SRI DHARMASTHALA MANJUNATHESHWARA COLLEGE, UJIRE-574240

(Autonomous)
(Re-Accredited by NAAC at 'A' Grade with CGPA 3.61 out of 4)

DEPARTMENT OF PHYSICS

CBCS SYLLABUS

(With effect from 2020-21)

SRI DHARMASTHALA MANJUNATHESHWARA COLLEGE, UJIRE-574240

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DEPARTMENT OF PHYSICS

Syllabus of

Bachelor's Degree in Science
Subject: PHYSICS

(CHOICE BASED CREDIT SYSTEM)
2020– 2021 onwards

Approved in BOS meeting on

08-08-2020

Approved in Academics Council meeting held on

10-11-2020

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Preamble

Education plays enormously significant role in building of a nation. However, our present education system is churning out youth who have to compete locally, regionally, nationally as well as globally. The present alarming situation necessitates transformation and/or redesigning of system by introducing innovations but developing "learner-centric" approach, so that students depending upon their interest can choose inter-disciplinary, intra-disciplinary and skill-based courses.

The choice-based credit system not only offers opportunities and avenues to learn core subjects but also explore additional avenues of learning beyond the core subjects for holistic development of an individual.

The syllabus is so designed to provide knowledge, skill and an exposure to the application of physics. The student on graduation gets in the way of any course of higher education and also employable.

Advantages of the choice-based credit system:

- Shift in focus from the teacher-centric to student-centric education.
- CBCS allows students to choose inter-disciplinary, intra-disciplinary courses, skill oriented papers (even from other disciplines according to their learning needs, interest and aptitude) and more flexibility for students.

Programme objectives

- To enhance Subject knowledge of all branches of Physics with exposure to new and recent developments in Physics
- To develop Experimental skills/Communication and Learning skills
- To enable ICT exposure through computer simulation experiments/presentations
- To have Research exposure through SRPs
- To develop Additional skills in the field of interest through CC
- To develop Scientific approach in attitude and reasoning, creativity and innovative ideas
- To create Awareness on energy conservation/environment/cleanliness
- To develop Motivation on Nation development

Programme Specific Outcomes

PSO1: Apply knowledge for developing technology to ease the problems related to the society.

PSO2: Understand the physical laws, concerning the motion of bodies, under the influence of system of forces.

PSO3: Understand the relationship between matter and energy

PSO4: Demonstrate the understanding of the core theories & principles of Physics, such as mechanics, electromagnetism, thermodynamics, & quantum mechanics.

PSO5: Understand the concepts, terminologies, methodologies of Physics

PSO6: Understand the fundamental theory of nature at small scale & levels of atom & sub-atomic particles

PSO7: Relate the structure of atoms & subatomic particles

PSO8: Understand physical properties of molecules and crystal structure

PSO9: Apply suitable mathematical theories to understand the laws of Physics

COURSE- PATTERN AND SCHEME OF EXAMINATION

Core/ Elective	Paper Code	Title of the Paper	Instruction Hours	Duration of the Examination (Hrs)	Max. Marks			Credits
					Exam	IA	Total	
I Semester B.Sc.								
Group I	Theory BSCPHC131	Paper I	4	3	80	20	100	2
	Practical BSCPHP 132	Physics Practical I	3	3	40	10	50	1
Group II Elective	Theory BSCPHCE	BSCPHCE 133,134,135	2	2	40	10	50	1*
Total number of Credits for Core Subject in I Semester: 04								
II Semester B.Sc.								
Group I	Theory BSCPHC 181	Paper II	4	3	80	20	100	2
	Practical BSCPHP 182	Physics Practical II	3	3	40	10	50	1
Group II Elective	Theory BSCPHCE183	BSCPHCE 183,184,185	2	2	40	10	50	1*
Total number of Credits for Core Subject in II Semester: 04								
III Semester B.Sc.								
Group I	Theory BSCPHC 231	Paper III	4	3	80	20	100	2
	Practical BSCPHP 232	Physics Practical III	3	3	40	10	50	1
Group II Elective	Theory BSCPHCE 233	BSCPHCE 233,234,235	2	2	40	10	50	1*
Total number of Credits for Core Subject in III Semester: 04								
IV Semester B.Sc.								
Group I	Theory	Paper IV	4	3	80	20	100	2

	BSCPHC 281							
	Practical BSCPHP 282	Physics Practical IV	3	3	40	10	50	1
Group II open Elective	Theory BSCPHOE 283	BSCPHOE 283,284,285	2	2	40	10	50	1*
Total number of Credits for Core Subject in IV Semester: 04								
V Semester B.Sc.								
Group I	Theory BSCPHC 331	Paper V	3	3	80	20	100	2
Group I	Theory BSCPHC 332	Paper VI	3	3	80	20	100	2
	Practical BSCPHP 333	Physics Practical VI	4	3	80	20	100	2
Total number of Credits for Core Subject in V Semester: 06								
VI Semester B.Sc.								
Group I	Theory BSCPHC 381	Paper VII	3	3	80	20	100	2
Group I	Theory BSCPHC 382	Paper VIII	3	3	80	20	100	2
	Practical BSCPHP 383	Physics Practical VII	4	3	80	20	100	2
Total number of Credits for Core Subject in VI Semester: 06 and Total number of Credits for Core Subject in I-VI Semesters: 28								

SCHEME OF QUESTION PAPERS

Question paper scheme for I, II, III and VI Semester

Internal Assessment: 20 marks

Semester Examination 80 marks

PART A

Questions carrying 1 mark (8 out of 10) 1 x 8 = 8 marks

PART B

Questions carrying 2 marks (6 out of 8) 2 x 6 = 12 marks

PART C

UNIT I, II, III& IV

Internal choice for each unit

Questions carrying 1 x 4 = 4

1 x 7 = 7

Problem 1 x 4 =4

Total 15 x 4 = 60

Question paper scheme for V & VI semester

Internal Assessment: 20 marks

Semester Examination 80 marks

PART A

Questions carrying 1 mark (8 out of 9)1 x 8 = 8 marks

PART B

Questions carrying 2 marks (6 out of 9) 2 x 6 = 12 marks

PART C

UNIT I, II, III

Internal choice for each unit

Questions carrying 1 x 3 = 3

1 x 5 = 5

1 x 8 =8

Problem 1 x 4 =4

Total 20 x 3 = 60

QUESTION PAPER SCHEME FOR ELECTIVES

Total Marks : 50

Internal : 10

Semester Examination:40

PART A

Questions carrying 1 mark (4 out of 7) 1 x 4 =4

PART B

Questions carrying 2 marks (4 out of 6) 2 x 4 =8

PART C

Questions carrying 4 marks (4 out of 6) 4 x 4 =16

PART D

Questions carrying 6 marks (2 out of 3) 2 x 6 =12

B.Sc. (Physics) Course

Allotment of Marks for Practical for I, II, III&IV Semesters

(Max – 50)

a) Internal Assessment (Max. Marks 10)

Splitting: marks

Lab performance based on Continuous assessment : 05

Model practical examination after completing the minimum number of experiments : 05

Total Marks. : 10

b) Practical Examination

Practical Examination Paper of 3 hours duration paper (Max. Marks 40)

Formula	:	03
Setup/circuit/tabulation	:	04
Observations and no. of trials	:	10
Knowledge about the Experiment/Viva	:	05
Calculation and Graph	:	05
Result and accuracy with units	:	03
Class Record	:	10

Total Marks -Practical Exam 40 (Minimum marks for pass =14/40)

Class records shall be valued at the time of Practical Exam by the External Examiner in consultation with Internal Examiner.

Record marks:

Regularity and completing the minimum number = 05marks

Neatness / General impression = 05 marks

Total = 10 marks

Total Marks = Internal Assessment marks +Practical Exam

= Max.10 + Max. 40 = 50

Resolutions of BOS Physics (approved)

1. Question once given to the candidate during the practical examination should not be changed under any circumstances.
2. Practical record shall be valued by the external examiner in consultation with the internal examiner.
3. Practical examination answer scripts should be valued jointly by the external and internal examiners.
4. The candidates shall produce a certified practical record book while appearing for the practical examination.
5. Scientific calculators without programming facility are only allowed.
6. Each candidate has to use his/her own calculator at the time of practical examination.

B.Sc.(Physics) Course
Allotment of Marks for Practical for V &VI Semesters
(Max – 100)

a) Internal Assessment (Max. Marks 20)

Splitting:	marks
Lab performance based on Continuous assessment	: 10
Model practical examination after completing the minimum number of experiments	: 10
Total Marks.	: 20

b) Practical Examination

Practical Examination Paper of 3 hours duration paper (Max. Marks 40)

Formula	:	05
Circuit diagram / figure	:	05
Setup/circuit/tabulation	:	10
Observations and no. of trials	:	20
Knowledge about the experiment	:	10
Calculation and Graph	:	15
Result and accuracy with units	:	05
Total	:	70
Class Record	:	10
Total Marks -Practical Exam	: 80	(Minimum marks for pass =28 / 80)

Class records shall be valued at the time of Practical Exam by the External Examiner in consultation with Internal Examiner.

Record marks:

Regularity and completing the minimum number = 05 marks
Neatness / General impression = 05 marks
Total = 10 marks

Total Marks = Internal Assessment marks + Practical Exam
= Max. 20 + Max. 80 = 100

Resolutions of BOS Physics (approved)

1. Question once given to the candidate during the practical examination should not be changed under any circumstances.
2. Practical record shall be valued by the external examiner in consultation with the internal examiner.
3. Practical examination answer scripts should be valued jointly by the external and internal examiners.
4. The candidates shall produce a certified practical record book while appearing for the practical examination.
5. Scientific calculators without programming facility are only allowed.
6. Each candidate has to use his/her own calculator at the time of practical examination.

COURSE STRUCTURE AND CONTENTS

<table>
<tr><th>SEM.</th><th>I YEAR</th><th>II YEAR</th><th>III YEAR</th></tr>
<tr><td rowspan="2">Odd</td><td rowspan="2"><u>Physics Paper I</u>

Unit I: Mechanics I
Unit II: Waves and Acoustics
Unit III: Thermal Physics
Unit IV: Low temperature Physics

<u>Electives</u>
Bio Physics, Geo Physics and Medical Physics, Physics of Music and Gadgets, Remote sensing and GIS</td><td rowspan="2"><u>Physics Paper III</u>

Unit I: Optics I
Unit II: Electromagnetism
Unit III: Electronic devices
Rectification
Unit IV: Power Transmission

<u>Electives</u>
Mathematical and statistical Physics
Meteorological Techniques
Energy storage techniques</td><td><u>Physics Paper V</u>

Unit I: Atomic Physics
Unit II: Quantum Mechanics II
Unit III Condensed matter physics I</td></tr>
<tr><td><u>Physics Paper VI</u>

Unit I: Nuclear Physics I
Unit II: Condensed matter Physics II
Unit III: Analog Electronics</td></tr>
<tr><td rowspan="2">Even</td><td rowspan="2"><u>Physics Paper II</u>

Unit I: Mechanics II
Unit II: Properties of Matter
Unit III: DC circuits
Unit IV:AC Circuits

<u>Electives</u>
Fundamentals of Electronic and Electrical devices, Sound and Acoustic sketching, Basics of instrumentation</td><td rowspan="2"><u>Physics Paper IV</u>

Unit I: Optics II
Unit II: Photonics and Energy Concern
Unit III: Quantum mechanics I
Unit IV: Statistical Physics and radiation

<u>Open Electives</u>
Astrophysics and - renewable energy sources, Nano technology and applications, how things work.</td><td><u>Physics Paper VII</u>

Unit I: Molecular Physics
Unit II: Astrophysics and General theory of Relativity
Unit III: Digital Electronics</td></tr>
<tr><td><u>Physics Paper VIII</u>

Unit I: Nuclear Physics II
Unit II: Nuclear physics III, Environmental Physics
Unit III: Communication Electronics</td></tr>
</table>

CORE SUBJECT- I Semester
CODE NUMBER-BSCPHC131: - Paper-I
(4Hrs/week; Total 48Hrs)
MECHANICS-I, WAVES &ACOUSTICS, THERMAL PHYSICS AND LOW TEMPERATURE PHYSICS

Objectives:

- **To get the knowledge of basics of mechanics and waves propagation**
- **To understand basic concepts of thermodynamics**

COURSE OUTCOMES:

CO1. Understand the difference between scalars and vectors
CO2. Understand the working of a rocket/satellites/satellite launching
CO3. Learn conservation laws of energy and linear and angular momentum and apply them to solve problems
CO4. Study the concepts of rigid body dynamics
CO5. Understand origin/propagation and properties of sound and fundamentals of acoustics.
CO6. Understand the nature of calorimetric by specific heat of solids and law of Thermodynamics and entropy
CO7. Have a clear understanding about Reversible and irreversible process and also working of a Carnot engine/production of low temperature

UNIT - I

MECHANICS- I

Derivative of a vector: Derivative of A+B, A-B, A.B and A X B (mention only) Definition of instantaneous velocity and acceleration. Derivative of a planar vector of constant magnitude but changing direction. Planar motion- Radial and Transverse component of velocity and acceleration. Deduction of results of uniform circular motion.
3Hrs

Rotational dynamics of a rigid body: Angular momentum, Kinetic energy. Moment of Inertia and radius of gyration (Review). Theorem of moment of Inertia – Parallel and Perpendicular axes theorems with proof. ***Calculation of MI of regular shaped bodies - rectangular lamina, thin rod, circular disc (about different axes***). (Problems) **2Hrs**

Conservation Laws

(i)Law of conservation of linear momentum: Application: ***Motion of rocket-multistage rockets and their advantages*** Statement for mutually interacting systems. Centre of mass, reduced mass (Problems). **2Hrs**

(ii) Law of conservation of angular momentum: Statement-Relation between angular momentum and torque. Kepler's Laws, Law of areas. Central forces-Conservative force field. Conservative nature of central force field. **Examples for central force motion, uniform circular motion.** Simple harmonic motion (Problems) **3Hrs**

iii) Conservation of Energy: Definition of Potential Energy in a Conservative force field. Deduction of the principle of conservation of energy. *Applications*: **Vertical oscillations of the light loaded spring.**(Problems) **2Hrs**

UNIT - II

WAVES AND ACOUSTICS

Progressive waves: Differential equation of wave motion. Expression for velocity of longitudinal waves in a fluid. Longitudinal vibrations in a rod (Qualitative)Velocity of transverse vibrations in a string. Expression for frequency of fundamental and overtones. Shock waves. Dispersion of waves. Introduction to Fourier series (Qualitative).

4Hrs

Applied acoustics

Basics: Noise, Music, Musical Scale, Temperament and Cladney's figure.

Acoustics of Buildings: Reverberations time, Sabine's formula and requisites of good acoustics.

