Dr. V.S.KRISHNA GOVERNMENT COLLEGE (A) ,VISAKHAPATNAM

B.Sc. Hons PHYSICS SYLLABUS UNDER CBCS

[For Mathematics combinations]

w.e.f. 2020-21 (Revised in May 2020)

PROGRAMSPECIFIC OUTCOMES :

After the completion of the B.Sc Honors Physics Program (3 year program) , the student will be able to

PSO 1: *Gain not only adequate knowledge in basic topics of the Physics subject like Classical Mechanics (Newtonian + Special Theory of relativity) , Optics , Heat , Electricity & Magnetism ,Electronics ,Modern Physics etc but also a fundamental level exposure in advanced topics like Mathematical Methods in Physics , Quantum Mechanics , Solid State Physics , StatisticalMechanics , Electro Magnetic Theory so that it will be comfortable while doing Post Graduation in Physics .*

PSO 3 : *Acquire diversepractical technical oriented skillsthrough various Skill Enhancement based Elective Courses not only related to Physics subject but also to the other science & Technical subjects so that it will be very beneficial in getting various technical related jobs.*

PSO 4:*Develop knowledge in very Advanced Topics of physics through Disciplined Specific Electives (Elective Courses) which are included in the syllabus with an intention to fill the gapbetween the Under graduate andthe Post Graduate Curricula.*

PSO 5 :*Get enough exposure in the subjects of Mathematics & Chemistry which are very Closely related to the to the fundamental aspects of Physics so that it will be very useful in Physics courses as well as in the skill Enhancement Courses.*

PSO 6 :*Get enough practical exposure & experience through Lab sessions in all the courses so that it will be helpful not only in understanding physics but also in understanding many Technical aspects of the Skill Enhancement Courses .*

PSO 7 : *Face confidently any competitive exam , Interview , Group discussions etcbecause of training they get through various types of Assessments (Online Quizzes , oral presentations , seminars , problem solving etc)*

Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM
B.Sc. PHYSICS Programme SYLLABUS UNDER CBCS
[For Mathematics Combination only]
w.e.f. 2020-21 (Revised in May 2020)

Generic Electives (GE) (Minor Physics) All the courses have 5 credits with 4 for other Departments/Disciplines credits of theory and 1 credits ofpracticals or 4 credits of theory and 1credit of Tutorials.

Elective papers for other B.SC. Main subject programs other than B.Sc Physics

1. Electricity and Magnetism+ Lab
2. Thermal Physics and Statistical Mechanics + Lab
3. Waves and Optics + Lab
4. Embedded Systems –Introduction of Microcontroller + Lab
5. Nuclear and Particle Physics + Tutorials
6. Digital , Analog and Instrumentation + Lab
7. Elements of Modern Physics + Lab
8. Mathematical Physics + Lab
9. Solid State Physics +Lab
10. Quantum Mechanics + Lab
11. Mechanics + Lab

1. Analytical Skills
2. Basic Computer Applications
3. Elementary Statistics
4. Entrepreneurship Development
5. Environmental Education
6. Health and Hygiene
7. Human Values Professional Ethics as part of Life skill courses
8. Indian Culture and Science
9. Information and Communication Technology
10. Personality Enhancement and Leadership

LIST OF LIFE SKILL COURSES

Semester	No. of Courses	Choices	Preferred Teaching Dept.
I	01	Computer Applications	Computers
		Human Values and Professional Ethics	English/Telugu/Any Dept
		Entrepreneurship	Commerce
II	01	Information and Communication Technology	Computers
		Indian Culture and Science	History/Telugu
		Elementary Statistics	Statistics/Maths/Economics/ Commerce
III	02	Health and Hygiene	Zoology/Botany
		Personality Development and Leadership	English/ Any Dept
		Analytical Skills	Maths/Statistics
		Environmental Education	Botany/Zoology/Environmental Sciences/Any Dept.

1. Tourism Guidance
2. Journalistic Reporting
3. Public Relations
4. Survey and Reporting
5. Financial Markets
6. Disaster Management
7. Social Work Methods
8. Performing Arts
9. Advertising
10. Agriculture Marketing
11. Business Communication
12. Insurance Promotion
13. Logistics and Supply chain Mangement
14. Online Business
15. Office Secretaryship
16. Retailing
17. Electrical Appliances
18. Solar Energy
19. Food Adulteration
20. Environmental Audit
21. Plant Nursery
22. Fruits and Vegetable Preservation
23. Dairy Technology
24. Poultry Farming

Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

B.Sc.HONORS PHYSICS SYLLABUS UNDER CBCS

For Mathematics Combinations

[2020-21 Batch onwards]

I Year B.Sc.-Physics:I Semester

CC- 1: MECHANICS

Work load:60 hrspersemester **4hrs/week**

Course outcomes:

On successful completion of this course, the students will be able to:

- *Understand Newton's laws of motion , motion of many particle systems ,laws of conservation of Linear Momentum , work & Energy and also about Collisions*
- *Apply the rotational kinematic relations, and Conservation of angular Momentum, symmetries of Moment of Inertia for the Combined Rotation Translation Motion*
- *Comprehend the general characteristics of central forces and the application of Kepler's laws to describe the motion of planets and satellite in circular orbit through the study of law ofGravitation and also about the basic aspects of Elasticity & Fluid Motion*
- *Get acquainted with the basics of Oscillatory motion and the motion w.r.t. the Non-inertial frames of Reference*
- *Understand postulates of Special theory of relativity and its consequences such as length contraction, time dilation, relativistic mass and mass-energyequivalence.*

Learning Objectives :

1. *To understand Newton's laws of motion and the three conservation laws of motion*
2. *To understand the laws of Rotational dynamics and apply them to Combined Rotation Translation motion*
3. *To understand the central force motion and basic aspects of Elasticity & Fluid motion*
4. *To understand the basic aspects of Oscillatory motion and about the motion w.r.t. Non-inertial Frames*
5. *To understand both the Kinematic as well as Dynamical aspects of Relativistic Mechanics*

I Year B.Sc.-Physics:I Semester

CC- 1: MECHANICS Syllabus

Work load:60 hrspersemester 4hrs/week

UNIT-I:
NEWTONIAN MECHANICS

1. **Fundamentals of Dynamics:** Reference frames. Inertial frames; Review of Newton's Laws of Motion. Galilean transformations; Galilean invariance. Momentum of variable-mass system: motion of rocket. Motion of a projectile in Uniform gravitational field Dynamics of a system of particles. Centre of Mass. Principle of conservation ofmomentum.Impulse. **(6 Lectures)**

2. **Work and Energy:** Work and Kinetic Energy Theorem. Conservative and non-conservative forces. Potential Energy. Energy diagram. Stable and unstable equilibrium. Elastic potential energy. Force as gradient of potential energy. Work & Potential energy. Work done by non- conservative forces. Law of conservationofEnergy. **(6Lectures)**

Unit-II:

3.Collisions: Elastic and inelastic collisions between particles. Center of Mass & Laboratory Frames of Reference , Rutherford Alpha Particle Scattering Experiment – Scattering Cross section Expression derivation. **(5Lectures)**

4.Rotational Dynamics: Angular momentum of a particle and system of particles Torque. Principle of conservation of angular momentum. Rotation about a fixed axis. Moment of Inertia. Calculation of moment of inertia for rectangular, cylindrical and spherical bodies. Kinetic energy of rotation. Motion involving both Translation and rotation.Euler's equations of motion – Torque free motion **(10 Lectures)**

UNIT-III:

5.Elasticity: Relation between Elastic constants. Twisting torque on a Cylinder or wire **(3Lectures)**

6.Fluid Motion: Kinematics of Moving Fluids: Poiseuille's Equation for Flow of a liquid through a Capillary tube. **(2 Lectures)**

7. Gravitation and Central Force Motion: Law of gravitation. Gravitational potential Inertial and gravitational mass. Potential and field due to spherical shell a and solidsphere. Motion of a particle under a central force field. Two-body problem and its reduction to one body problem and its solution. The energy equation and Energy diagram ,Kepler's laws. Satellite in circular orbit and applications.
Geosynchronous orbits.Weightlessness. Basic ideaof Global Positioning system(GPS). **(8Lectures)**

UNIT – IV

OSCILLATIONS & NON INERTIAL FRAMES :

8.Oscillations: SHM: Simple Harmonic Oscillations. Differential equation of SHM and its solution. Kinetic energy, potential energy, total energy and their time-average values. Damped oscillation. Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation andQualityFactor. **(7Lectures)**

9.Non-Inertial Systems: Non-inertial frames and fictitious forces. Uniformly rotating frameLaws of physics in rotating coordinate systems. Centrifugal force. Coriolis force and its Applications. Components of Velocity and Acceleration in
Cylindrical and spherical polar Coordinate systems. **(3Lectures)**

UNIT – V

SPECIAL THEORY OF RELATIVITY

10. Special Theory of Relativity: Michelson-Morley Experiment and its outcome. Postulates of Special Theory of Relativity. Lorentz Transformations. Simultaneity and order of events. Lorentz contraction. Time dilation. Relativistic transformation of velocity, frequency and wave number. Relativistic addition of velocities. Variation of mass with velocity. Massless Particles. Mass- energy Equivalence. Relativistic Doppler effect. Relativistic Kinematics. Transformation of EnergyandMomentum.

Reference Books:

- An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973,McGraw-Hill.
- Mechanics, Berkeley Physics, vol.1, C.Kittel, W.Knight, et.al. 2007, TataMcGraw-Hill.
- Physics, Resnick, Halliday and Walker 8/e. 2008,Wiley.
- Analytical Mechanics, G.R. Fowles and G.L. Cassiday. 2005, CengageLearning
- Feynman Lectures, Vol. I, R.P.Feynman, R.B.Leighton, M.Sands, 2008, PearsonEducation
- Introduction to Special Relativity, R. Resnick, 2005, John Wiley andSons.
- University Physics, Ronald Lane Reese, 2003, ThomsonBrooks/Cole.
- **Additional Books for Reference**
- Mechanics, D.S. Mathur, S. Chand and Company Limited,2000
- University Physics. F.W Sears, M.W Zemansky, H.D Young 13/e, 1986, AddisonWesley

PHYSICS LAB-CC 1 LAB

60 Lectures

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
2. To study the random error inobservations.
3. To determine the height of a building using aSextant.
4. To study the Motion of Spring and calculate (a) Spring constant, (b) **g** and (c) Modulus of rigidity.
5. To determine the Moment of Inertia of aFlywheel.
6. To determine **g** and velocity for a freely falling body using Digital TimingTechnique
7. To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
8. To determine the Young's Modulus of a Wire by Optical LeverMethod.
9. To determine the Modulus of Rigidity of a Wire by Maxwell'sneedle.
10. To determine the elastic Constants of a wire by Searle'smethod.
11. To determine the value of g using BarPendulum.
12. To determine the value of g using Kater'sPendulum.

Reference Books:

- Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4thEdition, reprinted 1985, Heinemann EducationalPublishers
- A Text Book of Practical Physics, I.Prakash& Ramakrishna, 11thEdn, 2011, KitabMahal
- Engineering Practical Physics, S.Panigrahi& B.Mallick,2015, Cengage Learning India Pvt. Ltd.

Dr. V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

□ PHYSICS Hons SYLLABUS (w.e.f. 2020-21)

□ SEMESTER- I

□ CC – 1MECHANICS

□ BLUE PRINT FOR QUESTION PAPER SETTER

TIME : 3 hrsMax.Marks :75

Sl.No.	UNIT NO. /CHAPTER NO.		SHORT ANSWER QUESTIONS 5 MARKS	ESSAY QUESTIONS 10 MARKS	MARKS ALLOETD TO THE UNIT
1	UNIT I	1.Fundamentals of Dynamics	1	1	30
		2.Work & Energy	1	1	
2	UNIT II	3. Collisions	1	1	30
		4. Rotational Dynamics	1	1	
3	UNIT III	5.Elasticity	0	1	30
		6.Fluid Motion	1		
		7.Gravitation & Central force Motion	1	1	
4	UNIT IV	Oscillations	1	1	30
		Non Inertial Systems	1	1	
5	UNIT V	Special Theory of Relativity	2	2	30
	Total no. of Questions		10	10	
	Total Marks including Choice				150

□ Note: 1.The question paper setters are requested to kindly adhere to the format given in the above table.

□ 2.The question paper setters are also requested to set the questions based on problems (conceptual or numerical) for a total of 20 marks.

Dr. V.S.KrishnaGovernemnt Degree College (A) , Visakhapatnam

Hons PHYSICS MODEL PAPER FOR I SEMESTER

MECHANICS – CC-1

Answer any FIVE of thefollowing:

5x5=25

1. Show and prove the law of conservation of Linear Momentum for a system of Particles.
2. Explain about Conservative forces and Potential energy.
3. Derive the expressions for the final velocities of the particles undergoing a perfectly elastic collision.
4. Find the moments and products of Inertia of a uniform square plate in the first quadrant of the XY plane with one corner at the origin.
5. A planet revolves around the sun in an Elliptic orbit with Maximum and Minimum speeds to be 18.3km/s and 17.7km/s respectively. Find the eccentricity of the orbit.
6. Derive Poiseuille's equation for flow of a liquid through a capillary tube using Dimensional analysis.
7. Explain about Length Contraction in Special Theory of Relativity.
8. If the total energy of a particle is three times its Rest mass energy , find the speed of the particle.
9. What fraction of the total Energy is kinetic and what fraction is potential when the displacement is one half of amplitude in a Simple Harmonic motion.
10. Derive the expressions for the Velocity and Acceleration vectors in Spherical polar coordinates.

Answer any FIVE ofthefollowing: **5x10=50**

11. Obtain the expression for the speed of a Rocket projected from the Earth as a function of time.

OR

State and prove the Conservation law of Energy and the Transformation law For Kinetic Energy for a system of particles

12. Derive the expression for the differential cross section for the Alpha particles

The Rutherford Alpha ray Scattering experiment.

OR

Explain the Torque free Motion of a Rigid body by solving Euler's equations Of motion.

13. Derive the relation between the Elastic constants of the material of a solid.

OR

State Kepler's laws of Planetary motion. Prove the Kepler's first law of Planetary motion.

14. Derive the equation of motion for a Simple Harmonic Oscillator and obtain its solution.

OR

Derive the expression for the Coriolis force on an object moving on the surface of the earth. Explain when and where it becomes zero and where it becomes maximum.

15. State the postulates of the Special Theory of Relativity and derive the Lorentz Transformation equations of motion.

OR

Explain how mass changes with the speed of the body according to Special Theory of Relativity. Derive the Einstein's Mass- Energy Equivalence equation .

Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

Honors PHYSICS SYLLABUS UNDER CBCS

For Mathematics Combinations

[2020-21 Batch onwards]

I Year B.Sc.-Hons Physics: I Semester

CC-2: WAVES & OPTICS

Work load:60 hrspersemester **4 hrs/week**

Course outcomes:

On successful completion of this course, the student will be able to:

CO-1:*Understand the basics of the Superposition of Collinear & Perpendicular Harmonic Oscillations and also about the Wave motion.*

CO-2:*Get acquainted with the theory of velocity of waves and also with the superposition of Harmonic Waves.*

CO-3:*Explain about the Electromagnetic nature of the Light and the phenomenon of Interference and also about the formation of Interference fringes in Thin films as well as about the formation of Newton's rings.*

CO-4:*Describe the construction and the working of the Michelson Interferometer & Fabry-perot Interferometer and also about the Fraunhofer Diffraction patterns due to single slit , Circular aperture as well as diffraction Grating.*

CO-5:*Apply the basic mathematical principles of Diffraction to Explain Fresnel Diffraction Patterns due to a straight edge , slit and a wire and comprehend the basic principles Holography*

Learning Objectives:

1. *To understand Harmonic oscillatory motion & wave motion*
2. *To comprehend the superposition of harmonic waves and also velocity of waves*
3. *To understand the Electromagnetic nature of the Light and the phenomenon of Interference*
4. *To understand the construction & working of various Interferometers and also the formation of Fraunhofer Diffraction patterns due to various objects*
5. *To understand the basic mathematical principles of Diffraction and the formation of Fresnel Diffraction patterns due to various objects.*

Skill Component :

UNIT – I :

1. *Obtain Lissajous figures with CRO*
2. *Analyze & apply the Superposition principle of Waves*

UNIT – II :

1. *Measurement of speed of mechanical waves in strings , speed of sound in air etc*
2. *Apply & analyze the superposition principle , Phenomenon of Beats in sound waves*
3. *Observe & analyze the situations where phase and Group velocities of waves arises*

UNIT –III :

1. *Measurement of wavelength of light from a source*
2. *Adjustments of Spectrometer , Telescopes , Microscopes etc*
3. *Observe & analyze the situations involving the phenomenon of the Interference of the light (Colours of thin oil films , Butterfly wings etc)*

UNIT – IV :

1. *Analyze & observe the Diffraction effects of the Light*
2. *Measurement of the Resolving power of a Telescope*
3. *Determination of light from a source using a Diffraction grating.*

UNIT – V :

1. *Construction of Fresnel zone plate*
2. *Observe & analyze the effects of Fresnel Diffraction*
3. *Develop the art of thinking in applying Holography*

PHYSICS-CC- 2 : WAVES AND OPTICS Syllabus

(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

UNIT - I

1.Superposition of Collinear & Perpendicular Harmonic oscillations: Linearity and Superposition Principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats). Superposition of N collinear Harmonic Oscillations with (1) equal phase differences and (2) equalfrequencydifferences. Graphical and Analytical Methods.Lissajous Figures with equal an unequal frequency andtheiruses.

