circuit – digital integrated circuit – IC terminology-

fabrication of monolithic ICs – fabrication of IC components – application of ICs –OP-AMP – ideal operational amplifier – Op-Amp applications (linear amplifier, unity follower, adder, subtractor, integrator, differentiator and comparator)

Unit 3 Number Systems (6 Hrs)

Number systems – decimal number system – binary system – binary to decimal conversion – binary fractions – Double- Dadd method – decimal to binary conversion – binary operations (addition, subtraction, multiplication and division) complement of a number – 1's complemental subtraction - 2's complemental subtraction – octal number system – octal to decimal and decimal to octal conversion – octal to binary and binary to octal conversion – advantages of octal number system – hexadecimal number system – binary to hexadecimal and hexadecimal to binary conversion.

Unit 4 Logic Gates (7 Hrs)

Positive and negative logic – the OR gate – equivalent relay circuit of an OR gate – diode OR gate – transistor OR gate – three input OR gate – Exclusive OR gate – AND gate – equivalent relay circuit of an AND gate – diode AND gate – transistor AND gate – the NOT gate – equivalent circuit for a NOT gate – Bubbled gates – the NOR gate – NOR gate is a universal gate – the NAND gate – NAND gate is a universal gate – the XNOR gate – Adders and Subtractors - Half Adder – Full Adder – parallel binary adder – Half Subtractor – Full Subtractor.

Unit 5 Boolean Algebra (3 Hrs)

Unique features of Boolean Algebra – laws of Boolean Algebra – equivalent switching circuits – De Morgan's Theorems

Unit 6 Logic Families (6 Hrs)

Important Logic Families - Saturated and Non Saturated Logic Circuits - Characteristics of Logic Families - RTL Circuit - DTL Circuit - TTL Circuit - ECL Circuit - I^2L Circuit - MOS Family - PMOS, NMOS and CMOS Circuits.

Unit 7 Transducers (8 Hrs)

Transducers and its Classification - Resistive Position Transducer - Resistive Pressure Transducer - Inductive Pressure Transducer - Capacitive Pressure Transducer - LVDT - Piezoelectric Transducer - Strain Gauge - Temperature Transducers - Resistance Temperature Detectors - Thermistors - Thermocouples - Various Types of Microphones - Loudspeaker.

Unit 8 Electronic Instruments (8 Hrs)

Analog and Digital Instruments - Essentials of an Electronic Instrument - The Basic Meter Movement - Characteristics of Moving Coil Meter Movement - Conversion of Basic Meter to DC Ammeter and DC Voltmeter - Loading Effect of Voltmeter - Ohmmeter - Multimeter - Electronic Voltmeters - Direct Current VTVM - Cathode Ray Oscilloscope - Cathode Ray Tube - Deflection Sensitivity of CRT - Lissajous Figures and Frequency Determination - Applications of CRO - Q Meter.

Books of Study

1. Basic Electronics Solid State – B. L. Theraja, S. Chand & Co. Ltd

2. Principles of Electronics – V. K. Mehta.

Semester 1 (Polymer chemistry Main)
PY1131.7–Mechanics and fluid dynamics (36 hours)

Unit I (18 hours)

Dynamics of rigid bodies (8 hours)

Theorems of M.I with proof -Calculation of M.I of bodies of regular shapes- rectangular lamina, uniform bar of rectangular cross section, circular disc, annular ring solid cylinder, solid sphere- spherical shell, K.E of a rotating body-

Oscillations and waves (10 hours)

Examples of S.H oscillator- oscillations of two particles connected by a spring, vibration state of a diatomic molecule- wave motion-general equation of wave motion-plane progressive harmonic wave - energy density of a plane progressive wave-intensity of wave and spherical waves, superposition principle-

Unit II (18 hours)

Mechanics of solids (8 hours)

Bending of beams-bending moment-cantilever-beam supported at its ends-and loaded in the middle-uniform bending-experimental determination of Y using the above principles with pin and microscope-twisting couple on a cylinder-angle of twist and angle of shear- Torsional rigidity (Qualitative study)

Surface Tension (5hours)

Excess of pressure on a curved surface- force between two plates separated by a thin layer of liquid-experiment with theory to find surface tension of a liquid by Jaeger' method- temperature dependence of surface tension.