Ultrasonic and its applications: Introduction, Production – Magneto-striction and Piezoelectric oscillators, ***Applications-Sonar, Non-destructive testing-industrial and medical application.*** **Infrasonic and Applications** **6Hrs**

Recording& reproduction of sound: Methods Mechanical and electromagnetic recording-Hard disc, Optical recording (Digital CD, DVD, Blue Ray). Acoustic **measurements**: Pressure level, Intensity level, Power level, units–bel, decibel Sound field, ***Sound level meter-applications***

2Hrs

UNIT - III

THERMAL PHYSICS

Thermodynamics: First law of Thermodynamics, Heat engine, Carnot's engine, Carnot cycle. Efficiency of Carnot's engine. Reversibility of Carnot's engine. Second law of thermodynamics. Clausius' statement. Refrigerator-coefficient of performance. - (Review)

Otto cycle /engine efficiency, Diesel cycle / engine efficiency. ***Two stroke and four stroke engines-comparison,*** Clausius-Clapeyron first latent heat equation and applications (Problems) **5Hrs**

Entropy: Concept of entropy (Review). General expression for entropy of a perfect gas. Isothermal and adiabatic process in T-S diagram. Change in entropy in reversible and irreversible process in T-S Diagram. Entropy and disorder. Principle of increase of Entropy. Third Law of thermodynamics. (Problems)

Thermo-emf: Seebeck effect thermoelectric series, neutral temperature inversion temperature, Measurement of temperature, Thermo couple. **5Hrs**

Production and measurement of high temperature. Radiation pyrometer, infrared thermometry **2Hrs**

UNIT - IV

LOW TEMPERATURE PHYSICS

Physics of Low Temperature: Real and perfect gases, Concept of critical Temperature, Boyle temperature, Joule – Thomson effect, Porous Plug experiment – Expression for inversion temperature, principle of regenerative cooling, adiabatic demagnetization.

Cryogenics-Properties of liquid helium and Hydrogen-uses-Sterling's cryogenic engine in rocket fuel, (preparation of liquid helium, nitrogen, hydrogen) Problems.

Physics of low pressure: Production and measurement of low pressure - Rotary pump - **Diffusion pump**-principle, construction and working. **Ionisation gauge**-principle, construction and working

Measurement of low temperature: Exhaust pump and its characteristics, Exhaust pressure, Degree of vacuum attainable, Speed of pump, **12Hrs**

CODE NUMBER-BSCPHP 132: PRACTICALS-I

Note: A minimum of 8 experiments should be done

1. Torsion Pendulum- MI of irregular body
2. Fly wheel-MI and mass of the wheel
3. Verification of theorems of MI - Law of perpendicular axis
4. Frequency of ac using sonometer (Estimation of error)
5. Helmholtz resonator
6. Specific heat by cooling
7. Spiral spring
8. Speaker and microphone characteristics
9. Sonometer -unknown frequency by comparison method
10. Thermocouple-measurement of unknown temperature (MP/BP)
11. Simulation experiments

Skill oriented programme

Open ended experiments / Projects: Any One or Two of the following Experiments may be included

1. ***To study the conservation energy with a simple pendulum***
2. ***To study the factors [like area of surface, nature of surface, material of the container] on the rate of cooling of a liquid .***
3. ***Effectiveness of materials as heat insulators.***
4. ***To compare the effectiveness different materials as absorbers of sound***

Reference Books:

1. Fundamentals of Physics by Halliday and Resnick, Wiley Publication (10th edn 2013)
2. Mechanics by D.S. Mathur, S Chand Publication (2014)
3. Physics for degree students by C.L. Arora & Dr. P.S. Hemne, S Chand Publication (2014)
4. Properties of Matter by D.S. Mathur, S Chand Publication (2010)
5. Mechanics - J C Upadhyaya, Himalaya Publishing House Pvt. Ltd.; First Edition (2016)
6. Heat and thermodynamics –Brijlal & Subramanyam S Chand Publication (2001)
7. Heat and thermodynamics - D S Mathur, Sultan Chand & Sons (2008)
8. Heat and thermodynamics - M W Zemansky, Sears &Dittman, McGraw Hill Education; 8 edition(2017)
9. Thermal Physics - C Kittel& H Kroemer, W. H. Freeman; Second edition (1980).5
10. Numerical Problems in Physics, Subramanyam&BrijLal S Chand (G/L) & Company Ltd (2011)
11. Waves and Oscillations by A. P. French, CRC Press (1971)
12. Textbook of Heat and thermodynamics by J B Rajam
13. Fundamentals of Physics- R.Resnik,D. Halliday and Walker; Wiley 6ed(**2001**)

14. Physics-Classical and Modern, FJ Keller, E Gettys and J JSkove, McGraw Hill Second Revised Edition (**1993**)
15. Classical Mechanics-K N Sreenivasa Rao, Universities Press- Orient Longman (**2003** ed)
16. Concepts of Physics Vol (1)-H C Verma, BharathiBhavan Publishers, **2004** Edition
17. University Physics- F W Sears, M W Zemansky& H D Young, Pearson Education First ed.(**2014**)
18. Mechanics- Berkeley Physics Course Vol (1)- SI units CharlesKitteletal, McGrawHill Education (India) 2e (2011)
19. Newtonian Mechanics- A P French, Nelson & Sons UK, (**1971**)
20. Mechanics & Thermodynamics, G Basavaraju&Dipan Ghosh, McGrawHill Education (India) 1ed (**1985**)
21. Waves & Oscillations, P K Mittal & Jai DevAnand, HariAnand Publications Pvt Ltd (2011ed)
22. Heat and Thermodynamics- M MZemansky,McGrawHill Education (India) 8ed (**2011**)
23. Heat & Thermodynamics, MWZemansky&RHDittman, McGraw Hill Book company,Inc.US Seventh Revised edition(**1997**)
24. Heat, Thermodynamics &Stastical Mechanics, BrijLal&Subramanyam, S. Chand &Company,Delhi; (**2008** ed)
25. Thermodynamics & Statistical Physics, Sharma & Sarkar, Himalaya Publishing House, Third Edition (1991)
26. Thermodynamics, Kinetic theory & Statistical Thermodynamics, FWSears&GLSalinger, Narosa Publishing House (Third Edition **1998**)
27. Fundamentals of Classical Thermodynamics, Gordon J V Wylen& Richard E Sonntag, John Wiley Eastern Limited; 4th ed (**1994**)
28. Thermal Physics, S C Garg, R M Bansal & C K Ghosh, McGrawHill Education (India) Second ed (**2013**)

CORE SUBJECT-II SEMESTER
CODE NUMBER-BSCPHC-181: - PAPER II
(4Hrs/week; Total 48Hrs)

MECHANICS-II, PROPERTIES OF MATTER, DC AND AC CIRCUITS

Objectives:

- **To understand the basics of higher mechanics**
- **To have fundamental idea about properties of matter**
- **To enhance the knowledge on AC and DC electrical circuits**

COURSE OUTCOMES

CO1. Understand the negative result of Michelson Morley experiment, Galilean and Lorentz Transformation
CO2. Have Fundamental ideas of special theory of relativity such as length contraction and time dilation and mass –energy invariance
CO3. Have a clear idea behind satellite launching/applications
CO4. Study of bending behavior of beams and analyze the expression for young's modulus
CO5. Understand the concepts of surface tension and viscosity of fluid and their examples in nature
CO6. Apply network theorems to analyze a circuit
CO7. Apply maximum power transfer theorem to solve problems
CO8. Understand growth and decay of charge in CR circuit/current in LR circuit
CO9. Develop Ability to study ac circuits/resonance circuits

Unit - I

MECHANICS- II

Motion in inertial and non-inertial frames*:* Galilean transformation equations. Galilean principle of relativity. Galilean invariance of space and time. Pseudo force with examples. Uniformly rotating frames of reference. Significance of centrifugal force and Coriolis force with examples. (Problems) **4Hrs**

Special theory of relativity: Search for absolute frame of reference – ether hypothesis. Michelson Morley experiment. Significance of the null result. Constancy of speed of light. Postulates of special theory of relativity. Invariance of length Lorentz transformation (Qualitative)Length contraction. Relativity of simultaneity. Time dilation, velocity addition theorem. Einstein's mass energy equivalence- (derivation based on photon gun experiment). Relativistic expression for kinetic energy. Relation between energy and momentum. Rest mass of the photon.(Problems)

6Hrs

Elements of Satellite Motion: Orbital velocity. Time period of satellite-energy consideration and shape of orbits. Geostationary satellites. Effects of injection conditions. Escape velocity. Entry problems-perturbation of orbits. Remote sensing satellite. An overview Indian space programme (Problems) **2Hrs**

Unit - II

PROPERTIES OF MATTER

Mechanical properties of materials: Stress strain diagrams of materials. Necking and breaking strength. Elasticity and plasticity- graphical explanation. Creep, stress relaxation

and fatigue. Thermal effect on stress and strain, practical applications, Expression for thermal stress. Design considerations-allowable stress -factor of safety. Application of elasticity (materials). Resistance of bent beams, columns pillars, struts, critical load-different cases. (Problems) **4Hrs**

Properties of solids: Elastic moduli, Poisons ratio, Relation between q,K,n and σ, limiting values of σ (no derivation -mention only)Bending moment, I section girder, Theory of light cantilever. Twisting couple on a cylinder**,** Torsion pendulum. **3Hrs**

Properties of Fluids:

i)Surface Tension: Elementary ideas- (Review)Excess of pressure-inside liquid drop and liquid bubble. Work done in blowing the bubbles, Theory of drop weight method and interfacial tension Shape of drops. ***Variation of surface tension with temperature and impurity and contamination, Effect of evaporation and condensation*** (Problems). **3Hrs**

ii) Viscosity: Elementary ideas- (Review) Derivation of Poisseuille's formula for the rate of flow of the liquid. Brownian motion. Super fluidity. Viscosity of gases. (Problems). **2Hrs**

Unit - III

DC CIRCUITS

Transients: Growth and decay of current in a LR circuit- time constant. Charging and discharging in a CR Circuit- time constant. Oscillatory discharge of a LCR circuit Expression for the charge and current (Mention only) Condition for under damped, critically damped and over damped oscillations (Mention only) (Problems). **4Hrs**

Network Analysis: Simple circuit elements, Lumped and distributed elements, Passive and active elements, Node, branch, loop, path and mesh in an electrical network Ideal voltage source and Ideal current source. Source transformation (colour coding). Kirchhoff's current and voltage laws Network theorems - Superposition theorem, Thevenin's and Norton's theorems, Maximum power transfer theorem. ***Applications- Impedance matching in electronic circuits.***(Problems). **8Hrs**

Unit- IV

AC CIRCUITS

Expression for the RMS value of voltage and currents, j - operator principles of superposition and phasor analysis. Response of LR, CR and LCR circuit to sinusoidal voltages using j-operators. Series and parallel resonance circuits –resonance frequencies- expression for the 'Q' factor, bandwidth – expression for the power.
Filters: High and low pass filters using CR and LR circuits, frequency response curves, cut - off frequency, qualitative study of band pass filters. (Problems). **12Hrs**

CODE NUMBER-BSCPHP 182: PRACTICAL-II

Note: A minimum of 8 experiments should be done.

1. q-by cantilever bending
2. Searle's double bar- determination of q, n and σ
3. Interfacial tension (Estimation of error)
4. CR circuit- charging and discharging
5. Verification of Thevenin's and Norton's theorems

6. Low pass and High pass filters
7. n- by Static torsion
8. q- by cantilever Oscillation
9. Comparison of viscosity of two liquids -Oswald's viscometer-(density using Hare's apparatus)
10. LR Circuit-transient response using CRO
11. Verification of Superposition theorem.
12. Simulation experiments

Skill oriented programme

Open ended experiments / Projects: Any One or Two of the following Experiments may be included

1. ***To determine the q of different materials (Or Types of wood) by using them as cantilevers***
2. ***To compare the Young's modules of different specimen of rubber and compare them***
3. ***To study the effect of nature of surface on emission and absorption of radiation***
4. ***Viscosity for different liquids by capillary flow method or study of variation with temperature***

Reference Books:

1. Fundamentals of Physics by Halliday and Resnick, Wiley Publication (10th edn 2013)
2. Mechanics by D.S. Mathur, S Chand Publication (2014)
3. Physics for degree students by C.L. Arora & Dr. P.S. Hemne, S Chand Publication (2014)
4. Properties of Matter by D.S. Mathur, S Chand Publication (2010)
5. Mechanics - J C Upadhyaya, Himalaya Publishing House Pvt. Ltd.; First Edition (2016)
6. Selected topics in Physics (COSIP)
7. Fundamentals of Physics by Halliday, Resnick and Walker, Wiley Publication (10th edition 2013)
8. Properties of matter By Brijalal &Subrahmanyam, S Chand (2002)
9. A treatise on general properties of matter, Sengupta and Chatterjee, New Central Book Agency Pvt Ltd, Calcutta (7th Revised edition -2010)
10. College Physics N Sunderajan, United Publisher
11. Mechanics by J C Upadhyaya, Himalaya Publishing House Pvt. Ltd.; First Edition edition (2016)
12. University text book
13. Introductory to Circuit Analysis – Robert Boylested, Pearson Education India, 2007

CORE SUBJECT-III Semester
CODE NUMBER-BSCPHC 231 -PAPER -III
(4Hrs/week; Total 48Hrs)
OPTICS-I, ELECTROMAGNETISM, ELECTRONIC DEVICES, POWER TRANSMISSION

Objectives:

- **To understand the basic principles in optics**
- **To study the theories in electro magnetism**
- **To understand the working of basic electronic devices**
- **To gain the knowledge on power transmission**

COURSE OUTCOMES

CO1. Study the electric field using coulomb's inverse square law in electrostatics of current
CO2. Understand Faraday's laws of electromagnetic induction by Rayleigh's method
CO3. Analyze the value of Maxwell equation- boundary conditions
CO4. Study the theory and experiment of interference using air wedge, newton's rings and Michelson interferometer
CO5. Understand the basic principle of laser and characteristics
CO6. Understand the current voltage characteristics of semiconductor devices,
CO7. Explain the basic concepts of Semiconductor diodes such as p-n junction diode, characteristics, DC load line, and Zener diode.
CO8. Understand working of rectifier circuits such as Full and half wave rectifiers.
CO9. Understand power generation. Different types of transmission

UNIT - 1

OPTICS-I

Interference of Light: Division of wave front-examples-Biprism and Lloyd's mirror. Expression for band width (mention) and determination of λ using biprism. Division of amplitude Theory of interference at a thin transparent film by reflected light. Colour of thin films. Interference at an air wedge. Fringes of equal thickness, expression for fringe width. Theory of Newton's rings with reflected light-experiment to determine wavelength of light and refractive index of a liquid. ***Application of interference in lens coating***. (Problems) **6Hrs**

Lasers: Types of electron emission-population inversion Stimulated emission, Derivation of Einstein's coefficients A and B-Characteristics of LASER, He-Ne gas laser, semiconductor laser, Nd-Yag laser, laser applications in holography, communication, ***optical media - CD and DVD writing /reading and Photonics and medical applications*.** **6Hrs**

UNIT II

ELECTROMAGNETISM

Scalar and Vector Fields: Scalar and Vector fields with examples. Gradient of a Scalar Field and its Geometrical Interpretation. Vector integration: line integral, surface integral, volume integral. Divergence and Curl of a Vector Field-physical significance.