(7 Lectures)

2.Wave Motion: Plane and Spherical Waves. Longitudinal and Transverse Waves. Plane Progressive (Travelling) Waves. Wave Equation. Particle and Wave Velocities. Differential Wave Equation. Pressure of a Longitudinal Wave. Energy Transport. Intensity of Wave. Water Waves: Ripple andGravityWaves. **(4Lectures)**

UNIT – II

3.Velocity of Waves: Velocity of Transverse Vibrations of Stretched Strings. Velocity of Longitudinal Waves in a Fluid in a Pipe. Newton's Formula for Velocity of Sound.Laplace'sCorrection.**(6Lectures)**

4.Superposition of Two Harmonic Waves: Standing (Stationary) Waves in a String: Fixed and Free Ends. Analytical Treatment. Phase and Group Velocities. Changes with respect to Position and Time. Energy of Vibrating String. Transfer of Energy. Normal Modes of Stretched Strings. Plucked and Struck Strings. Melde's Experiment. Longitudinal Standing Waves and Normal Modes. Open and Closed Pipes.Superpositionof N Harmonic Waves. **(7Lectures)**

UNIT – III

5. Wave Optics: Electromagnetic nature of light. Definition and properties of wave front. Huygens Principle. Temporal andSpatialCoherence. **(3Lectures)**

6. Interference: Division of amplitude and wavefront. Young's double slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton'sRings:Measurement of wavelength andrefractive index.**(9Lectures)**

UNIT - IV

7. Interferometers: Michelson Interferometer-(1) Idea of form of fringes (Notheory required),Determination of Wavelength, (3) Wavelength Difference, (4) Refractive Index, and (5) Visibility of Fringes.Fabry-Perotinterferometer.**(6 Lectures)**

8. Fraunhofer Diffraction: Kirchhoff's Integral Theorem, Fresnel-Kirchhoff's Integral formula. (Qualitativediscussiononly)Single slit, Circular aperture, Resolving Power of a telescope.Double slit. Multiple slits. Diffraction grating.Resolving powerofgrating.

(8Lectures)

UNIT – V

9. Fresnel Diffraction: Fresnel's Assumptions. Fresnel's Half-Period Zones for Plane Wave. Explanation of Rectilinear Propagation of Light. Theory of a Zone Plate: Multiple Foci of a Zone Plate.Fresnel's Integral, Fresnel diffraction pattern of a straight edge, a slit and a wire.

(7 Lectures)

10. Holography: Principle of Holography. Recording and Reconstruction Method. Theory of Holography as Interference between two Plane Waves. Pointsourceholograms.**(3 Lectures)**

Reference Books:

- Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, TataMcGraw-Hill.
- Fundamentals of Optics, F.A. Jenkins and H.E. White, 1981,McGraw-Hill
- Principles of Optics, Max Born and Emil Wolf, 7thEdn., 1999, PergamonPress.
- Optics, AjoyGhatak, 2008, Tata McGrawHill
- The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley andSons.
- The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGrawHill.
- Fundamental of Optics, A. Kumar, H.R. Gulati and D.R. Khanna, 2011, R. Chand Publications.

PHYSICS LAB- CC 2 LAB

60 Lectures

1. To determine the frequency of an electric tuning fork by Melde's experiment and verify $\lambda^2 - T$ law.
2. To investigate the motion of coupledoscillators.
3. To study LissajousFigures.
4. Familiarization with: Schuster`s focusing; determination of angle ofprism.
5. To determine refractive index of the Material of a prism using sodiumsource.
6. To determine the dispersive power and Cauchy constants of the material of a prism using mercurysource.
7. To determine the wavelength of sodium source using Michelson'sinterferometer.
8. To determine wavelength of sodium light using FresnelBiprism.
9. To determine wavelength of sodium light using Newton'sRings.
10. To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shapedFilm.
11. To determine wavelength of (1) Na source and (2) spectral lines of Hg source using plane diffractiongrating.
12. To determine dispersive power and resolving power of a plane diffractiongrating.

Reference Books:

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia PublishingHouse
- A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, KitabMahal
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann EducationalPublishers
- A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub.

Dr. V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

- PHYSICS Hons SYLLABUS (w.e.f. 2020-21)
- SEMESTER- I
- CC – 2WAVES & OPTICS
- **BLUE PRINT FOR QUESTION PAPER SETTER**

TIME : 3 hrsMax.Marks :75

Sl.No.	UNIT NO. /CHAPTER NO.		SHORT ANSWER QUESTIONS 5 MARKS	ESSAY QUESTIONS 10 MARKS	MARKS ALLOETD TO THE UNIT
1	UNIT I	1.Superposition of two collinear & perpendicular harmonic oscillations	1	1	30
		2.Wave motion	1	1	
2	UNIT II	3. velocity of waves	1	1	30
		4.Superposition of two Harmonic waves	1	1	
3	UNIT III	5. Wave optics	1		30
		6.Interference	1	2	
4	UNIT IV	7.Interferometers	1	1	30
		8.Fraunhofer Diffraction	1	1	
5	UNIT V	9.Fresnel diffraction	1	1	30
		10. Holography	1	1	
	Total no. of Questions		10	10	
	Total Marks including Choice				150

- Note: 1.The question paper setters are requested to kindly adhere to the format given in the above table.
- 2.The question paper setters are also requested to set the questions based on problems (conceptual or numerical) for a total of 20 marks.
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Dr. V.S.KrishnaGovernemnt Degree College (A) , Visakhapatnam
Hons PHYSICS MODEL PAPER FOR I SEMESTER

WAVES &OPTICS – CC-2

SECTION _A

Answer any FIVE of thefollowing:5x5=25 Marks

1. Explain the Linearity and the Superposition principles of Harmonic Oscillations.
2. Explain the term intensity of a Harmonic wave and derive an expression for it.
3. Compare the speeds of sound in Hydrogen and carbon dioxide .The ratio of Specific heats of hydrogen and Carbon dioxide are respectively 1.4 and 1.3.
4. Distinguish between Phase and group velocities.
5. write the differences between the Spatial and the Temporal coherence of Light.
6. A mixture of waves of wave lengths range 5800 $A^0$to 3500 A^0 is allowed to fall normally on a thin film of air of thickness 0.2945 μm . What is the colour shown in reflection by the Film.
7. A transparent film of glass of Refractive index 1.5 is introduced in the path of one of the interfering beams of Michelson Interferometer which is illuminated with light of wavelength 4800 A^0 . This causes 500 dark fringes to sweep across the field. Determine the thickness of the film.
8. A grating has got 6000 lines/cm on its surface. Find the Angular separation between the two sodium lines of wavelength 589 nm and 589.6 nm in the second order spectrum produced by the Grating.
9. Draw the Intensity distribution diagram of Fresnel Diffraction pattern at a straight edge and explain it.
10. Write any five applications of Holography.

SECTION -B

Answer allofthefollowing: 5x10=50 marks

11. Explain in detail about the resultant motion due to two mutually perpendicular simple Harmonic Oscillations having same frequency.

OR

Derive the Wave Equation for a Harmonic Wave and explain about its general Solution and the physical significance of the solution.

12. Derive an expression for the speed of Transverse waves in a stretched string

Explain about the Laplace correction for the Newton's expression for the Speed of sound in air.

OR

Derive the expression for the Energy of a vibrating stretched string.

13. Explain the Construction of the Fresnel Biprism . explain about the formation Of interference Fringes and the method of determination of wavelength.

OR

Explain the construction of the Newton's rings apparatus and explain about the formation of Interference Fringes. Derive the expressions for the

diameters of the Newton's rings.

14. Explain the construction and working of Michel son Interferometer to determine the wavelength of the Light from the source.

OR

Explain the formation of Fraunhofer Diffraction due to a Single slit illuminated by a Monochromatic Light.

15. Explain the construction and the working of a Zone plate. Write the differences between a Zone plate and a convex lens.

OR

Explain about Recording of a Hologram and the Reconstruction of Three dimensional image of an object from the Hologram with neat diagrams.

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B.Sc.HONORS PHYSICS SYLLABUS UNDER CBCS

For Mathematics Combinations

SKILL DEVELOPMENT COURSES

Revised CBCS w.e.f. 2020-21

Science Stream

Syllabus of ELECTRICAL APPLIANCES

Total 30hrs (02h/wk), ***02 Credits & Max Marks:50***

Learning Outcomes:

By successful completion of the course, students will be able to:

1. *Acquire necessary skills/hand on experience/ working knowledge on multimeters, galvanometers, ammeters, voltmeters, ac/dc generators, motors, transformers, single phase and three phase connections, basics of electrical wiring with electrical protectiondevices.*
2. *Understand the working principles of different household domesticappliances.*
3. *Check the electrical connections at house-hold but will also learn the skill to repair the electrical appliances for the general troubleshoots and wiringfaults.*

SYLLABUS:

UNIT-I **(6 hrs)**

Voltage, Current, Resistance, Capacitance, Inductance, Electrical conductors and Insulators, Ohm's law, Series and parallel combinations of resistors, Galvanometer, Ammeter, Voltmeter, Multimeter, Transformers, Electrical energy, Power, Kilowatt hour (kWh), consumption of electricalpower

UNIT-II (10hrs)

Direct current and alternating current,RMS and peak values, Power factor, Single phase and three phase connections , Basics of House wiring , Star and delta connection , Electric shock, First aid for electric shock, Overloading , Earthing and its necessity, Short circuiting , Fuses , MCB , ELCB, Insulation, Inverter, UPS

UNIT-III (10hrs)

Principles of working, parts and servicing of Electric fan, Electric Iron box, Water heater; Induction heater, Microwave oven; Refrigerator, Concept of illumination, Electric bulbs, CFL, LED lights, Energy efficiency in electrical appliances, IS codes & IEcodes.

Co-curricular Activities (Hands on Exercises): (04 hrs)

[Any four of the following may be taken up]

1. Studying the electrical performance and power consumption of a given number of bulbs connected in series and parallelcircuits.
2. Measuring parameters in combinational DC circuits by applying Ohm's Law for different resistor values and voltagesources

3. Awareness of electrical safety tools and rescue of person in contact with livewire.
4. Checking the specific gravity of lead acid batteries in home UPS and topping-up with distilledwater.
5. Identifying Phase, Neutral and Earth on powersockets.
6. Identifying primary and secondary windings and measuring primary and secondary voltages in various types oftransformers.
7. Observing the working of transformer under no-load and full loadconditions.
8. Observing the response of inductor and capacitor with DC and ACsources.
9. Observing the connections of elements and identify current flow and voltagedrops.
10. Studying electrical circuit protection using MCBs,ELCBs
11. Assignments, Model exametc.

Reference Books:

1. A Text book on Electrical Technology, B.L.Theraja, S.Chand&Co.,
2. A Text book on Electrical Technology,A.K.Theraja.
3. Performance and design of AC machines, M.G.Say,ELBSEdn.,
4. Handbook of Repair & Maintenance of domestic electronics appliances; BPBPublications
5. Consumer Electronics, S.P.Bali, Pearson
6. Domestic Appliances Servicing, K.P.Anwer, Scholar InstitutePublications

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Dr. V.S.KRISHNA GOVERNMENT DEGREE COLLEG) , VISAKHAPATNAM

- PHYSICS Hons SYLLABUS (w.e.f. 2020-21)
- SEMESTER- I
- SDC – ELECTRICAL APPLIANCES
- **BLUE PRINT FOR QUESTION PAPER SETTER**

TIME : 3 hrsMax.Marks :75

Sl.No.	UNIT NO.	SHORT ANSWER QUESTIONS 5 MARKS	ESSAY QUESTIONS 10 MARKS	MARKS ALLOETD TO THE UNIT
1	UNIT -I	2	1	20
2	UNIT – II	3	2	35
3	UNIT – III	3	2	35
	Total no. of Questions	8	5	
	Total Marks including choice			90

- Note: 1.The question paper setters are requested to kindly adhere to the format given in the above table.
- 2.The question paper setters are also requested to set the questions based on problems (conceptual or numerical) for a total of 20 marks.

Dr V S Krishna Government Degree College, Visakhapatnam

SKILL DEVELOPMENT COURSE

ELECTRICAL APPLIANCES

MODEL QUESTION PAPER

Max. Marks: 50 *Time: 1½ hrs (90 Minutes)*

SECTION- A (4x5M=20 Marks)

Answer any four questions. Each answer carries 5 marks
(At least 1 question should be given from each Unit)

1. State and Explain Ohm's law.
2. Define capacitance and inductance.
3. Distinguish between single phase and three phase connections
4. Explain First aid for electric shock.
5. Write a short notes on UPS
6. Explain power factor in an ac circuit.
7. Explain the principle of Refrigerator
8. Explain the working of microwave woven

SECTION B (3x10M = 30 Marks)

Answer any three questions. Each answer carries 10 marks
(At least 1 question should be given from each Unit)

9. Obtain expression for equivalent resistance when two resistors are connected in series and parallel
10. What is a transformer. Distinguish between step-up and step-down transformers. Explain the construction, principle and working of a transformer.
11. Explain star and delta connections.
12. Explain the principle of working, parts and servicing of Electrical Fan.
13. Write an essay on energy efficiency of electrical appliances

H. Sudheer

Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

Honors PHYSICS SYLLABUS UNDER CBCS

For Mathematics Combinations

[2020-21 Batch onwards]

I Year B.Sc.-Physics: II Semester

CC-3: MATHEMATICALPHYSICS

Work load:60 hrspersemester **4 hrs/week**

Course outcomes:

On successful completion of this course, the student will be able to:

CO-1: Solve various First & second order ordinary differential equations and also some problems with various constraints using Lagrangian multiplier method

CO-2:*Get acquainted with the basics of Scalar &Vector Fields and also with the basics of Vector Differentiation in cartesian as well as Orthogonal curvilinear coordinates*

CO-3:*Apply Gauss's Divergence , Stoke's and Green's theorms to solve various problems involving vector Integration*

CO-4:*Work out the problems involving Fourier series and special integrals like Gamma integral , beta integral*

CO-5: *Get acquainted with the properties of Delta function and also about the Theory of Errors as well as about the elementary aspects of Probability distribution functions*

Learning Objectives:

1. *To learn how to solve First & Second order Differential equations and also Lagrangian Multiplier method*
2. *To understand Scalar & Vector fields and also the basics of Vector Differentiation in Cartesian and Orthogonal curvilinear coordinates*
3. *To apply Gauss divergence , Stokes and Greens theorms to solve various problems involving Vector Integration*
4. *To work out the problems involving Fourier series , Gamma and Beta integrals*
5. *To understand Dirac Delta Function , Theory of errors & Probability Distribution Functions*

Skill Component :

UNIT – I :

1. *Plotting of various typical functions using analytical & computational techniques*

2. *Obtain solutions of Differential equations*

3. *Solve differential equations involving constraints*

UNIT – II &III :

1. *Geometrical interpretations of Vector algebra and Vector calculations*

2. *Applying Non – cartesian coordinates to Physics problems*

UNIT – IV &V :

1. *Apply & Analyze the Fourier Analysis for Physics applications (Amplifiers in Electronics)*

2. *Learn to apply & analyze the statistical probability theories for Real life Physics*

PHYSICS-CC 3: MATHEMATICAL PHYSICS-I

(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

The emphasis of course is on applications in solving problems of interest to physicists.

The students are to be examined entirely on the basis of problems, seen and unseen.

UNIT - I

1. **Recapitulation**: Limits, continuity, average and instantaneous quantities, differentiation. Plotting functions, Intuitive ideas of continuous, differentiable, etc. functions and plotting of curves. Approximation: Taylor and binomial series(statementsonly). **(2Lectures)**

2. **First Order and Second Order Differential equations**: First Order Differential Equations and Integrating Factor. Homogeneous Equations with constant coefficients. Wronskian and general solution. Statement of existence and Uniqueness Theorem for Initial Value Problems. ParticularIntegral. **(9 Lectures)**

3.Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials. Integrating factor, with simple illustration. Constrained Maximization using LagrangeMultipliers. **(3Lectures)**

UNIT - II

4. Vector Algebra:

Recapitulation of vectors: Properties of vectors under rotations. Scalar product and its invariance under rotations. Vector product, Scalar triple product and their interpretation in terms of area and volume respectively. Scalar andVectorfields.**(2 Lectures)**

5.Vector Differentiation: Directional derivatives and normal derivative. Gradient of a scalar field and its geometrical interpretation. Divergence and curl of a vector field. Del and Laplacian operators.Vectoridentities. **(6Lectures)**

6. Orthogonal Curvilinear Coordinates:
Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and CylindricalCoordinateSystems. **(3Lectures)**

UNIT – III

7. Vector Integration: Ordinary Integrals of Vectors. Multiple integrals, Jacobian. Notion of infinitesimalline,surfaceandvolumeelements.Line,surfaceandvolumeintegralsofVector fields. Flux of a vector field. Gauss' divergence theorem, Green's and Stokes Theorems and their applications (no rigorous proofs). **(12 Lectures)**

UNIT – IV

8.Fourier Series: Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only). Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients. Complex representation of Fourier series. Expansion of functions with arbitrary period. Expansion of non-periodic functions over an interval. Even and odd functions and their Fourier expansions. Application. Summing of Infinite Series. Term-by-Term differentiation and integration of FourierSeries.