Viscosity (5 hours)

Equation of continuity, Bernoulli's theorems- venturimeter, - Flow of liquid through a pipe - derivation of Poiseuille's formula-limitations – variation of viscosity with temperature-Stokes formula-

Books for study:

1. Mechanics: J. C. Upadhyaya, Ram Prasad & Sons
2. Oscillations & Waves: K. RamaReddy, S. Badami &V.Balasubramaniam (University Press)

Semester 2 (Polymer chemistry Main)
PY1231.7 – Thermal Physics (36 hours)

Unit I – Behaviour of real gases (4 hours)

Joule Thomson effect- Theory and experiment, Phase transition- first order and second order- liquid helium-super fluidity

Unit II – Transmission of Heat (14hours)

Thermal conductivity and thermometric conductivity-Lee's disc experiment Weidmann and Franz law (statement only) -Radiation of heat-black body radiation - absorptive power-emissive power-Stefan's law (no derivation) -energy distribution in the spectrum of black body and results-Wien's displacement law -Rayleigh-Jeans law - their failure and Planck's hypothesis-Planck's law-comparison-solar constant, temperature of sun.

Unit III – Thermodynamics (10 hours)

Isothermal and adiabatic processes-work done-isothermal and adiabatic elasticity Heat engines-Carnot's cycle -derivation of efficiency-petrol and diesel engine cycles-efficiency in these two cases-second law of thermodynamics-Kelvin and Clausius statements

Unit IV – Entropy (8 hours)

Concept of entropy-change of entropy in reversible and irreversible cycles-principle of increase of entropy-entropy and disorder-T-S diagram for Carnot's cycle-second law in terms of entropy-calculation of entropy when ice is converted into steam.

Books for Study:

1. The General Properties of Matter: F. H. Newman&V. H. L. Searle
2. Heat & Thermodynamics: N. Subramaniam& Brijlal, S. Chand & Co
3. Heat & Thermodynamics: W. Zemansky, McGraw Hill
4. Heat & Thermodynamics: C. L. Arora.

Semester 3 (Polymer chemistry Main)
PY1331.7 – Modern Optics and Electricity (54 hours)

Unit I (18 hours)

Interference (8 hours)

Analytical treatment of interference-theory of interference fringes and bandwidth Interference in thin films-reflected system-colour of thin films- Newton's rings-reflected system-measurement of wavelength and refractive index of liquid

Diffraction (10 hours)

Phenomenon of diffraction- classification-Fresnel and Fraunhofer diffraction Fresnel's theory of approximate rectilinear propagation of light-Fresnel diffraction at a straight edge Fraunhofer diffraction at a single slit, double slits. Plane transmission grating-determination of wavelength

Unit II (18 hours)

Polarization (10hrs)

Experiments showing the transverse nature of light-plane polarized light-polarization by reflection-Brewster's law-double refraction-Nicol prism-propagation of light in uni-axial crystals-positive and negative crystals-principal refractive indices-half wave plate and quarter wave plate-

elliptically and circularly polarized light-optical activity-Fresnel's theory and applications.

Laser and Fibre Optics (8 hours)

Principle of operation of laser-population inversion-optical pumping-ruby laser-applications of lasers -Light propagation in optical fibres-step index fibre-graded index fibre-single mode and multi-mode fibres (qualitative ideas only)

Unit III

Electricity (18 hrs)

EMF induced in a coil rotating in a magnetic field-peak, mean, rms and effective values of A.C. Ac circuits-AC through RC, LC, LR and LCR series circuits-resonance-sharpness of resonance-power factor and choke coil-transformers,

Electric motors principle of working Devices working with electric motors – electric fan wet grinder.