Electric Potential: Line Integral of Electric Field. Conservative Nature of Electrostatic Field. Relation between **E** and V.

Gauss's law in Differential form. Applications of Gauss's Law: **E** due to (1) an Infinite Line of Charge, (2) a Charged Cylindrical Conductor, Stokes' theorem. (Problems) **4Hrs**

Electromagnetic Theory: Equation of continuity, polarization of dielectric materials. Mention of Maxwell's field equations-concepts of displacement current. Field equations in a medium-wave equation for field vectors and deduction of the expression for velocity. Relation between refractive index and permittivity. Statement and significance of Poynting's vector. Transverse nature of E.M. waves**.** **5Hrs**

Dispersion: Normal and Anomalous dispersions, Mention of Cauchy's Formula-for Normal dispersion-Cauchy's Constants. (Problems) **1Hr**

Application of electromagnetism-*Loud speakers, Piezo Buzzer. Microphones, Condenser Microphone, Microwave Generators-Magnetrons, Klystrons and waveguides- Applications in induction heaters. Microwave Ovens &Communications*.

2Hrs

UNIT III

ELECTRONIC DEVICES

Rectification-Full wave bridge rectifier, expression for efficiency, ripple factor, percentage regulation, filters - Capacitor filter, LC filter and ∏ filter-Problems

Zener diode- Avalanche and zener break down. Working of Zener diode, forward and reverse bias characteristics curves –Applications **5Hrs**

Optoelectronic devices: Working, characteristic curves and applications of Photo diode, Photo transistor, Photo conductor (Photo resistor-LDR), LED and Solar cell. LCD-Action and applications.

BJT (NPN)-. Definition of Alpha and Beta, Biasing – Fixed bias and its drawback, Voltage divider bias. (Problems)

SCR- working and characteristics curves

JFET - working, characteristics curves. Comparison of BJT and JFET.

MOSFET – types -enhancement and depletion –working MOSFET characteristics curves **Integrated circuit (IC):** ***Fabrication of small circuits.***

7Hrs

UNIT IV

POWER TRANSMISSION

Power Transmission: Types-Principle of three phase power generation and transmission-its advantages. Energy loses in generation and transmission and methods of reducing them. Step up and step-down transformers-expression for output voltage- Star and delta connections. Line and phase voltage-Line and phase current, relation between them, eddy currents, ***Theory of induction motor- Squirrel cage rotor, power factor in an A.C-Measurement of Power***

Amplifiers used in communication: Classes and types of amplifiers, AF, IF, RF and power amplifiers **12Hrs**

CODE NUMBER-BSCPHP 232: PRACTICAL-III

Note: A minimum of 8 experiments should be done.

1. Bi prism – determination of wavelength of sodium light
2. Air wedge – determination of thickness of paper strip
3. Newton's rings – determination of R
4. LASER line width and beam divergence
5. Study of LED characteristics and determination of Planks constant h
6. Zener diode as voltage regulator
7. Study of transistor characteristics (CE Mode)
8. Transistor as a switch
9. Simulation experiments
10. Study of SCR Characteristics
11. Study of Photo diode/ Photo transistor characteristics
12. Measurement of Cauchy's constants

Skill oriented programme

Open ended experiments/ Projects: Any one or two of the following experiments may be included

1. ***Variation of reverse current in a diode as a function of temperature***
2. ***Study of transistor characteristics (CB/ CC Mode)***
3. ***Maintenance of laboratory equipment***
4. ***Familiarization of color code of resistors/capacitors***

Books for reference:

1. Fundamentals of Optics – Jenkins and White, Tata McGraw-Hill Education, 1937
2. Optics – Khanna and Gulati, R. Chand, 1984
3. A Text Book of Optics – B K Mathur, Gopal Printing, 1967
4. A Text Book of Electro Magnetism – Khan Academy, Faculty Press (1993)
5. Laser Fundamentals – Silfvast WT, Cambridge University Press; 2 edition (2008)
6. Optics by Subramnya&Brijlal, S Chand; 23rd Rev. Edn. 2006
7. Physics for degree students By C L Arora & P S Hemne, S Chand Publication (2014
8. Modern Physics by R. Murugeshan and KiruthigaSivaprasath, S Chand (2010)
9.Laser fundamentals- Silfvast W T; Cambridge university press (India)
10.Electricity and magnetism – E M Purcell, Cambridge University Press, 2013
11. Elements of Electromagnetism – Mathew and N O Sadiku, Oxford University Press, 2018
12. Introductory to Circuit Analysis – Robert Boylested, Pearson Education India, 2007
13. Electricity and magnetism – D C Tayal, Himalaya Publishing House, 1989
14. Electric Devices & circuits, 8th Edn – Boylested&Nashelsky, Pearson Education India, 2009
15. Electronic Devices, 6th Edn – Floyd, Prentice Hall, 12-Sep-2012
16. OP-AMPS and Linear Integrated Circuits, 3rd Edn – RA Gayakwad, Regents/Prentice Hall, 1993
17 Operational Amplifiers & Linear Integrated Circuits, 6th Edn. – RF Coughlin & FF Driscoll, Prentice Hall, 2001
18. Operational Amplifiers & Linear ICs, 2nd Edn – David A Bell, Oxford University Press; 2 edition, 2007
19 Basic electronics by Tereja
20.Fundamentals of electronics by V K Mehta
21.Basic electronics solid state by B.L. Theraja, S Chand 2006

22. Foundations of electronics 2nd Edn by D. Chattopaddhyay, P.C. Rakshit, B. Saha, N.N. Purkait, New Age International Private Limited, 2014
23. Modern Physics by R. Murugeshan, S Chand, 2010 8. Refresher course in physics Volume III by C. L. Arora, S Chand & Company, 1999

CORE SUBJECT-IV Semester
BSCPHC 281-PAPER-IV
(4Hrs/week; Total 48Hrs)

OPTICS-II, PHOTONICS, ENERGY CONSERVATION AND QUANTUM MECHANICS –I, STATISTICAL PHYSICS

Objectives:

- **To understand the basic concepts of optics**
- **To get the knowledge on working of optical fibres in communication**
- **To understand the techniques of conservation of energy**
- **To study basics of quantum mechanics**

COURSE OUTCOMES

CO1. Understand the principles of optics and Study the theory and experimental part of diffraction by Fresnel's and Fraunhofer methods
CO2. Study the theories for production of polarization of light
CO3. Understand the application part of optical fiber into communications systems
CO4. Learn the techniques of conservation of energy and production of energy by non-conventional methods
CO5. Understand the concepts of quantum mechanics/matter waves
CO6. Gain a clear knowledge about wave properties of particles, De Broglie waves and its implications on the uncertainty principle
CO7. Study the concept of uncertainty principle
CO8. Be able to use thermal and statistical principles in a wide range of applications.
CO9. Become familiar with Blackbody radiation, Quantum theory of radiation

UNIT I

OPTICS-II

Diffraction of Light: Fresnel and Fraunhofer diffraction. Concept of Fresnel's theory of half period zones-rectilinear propagation of light. Fresnel diffraction-zone plate. Comparison between zone plate and convex lens. Cylindrical wave front- diffraction at straight edge (Qualitative). Fraunhofer diffraction by a single slit- diffraction maxima and minima. Theory of plane diffraction grating-normal incidence and minimum deviation methods. Dispersive power of a grating. Resolving power of a grating. Comparison of prism spectra and grating spectra. (Problems) **6Hrs**

Polarization: (Plane of vibration and polarization. Double refraction. Optic axis. Principal section of a uniaxial crystal brief discussion). Huygens's theory of double refraction-oblique incidence - (optic axis in the plane of incidence, parallel to the surface and perpendicular to the surface). Principal refractive indices of doubly refracting crystals. Propagation of plane waves in uniaxial crystal (Qualitative). Theory of retarding plates-half wave plate and quarter wave plate.Babinet compensator,Production and analysis of different types of polarized light-analytical treatment.

Optical Activity: Fresnel's Theory. Biquartz,Rotatory dispersion, polarimeter using Biquartz. (Problems). **6Hrs**

UNIT II

PHOTONICS

Fibre optics-Introduction, principle of working, critical angle of propagation, acceptance angle, and fractional refractive index change, Numerical aperture, Condition for propagation, Modes of propagation and v number. Types of Optical Fibres-Index profile. Single mode step-index optical fibre, multimode step- index fibre, graded index fibres, advantages and disadvantages, Attenuation in optic fibres-Types, Bit rate, dispersion and optical bandwidth. Point to point transmission-Block diagram of optical fibre communication, nonlinear optics .(Problems)

New frontiers of energy and energy conservation: Energy crisis, energy alternatives-Solar, Wind, Bio gas, Tidal, Geo thermal energy. Energy conservation techniques in electrical devices. Renewable and non-renewable energy sources. Environmental pollution: air, water, soil and noise pollution. Radiation in environment: Nuclear hazards and human health risks. **8Hrs**

Atom Laser- Introduction, Bose-Einstein condensation, methods of cooling atoms, Basic atom laser, difference between atom laser and optical laser, Applications. **4Hrs**

UNIT III

QUANTUM MECHANICS–I

Limitations of Classical theory &Evidence in support of quantum theory: Photoelectric effect, Einstein's equation. Compton Effect – expression for Compton shift. (Using relativistic expressions for momentum and energy).

Wave properties of particles. De-Broglie waves, experimental verification by Davisson and Germer. Principle of electron microscope. Uncertainty principle, Gamma ray microscope. Three sets of uncertainty relations. Application of uncertainty relation- Estimation of width of spectral lines, impossibility of the existence of electron inside the nucleus. (Problems)

12Hrs

UNIT IV

STATISTICAL PHYSICS

Phase space, Macro state and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann law - distribution of velocity -Quantum statistics - Fermi-Dirac distribution law - Fermi sphere and Fermi energy, Fermi gas, - Bose-Einstein distribution law - photon gas - comparison of three statistics. of Fermi-Dirac Distribution to White dwarfs and Neutron stars.

Macroscopic and Microscopic descriptions, Ensembles, Probability; Thermodynamic probability, Boltzmann's theory on Entropy and Probability, Fundamental postulates of statistical mechanics, statistical equilibrium, quantum statistics. **8Hrs**

Radiation:

Distribution of energy in the black body spectrum. Stefan-Boltzmann law of radiation. Derivation of Planck's law. Deduction of Wien's law and Rayleigh- Jean's law from Planck's law. Stefan's law, Measurement of radiation-Bolometric method –Photoconductive and photovoltaic method, Radiation pressure(qualitative)

4Hrs

CODE NUMBER- BSCPHP 282:PRACTICALS-IV

Note: A minimum of 8 experiments should be done

1. Diffraction Grating-Minimum deviation
2. Diffraction at a straight wire
3. Particle size-diffraction using LASER
4. Polarimeter-Specific Rotation of sugar solution
5. Babinet compensator
6. Monte-Carlo experiment
7. Study of Characteristics of optical fiber using OFC Kit.
8. Study of solar cell characteristics
9. Series resonance-LCR Circuit
10. Stefan's Boltzmann law verification by Bridge method
11. Brewster's angle measurement using LASER
12. Resolving power of Grating
13. Diffraction Grating-Normal incidence method
14. Verification of Maximum power transfer theorem
15. Construction of Full wave rectifier using bridge rectifier and study of effect
16. *Simulation experiment*

Skill oriented programmes:

Open ended experiments / Projects: Any One or Two of the following Experiments may be included

1. ***Measurement of Wavelength of Laser(violet/blue/green/red) using diffraction grating***
2. ***Diffraction at a single slit using two razor blades and measurement of wavelength of light***

Suggested activities:

1. ***Field visit to fiber optics communication systems.***

Reference books

1.Concepts of Modern Physics 6th Edn. – Arthur Beiser, Tata McGraw-Hill Education, 2003
2. Introduction to Atomic and Nuclear Physics 5th Edn – Semat& Albright, Springer Science& Business Media, 2012
3. Modern Physics – Kenneth S Krane, Wiley, 2012
4. Fundamentals of Molecular spectroscopy, 4th Edn – Banwell, Tata McGraw-Hill Education, 1994
5. Quantum Physics – A P French, Routledge, 2018
6. Quantum Physics, Vol IV – E Wichman, Berkeley Physics Course, Tata McGraw-Hill Education
7. Quantum Physics – Gasorovicz, Wiley, 1995
8. Modern Physics – Murugeshan, Chand, 1997 9. Quantum Physics - G Aruldhas, PHI Learning Pvt. Ltd., 2008
9. Elementary solid state physics by M Ali Omar, Pearson Education India, 1975
10. Modem physics by J Bernstein, P.M. Fizhbane, S. Gasiorowicz, Prentice Hill, 2000
11. Modem physics by S.R. ShankaraNarayana, New Age Internationals; First edition, 1992
12. Modern Physics by R. Murugeshan, S Chand, 2010 8. Refresher course in physics Volume III by C. L. Arora, S Chand & Company, 1999
13.Fundamentals of Optics – Jenkins and White, Tata McGraw-Hill Education, 1937.
14. Optics – Khanna and Gulati, R. Chand, 1984

15. A Text Book of Optics – B K Mathur, Gopal Printing, 1967
16.Nonconventional energy resources-G D Pai-Khanna Publications new
17. Frontiers
18.Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
19.Solar energy - M P Agarwal - S Chand and Co. Ltd.
20.Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
21.Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004,
22.Oxford University Press, in association with The Open University.
23.Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009
24. Heat and Thermodynamics and stastical physics by Brijlal Subramanyam
25. Laser electro optics by C C Devis
26.Methods of experimental Physics BY CL Tang-volume 15
27. Solid state physics 6th Edn by S.O. Pillai, New Age International, 2006

CORE SUBJECT-V Semester
CODENUMBER -BSCPHC 331: PAPER V
(3Hrs/week; Total 48Hrs)
ATOMIC PHYSICS, QUANTUM MECHANICS- II, CONDENSED MATTER PHYSICS-I

Objectives:

- **To study the basic principles in atomic physics**
- **To understand the concepts in Quantum mechanics**
- **To have a knowledge on condensed matter physics**