ParsevalIdentity. **(10 Lectures)**

9. Some Special Integrals: Beta and Gamma Functions and Relation between them. Expression of Integrals in terms of Gamma Functions.

Error Function(ProbabilityIntegral). **(3Lectures)**

UNIT – V

10. Dirac Delta function and its properties:
Definition of Dirac delta function. Representation as limit of a Gaussian function and rectangular function. Properties of Diracdeltafunction. **(1Lecture)**

11. Theory of Errors: Systematic and Random Errors. Propagation of Errors. Normal Law of Errors. Standard and Probable Error. Least-squares fit. Error on the slope and intercept of a fitted line. **(5 Lectures)**

12.Introduction to probability:
Independent random variables: Probability distribution functions; binomial, Gaussian, and Poisson, with examples. Mean and variance. Dependent events: Conditional Probability.

Bayes' Theorem and the idea ofhypothesis testing. **(4 Lectures)**

Reference Books:

- Mathematical Methods for Physicists: Arfken, Weber, 2005, Harris,Elsevier.
- Fourier Analysis by M.R. Spiegel, 2004, TataMcGraw-Hill.
- Mathematics for Physicists, Susan M. Lea, 2004, ThomsonBrooks/Cole.
- Differential Equations, George F. Simmons, 2006, TataMcGraw-Hill.
- Partial Differential Equations for Scientists & Engineers, S.J. Farlow, 1993, DoverPub.
- Engineering Mathematics, S.Pal and S.C. Bhunia, 2015, Oxford UniversityPress
- Mathematical methods for Scientists & Engineers, D.A. McQuarrie, 2003, VivaBooks

PHYSICS LAB- CC- 3 LAB:

60 Lectures

The aim of this Lab is not just to teach computer programming and numerical analysis but to emphasize its role in solving problems in Physics.

- Highlights the use of computational methods to solve physicalproblems
- The course will consist of lectures (both theory and practical) in theLab
- Evaluation done not on the programming but on the basis of formulating theproblem
- Aim at teaching students to construct the computational problem to besolved
- Students can use any one operating system Linux or MicrosoftWindows

Topics	Description with Applications
Introduction and Overview	Computer architecture and organization, memoryand Input/output devices
Basics of scientific computing	Binary and decimal arithmetic, Floating point numbers, algorithms, Sequence, Selection and Repetition, single and double precision arithmetic, underflow &overflow-emphasize the importance of making equations in terms of dimensionless variables, Iterative methods
Errors and error Analysis	Truncation and round off errors, Absolute and relative errors, Floating point computations.
Review of C & C++ Programming fundamentals	Introduction to Programming, constants, variables and data types, operators and Expressions, I/O statements, scanf and printf, c in and c out, Manipulators for data formatting, Control statements (decision making and looping statements) (If-statement. If-else Statement. Nested if Structure. Else-if Statement. Ternary Operator. Goto Statement. Switch Statement. Unconditional and Conditional Looping. While Loop. Do-While Loop. FOR Loop. Break and Continue Statements. Nested Loops), Arrays (1D & 2D) and strings, user defined functions, Structures and Unions, Idea of classes and objects
Programs:	Sum & average of a list of numbers, largest of a given list of numbers and its location in the list, sorting of numbers in ascending descending order, Binary search
Random number generation	Area of circle, area of square, volume of sphere, value of pi (π)

Solution of Algebraic and Transcendental equations by Bisection, Newton Raphson and Secant methods	Solution of linear and quadratic equation, solving $\alpha = \tan\alpha$; $I = I_0 \left(\frac{\sin\alpha}{\alpha}\right)^2$ in optics
Interpolation by Newton Gregory Forward and Backward difference formula, Error estimation of linear interpolation	Evaluation of trigonometric functions e.g. *sin θ, cos θ, tan θ, etc.*
Numerical differentiation (Forward and Backward difference formula) and Integration (Trapezoidal and Simpson rules), Monte Carlo method	Given Position with equidistant time data to calculate velocity and acceleration and vice versa. Find the area of B-H Hysteresis loop
Solution of OrdinaryDifferential Equations(ODE) First order Differential equation Euler, modified Euler and Runge-Kutta (RK) second and fourth order methods	First order differential equation • Radioactivedecay • Current in RC, LC circuits with DCsource • Newton's law ofcooling • Classical equations ofmotion Attempt following problems using RK 4 order method: • Solve the coupled differentialequations $\frac{dx}{dt} = y + x - \frac{x^3}{3}$; $\frac{dy}{dx} = -x$ for four initial conditions x(0) = 0, y(0) = -1, -2, -3,-4. Plot x vs y for each of the four initial conditions on the same screen for $0 \le t \le 15$ The differential equation describing the motion of a pendulum is $\frac{d^2p}{dt^2} = -\sin(\vartheta)$. The pendulum is released from rest at an angular displacement α, i.e. $\vartheta(0) = \alpha$ and $\vartheta^u(0)=0$. Solve the equation for α=0.1,0.5 and 1.0 and plot ϑ as a function of time in the range $0 \le t \le 8\pi$. Also plot the analytic solution valid for small $\vartheta(\sin(\vartheta)) = \vartheta$

Referred Books:

- Introduction to Numerical Analysis, S.S. Sastry, 5thEdn. , 2012, PHI Learning Pvt.Ltd.
- Schaum's Outline of Programming with C++. J. Hubbard, 2000, McGraw-HillPub.
- Numerical Recipes in C: The Art of Scientific Computing, W.H. Pressetal, 3rdEdn. , 2007, Cambridge UniversityPress.
- A first course in Numerical Methods, U.M. Ascher & C. Greif, 2012, PHILearning.
- Elementary Numerical Analysis, K.E. Atkinson, 3rd Edn., 2007, Wiley IndiaEdition.
- Numerical Methods for Scientists & Engineers, R.W. Hamming, 1973, Courier DoverPub.
- An Introduction to computational Physics, T.Pang, 2ndEdn. , 2006,Cambridge Univ.Press
- Computational Physics, Darren Walker, 1stEdn., 2015, Scientific International Pvt.Ltd.

Dr. V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

- **PHYSICS Hons SYLLABUS (w.e.f. 2020-21)**
- **SEMESTER- II**
- **CC – 3 MATHEMATICAL PHYSICS - I**
- **BLUE PRINT FOR QUESTION PAPER SETTER**

TIME : 3 hrsMax.Marks :75

Sl. no.	UNIT NO. /CHAPTER NO.		SHORT ANSWER QUESTIONS 5 MARKS	ESSAY QUESTIONS 10 MARKS	MARKS ALLOTED TO THE UNIT
1	UNIT I	1. Recapitulation	1		30
		2. I & II Order Differential equations	1	1	
		3.Calculus of more than one variable		1	
2	UNIT II	3. vector Algebra	1		30
		4.vector Differentiation	1	1	
		5.orthogonal curvilinear coordinates		1	
3	UNIT III	6 Vector Integration	2	2	30
4	UNIT IV	7.Fourier Series	1	1	30
		8.Special integrals	1	1	
5	UNIT V	9.Dirac Delta function		1	30
		10. Theory of Errors	1		
		11.Introduction to Probability	1	1	
	Total no. of Questions		10	10	
	Total Marks including Choice				150

- ***Note:*** **1.The question paper setters are requested to kindly adhere to the format given in the above table.**
- **2.The question paper setters are also requested to set the questions based on problems (conceptual or numerical) for a total of 20 marks.**

Dr. V.S.KrishnaGovernemnt Degree College (A) , Visakhapatnam

Hons PHYSICS MODEL PAPER FOR I SEMESTER

MATHEMATICAL PHYSICS - I – CC-3

Section - A

Answer any FIVE of thefollowing:5x5=25 Marks

1. Show that every Differentiable function is a Continuous Function
2. Obtain the solution of the Differential equation

$$x^3y'''(x) + 5x^2y''(x) + 2xy'(x) - 2y(x) = 0$$

3. Prove the Transformation law of Vectors under rotation of Coordinate axes
4. Explain the physical significance of the Curl of a Vector
5. State and prove Green's theorm of Vector Calculus
6. Prove that the curl of the gradient of a scalar field and the Divergence of the Curl of a Vector field is zero
7. State fourier's theorm and the Dirichlet conditions to be satisfied by a function Whose Fourier series expansion is required.
8. Prove that $\Gamma\left(-\frac{3}{2}\right) = \frac{4\sqrt{\pi}}{3}$
9. Let ΔA be the error of a measurement of A, etc. Use error propagation to show that $\left(\frac{\sigma(C)}{C}\right)^2 = \left(\frac{\sigma(A)}{A}\right)^2 + \left(\frac{\sigma(B)}{B}\right)^2$ holds for the product C = AB.
10. If $\langle X\rangle$, $\langle Y\rangle$ are the values of two independent random variables X , Y , what is the expectation value of the product XY ?

Answer ALLofthefollowing: 5x10=50 Marks

11. a) Find the general solution of the differential equation $xy''(x) - y'(x) + x^3y(x) = x^5 + x^3$ **5 M**
    b) By Cauchy's method , obtain the general solution of the differential equation $x^2y''(x) + xy'(x) + 4y(x) = 0$ **5 M**

OR

a) For a lens of Focal length f , the object distance p and the image distance q are related by $\frac{1}{p} + \frac{1}{q} = \frac{1}{f}$. Find the minimum object-image distance (p+q) for fixed f . Assume p & q to be positive. **[5 M]**

b) Find the Integrating factor and hence the solution to the differential equation $xy''(x) + 2y'(x)$-xy(x)=0 **[5 M]**

12. Explain the Curl of a vector field with its physical significance. Derive an Expression for it in cartesian coordinates.

OR

Derive an expression for Laplacian operator in Spherical polar coordinates

13. Check the gauss theorm of Divergence for the function

$\bar{V} = r^2 cos\theta \hat{r} + r^2 cos\phi\ \hat{\theta} - r^2 cos\theta\ sin\phi\ \hat{\phi}$ using as your volume one octant

Of the sphere of radius R .

OR

Calculate the Volume integral of the function f = z^2over the

Tetrahedron with corners at (0,0,0) ; (1,0,0);(0,1,0);(0,0,1)

14 Expand the Fourier series of a Square wave function

OR

Prove that $\Gamma(n) = 2\int_0^\infty x^{2n-1}\, e^{-x^2}\, dx$ and hence show that

$$\Gamma(m)\,\Gamma(n) = 2\Gamma(m+n)\int_0^{\pi/2} (cos\theta)^{2m-1}(sin\theta)^{2n-1}\, d\theta$$

15 a) prove that

$\delta(f(x)) = \left|\frac{df(x)}{dx}\right|^{-1}_{x=x_0} \delta(x - x_0)$; where x_0 is chosen so that f(x_0) =0.

[5 M]

b) show that $\delta(x) = \frac{1}{2\pi}\int_{-\infty}^{\infty} e^{-ikx}\, dk$ using the sequence given by

$\delta_n(x) = \frac{n}{\sqrt{\pi}} e^{-n^2x^2}$ [5 M]

OR

Explain about poisson distribution and Gauss' Normal distribution and also prove that for large n and mean value μ , the poisson distribution approaches a gaussian distribution.

Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

Honors PHYSICS SYLLABUS UNDER CBCS

For Mathematics Combinations

[2020-21 Batch onwards]

I Year B.Sc.-Physics: II Semester

CC-4: ELECTRICITY AND MAGNETISM

Work load:60 hrspersemester **4 hrs/week**

- Get acquainted with the concepts of Electric field & Electric Potential
- *Apply the concepts of Electric Field & Electric potential to get expressions for the Capacitance of various types of Capacitors and also to understand about the Electric Polarization in Dielectric materials*
- *Derive the expressions for the Magnetic fields due to various current distributions using Biot-savart's law and Ampere's Circuital law*
- *Get acquainted with the basics of Magnetism and the phenomenon of Electro Magnetic Induction*
- *Work out the analysis required in various AC circuits like LCR by applying Kirchoff's law and also will be able to apply various Network Theorms like Thevinin , Norton for solving problems in DC circuits. Finally the student will be able to explain about the working of Ballastic Galvanometer.*

Learning Objectives:

1. *To understand Electric Field vector & Electric Potential*
2. *To derive expressions for Electric Capacitance and understand Electric Polarization Vector*
3. *To apply Biot-Savart law and Ampere's law to derive expressions for magnetic fields due to various Current distributions*
4. *To understand Magnetism and the phenomenon of Electro magnetic Induction*
5. *To apply kirchoff's laws to analyze AC circuits.*

   To apply Thevinin& Norton's Network theorms to analyze DC circuits

   To understand the working principle of the Ballastic Galvanometer

Skill Component:

Unit – I&II :

1. *Learn to apply to exploit the symmetry in Physics problems*
2. *Apply &analyze the properties of conductors in using various Electrical appliances.*

3. *Learn to use efficiently the Dielectric materials (Insulators) in the designing of Electrical gadgets.*

Unit – III &IV :

1. *Measurement of Magnetic field*
2. *Learn to use Bar magnets to design low cost Magnetic or Electromagnetic devices*

Unit – V :

1. *Design simple and low cost AC circuits*
2. *Learn to design AC circuits involving LCR combination for simple Electrical Applications*
3. *Apply Network theorms to do Calculations of very complicated Electric circuits.*

PHYSICS-CC – 4 :ELECTRICITY AND MAGNETISM
(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

UNIT- I

1.Electric field: Electric field lines. Electric flux. Gauss' Law with applications to charge distributions with spherical, cylindrical andplanarsymmetry. **(6Lectures)**

2.Electric Potential : Conservative nature of Electrostatic Field. Electrostatic Potential. Laplace's and Poisson equations. The Uniqueness Theorem. Potential and Electric Field of a dipole. Force and To

rque on a dipole. **(6Lectures)**

UNIT- II

3. **Electric Capacitance:** Electrostatic energy of system of charges. Electrostatic energy of a charged sphere. Conductors in an electrostatic Field. Surface charge and force on a conductor. Capacitance of a system of charged conductors. Parallel-plate capacitor. Capacitance of an isolated conductor. Method of Images and its application to: (1) Plane Infinite Sheet and(2)Sphere. **(10Lectures)**

4. Dielectric Properties of Matter: Electric Field in matter. Polarization, Polarization Charges. Electrical Susceptibility and Dielectric Constant. Capacitor (parallel plate, spherical,cylindrical)filledwithdielelctric.DisplacementvectorD.RelationsbetweenE,Pand

D. Gauss' Lawindielectrics , Boundary conditions at a Dielectric surface , Effect of Uniform Electric field on an uncharged Conducting sphere. **(8Lectures)**

UNIT- III

5.Magnetic Field: Magnetic force between current elements and definition of Magnetic Field **B**. Biot-Savart's Law and its simple applications: straight wire and circular loop. Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole). Ampere's Circuital Law and its application to (1) Solenoid and (2) Toroid. Properties of **B**: curl and divergence. Vector Potential. Magnetic Force on (1) point charge (2) current carrying wire (3) between current elements. Torque on a current loop in a uniformMagneticField. **(8 Lectures)**

UNIT- IV

6.Magnetic Properties of Matter: Magnetization vector (**M**). Magnetic Intensity (**H**). Magnetic Susceptibility and permeability. Relation between **B, H, M**. Ferromagnetism. B-H curve and hysteresis ,Langevin's theory of Diamagnetism &Langevin's theory of Paramagnetism , Weiss theory of Ferromagnetism **(6Lectures)**

7.Electromagnetic Induction: Faraday's Law. Lenz's Law. Self Inductance and Mutual Ind

uctance. Reciprocity Theorem. Energy stored in a Magnetic Field. Introduction to Maxwell's Equations. Charge Conservation andDisplacement current. **(5Lectures)**

UNIT -V

8.Electrical Circuits: AC Circuits: Kirchhoff's laws for AC circuits. Complex Reactance and Impedance. Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and (4) Band Width. ParallelLCRCircuit. **(4Lectures)**

9.Network theorems: Ideal Constant-voltage and Constant-current Sources. Network Theorems: Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity theorem, Maximum Power Transfer theorem. Applications todccircuits. **(4Lectures)**

10.Ballistic Galvanometer: Torque on a current Loop. Ballistic Galvanometer: Current and Charge Sensitivity. Electromagnetic damping. Logarithmicdamping.CDR. **(3Lectures)**

Reference Books:

- Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw
- Electricity and Magnetism, Edward M. Purcell, 1986 McGraw-HillEducation
- Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, BenjaminCummings.
- Feynman Lectures Vol.2, R.P.Feynman, R.B.Leighton, M. Sands, 2008, Pearson

- Education
- Elements of Electromagnetics, M.N.O. Sadiku, 2010, Oxford UniversityPress.
- Electricity and Magnetism, J.H.Fewkes&J.Yarwood. Vol. I, 1991, Oxford Univ.Press.