Books for Study:

1. A text book of optics – Brijlal & Subramaniam
2. Electricity and Magnetism – R. Murugeshan, S. Chand & Co. Ltd.
3. Electrical Technology B. L. Theraja, (Vol I & II)

Semester 4 (Polymer Science Main)

PY1431.7 – Atomic Physics and Electronics (54 hours)

Unit I Modern Physics (18 hours)

Basic features of Bohr atom model-Bohr's correspondence principle -vector atom model-various quantum numbers-magnetic moment of orbital electrons -electron spin-Spin-Orbit coupling-Pauli's exclusion principle-periodic table Atomic nucleus-basic of nucleus -charge, mass, spin magnetic properties moment- binding energy and packing fraction-nuclear forces-salient features-Radioactivity radioactive decay-decay laws-decay constant-half life and mean life-radioactive equilibrium-secular and transient equilibrium-measurement of radioactivity-

Unit II Superconductivity (8 hours)

Properties of superconductors-zero electrical resistance-Meissner effect-critical magnetic field-Type I and Type II superconductors-isotope effect-high temperature ceramic superconductors-applications of superconductors.

Unit III Quantum Mechanics (10 hours)

Inadequacies of classical physics-experimental evidences-evidences for quantum theory-Planck's hypothesis-foundation of quantum mechanics-wave function and probability density-Schrödinger equation-time dependent and time independent-particle in a potential box

Unit III (18 hours)

Electronics (18hours)

Current-voltage characteristics of a diode-forward and reverse bias-breakdown mechanism of p -n junction diode-Zener diode and its characteristics-half wave and full wave rectifiers-bridge rectifier-ripple factor, efficiency. Construction and operation of a bipolar junction transistor-transistor configurations-current components-transistor characteristics-DC load line-Q point-AC load line-transistor biasing-need for biasing-bias stabilization-biasing circuits-fixed bias, emitter feedback bias, voltage divider bias (qualitative study only).

Transistor amplifier-basic features of an amplifier-gain, input and output resistances-frequency response and band width-small signal CE amplifier-circuit and its operation

Books for Study:

1. Modern Physics – R. Murugeshan, S. Chand & Co. Ltd.
2. Principles of Electronics – V. K. Mehta.

COMPLEMENTARY PRACTICAL (PHYSICS)

(Common for all complementary subjects)

PY1432-Practical

List of Experiments (Minimum 18 experiments to be done)

1. Torsion Pendulum- n by torsional oscillations
2. Torsion Pendulum- n and I using equal masses
3. Fly Wheel
4. Cantilever- Y by pin and microscope method
5. Uniform bending- Y by pin and microscope
6. Symmetric bar pendulum - g and radius of gyration
7. Surface tension- capillary rise method
8. Coefficient of viscosity- capillary flow method
9. Specific heat-method of mixtures applying Barton's correction
10. Lee's disc- Thermal conductivity of cardboard
11. Melde's string- frequency of tuning fork
12. Method of parallax- optical constants of convex lens using
    i) mirror and mercury ii) mirror and water
13. Method of parallax- refractive index of liquid.
14. Spectrometer- A, D and n
15. Spectrometer- dispersive power of a prism
16. Spectrometer- Grating-normal incidence
17. Deflection and vibration magnetometer- M and B_h
18. Circular coil- magnetization of a magnet
19. Carey Foster's bridge - Resistivity

20. Potentiometer- Resistivity
21. Potentiometer- Calibration of ammeter
22. Mirror galvanometer- Current and Voltage sensitivity
23. Diode Characteristics (for Ge and Si diodes)
24. Half wave rectifier-Measurement of ripple factor with and without filter capacitor
25. Full wave rectifier- Measurement of ripple factor with and without filter capacitor

COMPLEMENTARY ELECTRONICS PRACTICAL
EL1432-Practical
List of Experiments (Minimum 18 experiments to be done)

1. Semiconductor diode (IN 4001/ IN 4007) characteristics; To
   (i) trace and construct the circuit,
   (ii)to draw the forward V-I characteristic curve and
   (iii) to determine the static and dynamic resistances of the diode at a particular operating point.

2. Zener diode characteristics: To (i) trace and construct the circuit, (ii) to plot the V-I characteristic under reverse biased condition and (iii) to calculate the dynamic resistance of the diode under reverse bias when conducting.

3. LED and photo diode characteristics: To (i) study the variations in resistance with varying current and (ii) to study the output characteristics of a photo diode.