COURSE OUTCOMES

C01. Expected to gain knowledge of superconductivity, its underlying principles and its applications in modern world
C02. Become familiar with molecular Atomic spectroscopy and have gained basic ideas regarding Stern Gerlach experiment. Zeeman effect etc.
C03. Learn to develop Schrodinger's wave equations
CO4. Understand the concepts of Eigen values and functions and linear operators
CO5. Understand the concepts of specific heat, Einstein's theory
CO6. Learn in details free electron theory of metals
CO7. Learn the technique of determination of e/m by Thomson's method

UNIT I

ATOMIC PHYSICS

Motion of charged particle in electric and magnetic fields. e/m of electron by Thomson's method. Charge of the electron by Millikan's oil drop experiment. **4Hrs**

Atomic Spectra: Review of atom models, vector atom model, space quantization, quantum numbers l and m_l, electron spin – quantum numbers s and m_s. Pauli's exclusion principle. Spectroscopic notation of energy levels of single and two electron systems. L-S and J-J coupling schemes. Magnetic moment due to orbital motion, magnetic moment due to spin motion. Total magnetic moment. Stern- Gerlach experiment- experimental procedure and interpretation of result. Spin-orbit coupling. Expression for the spin orbit interaction energy (qualitative). Fine structure. Separation of sodium lines. Normal Zeeman effect, Expression for Normal Zeeman effect, Expression for Zeeman shift (on the basis of vector atom model) determination of e/m of electron using Zeeman effect, Anomalous Zeeman effect (qualitative). (Problems) **12Hrs**

UNIT II

QUANTUM MECHANICS- II

Classical mechanics as an approximation of quantum mechanics. Wave function, need to represent wave function in a complex form, Properties of wave function. Setting up of time dependent Schrodinger wave equation. To arrives at the time independent wave equation. Expectation values. Eigen values and Eigen functions. Normalization of wave functions. Solution of Schrodinger equation i) for a free particle ii) a particle in a box of infinite barrier. Graphs of Ψ and $I\Psi I^2$- tunneling effect. Extension to three-dimensional box. Expression for energy of linear harmonic oscillator (Mention only), zero-point energy. (Problems)

10Hrs

Linear Operators: Hermitian and unitary. Eigen values and Eigen vector of Hermitian operators. Expectation values of operators, Normalization of Eigen functions, orthogonality. **6Hrs**

UNIT III

CONDENSED MATTER PHYSICS-I

Superconductivity: Discovery, Experimental observations- transition temperature, critical field, critical current, Meissner effect, Isotope effect, Type I and Type II super conductors, Josephson effect. BCS Theory. High temperature superconductivity. Applications of superconductivity- Production of high magnetic field. Role of ceramic materials. **4Hrs**

Specific Heat of Solids: Molar specific heat, Dulong –Pettit's law, its limitations, Einstein's theory of specific heat at low and high temperatures, its limitations, Debye's theory of specific heat at low and high temperatures assuming the modes of vibration in the frequency interval γ and $\gamma + d\gamma$, its limitations, concept of phonons comparison of Einstein's and Debye theories (Problems) **6Hrs**

Free electron theory of metals: Lorentz –Drude model. Concept of free electron, explanation of electrical resistance, expression for electrical conductivity, $\sigma = n e^2\tau /m$. deduction of ohm's law, limitations of classical theory, Quantum free electron theory(qualitative). Expression for Fermi energy and average energy of electrons at absolute zero. Mention of expressions above absolute zero. Statement for F(E) and <E> at T>0, Boltzmann tail. (Problems). **6Hrs**

Reference Books

1.Concepts of Modern Physics 6th Edn. – Arthur Beiser, Tata McGraw-Hill Education, 2003
2. Introduction to Atomic and Nuclear Physics 5th Edn – Semat& Albright, Springer Science & Business Media, 2012
3. Modern Physics – Kenneth S Krane, Wiley, 2012
4. Fundamentals of Molecular spectroscopy, 4th Edn – Banwell, Tata McGraw-Hill Education, 1994
5. Quantum Physics – A P French, Routledge, 2018
6. Quantum Physics, Vol IV – E Wichman, Berkeley Physics Course, Tata McGraw-Hill Education
7. Quantum Physics – Gasorovicz, Wiley, 1995
8. Modern Physics – Murugeshan, Chand, 1997 9. Quantum Physics - G Aruldhas, PHI Learning Pvt. Ltd., 2008
9.Solid state physics 6th Edn by S.O. Pillai, New Age International, 2006
10. Elementary solid state physics by M Ali Omar, Pearson Education India, 1975
11. Modem physics by J Bernstein, P.M. Fizhbane, S. Gasiorowicz, Prentice Hill, 2000
12. Modem physics by S.R. ShankaraNarayana, New Age Internationals; First edition, 1992
13.Refresher course in physics Volume III by C. L. Arora, S Chand & Company, 1999

CORE SUBJECT-V Semester
BSCPHC 332: PAPER VI
(3Hrs/week; Total 48Hrs)
NUCLEAR PHYSICS –I, CONDENSED MATTER PHYSICS-II AND ANALOG ELECTRONICS

Objectives:

- **To gain the knowledge about basics of nuclear physics**
- **To understand the basic concepts in condensed matter physics**
- **To gain the knowledge on basic electronic circuits**

COURSE OUTCOMES

CO1. Gain a clear picture of nuclear composition and various nuclear models.
CO2. Have a deep knowledge about Radio activity,
CO3.Gain the deep knowledge about nuclear models
CO4.Analyse the characteristics of transistor and transistor biasing circuits
CO5. Gain the knowledge to design a CE amplifier and its working
CO6.Understand the working and applications of Op Amps and different types of regulated power supplies
CO7. Understand Band theory of solids to distinguish different types of solids
CO8.Have a deep knowledge about smart materials and nano-materials and their applications
CO9.Understand the production/properties and application of X- rays

UNIT I

NUCLEAR PHYSICS –I

Nuclear decay and spectra of nuclear radiation: Successive disintegration (A->B-> C) Radioactive equilibrium (transient and secular). Radioactive series. Radio carbon dating. Determination of age of the earth.

Alpha decay, empirical relation between range and velocity, range and energy, Geiger – Nuttal relation. Tunnel effect (qualitative) Beta ray spectra, Neutrino hypothesis, conditions for three types of beta decay. Gamma ray emission. Interaction of γ rays with matter. (Problems) **6Hrs**

Nuclear Structure: [Rutherford's alpha scattering formula (assuming expression for impact parameter) Nuclear constituents and mention of general properties of the nucleus- nuclear radius, mass, charge, charge distribution, binding energy] nuclear angular momentum and magnetic moment, quadruple moment, isotopes, isobars, isotones, isomers, mirror nuclei. Dempster's mass spectrograph. (Problems). **6Hrs**

Nuclear models: Liquid drop model, semi empirical mass formula, Shell model (Qualitative), magic numbers. **4Hrs**

UNIT II

CONDENSED MATTER PHYSICS-II

Band theory of solids: Origin of energy bands in solids, distinction between metals insulators and semiconductors, intrinsic semiconductors – expression for Fermi energy' conductivity of intrinsic semiconductors, variation of resistance with temperature, extrinsic semiconductors, Fermi level in forward and reverse biased P-N Junction. Hall Effect, expression for Hall coefficient and its significance. Measurement of Hall coefficient (Problems) **6Hrs**

Physics of materials:

Dielectric properties of materials- Polarizability, Susceptibility, local field and dielectric constant, Ferro electricity& Piezoelectricity. Nano technology**:** Nanoscale systems Nanomaterials-synthesis, properties-examples and applications-Nanoelectronics, Nanomedicine, and Nano robotics. Smart Materials: Their properties, example and applications. **6Hrs**

X- Rays: Hard and soft X-rays. Continuous and characteristic X-ray spectra, Mosley's Law. X-ray Crystallography- Definition of a lattice, unit cell, seven crystal system. Miller indices, Bragg's law. Bragg's spectrometer- uses- to determine λ of X-rays, to study X-ray spectrum and crystal structure. Structure of NaCl& KCl. Diffraction techniques **–** Powder photography (Problems) **4Hrs**

UNIT III

ANALOG ELECTRONICS

Amplifiers: Classification of amplifiers, h– parameter model of BJT – Small signal CE amplifier (with voltage divider bias) – AC and DC equivalent circuits, DC and AC load lines, h-parameter equivalent circuit (CE). Amplifier calculations-current gain, voltage gain, input resistance and output resistance, frequency response. **4Hrs**

Operational amplifier (OPAMP): BJT differential amplifier – Dual input, balanced output(qualitative). Concept of an ideal amplifier. OPAMP characteristics (IC -741), Applications – inverting and non-inverting amplifiers with feedback. Expression for voltage gain, input and output resistances (no derivation). Frequency response of IC -741 (Qualitative). (Problems) **4Hrs**

Oscillators: Block Diagram for feedback network, +ve and –ve feedback. Barkhausen criterion for oscillation in electronic circuits. Wien bridge oscillator using OPAMP – expression for the frequency of oscillation. Astable multivibrator –derivation for frequency (Problems) **4Hrs**

Regulated Power Supply: Block diagram of Regulated power supply and explanation. Voltage Regulation – line and load regulation. Voltage regulators**:** Voltage regulators using zener diode, OPAMP and series transistor (npn) Expression for output voltage (problems) Three terminal IC regulators.- fixed voltage and variable voltage Fixed voltage and variable voltage regulated power supply.(Problems)
4Hrs

CODE NUMBER- BSCPHP 333: PRACTICAL –V

Note: A minimum of 8 experiments should be done. (*Data analysis and graphs for two experiments using data analysis software)*

1. Specific charge of electron-Thomson's method
2. Temperature response of thermistor -Eg
3. Stefan's Boltzman law
4. Efficiency of LED bulbs
5. CE Amplifier—Frequency Response
6. Astable multi vibrator using 555
7. Three pin regulated power supply
8. Wien bridge Oscillator using OPAMP

9. Andersons Bridge
10. Determination of Fermi energy.
11. Spectral response of LDR
12. Energy gap of photo-diode
13. G M Tube characteristics
14. Simulated experiments

Skill oriented programmes/Open ended experiments / Projects:

1. ***To study the effect of nature of surface on emission and absorption of radiation***
2. ***Verification Stefan's law of radiation using different electric bulbs to have a comparative study***
3. ***Survey for background radiation using Environmental Dosimeter.***
4. ***Construction of multiplexer and demultiplexer circuits and study their action***
5. ***Millikan's oil drop experiment.***
6. ***Rydberg constant- Hydrogen spectrum/Solar spectrum***
7. ***Inverting, non inverting and differential amplifiers using OPAMP***

Reference books

1.Elements of X- ray diffraction – Cullity& Stock, Addison-Wesley Publishing Co. 1978
2. Solid state Physics – H C Guptha, Vikas Publishing House Pvt Limited, 2001
3. Elementary Solid state Physics – Ali Omer, Pearson Education India, 1975
4. Modern Physics by R. Murugeshan and KiruthigaSivaprasath, S Chand, 2010
5.Solid state physics 6th Edn by S.O. Pillai, New Age International, 2006
2. Elementary solid state physics by M Ali Omar, Pearson Education India, 1975
3. Modem physics by J Bernstein, P.M. Fizhbane, S. Gasiorowicz, Prentice Hill, 2000
4. Modem physics by S.R. ShankaraNarayana, New Age Internationals; First edition, 1992
5. Basic electronics solid state by B.L. Theraja, S Chand 2006
6. Foundations of electronics 2nd Edn by D. Chattopaddhyay, P.C. Rakshit, B. Saha, N.N. Purkait, New Age International Private Limited, 2014
7. Modern Physics by R. Murugeshan, S Chand, 2010 8. Refresher course in physics Volume III by C. L. Arora, S Chand & Company, 1999
8.Concepts of Modern Physics, 6th Edn, Beiser, McGraw-Hill Education, 2003
9. Modern Physics – Berstein, Fishbane, Gasirowiez, Prentice Hill, 2000
10. Modern Physics – K.S. Krane, Wiley, 2012 4. Introductory Nuclear Physics – K.S. KraneWiley, 2008
11. Introduction to Atomic and Nuclear Physics, 5th Edn, Semat& Albright, Springer Science & Business Media, 2012
12. Quantum Physics of Atoms, Molecules, Solids, Nuclei & Particles, 2nd Edn, Eisberg&Resnick, Wiley, 1985
13. Nuclear Physics – Irving Kaplan, Addison-Wesley, 1953
14. Modern Physics – Murugesan, S Chand, 2010
15.Electric Devices & circuits, 8th Edn – Boylested&Nashelsky, Pearson Education India, 2009
16. Electronic Devices, 6th Edn – Floyd, Prentice Hall, 12-Sep-2012
17. OP-AMPS and Linear Integrated Circuits, 3rd Edn – RA Gayakwad, Regents/Prentice Hall, 1993
18. Operational Amplifiers & Linear Integrated Circuits, 6th Edn. – RF Coughlin & FF Driscoll, Prentice Hall, 2001
19. Operational Amplifiers & Linear ICs, 2nd Edn – David A Bell, Oxford University Press; 2 edition, 2007

CORE SUBJECT-VI Semester
BSCPHC 381: PAPER VII
(3Hrs/week; Total 48Hrs)

MOLECULAR PHYSICS, ASTROPHYSICS AND GENERAL THEORY OF RELATIVITY AND DIGITAL ELECTRONICS

Objectives:

- To study the basics of spectroscopy
- To gain knowledge on astrophysics and general theory of relativity
- To understand the concepts in digital electronics

COURSE OUTCOMES

CO1. Have Peripheral ideas about astronomy and astrophysics
CO2. Have enough knowledge about general theory of relativity
CO3. Become familiar with molecular spectroscopy and have gained basic ideas regarding microwave spectroscopy, infrared spectroscopy and Raman Spectroscopy.
CO4. Become familiar with NMR, ESR/TEM etc. and understand the uses in physics in medical field
CO5. List and explain the different number system.
CO6. Understand different logic gates using truth table.
CO7. Analyze and design different adder circuits.
CO8. Analyze, design and implement combinational/sequential logic circuits.