PHYSICS LAB-CC- 4 LAB

60 Lectures

1. UseaMultimeterformeasuring(a)Resistances,(b)ACandDCVoltages,(c)DCCurrent, (d) Capacitances, and (e) Checking electrical fuses.
2. To study the characteristics of a series RCCircuit.
3. To determine an unknown Low Resistance usingPotentiometer.
4. To determine an unknown Low Resistance using Carey Foster'sBridge.
5. To compare capacitances using De'Sauty'sbridge.
6. Measurement of field strength B and its variation in a solenoid (determinedB/dx)
7. To verify the Thevenin and Nortontheorems.
8. To verify the Superposition, and Maximum power transfertheorems.
9. To determine self inductance of a coil by Anderson'sbridge.
10. TostudyresponsecurveofaSeriesLCRcircuitanddetermineits(a)Resonantfrequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width.
11. To study the response curve of a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factorQ.
12. Measurement of charge and current sensitivity and CDR of BallisticGalvanometer
13. Determine a high resistance by leakage method using BallisticGalvanometer.
14. To determine self-inductance of a coil by Rayleigh'smethod.
15. To determine the mutual inductance of two coils by Absolutemethod.

Reference Books:

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- A Text Book of Practical Physics, I.Prakash& Ramakrishna, 11thEd., 2011, KitabMahal
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4thEdition, reprinted 1985, Heinemann EducationalPublishers
- Engineering Practical Physics, S.Panigrahi and B.Mallick, 2015, CengageLearning.
- A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, VaniPub.

Dr. V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

- PHYSICS Hons SYLLABUS (w.e.f. 2020-21)
- SEMESTER- II
- CC – 4 ELECTRICITY & MAGNETISM
- **BLUE PRINT FOR QUESTION PAPER SETTER**

TIME : 3 hrsMax.Marks :75

Sl.No.	UNIT NO. /CHAPTER NO.		SHORT ANSWER QUESTIONS 5 MARKS	ESSAY QUESTIONS 10 MARKS	MARKS ALLOETD TO THE UNIT
1	UNIT I	1.Electric Field	1	1	30
		2.Electric potential	1	1	
2	UNIT II	3. electric capacitance	1	1	30
		4.Dielectric properties of matter	1	1	
3	UNIT III	5. Magnetic field	2	2	30
4	UNIT IV	6.Magnetic properties of matter	1	1	30
		7.Electromagnetic induction	1	1	
5	UNIT V	8.Electric circuits	1	1	30
		9.Network theorms		1	
		10.Ballastic Galvanometer	1		
	Total no. of Questions		10	10	
	Total Marks including Choice				150

- Note: 1.The question paper setters are requested to kindly adhere to the format given in the above table.
- 2.The question paper setters are also requested to set the questions based on problems (conceptual or numerical) for a total of 20 marks.

Dr. V.S.KrishnaGovernemnt Degree College (A) , Visakhapatnam

Hons PHYSICS MODEL PAPER FOR I SEMESTER

ELECTRICITY &MAGNETISM – CC-4

Section – A

Answer any FIVE of the fpllowing

1. Write down the properties of Electric Lines of Force.
2. What do you mean by Electric potential ? What is the relation between the Electric potential and Electric Field vector ?
3. A parallel Plate capacitor of capacitance 100 μF is charged to a potential of 500 V . The plate separation is then reduced to half of its original value. Calculate the new potential on the capacitor and charge .
4. Define Electric Susceptibility and obtain the relation between it and the Electric permittivity.
5. Explain Biot – Savart's law.
6. A solenoid of 1000 turns is wound uniformly on a glass tube 50 cm long and 10 cm in diameter. Find the strength of the magnetic field at the center of the solenoid when a current of 0.1 amp flows through it.
7. Explain the phenomenon of Hysteresis.
8. A closed coil having 50 turns , area 300 cm^2 and resistance 40 ohm is held at right angles to uniform field of 0.02 T . it is then turned through an angle of 30^0 about an axis at right angles to the field. Find the charge induced in the coil.
9. The resistance of a lamp is 100 ohm . An alternating potential of 250 V and 50 cycles is applied across the lamp and a 10 μF capacitor in series. Calculate the current through the lamp and Phase lag.
10. Derive an expression for the Torque acting on a Current Loop.

Section -B

Answer ALL ofthefollowing: 5x10=50 Marks

11.State Gauss law and derive an expression for the Electric field due to an uniformly distributed charge on the surface of an infinite cylinder with finite radius.

OR

Derive the expressions for the Electric field and the Electric potential due to an Electric dipole.

12. Define Electric Capacitance and derive an expression for the Electric capacitance due to a Spherical Capacitor.

OR

Write down Poisson and Laplace equations for a Homogeneous Dielectric and Explain in detail the effect of uniform Electric field on an uncharged conducting sphere.

13. Derive an expression for the magnetic field at a point on the axis of circular current carrying loop.

OR

State Ampere's circuital law and derive an expression for the Magnetic field at a point inside a solenoid.

14. Explain the Weiss theory of ferromagnetism and derive an expression for Susceptibility.

OR

Derive an expression for the energy stored in a Magnetic field and Obtain Electromagnetic Maxwell's equations both in the Differential and the Integral form .

15. Derive an expression for the current in an A.C. circuit containing Resistance R , Inductance L and the capacitance C in series . Obtain the conditions for the Resonance.

OR

State and Explain with neat circuit diagrams

i. Reciprocity Theorem [3 M]

ii. Superposition Theorem [3 M]

iii. Maximum Power transfer Theorem [4 M]

MINOR Physics-I

L	T	P	Cr
3	1	2	6

Course outcomes:

On successful completion of this course, the students will be able to:

CO 1 :*Learn to use the formalism of Vector Algebra & Vector Analysis in the application of Newton's laws and in the analysis of Rigid body motion*

CO 2 :*To get acquainted withthe basic aspects oftheoscillations& waves and also about the Elementary aspects of the Ultrasonics*

CO 3 :*To get thorough with the fundamentals of Geometrical Optics & Interference of the light*

CO 4 :*To understand the basic practical aspects of the phenomena of the Diffraction & Polarization*

CO 5 :*To know about the basic and application aspects of the LASERS and Optical Fibers*

UNIT - I

1. ***Mathematical Physics & Particle dynamics:***

Scalar and vector products, polar and axial vectors, triple and quadruple products ,

Scalar and vector fields, differentiation of a vector, gradient, divergence, curl and O operations and their meaning, idea of line, surface and volume integrals, Gauss and Stokes' theorem.

Newton's laws of motion, conservation of linear momentum, center of mass, conservative forces, work energy theorem, particle collisions (one Dimension) **(8 Lectures)**

2. **Rotational kinematics and dynamics**:

Rotational motion, forces and pseudo forces, torque and angular momentum, kinetic energy of rotation, rigid body rotation dynamics, moment of inertia, conservation of angular momentum, comparison of linear and angular momentum, motion of a symmetric top. **(6 Lectures)**

UNIT – II

3. **Oscillations&waves :**

Linearity and superposition principle, free oscillation with one and two degrees of freedom, simple pendulum, combination of two simple harmonic motions. Lissajous figures, free and damped vibrations, forced vibrations and resonance, Q factor; wave equation, travelling and standing waves, superposition of waves, phase and group velocity. **(8 Lectures)**

4. **Ultrasonics :**

Characteristics of Ultrasonic waves , Production of Ultrasonic waves – Piezo Electric method and Magnetostriction method , Applications of Ultrasonics. **(4 Lectures)**

UNIT – III

5. **Geometric Optics :** Elementary aspects of Mirrors , Lenses & Prisms , Magnification & Resolution , Construction & working of simple , compound & Confocal Microscopes (6 Lectures)
6. **Interference** : Interference, division of amplitudes, Young's double split, Fresnel's biprism, interference in thin films and wedged shaped films , Newton's Rings. **(5 Lectures)**

UNIT – IV

7. **Diffraction :**

Diffraction at a single slit and a circular aperture, diffraction due to a double slit , plane transmission grating, resolving power of a telescope and a microscope, resolving and dispersive power of a plane diffraction grating.

(6 Lectures)

8. **Polarization :**

Polarization: Polarization by reflection and refraction, Brewster's law, double refraction, nicol prism, quarter and half-wave plates, Production and analysis of circularly and elliptically polarized light , Optical rotation , Specific rotatory power , Laurent's Half shade Polarimeter **(6 Lectures)**

UNIT – V

9. **LASERS** :Properties of LASERs , Spontaneous & Stimulated Emissions of Photons , Absorption of Photons , Metastable states , Conditions for achieving a sustained LASER , Ruby LASER , Helium – Neon LASER , CO_2 LASER, Applications of LASERs **(6 Lectures)**

10. **Optical Fibers** :Total Internal Reflection , Components of an Optical Fiber , Propagation of an EM wave through an Optical Fiber , Single & Multimode Fibers , Step index & Graded index Fibers , Applications of Optical Fibers **(5Lectures)**

Recommended Text books/references:

1. Spiegel, M. R. *Vector Analysis* Schaum Outline Series. McGraw-Hill(1974)
2. Beiser, A. *Concepts of Modern Physics* McGraw-Hill(2002).
3. Resnick, R., Halliday, D. and Krane, K. S. Physics I and II Fifth Ed. John Wiley(2004)
4. Serway, R. A. & Jewett, J. W. *Physics for Scientists and Engineers* SixthEd.

(The above course structure, number of classes and recommended books/references are suggestive. Faculty/academic bodies may incorporate revision as per need).

Physics-I– Practicals

(Recommended that physics practical to be carried out from mechanics and optics as per availability of facilities with minimum 3 experiments from each group)

Group-A: Mechanics

1. Determination of spring constant of a spring by (i) static, and (ii) dynamicmethods.
2. Study of damped harmonic oscillator- Qfactor.
3. Determination of temperature coefficient of resistance using platinum resistancethermometer.
4. Study of thermal couple calibration and inversiontemperature.
5. LCR study of resonanceQ-factor.
6. Kator's pendulum- Barpendulum.

Group-B:Optics

7. Determination of wavelength of light by Fresnel'sbiprism.
8. Determination of wavelength of sodium light by Newton'sarrangement.
9. Determination of refractive index of tint glass using aspectrometer.
10. Determination of dispersive power of a glass prism using Cauchy's constant. Also determine the resolving power of aprism.
11. Determination of wavelength of sodium light using a plane transmission grating and resolving power of a diffractiongrating.
12. Determination of specific rotation of cane sugar solution using apolarimeter.

Dr. V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

- PHYSICS Hons SYLLABUS (w.e.f. 2020-21)
- SEMESTER- II
- MINOR PHYSICS - I
- BLUE PRINT FOR QUESTION PAPER SETTER

TIME : 3 hrsMax.Marks :75

Sl.No.	UNIT NO. /CHAPTER NO.		SHORT ANSWER QUESTIONS 5 MARKS	ESSAY QUESTIONS 10 MARKS	MARKS ALLOETD TO THE UNIT
1	UNIT I	1.Mathematical Physics & Particle dynamics	1	1	30
		2.Rotational Kinematics & Dynamics	1	1	
2	UNIT II	3. Oscillations & waves	1	1	30
		4.Ultrasonics	1	1	
3	UNIT III	5. Geometrical optics	1		30
		6.Interference	1	2	
4	UNIT IV	7.Diffraction	1	1	30
		8.Polarization	1	1	
5	UNIT V	9.LASERs	1	1	30
		10. Optical Fibers	1	1	
	Total no. of Questions		10	10	
	Total Marks including Choice				150

- Note: 1.The question paper setters are requested to kindly adhere to the format given in the above table.
- 2.The question paper setters are also requested to set the questions based on problems (conceptual or numerical) for a total of 20 marks.

Dr. V.S.KrishnaGovernemnt Degree College (A) , Visakhapatnam

Hons PHYSICS MODEL PAPER FOR I SEMESTER

Physics General Elective Course

Answer any FIVE of thefollowing:5x5=25

1. Show and prove the law of conservation of Linear Momentum for a system of Particles.
2. Find the moments and products of Inertia of a uniform square plate in the first quadrant of the XY plane with one corner at the origin.
3. What fraction of the total Energy is kinetic and what fraction is potential when the Displacement is one half of amplitude in a Simple Harmonic motion.
4. Write any five applications of ultrasonics .
5. Explain the terms Magnification and Resolution .
6. In a Biprism experiment with sodium light , interference fringes are of fringe width 0.0195 cm are observed at a distance 100 cm from the slit . On introducing a Convex lense 30 cm away from the slit , two images of the slits are seen 0.7 cm Apart , at 100 cm distance from the slit . Calculate the wave length of the Sodium Light .
7. What is the highest order spectrum , which may be seen with Monochromatic light of wavelength 6000 A^0 by means of a Diffraction Grating with 5000 lines / cm .
8. Explain the Phenomenon of Double Refraction with a neat diagram .
9. Write the Characteristics of LASERS .
10. Write any five applications of Optical Fibers .

Answer any FIVE ofthefollowing: 5x10=50

11. State the law of Conservation of Linear Momentum and derive the expressions for the Final Velocities of two particles undergoing Elastic collision in terms of their initial Velocities .

OR

State the Law of Conservation of Angular Momentum and derive the expression for the Precession frequency of the motion about a fixed point on the Earth of a symmetric Top under Gravity .

12. Obtain the expressions for the displacement and Velocity in the steady state of a lightly damped Harmonic oscillator moving under a Harmonic force .

OR

Explain the production of Ultrasonics by using Magnetostriction method with a neat diagram .

13. Explain the construction and the working of Fresnel's Biprism with a neat Diagram .

OR

Explain the Interference phenomenon due to reflected light from a transparent Thin film with neat diagrams and obtain the conditions for Constructive and Destructive Interferences .

14. Explain the formation of Fraunhofer Diffraction pattern due to a single slit and obtain the equations for the positions of maximum and minimum intensities with neat diagrams .

OR

Explain the construction and the working of Lorentz Half shade Polarimeter with neat diagrams.

15. Explain the construction and working of Helium-Neon LASER with neat diagrams .

OR

Explain about the Classification of Optical Fibers based on Refractive index profile and the Mode of propagation of Light in them .

Dr. V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

B.Sc.HONORS PHYSICS SYLLABUS UNDER CBCS

For Mathematics Combinations

SKILL DEVELOPMENT COURSES

Revised CBCS w.e.f. 2020-21

Science Stream

Syllabus ofSOLAR ENERGY

Total 30hrs(02h/wk), *02 Credits & Max Marks:50*

Learning Outcomes:

After successful completion of the course, students will be able to:

1. *Acquire knowledge onsolarradiation principles with respect to solar energyestimation.*
2. *Get familiarized with various collecting techniques of solar energy and itsstorage*
3. *Learn the solar photovoltaic technology principles and different types of solar cells for energy conversion and different photovoltaicapplications.*
4. *Understand the working principles of several solar appliances like Solar cookers, Solar hot water systems, Solar dryers, Solar Distillation, Solargreenhouses*

SYLLABUS:

UNIT-I –Solar Radiation: **(6hrs)**

Sun as a source of energy, Solar radiation, Solar radiation at the Earth's surface, Measurement of Solar radiation-Pyroheliometer, Pyranometer, Sunshine recorder, Prediction of available solar radiation, Solar energy-Importance, Storage of solar energy, Solarpond

UNIT-II – SolarThermalSystems: **(10 hrs)**

Principle of conversion of solar radiation into heat, Collectors used for solar thermal conversion: Flat plate collectors and Concentrating collectors, Solar Thermal Power Plant, Solar cookers, Solar hot water systems, Solar dryers, Solar Distillation, Solar greenhouses.

UNIT-III – SolarPhotovoltaicSystems: **(10 hrs)**

Conversion of Solar energy into Electricity - Photovoltaic Effect, Solar photovoltaic cell and its working principle, Different types of Solar cells, Series and parallel connections, Photovoltaic applications: Battery chargers, domestic lighting, street lighting and water pumping

Co-curricular Activities (Hands on Exercises): (04 hrs)

[Any four of the following may be taken up]

1. *Plot sun chart and locate the sun at your location for a given time of theday.*
2. *Analyse shadow effect on incident solar radiation and find outcontributors.*
3. *Connect solar panels in series & parallel and measure voltage andcurrent.*
4. *Measure intensity of solar radiation using Pyranometer andradiometers.*
5. *Construct a solar lantern using Solar PV panel(15W)*
6. *Assemble solarcooker*
7. *Desigining and constructing photovoltaic system for a domestic house requiring 5kVA power*
8. Assignments/Model Exam.