4. Thevenin and Norton equivalent circuits: To (i) determine Thevenin's and Norton's equivalent circuits of Wheatstone's bridge and (ii) to verify the power transfer theorem.

5. R-C resonant circuits: To (i) study the input-output characteristics of an R -C circuit as a function of frequency and (ii) to study the square wave response of R-C circuits.

6. Transistor characteristics; CE configuration: (i) Construct the circuit, (ii) To plot the input characteristics (IB-VBE graph for constant V CE) and to calculate the dynamic resistance at an operating point, (iii) To study the output characteristics (IC-VCE graph for constant I B) and to calculate the output ac resistance, dc gain and ac current gain at a given operating point.

7. Transistor characteristics; CB configuration: (i) Construct the circuit, (ii) Plot the input characteristics (IE-VEB graph for constant VCB) and to calculate the dynamic resistance at an operating point, (iii) To study the output characteristics (IC-VCB graph for constant I C) and to calculate the output dynamic resistance, dc current gain and ac current gain at a given operating point.

8. FET characteristics: (i) Trace the circuit (ii) To plot the static drain characteristics of FET (iii) To calculate the FET parameters (drain dynamic resistance, mutual conductance and amplification factor at a given operating point).

9. Fixed-bias circuit with and without emitter resistor: (i) Trace the circuit (ii) To measure the Q-Point (IC and VCE) with and without emitter resistor RE. (iii) To note the variation of Q -point by increasing the temperature of the transistor in fixed bias circuit with and without emitter resistor (iv) To note the variation of Q-point by changing the base resistor in bias circuit with and without emitter resistor

10. Collector-to-base feedback bias circuit: (i) Trace the circuit (ii) To measure the Q-Point (IC and VCE) (iii) To note the variation of Q-point by increasing the temperature of the transistor

11. Potential -divider biasing circuit: (i) Trace the circuit (ii) To measure the Q-Point (IC and VCE) (iii) To note the variation of Q-point by increasing the temperature of the transistor (iv) To measure the operating point when one of the bias resistor changes

12. Half-wave rectifier: (i) To draw the input and output wave shapes (ii) To verify Vdc = Vm/p and ripple factor = 1.21 (Observe for different load resistances)

13. Full-wave rectifier – Centre tapped: (i) To draw the input and output wave shapes (ii) To verify Vdc = 2Vm/p and ripple factor = 0.482 (Observe for different load resistances)

14. Bridge rectifier: (i) To draw the input and output wave shapes (ii) To verify Vdc = 2Vm/p and ripple factor = 0.482 (Observe for different load resistances)

15. Filter circuits (shunt capacitor, LC and CLC filters): (i) To plot the output wave shapes with and without shunt capacitor (ii) To find the ripple factor with and without different filters

16. Single stage RC coupled amplifier: (i) To measure the Q-point (IC and VCE) (ii) To measure the maximum signal that can be amplified by the amplifier without clipping (iii) To measure the voltage gain at 1 KHz (iv) To plot the frequency response (v) To find the voltage gain for different values of load resistance

17. FET amplifier: (i) To measure the frequency response (ii) To measure voltage gain, BW and gain-BW product

18. Hartley oscillator: (i) Trace the circuit (ii) To measure the Q-point of the transistor (iii) To observe the output wave form and to measure the frequency of oscillations

19. Phase shift oscillator: (i) Trace the circuit (ii) To measure the frequency from the output wave form (iii) To observe the phase shift at different points

20. Clipping circuits: (i) To observe the output wave form corresponding to different clipping circuits

21. Clamping circuits: (i) To observe the output wave form corresponding to different clamping circuits

22. OP amp. - Inverting amplifier using IC 741 (i) Trace the circuit (ii) To construct an inverting amplifier using IC 741 and determine its voltage gain for different input voltage

23. OP amp. - Non inverting amplifier using IC 741 (i) Trace the circuit (ii) To construct a Non inverting amplifier using IC 741 and determine its voltage gain for different input voltage

24. OP amp. - Unity gain buffer using IC 741 (i) Trace the circuit and (ii) To construct a unity gain buffer using IC 741 and to find the voltage gain.