UNIT I

MOLECULAR PHYSICS

Molecular spectra and Scattering: Different regions of molecular spectra. Pure rotational spectra of diatomic molecules. Vibrational- Rotational spectra of diatomic molecules. Raman effect, experimental observation, quantum theory, characteristics of Raman lines and applications. Applications of molecular spectra. (Problems) **6Hrs**

Spectroscopic Techniques: N.M.R, E.S.R spectroscopy, Atomic absorption spectroscopy, UV, IR and ***Photoluminescence spectroscopy; with their applications***. (Problems) **3Hrs**

Experimental Techniques: Scanning electron microscopy, Transmission electron microscopy Scanning tunnelling microscopy, Fourier transform Infrared microscopy **3Hrs**

Biophysics- Bio electricity-origin, examples, measurement (ECG&EEG- Mention only) and Bio magnetism-origin, examples measurement (MCG&MEG -Mention only), nerve pulse transmission **4Hrs**

UNIT II

ASTROPHYSICS

Stellar constellations - Zodiacal constellations and their significance Evolution and life cycle of stars-Jeans criteria for the formation of stars -White dwarfs, Pulsars, Neutron stars and Black holes and accreditation discs. Supernova explosion, Chandrasekhar limit (Review). Measurement of stellar distances-Stellar parallax and red shift, Units of stellar distances. Definition of arc sec, parsec (pc), astronomical unit (AU), light year (Ly) and their relationship. (Problems) **5Hrs**

Hubble's law. Radius of a star. Mass – Luminosity relationship and expression for lifetime of a star. H-R diagram, Main sequence stars and their general characteristics. Virial Theorem. Doppler effect of light. **4Hrs**

Origin of Universe theories – steady state and big bang theories. Planck's length and time. Experimental evidence of Big-Bang, Penzias and Wilson experiment. Inflationary universe and its possible explanations **4Hrs**

General Theory of Relativity: Inertial and Gravitational mass. Principle of equivalence. Curved space and time. Brief account of Einstein's theory of gravitation. Experimental tests for the general theory of Relativity **3Hrs**

UNIT III

DIGITAL ELECTRONICS

Boolean algebra: (Basics-Number system – Decimal Binary – Hexadecimal conversion, Logic gates – basic logic gates NOT, OR and AND using discrete components) NAND Gate as Universal Gate-Realization of basic gate and XOR gate using NAND gate. TTL gates-Truth tables- Boolean theorems, De-Morgan's theorems, Digital design-K-Maps-simplification of Boolean expressions using Boolean algebra, sum of products, method of solving a digital problems - Half adder and full adder circuits. (Problems) **6Hrs**

Sequential logic circuits: Introduction to flip-flops - RS, D, and JK Flip-flop. JK- MS FF – timing diagrams- Serial and parallel shift register using D Flip-flop. Asynchronous binary counters using JK flip-flops. Woking of a Decade counter, 4 bit binary counter. Displaying the counter output using BCD to seven segment decoder (Block diagram) and seven segment display. **6Hrs**

Fundamentals of Multiplexing and de-multiplexing-Encoders and decoders **4Hrs**

Reference Books

1.Concepts of Modern Physics 6th Edn. – Arthur Beiser, Tata McGraw-Hill Education, 2003 2. Introduction to Atomic and Nuclear Physics 5th Edn – Semat& Albright, Springer Science & Business Media, 2012

3. Modern Physics – Kenneth S Krane, Wiley, 2012

4. Fundamentals of Molecular spectroscopy, 4th Edn – Banwell, Tata McGraw-Hill Education, 1994

5.Modern Physics by R. Murugeshan and KiruthigaSivaprasath, S Chand (2010)

6) Modern Physics by G. Aruldhas and P. Rajagopal, PHI Learning 0(2005)

7) Chandrashekar and his limits by B. Venkaraman, Universities Press (1992)

8) Theoretical Astrophysics, T. Padmanabhan, (Three Volumes) Cambridge University Press, 2000

9) Special theory of relativity by Resmick, Wiley; 1 edition (2007)

10) Astrophysics for Physicists by Arnab Rao Chaudhury, Cambridge University Press The Structure of the Universe, JayantNarlikar, Oxford University Press (1993)

11) Violent Phenomena in the Universe, JayantNarlikar, Oxford University Press (1984).

12) Astronomy – The Evolution of the Universe, Michel Zeilik, John Wiley & Sons (1994)

13) Theoretical Astrophysics, T. Padmanabhan, (Three Volumes) Cambridge University Press (2000)

14.Digital Fundamentals, 8th Edn – Floyd, Pearson Education India, 2011

15. Digital Design, 3rd Edn.-Morris Mano, EBSCO Publishing, Inc., 2002

16. Digital Systems, 8th Edn – R Tocci, Pearson Education, 2016

17. Electronic Communication, 4th Edn.- Kennedy & Davis, Tata McGraw-Hill Education, 1999

18. Electronic Communication, 6th Edn – Miller & Beasley, Pearson/Prentice Hall, 2005

19. Electronic Principles by A P Malvino, Tata McGraw-Hill Education, 2007

20. Digital Electronics B LTheraja, S. Chand Limited, 2006

21.Text book of astronomy and astro physics with elements of cosmology-By V B Bhatia

22.Introduction to Cosmology-By J V Narlikar

CORE SUBJECT-VI Semester
BSCPHC 382: PAPER VIII
(3Hrs/week; Total 48Hrs)

NUCLEAR PHYSICS-II AND III, ENVIRONMENTAL PHYSICS AND COMMUNICATION ELECTRONICS

Objectives:

- To get the knowledge on Nuclear physics
- To study about the atmosphere
- To get a knowledge on techniques communication electronics

COURSE OUTCOMES

C01. Understand the working of nuclear detectors and counters. Realize the importance of Cosmic rays and its effects on earth and fundamental particles
C02. Become familiar with nuclear particles and different particle accelerators.
C03. Have a deep knowledge about nuclear fission and nuclear fusion, and the relevance of nuclear transformation
CO4.Understand the origin of atmosphere/greenhouse effect /ozone layer
CO5. Sketch and explain the basic block of communication system.
CO6. State the principles of modulation and explain the different modulation techniques.
CO7. Describe the theory and operation of radio systems and super heterodyne receivers.
CO8. Use of different modulation and demodulation techniques used in analog communication
CO9. Understand GSM, CDMA concepts, architecture, frame structure, system capacity and services.

UNIT I

NUCLEAR PHYSICS–II

Nuclear forces: Characteristics of nuclear forces, Yukawa's theory, Exchange of mesons, estimation of meson mass using uncertainty principle. **4Hrs**

Artificial transmutation of elements: Rutherford's experiment, Q values of nuclear reaction. Threshold energy for endoergic reaction. Types of nuclear reactions. Transuranic elements.Cross section for nuclear reaction. Neutron-Discovery, Properties and classification. **6Hrs**

Particle accelerators and detectors: Linear accelerator, Cyclotron, and Betatron. GM Counter, Principle of Semiconductor detector, Scintillation Detectors,Detection of neutrons (Problems) **6Hrs**

UNIT II

NUCLEAR PHYSICS–III

Cosmic rays: Discovery, latitude, altitude and east west effects. Primary and secondary cosmic rays – composition, cosmic ray showers, Van Allen belts. **3Hrs**

Fundamental Particles: Particles and antiparticles (qualitative discussion of Dirac's theory).Classification of fundamental particles. Basic interactions in nature, their strengths, ranges and quanta exchanged. Quark model. **3Hrs**

Nuclear fission & fusion:

Fission: Reactors – Breeder reactor, Swimming pool type reactor. Four factor formula**.** Fusion – Thermonuclear reaction – plasma containment – Magnetic Bottle.Background radiation, radiation dosage, radiation hazards and safety techniques

6hrs

EVIRONMENTAL PHYSICS

Effect of atmosphere- Greenhouse gases-IR radiation and the radiation effect-energy balance models and feedback effects-UV radiation -ozone layer-ozone depletion. The origin of atmosphere of the terrestrial planets-Modification of the atmosphere of the terrestrial planets.

Physical principles involved in climate modelling- Radiative forcing and atmospheric structure- and global circulation-the ocean, Thermohaline circulation-the temperature history of the earth, global climate model prediction in general

Basics of E- waste management **4Hrs**

UNIT III

COMMUNICATION ELECTRONICS:

Electronic Communication: Need for modulation – Amplitude modulation – derivation of expression for AM wave. Power relations (mention of expression), Advantages and disadvantages of SSB transmission in AM. Qualitative discussion of FM. Comparison of AM and FM, Block diagram of AM and FM transmitters. Demodulation– Diode detector. Block diagram of AM receivers-Strait receiver drawbacks, super heterodyne receiver, and Block diagram of FM receiver. (Problems) **4Hrs**

Cathode Ray Oscilloscope (CRO): CRT working, time base signals, scanning principle, uses of CRO. Problems.

Television: – Scanning principle types. CCD Camera, Digital Camera, CMOS in digital cam cords, Basics of black/white and Colour TV - Transmission and reception. LCD and LED monitor (Qualitative). **3Hrs**

Mobile communication: Introduction to wireless communication systems-GSM-architecture-location tracking and call setup, mobility management, multiple access Technique in Wireless communications. Frequency division multiple access (FDMA), Time division multiple access (TDMA) and CDMA-digital cellular standard. Comparison between 4G and 5G, GSM and CDMA technologies. **4 Hrs**

Remote Sensing: Principle of remote sensing, Methods of data acquisition Applications of remote sensing. GPS and Terrain mapping. Data analysis techniques. **5Hrs**

CODE NUMBER - BSCPHP 383: PRACTICAL – VI

Note: A minimum of 8 experiments should be done. (Data analysis and graphs for two experiments using data analysis software)

1. Inverse square law –GM Tube
2. Verification of truth table of JK FF (7476) and Construction of 4 bit binary counter
3. Verification of De-morgan's theorem using ICs
4. Construction of Half adder and Full adder.
5. Logic Gates – OR,AND and NOT gates using diode and transistors
6. Logic Gates using TTL.

7. De-Sauty's Bridge
8. Construction of decade counter using counter decoder IC.7493
9. Logic Gates using NAND gate IC 7400
10. Study of optical communication using OFC Kit
11. NAND gate Characteristics
12. Half-life of K-40
13. Decay constant of radio isotope
14. Verification of truth table of D- Flip-flop (7474) and Construction of 4 bit shift register.
15. Simulation experiments

Skill oriented programmes/Open ended experiments / Projects:

1. ***Carbon dating using GM counting systems.***
2. ***Construction and study of action of frequency modulator using IC***

Suggested activities:

Field visitfor the study of Bio medical systems

Reference Books

1.Concepts of Modern Physics, 6th Edn, Beiser, McGraw-Hill Education, 2003
2. Modern Physics – Berstein, Fishbane, Gasirowiez, Prentice Hill, 2000
3. Modern Physics – K.S. Krane, Wiley, 2012
4. Introductory Nuclear Physics – K.S. KraneWiley, 2008
5. Introduction to Atomic and Nuclear Physics, 5th Edn, Semat& Albright, Springer Science & Business Media, 2012
6.Nuclear Physics – Irving Kaplan, Addison-Wesley, 1953
7. Modern Physics – Murugesan, S Chand, 2010
8.Digital Fundamentals, 8th Edn – Floyd, Pearson Education India, 2011
9. Digital Design, 3rd Edn.-Morris Mano, EBSCO Publishing, Inc., 2002
10. Digital Systems, 8th Edn – R Tocci, Pearson Education, 2016
11. Electronic Communication, 4th Edn.- Kennedy & Davis, Tata McGraw-Hill Education, 1999
12. Electronic Communication, 6th Edn – Miller & Beasley, Pearson/Prentice Hall, 2005
13. Electronic Principles by A P Malvino, Tata McGraw-Hill Education, 2007
14. Digital Electronics B LTheraja, S. Chand Limited, 2006
15.Environmental Studies – Challenges and Solutions A quick compendium by NG Dhawan and KiranBisht, I K International Publishing House Pvt. Ltd, 2013
16.Environmental Physics by Claresmith Google book publication
17. Fundamental of environmental Physics by N K Mahapatra
18.Environmental problems and solutions by D.K AsthanaandMeeraAsthana.
19.An introduction to Environmental physics of soil and water sheds by Calvinron
20.Fundamental concepts in environmental studies by DD Mishra.

SHREE DHARMASTHALA MANJUNATHESHWARA COLLEGE (AUTONOMOUS), UJIRE

CORE SUBJECT-INTERNAL EXAMINATIONS-CBCS

PHYSICS

CODE NUMBER **PAPER -** **SEMESTER-** **I/II/III/IV**

TOPIC-

Time::1 hr **Max marks: 25**

I Answer any THREE of the following 1X3=3

1.
2.
3.
4.

IIAnswer any THREE of the following

1

a) 2 Marks

b) 4 Marks

2.

a) 2 Marks

b) 4 Marks

3

a) 2 Marks

b) 4 Marks

4

a) 2 Marks

b) 4 Marks

III Solve any ONE of the following 4X1=4

1
2.

Xxxxxxxxxx

SHREE DHARMASTHALA MANJUNATHESHWARA COLLEGE (AUTONOMOUS), UJIRE

CORE SUBJECT-INTERNAL EXAMINATIONS-CBCS

PHYSICS

CODE NUMBER **PAPER -** **SEMESTER- V/VI**

TOPIC-

TIME: 3HRS MARKS:80

I Answer any THREE of the following **2X3=6**

1.
2.
3.
4.

II Answer any TWO of the following

1

a) 3 Marks

b) 4 Marks

2.

a) 3 Marks

b) 4 Marks

3

a) 3 Marks

b) 4 Marks

III Solve any ONE of the following 5X1=5

1
2.