Reference Books:

1. Solar Energy Utilization, G. D. Rai, Khanna Publishers
1. Solar Energy- Fundamentals, design, modeling & applications, G.N. Tiwari, Narosa Pub., 2005.
2. Solar Energy-Principles of thermal energy collection & storage, S.P. Sukhatme, Tata Mc-Graw Hill Publishers, 1999.
3. Solar Photovoltaics- Fundamentals, technologies and applications, Chetan Singh Solanki, PHI Learning Pvt.Ltd.,
4. Science and Technology of Photovoltaics, P. Jayarama Reddy, BS Publications,2004.

Reference Books:

1. Solar Energy Utilization, G. D. Rai, Khanna Publishers
1. Solar Energy- Fundamentals, design, modeling & applications, G.N. Tiwari, Narosa Pub., 2005.
2. Solar Energy-Principles of thermal energy collection & storage, S.P. Sukhatme, Tata Mc-Graw Hill Publishers, 1999.
3. Solar Photovoltaics- Fundamentals, technologies and applications, Chetan Singh Solanki, PHI Learning Pvt.Ltd.,
4. Science and Technology of Photovoltaics, P. Jayarama Reddy, BS Publications,2004.

Dr. V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

PHYSICS Hons SYLLABUS (w.e.f. 2020-21)

SEMESTER- I

SDC – SOLAR ENERGY

BLUE PRINT FOR QUESTION PAPER SETTER

TIME : 3 hrsMax.Marks :75

Sl.No.	UNIT NO. /CHAPTER NO.		SHORT ANSWER QUESTIONS 5 MARKS	ESSAY QUESTIONS 10 MARKS	MARKS ALLOETD TO THE UNIT
1	UNIT I	Solar Radiation	2	1	20
2	UNIT II	Solar Thermal Systems	3	2	35
3	UNIT III	Solar Photovoltaic Systems	3	2	35
	Total no. of Questions		8	5	
	Total Marks including Choice				90

- Note: 1.The question paper setters are requested to kindly adhere to the format given in the above table.
- 2.The question paper setters are also requested to set the questions based on problems (conceptual or numerical) for a total of 20 marks.

MODEL QUESTION PAPER FORMAT FOR SKILL DEVELOPMENT COURSES

Max. Marks: 50 *Time: 1½ hrs (90 Minutes)*

SECTION-A (4x5M=20Marks)

Answer any four questions. Each answer carries 5 marks (At least 1 question should be given from each Unit)

1.	Short Answer Question from Unit – I
2.	Short Answer Question from Unit – I
3.	Short Answer Question from Unit – II
4.	Short Answer Question from Unit – II
5.	Short Answer Question from Unit – II
6.	Short Answer Question from Unit – III
7.	Short Answer Question from Unit – III
8.	Short Answer Question from Unit – III

SECTIONB (3x10M = 30Marks)

Answer any three questions. Each answer carries 10 marks (At least 1 question should be given from each Unit)

1.	Essay Question from Unit – I
2.	Essay Question from Unit – II
3.	Essay Question from Unit – II
4.	Essay Question from Unit – III
5.	Essay Question from Unit – III

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Dr. V.S.KrishnaGovernemnt Degree College (A) , Visakhapatnam

Honors PHYSICS SYLLABUS UNDER CBCS

For Mathematics Combinations

[2020-21 Batch onwards]

II Year B.Sc.-Physics: III Semester

CC-5: MATHEMATICALPHYSICS

Work load:60 hrspersemester **4 hrs/week**

Course outcomes:

On successful completion of this course, the student will be able to:

- *Comprehend the Frobenius method of obtaining series solutions of ordinary Second order Differential equations and apply to it to get the series solutions of Hermite's ,Legender's , Bessel's &Lauguerre's differential equations*
- *Get acquainted with the elementary methods of obtaining solutions to Partial Differential equations*
- *Understand various ideas &theorms of Complex variables and apply them to solve many integrals one encounters in physics problems*
- *To derive the fundamental theorms of Fourier transforms and apply them to solve some partial differential equations one comes across in physics*
- *To know the basic aspects of Laplace transforms and their properties and hence will be able to work out some second order Ordinary Differential equations in Physics problems*

Learning Objectives:

1. *To understand and apply Frobenius method to get series solutions ofHermite , Legendre , Bessel & Laguerre Differential equations*
2. *To understand the elementary methods of solving Partial Differential Equations*
3. *To understand the basic theorms of Complex Analysis and work out the problems involving Complex variables*
4. To work out with the theorms of Fourier Integral Transforms and apply to solve Partial Differential Equations
5. To work out with the basic theorms of Laplace transforms and apply to solve Ordinary Differential Equations

Skill Component :

Unit- I &II :

1. *Calculation of sums of infinite series and analysis of them*

2. *Working out the Partial Differential equations with symmetrical aspects*

Unit – III :

1. *Working out with complex numbers useful in analyzing AC electrical circuits.*
2. *Learn to work with the Analyticity of functions*

Unit – IV &V :

1. *Apply & Analyze Fourier and Laplace Transforms in analyzing and designing simple Electrical and Electronic circuits.*

PHYSICS-CC-5 : MATHEMATICAL PHYSICS-II

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

UNIT – I

1. **Frobenius Method and Special Functions**: Singular Points of Second Order Linear Differential Equations and their importance. Frobenius method and its applications to differential equations. Legendre, Bessel, Hermite and Laguerre Differential Equations. Properties of Legendre Polynomials: Rodrigues Formula, Generating Function, Orthogonality. Simple recurrence relations. Expansion of function in a series of Legendre Polynomials. Bessel Functions of the First Kind: Generating Function, simple recurrence relations. Zeros of Bessel Functions (Jo(x) and J1(x))andOrthogonality. **(15 Lectures)**

UNIT-II

2. **Partial Differential Equations**: Solutions to partial differential equations, using separation of variables: Laplace's Equation in problems of rectangular, cylindrical and spherical symmetry. Wave equation and its solution for vibrational modes of a stretched string, rectangular and circular membranes.DiffusionEquation. **(10Lectures)**

UNIT- III

3. **Complex Analysis**: Brief Revision of Complex Numbers and their Graphical Representation. Euler's formula, De Moivre's theorem, Roots of Complex Numbers. Functions ofComplex Variables. Analyticity and Cauchy-Riemann Conditions. Examples of analytic functions. Singular functions: poles and branch points, order of singularity, branch cuts. Integration of a function of a complex variable. Cauchy's Inequality. Cauchy's Integral formula. Simply and multiply connected region. Laurent and Taylor's expansion. Residues and Residue Theorem. Application in solvingDefiniteIntegrals. **(15Lectures)**

UNIT- IV

4. **Integrals Transforms**: Fourier Transforms: Fourier Integral theorem. Fourier Transform. Examples. Fourier transform of trigonometric, Gaussian, finite wave train & other functions. Representation of Dirac delta function as a Fourier Integral. Fourier transform of derivatives,

Inverse Fourier transform, Convolution theorem. Properties of Fourier transforms (translation, change of scale, complex conjugation, etc.). Three dimensional Fourier transforms with examples. Application of Fourier Transforms to differential equations: One dimensional Wave and Diffusion/HeatFlowEquations. **(10Lectures)**

UNIT- V

Laplace Transforms: Laplace Transform (LT) of Elementary functions. Properties ofLTs: Change of Scale Theorem, Shifting Theorem. LTs of 1st and 2nd order Derivatives and Integrals of Functions, Derivatives and Integrals of LTs. LT of Unit Step function, Dirac Delta function, Periodic Functions. Convolution Theorem. Inverse LT. Application of Laplace Transforms to 2nd order Differential Equations: Damped Harmonic Oscillator, Simple Electrical Circuits, Coupled differential equations of 1st order. Solution of heat flow along infinite bar using Laplace transform. **(10Lectures)**

Reference Books:

- Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7thEdn., Elsevier.
- An introduction to ordinary differential equations, E.A. Coddington, 2009, PHIlearning
- Differential Equations, George F. Simmons, 2007, McGrawHill.
- Mathematical Tools for Physics, James Nearing, 2010, DoverPublications.
- Mathematical methods for Scientists and Engineers, D.A. McQuarrie, 2003, VivaBook
- Advanced Engineering Mathematics, D.G. Zill and W.S. Wright, 5 Ed., 2012, Jones and BartlettLearning
- Mathematical Physics, Goswami, 1stedition, CengageLearning
- Engineering Mathematics, S.Pal and S.C. Bhunia, 2015, Oxford UniversityPress
- Advanced Engineering Mathematics, Erwin Kreyszig, 2008, WileyIndia.
- Essential Mathematical Methods, K.F.Riley&M.P.Hobson, 2011, Cambridge Univ.Press.
- Mathematical Physics, H.K. Dass and R. Verma, S. Chand &Company.
- Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence, 3rded., 2006, Cambridge UniversityPress
- Mathematics for Physicists, P. Dennery and A.Krzywicki, 1967, DoverPublications
- Complex Variables, A.S.Fokas&M.J.Ablowitz, 8thEd., 2011, Cambridge Univ.Press
- Complex Variables, A.K. Kapoor, 2014, Cambridge Univ.Press
- Complex Variables and Applications, J.W. Brown & R.V. Churchill, 7thEd. 2003, Tata McGraw-Hill
- First course in complex analysis with applications, D.G. Zill and P.D. Shanahan, 1940, Jones &Bartlett

PHYSICS LAB-CC-5 LAB

60 Lectures

The aim of this Lab is to use the computational methods to solve physical problems. Course will consist of lectures (both theory and practical) in the Lab. Evaluation done not on the programming but on the basis of formulating the problem

Topics	Description with Applications
Introduction to Numerical computation software Scilab	Introduction to Scilab, Advantages and disadvantages, Scilab environment, Command window, Figure window, Edit window, Variables and arrays, Initialising variables in Scilab, Multidimensional arrays, Subarray, Special values, Displaying output data, data file, Scalar and array operations, Hierarchy of operations, Built in Scilab functions, Introduction to plotting, 2D and 3D plotting (2), Branching Statements and program design, Relational & logical operators, the while loop, for loop, details of loop operations, break & continue statements, nested loops, logical arrays and vectorization (2) User defined functions, Introduction to Scilab functions,Variable passing in Scilab, optional arguments, preserving data between calls to a function, Complex and Character data, string function, Multidimensional arrays (2) an introduction to Scilab file processing, file opening and closing, Binary I/o functions, comparing binary and formatted functions, Numerical methods and developing the skills of writing a program(2).
Curve fitting, Least square fit, Goodness of fit, standard deviation	Ohms law to calculate R, Hooke's law to calculate spring Constant
Solution of Linear system of equations by Gauss elimination method and Gauss Seidal method. Diagonalization of matrices, Inverse of a matrix, Eigen vectors, eigen values problems	Solution of mesh equations of electric circuits (3 meshes) Solution of coupled spring mass systems (3 masses)
Generation of Special functions using User defined functions in Scilab	Generating and plotting Legendre Polynomials Generating and plotting Bessel function
Solution of ODE First order Differential equation Euler, modified Euler and Runge-Kutta second order methods Second order differential equation Fixed difference method Partial differential equations	First order differential equation • Radioactivedecay • Current in RC, LC circuits with DCsource • Newton's law ofcooling • Classical equations of motion Second order DifferentialEquation • Harmonic oscillator (nofriction) • Damped Harmonicoscillator • Overdamped • Criticaldamped • Oscillatory • Forced Harmonicoscillator • Transientand • Steady state solution

	Apply above to LCR circuits also Solve $x2$ d2y — $4x(1 + x)$ dy + $2(1+ x) = x3$ ds2 ds with the boundary conditions at x = 1, y = 1 $e2$, dy = — 3 $e2$ — 0.5, 2 ds 2 in the range $1 \leq x \leq 3$. Plot y and dyagainst x in the ds given range on the same graph. Partial Differential Equation: • Wave equation • Heatequation • Poissonequation • Laplaceequation
Using Scicos / xcos	• Generating square wave, sine wave, saw toothwave • Solution to harmonicoscillator • Study of beatphenomenon • Phase spaceplots

Reference Books:

- MathematicalMethodsforPhysicsandEngineers,K.FRiley,M.P.Hobsonand S. J. Bence, 3rded., 2006, Cambridge University Press
- Complex Variables, A.S. Fokas& M.J. Ablowitz, 8thEd., 2011, Cambridge Univ.Press
- First course in complex analysis with applications, D.G. Zill and P.D. Shanahan, 1940, Jones &Bartlett
- Computational Physics, D.Walker, 1stEdn., 2015, Scientific International Pvt.Ltd.
- A Guide to MATLAB, B.R. Hunt, R.L. Lipsman, J.M. Rosenberg, 2014, 3rdEdn., Cambridge UniversityPress
- Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific and Engineering Applications: A.V. Wouwer, P. Saucez, C.V. Fernández. 2014Springer
- Scilab by example: M. Affouf 2012, ISBN:978-1479203444
- Scilab (A free software to Matlab): H.Ramchandran, A.S.Nair. 2011 S.Chand&Company
- Scilab Image Processing: Lambert M. Surhone. 2010 BetascriptPublishing
- www.scilab.in/textbook_companion/generate_book/291

Dr. V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

- **PHYSICS Hons SYLLABUS (w.e.f. 2020-21)**
- **SEMESTER- I II**
- **CC – 5 MATHEMATICAL PHYSICS II**
- **BLUE PRINT FOR QUESTION PAPER SETTER**

TIME : 3 hrsMax.Marks :75

Sl.No.	UNIT NO. /CHAPTER NO.		SHORT ANSWER QUESTIONS 5 MARKS	ESSAY QUESTIONS 10 MARKS	MARKS ALLOTED TO THE UNIT
1	UNIT I	1.Frobenius method & special functions	2	2	30
2	UNIT II	2.Partial differential equations	2	2	30
3	UNIT III	3.Complex Analysis	2	2	30
4	UNIT IV	4.Integral Transforms	2	2	30
5	UNIT V	5.Laplace Transforms	2	2	30
	Total no. of Questions		10	10	
	Total Marks including Choice				150

- **Note: 1.The question paper setters are requested to kindly adhere to the format given in the above table.**
- **2.The question paper setters are also requested to set the questions based on problems (conceptual or numerical) for a total of 20 marks.**

Dr. V.S.KrishnaGovernemnt Degree College (A) , Visakhapatnam

Hons PHYSICS MODEL PAPER FOR I SEMESTER

MATHEMATICAL PHYSICS - II – CC-5

SECTION – A

Answer all Questionsof the following [5 X 10 = 50]

1. Write the Bessel Differential equation and obtain the series solution of it if the parameter in it is a half integer.

[OR]

Write Hermite Differential equation and obtain the two linear independent series solutions of it.

2. Solve the Laplace equation and find the Temperature distribution for a finite Rectangular plate of length 10 cm and breadth 30 cm with two thermally insulated sides, third side at 0^0 and the fourth side at a given temperature distribution f(x) = x.

[OR]

Find the steady state temperature distribution in a spherical shell of inner radius 1 and outer radius 2 if the inner surface is held at 0^0 and the outer surface has its upper half at 100^0 and its lower half at 0^0.

3. Evaluate the Fresnel integrals in optics using Complex variable analysis in the case of infinite upper limits. $\int_0^a \sin x^2\, dx$ *and* $\int_0^a \cos x^2\, dx$ are the Fresnel integrals.

[OR]

Evaluate $\int_0^\infty \frac{\sqrt{x}\ln x}{(1+x)^2}\, dx$

4. Find the Fourier transforms of the functions $\cos[\pi x^2]$ *and* $\sin[\pi x^2]$

[OR]

Find the Fourier transform of the function $f(x) = e^{-\alpha|x|}e^{i\beta x}$ and from it evaluate the integrals

$\int_{-\infty}^{+\infty} \frac{\cos kx}{\alpha^2+(\beta-k)^2}\, dk$ and $\int_{-\infty}^{+\infty} \frac{\sin kx}{\alpha^2+(\beta-k)^2}\, dk$.

5. Find the expression for the steady state temperature distribution in a solid semi-infinite cylinder if the boundary temperatures are T = 0 at $\rho = a$ and T = y = $\rho \sin\theta$ at z = 0.

[OR]

Evaluate by contour Integration the integral $\int_0^\infty \frac{\cos^2(\frac{\pi x}{2})}{(1-x^2)^2}\, dx$ by choosing an appropriate contour.

SECTION – B

Answer any FIVE Questions of the following [5 x 5 = 25]

1. Expand the function x^5 as a linear combination of Legendre polynomials.

2. Prove the Recurrence relation $J_{n-1}(x) + J_{n+1}(x) = \frac{2n}{x} J_n(x)$

3. Prove that $\lim_{x \to 0} x^{-3/2} J_{3/2}(x) = \frac{\sqrt{2/\pi}}{3}$

4. Derive the Heat diffusion partial differential equation $\overline{\nabla}^2 T(x,y,z,t) = \frac{1}{\alpha^2} \frac{\partial T(x,y,z,t)}{\partial t}$ where T(x, y ,z, t) is Temperature distribution function and α is a constant.

5. Find out whether the following functions are analytic a) $\frac{x-iy}{x^2+y^2}$ b) $\frac{y-ix}{x^2+y^2}$

6. Find the first four terms of the Taylor series for the function $\frac{z}{z^2+9}$ about the origin.

7. Find the first four terms of the Laurent series about the origin, i.e. one series for each annular ring between singular points and also find the residue of the function $\frac{2-z}{1-z^2}$ about the origin.

8. Prove the Parseval's theorem of Fourier transforms.

9. Prove a) Linearity theorem and b) The shifting of origin theorem of Fourier transforms.

10. Use Generating function to show that $P_{2n+1}(0) = 0$ *and* $P_{2n}(0) = \frac{(-1)^n (2n-1)!}{2^n n!}$ When n >1 and $P_2(0) = -1/2$.

Honors PHYSICS SYLLABUS UNDER CBCS

For Mathematics Combinations

[2020-21 Batch onwards]

II Year B.Sc.-Physics: III Semester

CC-6: ELEMENTS OF MODERN PHYSICS

Work load:60 hrspersemester **4 hrs/week**

On successful completion of this course, the student will be able to:

- *To get the exposure in terms of theoretical as well as experimental aspects both in Quantum theory of radiation & the existence of Matter waves*
- *To understand and also will be able apply Hisenberg'sUncertainity principle and the Schrodinger's formalism of the Quantum Mechanics*
- *To apply the Time Independent Schrodinger equation to some basic problems in quantum mechanics and also to get aware of the basic ideas about Quantum Tunneling*
- *To get acquainted with the elementary aspects of properties of Atomic Nuclei and also of Nuclear Models and the phenomenon of Radio Activity*
- *To know about the various applications of Nuclear Physics like Nuclear reactors in detail and the student will also be able to understand the basic aspects of LASER systems*

Learning Objectives:

1. *To understand the Quantum Theory of Radiation and the Matter Waves*
2. *To understand HisenbergUncertainity principle and Schrodinger formalism of Quantum Mechanics*
3. *To apply Time Independent Schrodinger Equation to some problems in Quantum Mechanics and also about Quantum Tunneling*
4. *To comprehend the basic properties of Nuclei and understand Nuclear models and the phenomenon of Radioactivity*
5. *To get acquainted with the applications of Nuclear Physics and understand the basic aspects of LASER systems*

Skill Component :

Unit – I &II :

1. *To work out rough & quick calculations regarding Atomic & Nuclear phenomena using HisenbergUncertainity principle*
2. *Apply &Analyze some thought experiments to design real physics experiments*
3. *Develop the skills in constructing wave packets using computations.*

Unit – III :

1. *Apply & analyze the functioning of Quantum dots in the designing of Advanced instruments and solid state Technology*
2. *Analyze the applications of Tunneling phenomenon in Electronic devices*

Unit – IV :

1. *Develop the computational skills to do modelling & curve fitting*
2. *Apply & analyze the phenomenon of Radioactivity in Real life applications (medicine -cancer treatment)*

Unit – V :

1. *Apply & analyze the phenomena of Nuclear Fission & Fusion to generate Electricity*
2. *Develop the art of designing simple equipment with the He-Ne LASER*

PHYSICS-CC - 6: ELEMENTS OF MODERN PHYSICS

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

UNIT- I

1.Quantum Theory of Light & Matter Waves : Planck's quantum, Planck's constant and light as a collection of photons; Blackbody Radiation: Quantum theory of Light; Photo-electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment. Wave description of particles by wave packets. Group and Phase velocities and relation between them. Two-Slit experiment with electrons. Probability. Wave amplitude andwavefunctions.**(14Lectures)**

UNIT- II

2.Uncertainity Principle : Position measurement- gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle (Uncertainty relations involving Canonical pair of variables): Derivation from Wave Packets impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle-application to virtual particles and range ofaninteraction. **(5Lectures)**

3.Quantum Mechanics: Two slit interference experiment with photons, atoms and particles; linear superposition principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of a wave function, probabilities and normalization; Probability and probability current densities in one dimension. **(10Lectures)**

UNIT- III

4. Quantum Mechanical problems in One Dimension: One dimensional infinitely rigid box- energy eigenvalues and eigenfunctions, normalization; Quantum dot as example; Quantum mechanical scattering and tunnelling in one dimension- across a step potential & rectangularpotentialbarrier. **(10Lectures)**

UNIT- IV

5.Properties of Nuclei & Nuclear Models: Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle. Nature of nuclear force, NZ graph, Liquid Drop model: semi-empirical mass formula and binding energy, Nuclear Shell Model andmagicnumbers. **(6 Lectures)**

6.Radioactivity: stability of the nucleus; Law of radioactive decay; Mean life and half-life; Alpha decay;Betadecay-energyreleased,spectrumandPauli'spredictionofneutrino;Gammaray emission, energy-momentum conservation: electron-positron pair creation by gamma photons in the vicinity ofanucleus. **(8Lectures)**

UNIT- V

7.Nuclear Physics Applications : Fission and fusion- mass deficit, relativity and generation of energy; Fission - nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting with Uranium 235; Fusion and thermonuclear reactions driving stellarenergy (brief qualitative discussions). **(3 Lectures)**

8.Lasers: Einstein's A and B coefficients. Metastable states. Spontaneous and Stimulated emissions. Optical Pumping and Population Inversion. Three-Level and Four-Level Lasers. Ruby Laser and He-Ne Laser.Basiclasing. **(4Lectures)**

Reference Books:

- Concepts of Modern Physics, Arthur Beiser, 2002,McGraw-Hill.
- Introduction to Modern Physics, Rich Meyer, Kennard, Coop, 2002, Tata McGrawHill
- Introduction to Quantum Mechanics, David J. Griffith, 2005, PearsonEducation.
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- Quantum Mechanics: Theory & Applications, A.K.Ghatak&S.Lokanathan, 2004,Macmillan

Additional Books for Reference

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- Quantum Physics, Berkeley Physics, Vol.4. E.H.Wichman, 1971, Tata McGraw-HillCo.
- Basic ideas and concepts in Nuclear Physics, K.Heyde, 3rd Edn., Institute of PhysicsPub.
- Six Ideas that Shaped Physics: Particle Behave like Waves, T.A.Moore, 2003, McGrawHill
- Quantum Mechanics, R. Eisberg and R. Resnick, John Wiley &Sons.

PHYSICS PRACTICAL-CC-6 LAB

60 Lectures

1. Measurement of Planck's constant using black body radiation andphoto-detector
2. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light
3. To determine work function of material of filament of directly heated vacuumdiode.
4. To determine the Planck's constant using LEDs of at least 4 differentcolours.
5. To determine the wavelength of H-alpha emission line of Hydrogenatom.
6. To determine the ionization potential ofmercury.
7. To determine the absorption lines in the rotational spectrum of Iodinevapour.
8. To determine the value of e/m by (a) Magnetic focusing or (b) Barmagnet.
9. To setup the Millikan oil drop apparatus and determine the charge of anelectron.
10. To show the tunneling effect in tunnel diode using I-Vcharacteristics.
11. To determine the wavelength of laser source using diffraction of singleslit.
12. To determine the wavelength of laser source using diffraction of doubleslits.
13. To determine (1) wavelength and (2) angular spread of He-Ne laser using plane diffraction grating

ReferenceBooks

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann EducationalPublishers
- A Text Book of Practical Physics, I.Prakash& Ramakrishna, 11th Edn, 2011,Kitab

Dr. V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

□ PHYSICS Hons SYLLABUS (w.e.f. 2020-21)

□ SEMESTER- III

□ CC – 6 (ELEMENTS OF MODERN PHYSICS)

□ BLUE PRINT FOR QUESTION PAPER SETTER

TIME : 3 hrsMax.Marks :75

Sl.No.	UNIT NO. /CHAPTER NO.		SHORT ANSWER QUESTIONS 5 MARKS	ESSAY QUESTIONS 10 MARKS	MARKS ALLOETD TO THE UNIT
1	UNIT I	1.Quantum theory of the Light & Matter waves	2	2	30
2	UNIT II	2.Uncertainity principle	1	1	30
		3.Quantum mechanics	1	1	
3	UNIT III	4.Quantum mechanical problems in one dimension	2	2	30
4	UNIT IV	5.Properties of Nuclei & Nuclear models	1	1	30
		6.Radioactivity	1	1	
5	UNIT V	7.Nuclear physics applications	1	1	30
		8.LASERS	1	1	
	Total no. of Questions		10	10	
	Total Marks including Choice				150

□ Note: 1.The question paper setters are requested to kindly adhere to the format given in the above table.

□ 2.The question paper setters are also requested to set the questions in the following way:

□ a. 80 % of Questions - Memory and Understanding based

□ b. 20 % of Questions - Creativity , Application and Skill based

Dr. V.S.KrishnaGovernemnt Degree College (A) , Visakhapatnam
Hons PHYSICS MODEL PAPER FOR III SEMESTER

MODERN PHYSICS – CC-6

Time: 3 Hrs **Max. Marks: 75**

SECTION – A

Answer all Questionsof the following [5 X 10 = 50]

1. Explain the Planck's Quantum theory of Blackbody Radiation and derive an expression for Monochromatic Energy density of Blackbody Radiation.

[OR]

Explain the experimental arrangement of the Davisson- Germer experiment and also explain how the existence of matter waves was confirmed by this experiment.

2. Explain the arrangement and the working of the Gamma ray microscope thought experiment.

[OR]

Derive Time dependent and Time independent Non-relativistic Schrodinger's equations in Quantum mechanics.

3. Derive expressions for Eigen energy values and the corresponding Eigen functions for a particle moving in a one-dimensional infinite potential well.

[OR]

Derive the expressions for Reflection and Transmission probabilities for an incident plane matter wave due to a one-dimensional finite potential step.

4. Explain the Liquid drop model of Atomic nuclei.

[OR]

Explain the shell model of Atomic nuclei and also explain the high stability of nuclei

associated with the magic numbers.

5. Explain the Gamow's theory of Alpha decay in Atomic nuclei.

[OR]

Explain the construction and the working of a He-Ne LASER.

SECTION – B

Answer any FIVE Questions of the following [5 x 5 = 25]

6. Explain the deBroglie hypothesis of Matter waves and derive an expression for wavelength of Matter waves.

7. Distinguish between Phase and Group velocities.

8. Estimate the width of an excited energy state of an atom if the lifetime of the atom in the state is 1 ns.

9. Explain the physical significance of Wavefunction and also explain the conditions on it.

10. Calculate the third excited energy eigen value for a particle of a proton moving in an infinite
one-dimensional potential well of width 3 fm.

11. Explain briefly about the Quantum mechanical Tunneling.

12. Calculate the potential energy due to the electric repulsion between two nuclei of $^{12}_{6}C$ when
they touch each other at the surface.

13. Calculate the decay constant, the average life and the activity of 1 mg of $^{198}_{79}Au$ if the half
life time of the Gold nuclei is 2.7 days.

14. Write the characteristics of Nuclear forces.

15. Explain about i) Meta stable states ii) Population Inversion.

Dr. V.S.KrishnaGovernemnt Degree College (A) , Visakhapatnam

Honors PHYSICS SYLLABUS UNDER CBCS

For Mathematics Combinations

[2020-21 Batch onwards]

II Year B.Sc.-Physics: III Semester

CC-6: ELEMENTS OF MODERN PHYSICS

Work load:60 hrspersemester **4 hrs/week**

On successful completion of this course, the student will be able to:

- *To get the exposure in terms of theoretical as well as experimental aspects both in Quantum theory of radiation & the existence of Matter waves*
- *To understand and also will be able apply Hisenberg'sUncertainity principle and the Schrodinger's formalism of the Quantum Mechanics*
- *To apply the Time Independent Schrodinger equation to some basic problems in quantum mechanics and also to get aware of the basic ideas about Quantum Tunneling*
- *To get acquainted with the elementary aspects of properties of Atomic Nuclei and also of Nuclear Models and the phenomenon of Radio Activity*
- *To know about the various applications of Nuclear Physics like Nuclear reactors in detail and the student will also be able to understand the basic aspects of LASER systems*

Learning Objectives:

1. *To understand the Quantum Theory of Radiation and the Matter Waves*
2. *To understand HisenbergUncertainity principle and Schrodinger formalism of Quantum Mechanics*
3. *To apply Time Independent Schrodinger Equation to some problems in Quantum Mechanics and also about Quantum Tunneling*
4. *To comprehend the basic properties of Nuclei and understand Nuclear models and the phenomenon of Radioactivity*
5. *To get acquainted with the applications of Nuclear Physics and understand the basic aspects of LASER systems*

Skill Component :

Unit – I &II :

1. *To work out rough & quick calculations regarding Atomic & Nuclear phenomena using HisenbergUncertainity principle*
2. *Apply &Analyze some thought experiments to design real physics experiments*
3. *Develop the skills in constructing wave packets using computations.*

Unit – III :

1. *Apply & analyze the functioning of Quantum dots in the designing of Advanced instruments and solid state Technology*
2. *Analyze the applications of Tunneling phenomenon in Electronic devices*

Unit – IV :

1. *Develop the computational skills to do modelling & curve fitting*
2. *Apply & analyze the phenomenon of Radioactivity in Real life applications (medicine -cancer treatment)*

Unit – V :

1. *Apply & analyze the phenomena of Nuclear Fission & Fusion to generate Electricity*
2. *Develop the art of designing simple equipment with the He-Ne LASER*

PHYSICS-CC - 6: ELEMENTS OF MODERN PHYSICS

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

UNIT- I

1.Quantum Theory of Light & Matter Waves : Planck's quantum, Planck's constant and light as a collection of photons; Blackbody Radiation: Quantum theory of Light; Photo-electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment. Wave description of particles by wave packets. Group and Phase velocities and relation between them. Two-Slit experiment with electrons. Probability. Wave amplitude andwavefunctions.**(14Lectures)**

UNIT- II

2.Uncertainity Principle : Position measurement- gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle (Uncertainty relations involving Canonical pair of variables): Derivation from Wave Packets impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle-application to virtual particles and range ofaninteraction. **(5Lectures)**

3.Quantum Mechanics: Two slit interference experiment with photons, atoms and particles; linear superposition principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of a wave function, probabilities and normalization; Probability and probability current densities in one dimension. **(10Lectures)**

UNIT- III

4. Quantum Mechanical problems in One Dimension: One dimensional infinitely rigid box- energy eigenvalues and eigenfunctions, normalization; Quantum dot as example; Quantum mechanical scattering and tunnelling in one dimension- across a step potential & rectangularpotentialbarrier. **(10Lectures)**

UNIT- IV

5.Properties of Nuclei & Nuclear Models: Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle. Nature of nuclear force, NZ graph, Liquid Drop model: semi-empirical mass formula and binding energy, Nuclear Shell Model andmagicnumbers. **(6 Lectures)**

6.Radioactivity: stability of the nucleus; Law of radioactive decay; Mean life and half-life; Alpha decay;Betadecay-energyreleased,spectrumandPauli'spredictionofneutrino;Gammaray emission, energy-momentum conservation: electron-positron pair creation by gamma photons in the vicinity ofanucleus. **(8Lectures)**

UNIT- V

7.Nuclear Physics Applications : Fission and fusion- mass deficit, relativity and generation of energy; Fission - nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting with Uranium 235; Fusion and thermonuclear reactions driving stellarenergy (brief qualitative discussions). **(3 Lectures)**

8.Lasers: Einstein's A and B coefficients. Metastable states. Spontaneous and Stimulated emissions. Optical Pumping and Population Inversion. Three-Level and Four-Level Lasers. Ruby Laser and He-Ne Laser.Basiclasing. **(4Lectures)**

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PHYSICS PRACTICAL-CC-6 LAB

60 Lectures

1. Measurement of Planck's constant using black body radiation andphoto-detector
2. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light
3. To determine work function of material of filament of directly heated vacuumdiode.
4. To determine the Planck's constant using LEDs of at least 4 differentcolours.
5. To determine the wavelength of H-alpha emission line of Hydrogenatom.
6. To determine the ionization potential ofmercury.
7. To determine the absorption lines in the rotational spectrum of Iodinevapour.
8. To determine the value of e/m by (a) Magnetic focusing or (b) Barmagnet.
9. To setup the Millikan oil drop apparatus and determine the charge of anelectron.
10. To show the tunneling effect in tunnel diode using I-Vcharacteristics.
11. To determine the wavelength of laser source using diffraction of singleslit.
12. To determine the wavelength of laser source using diffraction of doubleslits.
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Dr. V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

- PHYSICS Hons SYLLABUS (w.e.f. 2020-21)
- SEMESTER- III
- CC – 6 (ELEMENTS OF MODERN PHYSICS)
- **BLUE PRINT FOR QUESTION PAPER SETTER**

TIME : 3 hrsMax.Marks :75

Sl.No.	UNIT NO. /CHAPTER NO.		SHORT ANSWER QUESTIONS 5 MARKS	ESSAY QUESTIONS 10 MARKS	MARKS ALLOETD TO THE UNIT
1	UNIT I	1.Quantum theory of the Light & Matter waves	2	2	30
2	UNIT II	2.Uncertainity principle	1	1	30
		3.Quantum mechanics	1	1	
3	UNIT III	4.Quantum mechanical problems in one dimension	2	2	30
4	UNIT IV	5.Properties of Nuclei & Nuclear models	1	1	30
		6.Radioactivity	1	1	
5	UNIT V	7.Nuclear physics applications	1	1	30
		8.LASERS	1	1	
	Total no. of Questions		10	10	
	Total Marks including Choice				150

- *Note:* 1.The question paper setters are requested to kindly adhere to the format given in the above table.
- 2.The question paper setters are also requested to set the questions in the following way:
  - a. 80 % of Questions - Memory and Understanding based
  - b. 20 % of Questions - Creativity , Application and Skill based

Dr. V.S.KrishnaGovernemnt Degree College (A) , Visakhapatnam

Hons PHYSICS MODEL PAPER FOR III SEMESTER

MODERN PHYSICS – CC-6

Time: 3 Hrs **Max. Marks: 75**

SECTION – A

Answer all Questionsof the following [5 X 10 = 50]

1. Explain the Planck's Quantum theory of Blackbody Radiation and derive an expression for Monochromatic Energy density of Blackbody Radiation.