Xxxxxxxxxx

QUESTION PAPER PATTERN (TERM END EXAMINATION)

CODE NO: Reg No:

SRI DHARMASTHALA MANJUNATHESHWARA COLLEGE (AUTONOMOUS),UJIRE
CORE SUBJECT-SEMESTER END EXAMINATIONS-CBCS
B.Sc.-PHYSICS

PAPER-SEMESTER I/II/III/IV

TOPIC-

TIME: 3HRS MARKS:80

Note: Answer all Parts

PART- A

I. Answer any EIGHT of the following 1X8=8

1)
2)
3)
4)
5)
6)
7)
8)
9)
10)

PART-B

II. Answer any SIX of the following 2X6=12

1)
2)
3)
4)
5)
6)
7)
8)

PART C

Answer all Units

UNIT-1

III.

a) 4 marks
b) 7 marks

OR

c) 4 marks
d) 7 marks

IV a) Problem 4 marks

OR

b)Problem 4 marks

UNIT-II

V. a) 4 marks

b) 7 marks

OR

c) 4 marks

d) 7 marks

VI a) Problem 4 marks

OR

b)Problem 4 marks

UNIT-III

VII. a) 4 marks

b) 7 marks

OR

c) 4 marks

d) 7 marks

VIII a) Problem 4 marks

OR

b)Problem 4 marks

UNIT-IV

IX a) 4 marks

b) 7 marks

OR

c) 4 marks

d) 7 marks

X a) Problem 4 marks

OR

b) Problem 4 marks

xxxxxxxxxx

QUESTION PAPER PATTERN (TERM END EXAMINATION)

CODE NO: Reg No:

SRI DHARMASTHALA MANJUNATHESHWARA COLLEGE (AUTONOMOUS),UJIRE

Core subject-SEMESTER END EXAMINATIONS-CBCS

B.Sc.-PHYSICS

PAPER-V/VI/VII/VIII-SEMESTER V/VI

TOPICTIME: 3HRS

MARKS:80

Note: Answer all Parts

PART- A

I. **Answer any EIGHT of the following** 1X8=8

1)
2)
3)
4)
5)
6)
7)
8)
9)

PART-B

II. **Answer any SIX of the following** 2X6=12

1)

2)
3)
4)
5)
6)
7)
8)
9)

PART C

Answer all Units

UNIT-1

III. a) 3 marks

b) 5 marks

c) 8 marks

OR

d) 3 marks

e) 5 marks

f) 8 marks

IV a) Problem 4 marks

OR

b)Problem 4 marks

UNIT-1I

V. a) 3 marks

b) 5 marks

c) 8 marks

OR

d) 3 marks

e) 5 marks

f) 8 marks

VI a)Problem 4 marks

OR

b)Problem 4 marks

UNIT-1II

VII a) 3 marks

b) 5 marks

c) 8 marks

OR

d) 3 marks

e) 5 marks

f) 8 marks

VIII a) Problem 4 marks

OR

b) Problem 4 marks

Xxxxxxxxxx

ELECTIVS AND VALUE-ADDED COURSES

INDEX

I -SEMESTER -B.Sc.-ELECTIVE PAPER-1
(2Hrs/week; Total 24Hrs)

CODE NUMBER-BSCPHCE 133- BIO PHYSICS GEO PHYSICS AND MEDICAL PHYSICS

Objectives: To understand basics of Bio. Geo and Medical Physics

Course outcomes:

CO1. Understand biological aspects of Physics
CO2. Learn Physics of Earth and understand geography
CO3. Understand medical aspects of Physics

BIOPHYSICS: Accommodation of the eye, Colour Vision, Speech and hearing, biological effects of radiation, Medical Use of Radiation, Radioactive isotopes as tracers, Thermodynamics of Life. Bio electricity and Bio Magnetism

Geophysics: The Deeper, The hotter, Earthquakes, Why is the earth hot inside, Upside Down Mountains, Floating Continents, The raise of Mountains, Terrestrial Magnetism, Physics of the atmosphere. Introduction to Seismology: The Earth's interior and crust as revealed by the earth quakes – Rayleigh waves. Tsunami causes and impacts. Rictor scale (qualitative)

(8hrs)

Ecosystems: Structure and functions (abiotic and biotic), environmental problems: global warming and climate change, ozone layer depletion, deforestation, acid rain. Renewable and non-renewable energy sources. Environmental pollution: air, water, soil and noise pollution. Radiation in environment: Nuclear hazards and human health risks. **Ocean energy** : Energy from Sea waves, Ocean Thermal energy- temperature gradient in sea and their use for power generation- **(8hrs)**

Medical Physics: Introduction to Medical Physics.-**Bio electricity:** Origin,examples, measurement- ECG and EEG-**Bio magnetism-**Origin-Examples, measurement MCG and MEG-Nerve pulse transmission **- X-rays:** Electromagnetic spectrum, production of X-rays, X-ray diagnostics and imaging. Physics of NMR, NMR imaging, MRI radiological imaging, Ultrasound imaging, Physics of Doppler with applications.

(8hrs)

Reference Books:

1. Physics- Foundation and Frontiers- George Gamow, John M. Cleveland, Prentice-Hall, 1960
2. Garland, Introduction to Geophysics 11th edition, WB Saunder Company, London 1979
3. William Lowrie, Fundamentals of Geophysics 11th edition, Cambridge press, UK.
4. Physics of Radiation Therapy, F M khan- Williams and Wilkins, 3rd Edition, 2003.

5. The essential Physics of Medical imaging, Bushberg, Seibert, Leidholdt and Boone Lippincott Williams and Wilkins, 2nd edition 2002.
6. Handbook of Physics in Diagnostic Imaging, R.S Livingstone, B.I. Publications pvt.Ltd.
7. Environmental Studies – Challenges and Solutions A quick compendium by NG Dhawan and KiranBisht, I K International Publishing House Pvt. Ltd, 2013
8. Nuclear Science – A guide to the nuclear science Wall chart, 2018 (CPEP)
9. Physics for life science Arlancromer

I -SEMESTER -B.Sc.-ELECTIVE PAPER-2
(2Hrs/week; Total 24Hrs)

CODE NUMBER-BSCPHCE 134-Physics of Music and Gadgets

Objectives

- To provide overview of the physics involved in the production, analysis and synthesis of musical sounds.
- Encouraging Students to explore and learn concepts of Physics working principle of toys

Course Outcomes

CO1. Acquire an understanding of the physical principles involved in the listening, analysing and Synthesizing of musical sounds.

CO2. Able to understand concepts of Physics behind music.

CO3 Ability to recognize the instrument groups and to understand how they function

CO4 Understand basic principles behind the design of toys.

Physics of Music:

Introduction, Definition of music. Music in Nature. Origin, detection. Human &animal hearing/sound perception, Simple Vibrating Systems-Simple harmonic motion-Travelling waves and wave propagation in a medium-One-dimensional standing waves-Standing waves in two and three dimensions, Doppler effect, (Qualitative)Beats-interference between 2 frequencies, distortion -Musical Tone Quality/Timbre- Pure tones/simple tones, Complex tone, Periodic complex waveform ,fundamental and harmonics/overtones ,phase sensitivity of human ear to complex tone/tone quality/timbre-harmonic ,Fourier analysis of musical instrument tones , Sound Effects, Musical intervals, musical scales(Qualitative), tuning and temperament Production of musical sounds by musical instruments. Human Voice & Singing – 1musical instrument -1-D vibrational system. Stringed Instruments, Woodwind Instruments, Brass Instruments, Percussion Instruments, Electronic Musical Instruments(12hr)

Physics of Gadgets:

Spinning Tops-Angular Momentum & Energy conservation, Newton's Cradle-Laws of conservation of linear momentum, Rattleback-Unbalanced moments, tumbling toy, descendent woodpecker, Walking Duck- Conservation principle and application of formalism of moments, Slinky-Understanding-standing, transverse and longitudinal waves. Balloon car and helicopter-Newton's third law, Cartesian diver, Galileo's thermometer-Change of liquid density with temperature, Thermal Swing-Periodic motion, The drinking bird-Thermal Engine, Chop-Chop Boat-Homopolar motor-Lorentz force, Chaotic Pendulum- Chaotic motion, Gauss Gun-Conversion of magnetic energy to Kinetic Energy, Leviton-Magnetic levitation, Plasma Lamp, Mirage –Snell-Descartes law of reflection. (12hr)

References

[1].The physics of music and musical instrument- David R. Lapp, fellow wright center for innovative science education tufts university medford, massachusetts

[2]http://resourcelists.st-andrews.ac.uk/modules/ph4036.html

[3] Aref H, Hutzler S and Weaire D 2007 Toying with physics Europhys. News 38 23
Featonby D 2005 Toys and physics Phys. Educ.40 537
[4] Shugart C G 1976 Saturday science Phys. Teach. 14 91
Willis J and Kirwan D F 1976 Physics demonstrations for the public Phys. Teach.14 210
[5] Fort J, Llebot J E, Saurina J and Su˜nol J J 1998 A counterintuitive toy: the bird that never falls down Phys. Educ. 33 98Turner R C 1987 Toys in physics teaching: balancing man Am. J. Phys. 55 84
[6] Guilbert N R 1999 Deconstructing a plasma globe Phys. Teach. 37 11
[7] Bolina O 2000 The precessing top Phys. Teach.38 312
[8] Case W 1977 The gyroscope: an elementary discussion of a child's toy Am. J. Phys45 1107
[9] Taylor M 2001 Curiosity: the Levitron Phys.
Educ. 36 259–60
[10] Soodak H 2002 A geometric theory of rapidly spinning tops, tippe tops, and footballs Am. J.
Phys. 70 815Cohen R J 1977 The tippe top revisited Am. J.Phys. 45 12Sasakia K 2004 Spinning eggs—which end willrise? Am. J. Phys. 72 782
[11] Edge R D and Childers R 1999 Curious celts and riotous rattlebacks Phys. Teach. 37 80
Crane H R 1991 The rattleback revisited Phys.Teach. 29 278
[12] Bowen J M 1982 Slinky oscillations and thenotion of effective mass Am. J. Phys. 50 1145
Cromer A 1995 Many oscillations of a rigid rodAm. J. Phys. 63 112Gavenda J D and Edgington J R 1997 Newton'scradle and scientific explanation Phys. Teach.35 411Ehrlich R 1996 Experiments with 'Newton'scradle' Phys. Teach. 34 181

I -SEMESTER -B.Sc.-ELECTIVE PAPER-3
(2Hrs/week; Total 24Hrs)

CODE NUMBER-BSCPHCE 135 –Remote Sensing and GIS

Course objectives:

- Understand the basics of remote sensing and Geographic Information System

Course Outcomes:

CO1. Able to understand the concepts of remote sensing

CO2. Able to understand the basic techniques of GIS

CO3. Get an idea of applications of remote sensing.

Introduction to Remote Sensing and GIS:

Introduction to Remote Sensing:
Definition and Overview of Remote Sensing and Remote Sensing Systems- Electromagnetic Radiation, Terms and Definitions, Laws of Radiation, EM Spectrum, Sources of EMR - Interaction between EM Radiation and matter, Reflection, Absorption and Transmission
Spectral Signature In-situ measurements and Visual image interpretation-Spectral Signatures for common LULC features, e.g., Water, Soil, Vegetation and Snow - Instruments for ground truth data collection (e.g., instatherm, spectroradiometers, etc.) Principles of visual Interpretation of aerial photos and satellite imagery

Introduction to Geographical Information Systems:

Definitions, Components of GIS, Spatial data models – Raster and vector, Spatial and Non-Spatial data, Linkage between spatial and non-spatial data, Introduction to Cartography, map components and projection systems, (12hrs)

Platforms, sensors and Application of Remote Sensing and GIS

Platforms and Sensors
Remote Sensing Systems - Active and Passive Systems, geostationary and polar satellite, Concept of Resolutions.

Applications of Remote Sensing and GIS

Georeferencing, Image Classification (supervised and Unsupervised), Change Detection, Digitization, Feature Extraction, Application of Remote Sensing and GIS in Agriculture, Urban Planning, Disaster Management (12hrs)

References

1. Lillesand Thomas M. & Kiefer Ralph: Remote Sensing and Image Interpretation Third Edition John Wiley
2. Campbell John B.: Introduction to Remote Sensing Taylor & Francis
3. Floyd F. Sabins : Remote Sensing and Principles and Image Interpretation
4. Manual of Remote Sensing: American Society of Photogrammetry and Remote Sensing.

5. George Joseph: Fundamentals of Remote Sensing; Universities Press India Pvt Ltd, Hyderabad,India
6. Editors:John D. Bossler; John R. Jensen; Robert B. McMaster; Chris Rizos, 2001. Manual of Geospatial Science and Technology, November 2001, Vol 1 Part 1and II.
7. Paul M. Mather, 1999. Computer Processing of Remotely sensed Images: An Introduction. John Wiley.
8. M. Anji Reddy 2012 Text Book of Remote Sensing and Geographical Information Systems
9. John R. Jensen Remote Sensing of the Environment: An Earth Resource Perspective
10. C P Lo Concepts and Techniques of Geographic Information Systems

II-SEMESTER -B.Sc.-ELECTIVE PAPER-1
(2Hrs/week; Total 24Hrs)
CODE NUMBER-BSCPHCE 183 -FUNDAMENTALS OF ELECTRONIC AND ELECTRICAL DEVICES

Course objectives:

- To understand the basic working principle of electrical and electronic devices

Course outcomes:

CO1. Understand the design and working principles of electronic devices
CO2. Develop the skills to repair such devices
CO3. Learn the design and working principles of electrical devices
CO4. Develop the skills to repair electrical devices

Working Principle of Electronic devices

Electric current, Ohms law, emf, Electric Power, KWh, generator, reactance, impedance, capacitor, inductor, choke &transformer. Introduction to Current and voltage measuring instruments: AC & DC Ammeter, AC & DC Voltmeter, watt hour meter, Potentiometer, Multi meter, use of CRO –Measurement of frequency/voltage/phase difference- Basic working principle of Radio/TV /-Mobile phones-Chargers-remote controllers-Blue tooth-2G/3G/5G Concepts-GPRS-Digital devices –digital measuring instruments-digital display-Digital camera-Resolution–Pixels-advantages and limitations-Digital Zoom-Optical Zoom. Digital storage devices-CD/DVD/Pen drive. **(12hrs)**

Working Principle of Electrical devices:

Working of switches (1-way 2-way), Principle and working of regulator, principle and working of starter and chokes, Domestic wiring -Application of Fuses, ELCB (Earth Leakage Circuit Breaker) Principle and working of lightning arrester-precautions during lightning-, Principle and working of Iron box, Mixer grinder-induction coil- Principle and working of filament bulb, tube light, fluorescent bulb and LED bulbs, Working of ceiling & table fan, working of Mixer and Grinder, Working of Fridge/ AC/-washing machine.Smart electrical devices **(12hrs)**

Reference Books:

1.Electrical Engineering, MV Rao, Subhas Stores Books Corner, 2013
2. Electrical Wiring, SL Uppal, GC Gang, Khanna, 1986
3. Electrical Engineering, NL Anwani, DhanpatRai& Sons, 1978

II-SEMESTER -B.Sc.-ELECTIVE PAPER-2
(2Hrs/week; Total 24Hrs)

CODE NUMBER-BSCPHCE 184 -Sound and Acoustic Sketching

Objectives:

- To get the knowledge of fundamentals of sound and acoustics sketching

Course outcomes:

CO1. Able to analyze the use of soundscapes and acoustics

CO2. Able to learn how to record an acoustic impulse response from a physical space

CO3. Able to understand the basics of acoustics of buildings

CO4. Able identify, simplify, and apply physical principles in analyzing and modelling of acoustical systems

Introduction to Architectural Acoustics and Building Physics: Introduction and historical overview, characteristic and measurement of sound, frequency, intensity, loudness. Design Principles of Auditorium: Different acoustical defects in the auditorium and its solution, acoustical correction design and modification techniques, Design of Auditorium and motion picture hall

(8hrs)

Sound Absorption: General description of acoustical materials - acoustical tiles, fiber board, resonator absorption unit absorber, carpets, acoustical plaster, resilient packing composite materials, etc. Their use, selection criteria and construction Acoustical Criteria of Space Design: Principle of geometrical acoustics. Design criteria for speech and music, Design of Lecture hall, studio, classroom **(8hrs)**

Design Principles of Auditorium: Different acoustical defects in the auditorium and its solution, acoustical correction design and modification techniques, Design of Auditorium and motion picture hall

Air & Structure Borne Sound Propagation: Propagation of noise of mechanical operation and impact noise,sound transmission through wall and partition. Environmental Acoustics: Type, measurement of noise, Reduction of noise by Town Planning and Regional Planning consideration.