[OR]

Explain the experimental arrangement of the Davisson- Germer experiment and also explain how the existence of matter waves was confirmed by this experiment.

2. Explain the arrangement and the working of the Gamma ray microscope thought experiment.

[OR]

Derive Time dependent and Time independent Non-relativistic Schrodinger's equations in Quantum mechanics.

3. Derive expressions for Eigen energy values and the corresponding Eigen functions for a particle moving in a one-dimensional infinite potential well.

[OR]

Derive the expressions for Reflection and Transmission probabilities for an incident plane matter wave due to a one-dimensional finite potential step.

4. Explain the Liquid drop model of Atomic nuclei.

[OR]

Explain the shell model of Atomic nuclei and also explain the high stability of nuclei

associated with the magic numbers.

5. Explain the Gamow's theory of Alpha decay in Atomic nuclei.

[OR]

Explain the construction and the working of a He-Ne LASER.

SECTION – B

Answer any FIVE Questions of the following [5 x 5 = 25]

6. Explain the deBroglie hypothesis of Matter waves and derive an expression for wavelength of Matter waves.

7. Distinguish between Phase and Group velocities.

8. Estimate the width of an excited energy state of an atom if the lifetime of the atom in the state is 1 ns.

9. Explain the physical significance of Wavefunction and also explain the conditions on it.

10. Calculate the third excited energy eigen value for a particle of a proton moving in an infinite
one-dimensional potential well of width 3 fm.

11. Explain briefly about the Quantum mechanical Tunneling.

12. Calculate the potential energy due to the electric repulsion between two nuclei of $^{12}_{6}C$ when
they touch each other at the surface.

13. Calculate the decay constant, the average life and the activity of 1 mg of $^{198}_{79}Au$ if the half
life time of the Gold nuclei is 2.7 days.

14. Write the characteristics of Nuclear forces.

15. Explain about i) Meta stable states ii) Population Inversion.

Dr. V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

PHYSICS SYLLABUS UNDER CBCS

For Mathematics Combinations

[2020-21 Batch onwards]

II Year B.Sc.-Physics: IV Semester

CC-7: THERMAL PHYSICS

Work load:60 hrspersemester **4 hrs/week**

On successful completion of this course, the student will be able to:

- *To understand the First law of Thermodynamics and apply them to analyze various Thermodynamic processes*
- *To comprehend the importance of the Second law of Thermodynamics and its various applications*
- *To get a thorough knowledge of the concept of Entropy and get acquainted with the Maxwell's Thermodynamic Potentials*
- *To get enough exposure to work out with the maxwell's Thermodynamic relations & Kinetic theory of gasses to apply the theory to understand the basic aspects of molecular collisions*
- *To get a thorough understanding about the behaviour of Real gasses*

Learning Objectives :

1. *To understand the First law of Thermodynamics and apply to various Thermodynamic processes*
2. *To understand the Second law of Thermodynamics and its various applications*
3. *To understand the Concept of Entropy and get acquainted with Maxwell's Thermodynamic potentials*
4. *To work out to derive Maxwell's Thermodynamic relations and understand Maxwell's Kinetic Theory of Gasses and apply it to Molecular Collisions*
5. *To understand the behaviour of Real Gasses*

Skill Component :

Unit – I :

1. *Enhance the skills in measuring Temperature and Heat energy*
2. *Determination of the Specific Heats of various substances*
3. *Energy calculations in various Thermodynamic phenomena of every day life*

Unit – II :

1. *Apply & analyze the design of various Heat engines in the nearby surroundings (Automobiles , Refrigerators , ACs etc)*
2. *Calculations of efficiencies of various Thermodynamic cycles in daily life*

Unit – III :

1. *Entropy calculations for real life Thermodynamic phenomena*
2. *Apply & analyze Thermodynamic phenomena like Adiabatic demagnetization to attain low Temperatures*

Unit – IV & V:

1. *Measurement of specific Heats of gasses and Thermal conductivity of solid Heat conductors*
2. *Analyze the Measurements of critical constants for Real Gasses*

PHYSICS-CC - 7: THERMAL PHYSICS

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

(Include related problems for each topic)

UNIT- I

1.Zeroth and First Law of Thermodynamics: Extensive and intensive Thermodynamic Variables, Thermodynamic Equilibrium, Zeroth Law of Thermodynamics & Concept of Temperature, Concept of Work & Heat, State Functions, First Law of Thermodynamics and its differential form, Internal Energy, First Law & various processes, Applications of First Law: General Relation between CP and CV, Work Done during Isothermal and Adiabatic Processes, Compressibility andExpansionCo-efficient.

(10 Lectures)

UNIT-II

2.Second Law of Thermodynamics: Reversible and Irreversible process with examples. Conversion of Work into Heat and Heat into Work. Heat Engines. Carnot's Cycle, Carnotengine &efficiency. Refrigerator & coefficient of performance, 2nd Law of Thermodynamics: Kelvin- Planck and Clausius Statements and their Equivalence. Carnot's Theorem. Applications of Second Law of Thermodynamics: Thermodynamic Scale of Temperature and its Equivalence to PerfectGasScale.

(10Lectures)

UNIT-III

3.Entropy: Concept of Entropy, Clausius Theorem. Clausius Inequality, Second Law of Thermodynamics in terms of Entropy. Entropy of a perfect gas. Principle of Increase of Entropy. Entropy Changes in Reversible and Irreversible processes with examples. Entropy of the Universe. Entropy Changes in Reversible and Irreversible Processes. Principle of Increase of Entropy. Temperature–Entropy diagrams for Carnot's Cycle. Third Law of Thermodynamics. Unattainability ofAbsoluteZero. **(7Lectures)**

4.Thermodynamic Potentials: Thermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy. Their Definitions, Properties and Applications. Surface Films and Variation of Surface Tension with Temperature. Magnetic Work, Cooling due to adiabatic demagnetization, First and second order Phase Transitions with examples, Clausius Clapeyron Equation andEhrenfestequations. **(7Lectures)**

UNIT- IV

5.Maxwell's Thermodynamic Relations: Derivations and applications of Maxwell's Relations, Maxwell's Relations:(1) Clausius Clapeyron equation, (2) Values ofC_p-C_v,

(2) T dS Equations, (4) Joule-Kelvin coefficient for Ideal and Van der Waal Gases, (5) Energy equations, (6) Change of Temperature duringAdiabaticProcess. **(6Lectures)**

6.Maxwell Distribution of Velocities: Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas and its Experimental Verification. Doppler Broadening of Spectral Lines and Stern's Experiment. Mean, RMS and Most Probable Speeds. Degrees of Freedom. Law of Equipartition of Energy (No proof required). Specific heatsofGases. **(6Lectures)**

7.Molecular Collisions: Mean Free Path. Collision Probability. Estimates of Mean Free Path. Transport Phenomenon in Ideal Gases: (1) Viscosity, (2) Thermal Conductivity and (3) Diffusion. Brownian Motion anditsSignificance. **(4 Lectures)**

UNIT- V

8.Real Gases: Behavior of Real Gases: Deviations from the Ideal Gas Equation. The Virial Equation. Andrew's Experiments on CO_2 Gas. Critical Constants. Continuity of Liquid and Gaseous State. Vapour and Gas. Boyle Temperature. Van der Waal's Equation of State for Real Gases. Values of Critical Constants. Law of Corresponding States. Comparison with Experimental Curves. P-V Diagrams. Joule's Experiment. Free Adiabatic Expansion of a Perfect Gas. Joule-Thomson Porous Plug Experiment. Joule-Thomson Effect for Real and Van der Waal Gases. Temperature of Inversion.Joule-ThomsonCooling. **(10 Lectures)**

Reference Books:

- Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981,McGraw-Hill.
- A Treatise on Heat, MeghnadSaha, and B.N.Srivastava, 1958, IndianPress
- Thermal Physics, S. Garg, R. Bansal and Ghosh, 2nd Edition, 1993, TataMcGraw-Hill
- Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009,Springer.
- Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger. 1988, Narosa.
- Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, 2nd Ed., 2012, Oxford UniversityPress
-
- Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. ChandPublications.
- Thermal Physics, B.K. Agrawal, Lok BhartiPublications.

PHYSICS LAB- CC- 7 LAB

60 Lectures

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. To determine the Coefficient of Thermal Conductivity of Cu by Searle'sApparatus.
3. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom'sMethod.
4. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee and Charlton's discmethod.
5. To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer(PRT).
6. To study the variation of Thermo-Emf of a Thermocouple with Difference of Temperature of its TwoJunctions.
7. To calibrate a thermocouple to measure temperature in a specified Rangeusing
   (I) Null Method, (2) Direct measurement using Op-Amp difference amplifier and to determine NeutralTemperature.

Reference Books:

- Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- A Text Book of Practical Physics, I.Prakash& Ramakrishna, 11th Ed., 2011, KitabMahal
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann EducationalPublishers
- A Laboratory Manual of Physics for undergraduate classes,D.P.Khandelwal,1985, VaniPub.

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Dr. V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A),VISAKHAPATNAM

B.Sc. HONORS PHYSICS

w.e.f.2020-21(Revised in May2020)

MODELQUESTIONPAPERCOMMONFOR ALLCORETHEORYCOURSES

Time: 3 hrs *Maxmarks: 75*

SECTION-A

(EssayTypeQuestions) *Marks*:5x10M =50M

AnswerAllquestionswith internalchoicefrom eachUnit

1.A. Derive Work Done during Isothermal and Adiabatic Processes? 5+5

OR

B. Explain the First Law of thermodynamics and its Applications? 5+5

2.A Describe the working of carnot's engine and derive an expression for its efficiency. 7+3

OR

B. Explain about Thermodynamic Scale of Temperature and its Equivalence to PerfectGasScale.

3.A Explain the four Thermodynamic Potentials?

OR

B Explain the Entropy Changes in Reversible and Irreversible processes ? 5+5

4.A Explain the property of Viscosity of a gas on the basis of kinetic theory?

OR

B Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas

5.A Obtain an expression for Joule-Thomson cooling?

OR

B. Explain about Andrew's Experiments on CO_2 Gas?

SECTION-B

(ShortAnswerTypeQuestions) *Marks*: 5x5M=25M

Answeranyfiveout ofthe followingten questions

[**Note:***Question Paper setters are instructed to add Numerical Problems (each of 5*

6. Explain about Zero'th Law of Thermodynamics?

7. Calculate the efficiency of a reversible engine working between 72 ^{0}c and 187^{0}c?

8. Explain about Entropy of the Universe.?

9. Derive First T ds equation?

10. Write short note on Transport Phenomenon in Ideal Gases?

11 Discuss about Mean Free Path

12. Wrote short note on Temperature of Inversion?.

13. Explain about The Virial Equation of state for real gas?

marks)with a maximum weightage of 20 marks either in Section-A or Section-B covering all the fiveunits inthesyllabus]

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Dr. V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

- PHYSICS Hons SYLLABUS (w.e.f. 2020-21)
- SEMESTER- IV
- CC – 7 (TERMAL PHYSICS)
- **BLUE PRINT FOR QUESTION PAPER SETTER**

TIME : 3 hrsMax.Marks :75

Sl.No.	UNIT NO. /CHAPTER NO.		SHORT ANSWER QUESTIONS 5 MARKS	ESSAY QUESTIONS 10 MARKS	MARKS ALLOETD TO THE UNIT
1	UNIT I	1.Zeroth law & First law of Thermodynamics	2	2	30
2	UNIT II	2.Second law of Thermodynamics	2	2	30
3	UNIT III	3.Entropy	1	1	30
		4.Thermodynamic potentials	1	1	
4	UNIT IV	5.Maxwell thermodynamic relations		1	30
		6.Kinetic Theory of gasses	1	1	
		7.Molecular collisions	1		
5	UNIT V	8.Real gasses	2	2	30
	Total no. of Questions		10	10	
	Total Marks including Choice				150

- Note: 1.The question paper setters are requested to kindly adhere to the format given in the above table.
- 2.The question paper setters are also requested to set the questions based on problems (conceptual or numerical) for a total of 20 marks.

Dr. V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

PHYSICS SYLLABUS UNDER CBCS

For Mathematics Combinations

[2020-21 Batch onwards]

II Year B.Sc.Hons-Physics: IV Semester

CC-8: QUANTUM MECHANICS AND APPLICATIONS

Work load:60 hrspersemester **4 hrs/week**

On successful completion of this course, the student will be able to:

- *To get acquainted with and understand the basic aspects of Time Dependent Schrodinger equation Time Independent Schrodinger equation and the physical significance of the wavefunction*
- *To get the knowledge to work out with the Time Independent Schrodinger Equation to solve some basic One dimensional problems in quantum Mechanics*
- *To comprehend the analysis of the mathematical as well as the physical aspects of the Wavefunctions of electron in Hydrogen Atom*
- *To understand the details of the theoretical as well as the experimental aspects of Stark & Zeeman effects*
- *To learn how to extend the formalisms of vector Atom model & Schrodinger to many electron atoms*

Learning Objectives :

1. *To understand the basic aspects of Time Dependent Schrodinger Equation , Time Independent Schrodinger Equation and the physical significance of wave function*
2. *To solve Time Independent Schrodinger Equation for some one dimensional Potential functions in the Quantum Mechanics*
3. *To comprehend the wavefunctions of the electron in Hydrogen atom*
4. *To understand the stark & the Zeeman effects*
5. *To extend the vector Atom model and the formalism of Schrodinger to Many Electron atoms*

Skill Component :

Unit – I:

1. *Analyze the applications of Time Dependent & Independent Schrodinger Equations to Quantum devices(Quantum wires , Quantum wells etc)*
2. *Simple & Quick calculations for quantum phenomena using Uncertainity principle*

Unit – II & III:

1. *Calculations of allowed discrete energy levels for simple potential functions using a computer*
2. *Apply & analyze the Quantum mechanical concepts of electrons in atoms to exploit their chemical properties in real life applications*

Unit – IV &V :

1. *Analyze the properties of elements in the Periodic Table using Atomic orbital wave functions*
2. *Learn to design some methods to vary Atomic energy levels using phenomena like Zeeman & Stark effects.*
3. *Hartree calculations of Atomic orbital wavefunctions in many electron Atoms.*

□

PHYSICS-CC- 8: QUANTUM MECHANICS AND APPLICATIONS

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

UNIT-I

1.Time dependent Schrodinger equation: Time dependent Schrodinger equation and dynamical evolution of a quantum state; Properties of Wave Function. Interpretation of Wave Function Probability and probability current densities in three dimensions; Conditions for Physical Acceptability of Wave Functions. Normalization. Linearity and Superposition Principles. Eigenvalues and Eigenfunctions. Position, momentum and Energy operators; commutator of position and momentum operators; Expectation values of position and momentum. Wave Function of aFreeParticle. **(6 Lectures)**

2.Time independent Schrodinger equation-Hamiltonian, stationary states and energy eigenvalues; expansion of an arbitrary wavefunction as a linear combination of energy eigenfunctions; General solution of the time dependent Schrodinger equation in terms of linear combinations of stationary states; Application to spread of Gaussian wave-packet for a free particle in one dimension; wave packets, Fourier transforms and momentum space wavefunction; Position-momentumuncertaintyprinciple. **(10 Lectures)**

UNIT- II

3.General discussion of bound states in an arbitrary potential- continuity of wavefunction, boundary condition and emergence of discrete energy levels; application to one-dimensional problem-square well potential; Quantum mechanics of simple harmonic oscillator-energy levels and energy eigenfunctions using Frobenius method; Hermite polynomials; ground state, zero point energy &uncertaintyprinciple. **(12Lectures)**

UNIT- III

HYDROGEN ATOM PROBLEM

4.Quantum theory of hydrogen-like atoms: Time independent Schrodinger equation in spherical polar coordinates; separation of variables for second order partial differential equation; angular momentum operator & quantum numbers; Radial wavefunctions from Frobenius method; shapes of the probability densities for ground & first excited states; Orbital angular momentum quantum numbers l and m; s, p,d,.. shells. **(10Lectures)**

UNIT- IV

5.Atoms in Electric & Magnetic Fields: Electron angular momentum. Space quantization. Electron Spin and Spin Angular Momentum. Larmor's Theorem. Spin Magnetic Moment. Stern- Gerlach Experiment. Zeeman Effect: Electron Magnetic Moment and Magnetic Energy, Gyromagnetic Ratio andBohrMagneton. Normal and Anomalous Zeeman Effect. Paschen Back and Stark Effect (QualitativeDiscussiononly). **(12 Lectures)**

UNIT- V

MANY ELECTRON ATOMS

6.Many electron atoms: Pauli's Exclusion Principle. Symmetric & Antisymmetric Wave Functions. Periodic table. Fine structure. Spin orbit coupling. Spectral Notations for Atomic States. Total angular momentum. Vector Model. Spin-orbit coupling in atoms-L-S and J- J couplings. Hund'sRule. Term symbols. Spectra of Hydrogen and Alkali Atoms(Na etc.). **(10 Lectures)**

Reference Books:

- A Text book of Quantum Mechanics, P.M.Mathews and K.Venkatesan, 2nd Ed., 2010, McGrawHill
- Quantum Mechanics, Robert Eisberg and Robert Resnick, 2nd Edn., 2002, Wiley.
- Quantum Mechanics, Leonard I. Schiff, 3rd Edn. 2010, Tata McGrawHill.