(8hrs)

Reference

1.Moore, J.E., Design for Good Acoustics and Noise Control.
2.Eagn M.D., Concepts in Architectural Acoustics
3.Long Marshall, Architectural Acoustics
4.Mark Holden, Acoustics of Multi-use performing arts Centres
5.Templeton, D., Acoustics in the Built Environment.
6.Wood, A.B., A Text book of sound. 7.Yarwood, T.M.,Acoustics

II-SEMESTER -B.Sc.-ELECTIVE PAPER-3
(2Hrs/week; Total 24Hrs)

CODE NUMBER-BSCPHCE 185 –Basics of Instrumentation

Objective:

- To study the basic design of instruments and to know principles behind measuring techniques

Course outcomes:

CO1: Recognize the evolution and history of units and standardizing Measurements
CO2 : Identify the various parameters that are measurable in electronic instrumentation
CO3 : Employ appropriate instruments to measure given sets of parameters
CO5: To have a deep understanding about instrumentation concepts

Basics of Measurement: Instrument accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects. Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance. Electronic Voltmeter: Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity. **(8hrs)**

Cathode Ray Oscilloscope: Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only no mathematical treatment). Specifications of a CRO and their significance. Use of CRO for the measurement of voltage (dc and ac frequency, time period. Special features of dual trace **(8hrs)**

Signal Generators: Block diagram, explanation and specifications of low frequency signal generators. Pulse generator, and function generator. Brief idea for testing, specifications. Digital Instruments: Principle and working of digital meters. Comparison of analog & digital instruments. Block diagram and working of a digital multimeter. **(8hrs)**

Reference

1. A text book in Electrical Technology - B L Theraja - S Chand and Co.
2. Performance and design of AC machines - M G Say ELBS Edn.
3. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
4. Logic circuit design, Shimon P. Vingron, 2012, Springer.
5. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
6. Electronic Devices and circuits, S. Salivahanan& N. S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill.
7. Electronic circuits: Handbook of design and applications, U.Tietze, Ch.Schenk, 2008, Springer 8. Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson

III-SEMESTER -B.Sc.-ELECTIVE PAPER-1
(2Hrs/week; Total 24Hrs)

CODE NUMBER-BSCPHCE 233: MATHEMATICAL AND STATISTICAL PHYSICS

Objective:

- To enable the students in mathematical and statistical analysis to study Physical concepts

Course outcomes:

CO1. Understand the importance of mathematics and statistics to study Physics
CO2. Learn mathematical and statistical concepts which are required to study higher Physics
CO3. Calculate mathematical and statistical parameters
CO4. Understand the basic concepts of probability and sampling

Mathematical physics:

Tensors: Scalar and Vectors-3D vectors, 3D components, unit vectors, vector products (dot & cross product), work done as scalar product
Vector Differentiation: Position vector, velocity, acceleration problems **Vector Analysis**: Gradient, divergence, Curl, Unit Tangent Vector and Unit Normal Vector, Qualitative approach on Deland Laplacian Operators. Vector identities.
Vector Integration:- Ordinary Integral of Vectors. Line, Surface and Volume Integrals. Flux of a Vector Field. Gauss' Divergence Theorem, Green's Theorem and Stoke's theorem of vectors (statement only). (Problems)
Differential Equations Classification: Ordinary and Partial, Order and Degree, Linear and Nonlinear, Homogeneous and Non-homogeneous
Curvilinear Coordinates-Orthogonal Curvilinear Coordinates. Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems. **(12hrs)**

Statistical physics:

Introduction-Definition of statistics-Importance in Physics-, Functions, Limitations, Weighted averages, partition values. Measures of Dispersion Range, quartile deviation, Standard Deviation measurers of central Tendency – Mean, median, mode, Geometric mean, Harmonic mean, sampling techniques-Correlation & Regression-Definition and example of sample space-simple Event-Compound event Classical definition of probability -Definition of conditional probability-Normal distribution-Poisson distribution- Monte- Carlo experiment. Problems. **(12hrs)**

Reference books

1. Mathematical Physics by Satya Prakash, Sulthan Chand and sons.
2. Mathematical Methods for Physicists: Arfken, Weber, 2005, Harris, Elsevier.
3. Mathematics for Physicists, Susan M. Lea, 2004, Thomson Brooks/Cole.
4. Essential Mathematical Methods, K.F. Riley and M.P. Hobson, 2011, Cambridge University Press
5. Mathematical methods for Scientists and Engineers, D.A. McQuarrie, 2003, Viva

III-SEMESTER -B.Sc.-ELECTIVE PAPER-2
(2Hrs/week; Total 24Hrs)

CODE NUMBER-BSCPHCE 234 –Meteorological Techniques

Objective:

- To enable to develop an awareness and understanding regarding the causes and effects of different weather phenomenon and basic forecasting techniques

Course outcomes:

CO1. Understand the principles and use of meteorological instrumentation.
CO2. Describe, analyze and create graphical depictions of meteorological information.
CO4. Explain scientific ideas, results, and weather information to public
CO5. Understand climate phenomena and factors for climate change.

Introduction: Elementary idea of atmosphere: physical structure and composition; compositional layering of the atmosphere; variation of pressure and temperature with height; air temperature; requirements to measure air temperature; temperature sensors: types; atmospheric pressure: its measurement; cyclones and anticyclones: its characteristics-environment sensor and gas sensors **(8hrs)**

Measuring the weather: Wind; forces acting to produce wind; wind speed direction: units, its direction; measuring wind speed and direction; humidity, clouds and rainfall, radiation: absorption, emission and scattering in atmosphere. Weather systems: Global wind systems; air masses and fronts: classifications; jet streams; local thunderstorms; tropical cyclones: classification; tornadoes; hurricanes. **(8hrs)**

Climate and Climate Change: classification; causes of climate change; global warming and its outcomes; air pollution; aerosols, ozone depletion, acid rain, environmental issues related to climate. Basics of weather forecasting: need of measuring weather; types of weather forecasting; weather forecasting methods; criteria of choosing weather station; basics of choosing site and exposure; satellites observations in weather forecasting; weather maps; uncertainty and predictability; probability forecasts.

(8 hrs)

Reference:

1. Aviation Meteorology, I.C. Joshi, 3rd edition 2014, Himalayan Books
2. The weather Observers Hand book, Stephen Burt, 2012, CambridgeUniversity Press.
3. Meteorology, S.R. Ghadekar, 2001, Agromet Publishers, Nagpur.
4. Text Book of Agrometeorology, S.R. Ghadekar, 2005, AgrometPublishers,Nagpur.
5. Why the weather, Charls Franklin Brooks, 1924, Chpraman& Hall, London.
6. Atmosphere and Ocean, John G. Harvey, 1995, The Artemis Press.

III-SEMESTER -B.Sc.-ELECTIVE PAPER-3
(2Hrs/week; Total 24Hrs)

CODE NUMBER-BSCPHOE 235 –Energy Storage Techniques

Objective:

- To understand the techniques and types of energy storage systems and applications

Course outcomes:

CO1. Understand the scientific principles behind energy storage systems.

CO2. Know different types of energy storage devices

CO3. Identify available technologies and materials for energy storage

CO4. Understand the need of energy storage

Energy Storage: Need of energy storage; Different modes of energy storage, Flywheel storage, Electrical and magnetic energy storage: Capacitors, electromagnets; Chemical Energy storage: Thermo-chemical, photo-chemical, bio-chemical, electro-chemical, fossil fuels and synthetic fuels. Hydrogen for energy storage. **(12 hrs)**

Electrochemical Energy Storage: Batteries: Primary, Secondary, Lithium, Solid state and molten solvent batteries; Lead acid batteries; Nickel Cadmium Batteries; Advanced Batteries. Role of carbon nano-tubes in electrodes. Hydrogen fuel cells and Methanol fuel cells

Magnetic and Electric Energy Storage: Superconducting Magnet Energy Storage(SMES) systems; Capacitor and battery: Comparison and application; **Fuel Cell**: Fuel cell definition, difference between batteries and fuel cells, fuel cell components Types of Fuel Cells: problems with fuel cells, applications of fuel cells. **(12 hrs)**

Reference:

1. J. Jensen and B. Squrensen, Fundamentals of Energy Storage, John Wiley, NY, 1984.
2. M. Barak, Electrochemical Power Sources: Primary and Secondary Batteries by, P. Peregrinus,IEE,1980.
3.P.D.Dunn, Renewable Energies, Peter Peregrinus Ltd, London, 1986.
4. B.Viswanathan and M. A. Scibioh, Fuel Cells-Principles and Applications, University Press, 2006. 34
5. Hart, A.B and G.J.Womack, Fuel Cells: Theory and Application, Prentice Hall, NewYork, 1989.

IV-SEMESTER -B.Sc.-OPEN ELECTIVE PAPER-1
(2Hrs/week; Total 24Hrs)
CODE NUMBER-BSCPHOE 283 –ASTROPHYSICS - RENEWABLE ENRGY SOURCES

Objective:

- To understand the basics of Astro Physics and renewable energy sources

Course outcomes:

CO1.Understand basic principles of telescope
CO2. Learn evolution of the universe
CO3. Learn the techniques of conservation of energy and production of energy by non-conventional methods
CO4. Learn about radiation hazards and safety measures

Astrophysics:

Brief History of Astronomy**:** Kepler's Laws, Newton's law of gravitation, Galileo and new astronomy. Basic principle of telescope, Types of telescopes – Optical, IR, Gamma ray, X- ray and radio telescopes.

Solar system: Birth and evolution of solar system. Sun and its structure (mass, radius, size, density, temperature), photosphere, chromosphere, corona, sun spots and sun spot cycle.

Evolution of the earth, Structure of the earth (interior of the earth, mass, size and density, atmosphere, seasonal variation, magnetic field) Moon – structure of the moon (distance from the earth, mass, size, density, atmosphere, phases of the moon). Exploration of the moon. Eclipses – solar and lunar Structure and formation of planets – Distance from sun, mass, radius, size, density, presence of atmosphere, existence of moon, presence of rings. Exploration of solar system using different space crafts. Comets & meteors **Stars:** Birth, life and death of stars – life cycle of stars – Prostar to black hole. **Universe:** Origin and evolution of the universe. Expanding universe. Concept of Dark matter and dark energy. **(12 hrs)**

Renewable energy sources:

Energy crisis, energy alternatives- Solar, Wind, Bio gas, Tidal, Geo thermal energy. Nuclear Energy- Energy conservation techniques in electrical devices. Renewable and non-renewable energy sources. **Environmental degradation and prevention** -Radiation in environment: Nuclear hazards –safety measures **Energy storage**: Sensible heat storage – liquids and solids, latent heat storage, thermo chemical storage, storage through charged batteries.

Solar Energy & its utilization

Origin of Solar Energy, Spectral distribution of Solar radiation, Attenuation of beam radiation, Basic earth solar angle and derived solar angle, Estimation of average solar radiation, sunshine recorder Principle of conversion of solar energy into heat, , Flat plate and concentrating collectors, construction, Thermal efficiency and coating, Heat losses, Solar cell and its efficiency , P.V. Panels. **Photo thermal Devices**: Solar cooker, solar dryer, solar hot water systems- Principles and Working. **Photovoltaic Systems**: Solar lantern, Water Pumps and Street lights- Principles and Working. **(12 hrs)**

Reference books

1.Introduction to Astrophysics, BaidyanathBasu, Prentis Hall Publication (1997)
2. Astronomy – The Evolution of Universe, Michel Zeilik, John Weiley& Sons (1988
3. Non-conventional energy resources-G D Pai-Khanna Publications new
4.Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
5.Solar energy - M P Agarwal - S Chand and Co. Ltd.
6.Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
7.Godfrey Boyle, “Renewable Energy, Power for a sustainable future”, 2004,
Oxford University Press, in association with The Open University.
8.Dr. P Jayakumar, Solar Energy: Resource Assessment Handbook, 2009
9.J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).

IV-SEMESTER -B.Sc.-ELECTIVE PAPER-2
(2Hrs/week; Total 24Hrs)

CODE NUMBER-BSCPHOE 284 –Nano Technology and applications

Objective:

- To enable the students to understand properties of nanomaterials, nanotechnology and its applications.

Course Outcomes:

CO1: Understand properties of materials at nanoscale
CO2: Know the fabrication and characterization methods used in nanotechnology
CO3: Acquaint with the various applications of nanotechnology

Introduction:

Definition, Importance of the Nanoscale, History of Nanotechnology, Moore's Law. Types of nanostructure and properties of nanomaterials: One dimensional, two dimensional and three dimensional nanostructured materials, Quantum Dots shell structures, Nanomaterials. Carbon-based Materials: Fullerenes, Carbon Nanotubes (CNTs)-SW, MW, Nanobuds; Inorganic Nanotubes; Nano shells; Quantum Well; Quantum Wires; metal oxides, semiconductors, composites. Size Dependence of Properties, mechanical-physical-chemical properties. **(8hrs)**

Fabrication methods: Top down and bottom up approaches-Top down processes: Milling, Lithographic, machining process, pulsed laser methods- Bottom up processes: Vapour phase deposition methods, PVD, CVD, electro deposition, plasma assisted deposition process, MBE, chemical methods, colloidal and sol-Gel methods.

(8hrs)

Applications:

Nano Medicine- Drug Delivery System, Nano robots, Cellular Imaging-MRI, Cancer Therapy; Nanoelectronics, Batteries, Environmental Protection, Food and Agriculture, Nano cosmetics, Textiles, Nano sensors. Nanomaterials in Communication Sector- Nano lasers, Electronic Communication and Informatics, Quantum Computers, Optical Communication, Nanomaterial-based Products, Smart Dust. Use of nano chips microchips

(8hrs)

Reference:

1. Chemistry of nanomaterials: Synthesis, properties and applications by CNR Rao et.al.
2. A.K. Bandyopdhyay, Nanomaterials, New age international publishers,2008
3. Bharat Bhushan, Springer Handbook of Nanotechnology, 2010 Charles P Poole, Frank J Owens,
4. Introduction to Nanotechnology, John Wiley and Sons, 2003
5. Jeremy Ramsden,Nanotechnology, William Andrew, Elsevier, 2011
6. T Pradeep, Nano: The essentials, McGraw – Hill education,2 007
7. V.S.Muralidharan, A Subramanian,Nano science and Technology, Ane books Pvt Ltd

IV-SEMESTER -B.Sc.-OPEN ELECTIVE PAPER-3
(2Hrs/week; Total 24Hrs)

CODE NUMBER-BSCPHOE 285 –HOW THINGS WORK

Objective:

- To Gain the knowledge about working concepts of different house hold and other items

Course Outcomes:

CO1. Able to understand working principles of mechanical and electrical gadgets

CO2. Able to understand working principles of optical, electronic instruments

CO3. Understand wave propagation and its effects

CO4. Able to understand sound propagation and measurement

Mechanics:

Skating, Falling Balls, Ramps, See saws levers; Wheels, friction, Bumper Cars Using levers, Construction work, Moving stuff, Wheels and axles, Pedal power, Holding the road, Piston power, Engines of fire, Race cars, Powering up, Trains and tracks

Resonance and mechanical waves: Clocks, Musical Instruments, mechanical waves; superposition; Doppler effect, The Sea, tidal forces; **Fluids,** Balloons, Water Distribution, Gases and liquids, How fluids work, Float that boat, Floating balloons, Roller coaster, How do planes fly?, Garden Watering , Air (aerodynamics, aerodynamic lift, stalls, Airplanes Spring Scales Ball Sports: Bouncing Bicycles -Rockets and Space Travel

(8hrs)

Heat and Thermodynamics:

Woodstoves, Clothing, Insulation, and Climate, blackbody spectrum, thermal expansion, greenhouse effect cooking, Keeping cool, Energy Efficiency-Air Conditioners, heat engines and thermodynamic efficiency.

Electricity and magnetism:

Static Electricity charging by contact, electric polarization, electrical conductor sand insulators, Xerographic Copiers charging by induction, capacitors, Flashlights electrical resistance; Household Magnets ferromagnetism, magnetic polarization, magnetic domains, magnetic materials, Electric Power Distribution, superconductivity, transformers, induction, magnetic field energy, electrical safety, generators, motors

(8hrs)

Electromagnetic waves and optics:

Radios, antennas, electromagnetic waves, Microwave Ovens, Discharge Lamps, color vision, primary colors of light and pigment, illumination, gas discharges, LEDs and Lasers p-n junction; diodes; light-emitting diodes; incoherent and coherent light; spontaneous and stimulated emission; population inversion; laser amplification

Cameras , converging lenses, real images, focus, focal lengths, f-numbers , diverging lenses, virtual images, light sensors, vision and vision correction, mirages, Mirror, Fireworks, Measuring sound, How ears hear.

Electronics

Bits and bytes, Inside a laptop, Binary code, Sharing data, Cell phones, Digital photography, Radio and TV, Barcodes, Internet, Search engines, Robots

(8hrs)

Reference:

1.How things work-LOUIS A. BLOOMFIELD
2.How Things Work-Encyclopedia

VALUE ADDED COURSES
(2Hrs per week total 40Hrs)

CODE NUMBER-BSCPHCC1 –ESSENTIALS OF EVERY DAY PHYSICS

Objectives:

- To introduce the concepts of natural phenomena in a scientific perspective.
- To understand the role of physics as a basic science, in the development of technology and the welfare of mankind.
- To foster rational thinking in complex decision situations related to environmental problems by studying the physical laws underlying environmental phenomena.

Course outcomes:

CO1. Students shall be able to ask critical questions and perform scientifically based evaluations about current technologies.
CO2. Students shall be able to appreciate the scientific aspects lying behind various technological tools.
CO3. Students shall be able to understand principles and applications associated with general physics as applied to a broad range of technological systems and aspects of everyday life.

Part I - Odd Semester

Environmental and Atmospheric Physics: Introduction to environmental Physics-Our Environment, Constituents of Environment- Biotic and Abiotic Factors. Atmosphere, Formation of atmosphere-Theories, Our atmosphere, Climate, Global Circulation. Energy Sources- Renewable and Non Renewable Energy Sources, Renewable Energy Sources- Solar, Wind, Geo thermal, Tidal, Biomass. **(6Hrs)**

Astrophysics: Stellar Constellations- Zodiacal Constellations and their significance, Evolution and life cycle of Stars- Nebula, White dwarfs, Pulsars, Neutron stars and Black holes, Supernova Explosion. Solar System, Galaxies, Astronomical Units, a Guide to the Cosmology-Origin of Universe theories **(12hrs)**

Nuclear Physics: Nuclear Physics – Introduction, Radioactivity, Radioactive elements, Radioactive Decay, Half-life, Nuclear fission, Nuclear fusion, Applications of radioactive elements **(2Hrs)**

Part II-Even Semester

Radiation Physics: Radiation Physics- Introduction, Types of Radiations, Radiation Hazards, Applications, and Radiation Safety measure -Nuclear Reactors – Introduction, Types of Nuclear Reactors and their Applications**.** **(4hrs)**

Digital Electronics: Analog and Digital systems –need for understanding the digital devices-Basics of Digital Electronics-applications in daily life. Number Systems- Binary, Decimal, Basic gates- OR, AND, NOT, gates. LEDs-Seven segment display. Digital Photography-Digital camera-Resolution–Pixels-advantages and limitations-Digital Zoom-Optical Zoom. Digital storage devices-CD/DVD/Pen drive. Sound recording and storage.

(4hrs)

Communication Electronics: Electric Communication: Need for modulation AM, FM, Transmitters and Receivers, Demodulation, Mobile Communication: Introduction, GSM architecture- Location tracking, Generations in mobile Communication, Television: Scanning Principle, types, CRT, WORKING, Basics of B/W and Color TV, Plasma, LCD and LED monitors **(8hrs)**

Recent Trends in Physics: Laser Principles and Applications Nanotechnology: Principles and future prospective -Medical Applications of Physics **(4hrs)**

Reference Books

1. Fundamentals of Environmental Physics by N K Mahapathra
2. Fundamental concepts in environmental studies by DD Mishra
3. Astronomy- the Evolving Universe III Edition (Harper and Row) by Felik M
4. Dawn of Universe by BimaNath
5. Sky watching by David H. Levy
6. Modern Physics by R. Murugeshan
7. Nuclear Physics by S. N. Ghoshal
8. Fundamentals of Digital Electronics by Malvino and Leach
9. Fundamentals of Digital Electronics by Floyd
10. Mobile Communications by Jochen Schiller
11. Wireless communications and Networks by William Stallings
12. Wireless Communication by UpenaDalal

VALUE ADDED COURSES
(2Hrs per week total 40Hrs)

CODE NUMBER-BSCPHCC2 –PHYSICS OF MATERIALS

Objectives:

- To understand the physics of various materials relevant to different branches of technology

Course outcomes:

CO1. Acquire knowledge on basics of material science
CO2. Able to distinguish between different types of materials
CO3. Get knowledge on the functioning of mechanical behavior of materials and their applications
CO4.Understand the properties of various dielectric and magnetic materials and their applications

Part I - Odd Semester

Atomic Scale of the Materials: Atomic Bonding, Bond Energy, Bond Stiffness. Classification, Crystalline, Amorphous, Glasses; Crystal Lattice Scale of the Materials: Crystal Structures and Their Properties Crystal systems and Bravais lattices **(10hrs)**

Metals, Alloys, Semiconductors, Polymers, Ceramics-Types and applications-, Plastics, Bio-materials, Composites, Bulk and nano materials Defects and Diffusion in Materials: Introduction – Types of defects - Point defects- Line defects- Surface defects- Volume defects- Production and removal of defects- Deformation- irradiation- quenching- annealing

(10hrs)

Part II-Even semester

Mechanical Behaviour of Materials: Different mechanical properties of engineering materials – Creep – Fracture – Technological properties – Factors affecting mechanical properties of a material – Heat treatment - Cold and hot working -Magnetic Materials: Dia-Para-Ferro- and Ferromagnetic materials. **(10hrs)**

Dielectric Materials: Dielectric constant, dielectric strength and dielectric loss, polarizability, mechanism of polarization, factors affecting polarization, types of dielectric materials, applications; ferroelectric, piezoelectric and pyro electric materials -Metallic glasses – Shape memory alloys: Copper, Nickel and Titanium based alloys – graphene and its properties - fibre reinforced plastics and fibre reinforced metals. **(10hrs)**

Reference books:

1. Materials Science by M.Arumugam, Anuradha Publishers. 1990, Kumbakonam.
2.Materials Science and Engineering V.Raghavan, Printice Hall India Ed. V 2004. New Delhi.
3. Elementary Solid State Physics, 1/e M. Ali Omar, 1999, Pearson India
4. Solid State Physics, M.A. Wahab, 2011, Narosa Publications
5. Crystals and Crystal structures, R.J.D. Tilley, John Wiley and Sons, 2006
6. Materials Science and Engineering – W.D. Callister, Jr.Wiley India(P) Ltd., 2007
7. Materials Science and Engineering, G.S. Upadhyaya and Anish Upadhyaya, Viva books,

2010
8. Fundamentals of Materials Science-the microstructure-property relationship using metals as model systems, E.J.Mittemeijer, Springer, 2010
9. Microstructural Characterization of Materials – D. Brandon and W.D. Kaplan, John Wiley and Sons, 2008
9. Balasubramaniam, R. "Callister's Materials Science and Engineering". Wiley India Pvt. Ltd. 2014.
10.Wahab M A "Solid state Physics"Narosa Publishing House 2009
11.Raghavan V "Material science and Engineering AFirst Course" 2015

SHREE DHARMASTHALA MANJUNATHESHWARA COLLEGE (AUTONOMOUS), UJIRE

ELECTIVES-INTERNAL EXAMINATIONS-CBCS

PHYSICS

CODE NUMBER PAPER - SEMESTER- I/II/III/IV

TOPIC-

Time::1 hr **Max marks: 25**

I Answer any FIVE of the following **1X5=5**

1.
2.
3.
4.
5.
6.
7.

II Answer any FIVE of the following **2X5=10**

1.
2.
3.
4.
5.
6.
7.

III Answer the following

1

a) 4 Marks

b) 6 Marks

OR

2

a) 4Marks

b) 6 Marks

Xxxxxxxxxx

QUESTION PAPER PATTERN –ELECTIVES-(TERM END EXAMINATION)

CODE NO: Reg No:

B.Sc.-PHYSICS

PAPER- **SEMESTER I/II/III/IV**

TOPIC-

TIME: 2HRS **MARKS:40**

Answer all Parts

PART- A

I. **Answer any FOUR of the following** 1X4=4

1)
2)
3)
4)
5)
6)
7)

PART-B

II. **Answer any FOUR of the following** 2X4=8

1)
2)
3)
4)
5)
6)

PART-C

III. **Answer any FOUR of the following** 4X4=16

1)
2)
3)
4)
5)
6)

PART-D

IV. **Answer any TWO of the following** 2X6=12

1)
2)
3)

Xxxxxxxxxx

Scheme of Examination

Short term certificate courses

Multiple choice Objective type questions 25 out of 30 questions carrying 2 marks each
Total marks- 50 in each semester

Award of certificate on the completion of the course

ADDITIONAL WORKSHOP COURSES

BSCPHWS1-Fundamentals of LaTeX

Objective:

- To Gain the knowledge about documentation and to develop the basic understanding of Latex
- **Course Outcomes:**

CO1.write documents containing mathematical formulas.

CO2.write articles in different journal styles. .

CO3. Draw graphs and figures in LaTeX.

CO4. Prepare presentation using LaTeX.

Installation of the software LaTeX -Understanding Latex compilation Basic Syntex, Writing equations, Matrix, Tables Page Layout -Titles, Abstract Chapters, Sections, Referrences, Equation references, citation. List making environments ,Table of contents, Generating new commands, Figure handling numbering, List of figures, List of tables, Generating index. Packages: Geometry, Hyperref, amsmath, amssymb, algorithms, algorithmic graphic, color, tilez listing. Classes: article, book, report, beamer, slides. IEEtran.Applications to:Writing Resumae Writing question paper Writing articles/ research papers Presentation using beamer.

(12hrs)

Basic syntax, Mathematical Operators, Predefined constants,Built in functions. Complex numbers, Polynomials, Vectors, Matrix.Handling these data structures using built in functions. Programming Functions -Loops -Conditional statements -Handling .sci files-Graphics handling-2D, 3D -Generating .jpg files . Writing resumae, writing question paper, writing articles/ research papers""presentation using slides and beamer".

(12hrs)

Reference:

1.George Grätzer (2016), *More Math Into LaTeX*, 5th edition, Springer, ISBN 978-3-319-23796-1

2.LaTeX Beginner's Guide by Stefan Kottwitz

3.LATEX Notes: Practical Tips for Preparing Technical Documents by Kenneth J. Shultis

4.LaTeX: A Document Preparation System (Addison-Wesley Series on Tools and Techniques for Computer T

ADDITIONAL WORKSHOP COURSES

BSCPHWS2-Robotics and Home Automation

Course objectives:

- Understand the basics of embedded system and learn to work with Arduino (ATMEGA 328P microcontroller) and its uses in real life

Course Outcomes:

CO1. Describe the need of embedded system in daily life.

CO2. Program the Arduino with different components such as LED, sensors.

CO3. Interface displays with Arduino and to develop robot car.

CO4. Understand the application of home automation and security in real world application.

Introduction to Embedded systems: Historical background, system, embedded system, components, embedded system structure, characteristics, classification of embedded system and its applications.**Processors and Controllers:** Processor definition, various types, microprocessor and its application. Controller definition, various types, microcontroller and its application. Difference between microprocessor and microcontroller. (6hrs

Arduino Uno Board: introduction to board, Arduino board specifications, Arduino software.**Experiments:** LED, Traffic control, PWM, serial communication, Bluetooth module.**Sensors:** introduction, working of sensors. Interfacing these sensors with Arduino: LDR, IR sensor, humidity and temperature sensor, Ultrasonic sensor, Microphone, passive buzzer,Motionsensor,gassensor..Projectsusing RaspberryPiboard (6hrs)

Electronic display: Introduction to Nokia 5110 LCD, Interfacing with Arduino ProgrammingLCD and displaying images. Introduction to 16×2 LCD display, interfacing with Arduino, displaying the messages and studying its application.**Arduino controlled Robotic Car:** Introduction to Robotics, Concept of motor and motor Driver IC and its applications, Programming the Arduino powered robot, Interfacing Bluetooth, Making obstacle avoiding robot using ultrasonic. (6hrs)

Home automation: introduction to home automation, concept of relay and AC power system, interfacing Bluetooth, programming the Arduino, controlling AC appliances through Arduino.**Security system:** introduction to RFID, interfacing RFID with board, programming Arduino and studying its applications. (6hrs)

Reference books

1.“Beginning Arduino Programming”, Brian Evans
2.“An Absolute Beginner’s Guide to Arduino”, Prashanth Kumar G N