- Quantum Mechanics, G. Aruldhas, 2nd Edn. 2002, PHI Learning ofIndia.
- Quantum Mechanics, Bruce Cameron Reed, 2008, Jones and BartlettLearning.
- Quantum Mechanics: Foundations & Applications, Arno Bohm, 3rd Edn., 1993,Springer
-
- Quantum Mechanics for Scientists & Engineers, D.A.B. Miller, 2008, Cambridge University Press

Additional Books for Reference

- Quantum Mechanics, Eugen Merzbacher, 2004, John Wiley and Sons,Inc.
- Introduction to Quantum Mechanics, D.J. Griffith, 2nd Ed. 2005, PearsonEducation
- Quantum Mechanics, Walter Greiner, 4th Edn., 2001,Springer

PHYSICS PRACTICAL-CC- 8 LAB

60 Lectures

Use C/C++/Scilab for solving the following problems based on Quantum Mechanics like

1. Solve the s-wave Schrodinger equation for the ground state and the first excited state of the hydrogenatom:

$\frac{d^2y}{dr^2}=A(r)u(r), A(r)=2M[V(r)-E]$ where $V(r)=-\frac{e^2}{r}$

Here, m is the reduced mass of the electron. Obtain the energy eigenvalues and plot the corresponding wavefunctions. Remember that the ground state energy of the hydrogen atom is ≈ -13.6 eV. Take e = 3.795 $(eVÅ)^{1/2}$, ħc = 1973 (eVÅ) and m = 0.511×10^6 eV/c^2.

Find the energy (in eV) of the ground state of the atom to an accuracy of three significant digits. Also, plot the corresponding wavefunction. Take e = 3.795 $(eVÅ)^{1/2}$, m = 0.511×10^6 eV/c^2, and a = 3 Å, 5 Å, 7 Å. In these units ħc = 1973 (eVÅ). The ground state energy is expected to be above -12 eV in all three cases.

2. Solve the s-wave radial Schrodinger equation for a particle of massm:

$d^2y=A(r)u(r), A(r)=2N[V(r)-E]$

For the anharmonic oscillator potential $V(r) = \frac{1}{2} kr^2 \pm \frac{1}{3} br^3$ –

for the ground state energy (in MeV) of particle to an accuracy of three significant digits. Also, plot the corresponding wave function. Choose m = 940 MeV/c^2, k = 100MeV fm^{-2}, b = 0, 10, 30 MeV fm^{-3} In these units, ch = 197.3 MeV fm. The ground state energy I expected to lie between 90 and 110 MeV for all three cases.

3. Solve the s-wave radial Schrodinger equation for anatom:

$\frac{d^2y}{dr^2}=A(r)u(r), A(r)=2N[V(r)-E]$

where m is the reduced mass of the system (which can be chosen to be the mass ofan

electron), for the screened coulomb potential $V(r) = -\frac{e^2}{r}e^{-\frac{r}{a}}$

4. Solve the s-wave radial Schrodinger equation for the vibrations of hydrogenmolecule: $\frac{d^2y}{dr^2} = A(r)u(r), A(r) = {}^{2\mu}[\frac{V(r)}{\hbar^2} - E]$ Where μ is the reduced mass of the two-atom system for the Morse potential $V(r) = D(e^{-2\alpha r^F} - e^{-\alpha r^F}), r^u = \frac{r-r^0}{r}$

   Find the lowest vibrational energy (in MeV) of the molecule to an accuracy of three significant digits. Also plot the corresponding wave function.
   Take: m = 940x10^6 eV/C^2, D = 0.755501 eV, α = 1.44, r_o = 0.131349 Å

Laboratory based experiments:

5. Study of Electron spin resonance- determine magnetic field as a function of the resonance frequency
6. Study of Zeeman effect: with external magnetic field; Hyperfinesplitting
7. To show the tunneling effect in tunnel diode using I-Vcharacteristics.
8. Quantum efficiency ofCCDs

Reference Books:

- Schaum's outline of Programming with C++. J.Hubbard, 2000,McGraw-HillPublication
- Numerical Recipes in C: The Art of Scientific Computing, W.H. Pressetal., 3rdEdn., 2007, Cambridge UniversityPress.
- An introduction to computational Physics, T.Pang, 2ndEdn.,2006, Cambridge Univ.Press
- Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific & Engineering Applications: A. VandeWouwer, P. Saucez, C. V. Fernández.2014Springer.
- Scilab (A Free Software to Matlab): H. Ramchandran, A.S. Nair. 2011 S. Chand &Co.
- A Guide to MATLAB, B.R. Hunt, R.L. Lipsman, J.M. Rosenberg, 2014, 3rdEdn., Cambridge UniversityPress
- Scilab Image Processing: L.M.Surhone.2010 Betascript PublishingISBN:978-6133459274

MODEL QUESTION PAPER

[QUANTUM MECHANICS AND APPLICATIONS]

II B.Sc. Physics Hons: SEM-IV / CC-8

Time: 3 Hrs **Max. Marks: 75**

SECTION – A

Answer all Questions of the following **[5 X 10 = 50]**

1. (a) Define wavefunction. Derive Schrodinger's Time dependent wave equations.

[OR]

(b) Explain Heisenberg's Uncertainty principle in position and momentum. Define Hamiltonian?

2. (a) Derive an expression for allowed energy values and the corresponding wave functions for a particle in an infinite one-dimensional potential well.

[OR]

(b) Derive energy levels and energy eigenfunctions of a quantum mechanical simple harmonic oscillator?

3. (a) Describe all the quantum numbers?

[OR]

(b) Derive an expressions for Angular momentum operator.

4. (a) Explain the experimental arrangement of Stern – Gerlach experiment.

[OR]

(b) Explain the Zeeman effect and derive an equation for Zeeman shift.

5. (a) Define Pauli's Exclusion Principle. Explain L-S and J- J coupling schemes.

[OR]

(b) What is Fine structure? Explain Symmetric & Antisymmetric Wave Functions.

SECTION – B

Answer any FIVE Questions

6. Write the properties of the wavefunction.
7. Explain momentum space wavefunction.
8. Explain the ground state wave function and zero-point energy of harmonic oscillator.
9. Write the Time independent Schrodinger equation in spherical polar coordinates.
10. Explain the Larmor's Theorem.
11. Discuss Normal and Anomalous Zeeman Effect.
12. Explain Na fine structure.
13. Explain Spectral Notations and Term symbols for Atomic States.

Dr.V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

PHYSICS Hons SYLLABUS (w.e.f. 2020-21)

SEMESTER- IV

CC – 8 (QUANTUM MECHANICS AND APPLICATIONS)

BLUE PRINT FOR QUESTION PAPER SETTER

TIME : 3 hrsMax.Marks :75

Sl.No.	UNIT NO. /CHAPTER NO.		SHORT ANSWER QUESTIONS 5 MARKS	ESSAY QUESTIONS 10 MARKS	MARKS ALLOETD TO THE UNIT
1	UNIT I	1.Time dependent Schrodinger equation	1	1	30
		2.Time Independent Schrodinger equation	1	1	
2	UNIT II	3.General discussion of Bound states in arbitrary potential	2	2	30
3	UNIT III	4. Hydrogen atom problem	2	2	30
4	UNIT IV	5.Atoms in Electric & Magnetic fields	2	2	30
5	UNIT V	6.Many Electron atoms	2	2	30
	Total no. of Questions		10	10	
	Total Marks including Choice				150

Note: 1.The question paper setters are requested to kindly adhere to the format given in the above table.

2.The question paper setters are also requested to set the questions based on problems (conceptual or numerical) for a total of 20 marks.

Dr.V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

PHYSICS SYLLABUS UNDER CBCS

For Mathematics Combinations

[2020-21 Batch onwards]

II Year B.Sc.Hons-Physics: IV Semester

CC-9: SOLID STATE PHYSICS

Work load:60 hrspersemester **4 hrs/week**

On successful completion of this course, the student will be able to:

- *To get the exposure about the geometrical and Algebraical descriptions of crystal structure and also about the determination of crystal structure*
- *To understand the elementary Lattice Dynamics and apply it to understand about the basic aspects of Specific heat of solids*
- *To comprehend the theoretical & experimental aspects of Magnetic and Dielectric Properties of Matter*
- *To understand and apply elementary band theory to understand the conduction properties of various solid materials*
- *To get acquainted with the basic aspects of Ferroelectricity & Superconductivity*

Learning Objectives :

1. *To understand the geometrical as well as the Vectorial descriptions of Crystal structure and also about the methods of determination of crystal structure*
2. *To comprehend the fundamentals of the Lattice Dynamics and apply to understand the variation of specific Heats of solids with Temperature*
3. *To understand the theoretical and experimental aspects of the Magnetic and the Dielectric properties of matter*
4. *To understand the Band theory of solids to distinguish between conductors , Semiconductors and Insulators*
5. *To understand the basic aspects of the Ferroelectricity & the Superconductivity*

Skill Component :

Unit – I :

1. *Geometrical calculations of periodicity and symmetries in crystal structures*
2. *Analysis of X ray Diffraction patterns of various samples*

Unit – II :

1. *Calculations of the fundamental normal mode frequencies of model systems identical to lattices in solids using a computer*
2. *Analyzing phonon spectra*

Unit – III:

1. *Measurement of Magnetic susceptability and Dielectric constant*
2. *Apply & analyze the Hysteresis curves of ferromagnetic materials which are used in daily life applications (electrical motor cores , Electro magnets etc*
3. *Apply & analyze the insulating properties liquids useful in Electrical devices (Transformer oil etc)*

Unit – IV :

1. *Band theory calculations of simple one dimensional systems using a computer*
2. *Apply & analyze the Band diagrams of solids which are useful in daily applications*

Unit – V :

1. *Develop the skills in the design aspects of ferroelectric Supercapacitors*
2. *Analyze & apply the properties of piezo electric materials to design simple & low cost Electro mechanical devices.*
3. *Develop the skills in designing various simple devices which exploits the phenomenon of superconductivity.*

PHYSICS-CC - 9: SOLID STATE PHYSICS
(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

UNIT- I

1.Crystal Structure: Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis – Central and Non-Central Elements. Unit Cell. Miller Indices. Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Atomic andGeometricalFactor. **(12Lectures)**

UNIT- II

2.Elementary Lattice Dynamics: Lattice Vibrations and Phonons: Linear Mono atomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative description of the Phonon Spectrum in Solids. Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids.T^3law **(10 Lectures)**

UNIT- III

3.Magnetic Properties of Matter: Dia-, Para-, Ferri- and Ferromagnetic Materials. Classical Langevin Theory of dia– and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis andEnergyLoss. **(8Lectures)**

4.Dielectric Properties of Materials: Polarization. Local Electric Field at an Atom. Depolarization Field. Electric Susceptibility. Polarizability. Clausius Mosotti Equation. Classical Theory of Electric Polarizability. Normal and Anomalous Dispersion. Cauchy and Sellmeir relations. Langevin-Debye equation. Complex Dielectric Constant. Optical Phenomena. Application: Plasma Oscillations, Plasma Frequency, Plasmons,TOmodes. **(8Lectures)**

UNIT- IV

5.Elementary band theory: Kronig Penny model. Band Gap. Conductor, Semiconductor (P and N type) and insulator. Conductivity of Semiconductor, mobility, Hall Effect. Measurement of conductivity (04 probe method) & Hall coefficient. **(10 Lectures)**

UNIT- V

6.Ferroelectric Properties of Materials: Structural phase transition, Classification of crystals, Piezoelectric effect, Pyroelectric effect, Ferroelectric effect, Electrostrictive effect, Curie-Weiss Law, Ferroelectric domains, PEhysteresisloop. **(6lectures)**

7.Superconductivity: Experimental Results. Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect. Idea of BCS theory(Noderivation) **(6Lectures)**

Reference Books:

- Introduction to Solid State Physics, Charles Kittel, 8thEdition, 2004, Wiley India Pvt.Ltd.
- Elements of Solid State Physics, J.P. Srivastava, 4thEdition, 2015, Prentice-Hall ofIndia
- Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-GrawHill
- Solid State Physics, N.W. Ashcroft and N.D. Mermin, 1976, CengageLearning
- Solid-state Physics, H. Ibach and H. Luth, 2009,Springer

- Solid State Physics, Rita John, 2014, McGrawHill
- Elementary Solid State Physics, 1/e M. Ali Omar, 1999, PearsonIndia
- Solid State Physics, M.A. Wahab, 2011, NarosaPublications

PHYSICS PRACTICAL-CC- 9 LAB

60 Lectures

1. Measurement of susceptibility of paramagnetic solution (Quinck's TubeMethod)
2. To measure the Magnetic susceptibility ofSolids.
3. To determine the Coupling Coefficient of a Piezoelectriccrystal.
4. To measure the Dielectric Constant of a dielectric Materials withfrequency
5. To determine the complex dielectric constant and plasma frequency of metal using Surface Plasmon resonance(SPR)
6. To determine the refractive index of a dielectric layer usingSPR
7. To study the PE Hysteresis loop of a FerroelectricCrystal.
8. To draw the BH curve of Fe using Solenoid & determine energy loss fromHysteresis.
9. To measure the resistivity of a semiconductor (Ge) with temperature by four-probe method (room temperature to 150 °C) and to determine its bandgap.
10. To determine the Hall coefficient of a semiconductorsample.

Reference Books:

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4thEdition, reprinted 1985, Heinemann EducationalPublishers.
- A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11thEd., 2011, KitabMahal
- Elements of Solid State Physics, J.P. Srivastava, 2ndEd., 2006, Prentice-Hall ofIndia.

□ Dr.V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

□ PHYSICS Hons SYLLABUS (w.e.f. 2020-21)

□ SEMESTER- IV

□ CC – 9 (SOLID STATE PHYSICS)

□ **BLUE PRINT FOR QUESTION PAPER SETTER**

TIME : 3 hrsMax.Marks :75

Sl.No.	UNIT NO. /CHAPTER NO.		SHORT ANSWER QUESTIONS 5 MARKS	ESSAY QUESTIONS 10 MARKS	MARKS ALLOETD TO THE UNIT
1	UNIT I	1.Crystal Structure	2	2	30
2	UNIT II	2.Elementary Lattice Dynamics	2	2	30
3	UNIT III	4. Magnetic properties	1	1	30
		5.Dielectric properties	1	1	
4	UNIT IV	6.Band Theory of solids	2	2	30
5	UNIT V	6.Ferro electric properties	1	1	30
		7.Superconductivity	1	1	
	Total no. of Questions		10	10	
	Total Marks including Choice				150

□ Note: 1.The question paper setters are requested to kindly adhere to the format given in the above table.

□ 2.The question paper setters are also requested to set the questions based on problems (conceptual or numerical) for a total of 20 marks.

Dr. V.S.KrishnaGovernemnt Degree College (A) , Visakhapatnam

Hons PHYSICS MODEL PAPER FOR IV SEMESTER

SOLID STATE PHYSICS – CC-9

SECTION - A

Answer any FIVE of thefollowing5 x 5=25 Marks

1. Write the differences between Amorphous and Single crystalline form of a solid material.
2. Draw the Lattice plane with the Miller indices (112).
3. Write the differences between Acoustical and Optical phonons.
4. Explain Dulong and Petit's law.
5. Write the differences between ferromagnetic and paramagnetic materials.
6. Find the total Polarizability of CO_2, if its Susceptibility is 0.985×10^{-3}. The density of Carbon dioxide is 1.977 Kg/m^3.
7. Explain about the formation of Energy Bands and Energy gaps in solids.
8. For a Semiconductor, the Hall coefficient is $-6.85 \times 10^{-5} \frac{m^3}{Coulomb}$, *and* electrical conductivity is 250 $m^{-1}\Omega^{-1}$. Calculate the density and mobility of charge carriers.
9. Explain about Electrostrictive effect.
10. A Superconducting tin has a critical temperature of 3.7 K at zero magnetic field and a critical field of 0.0306 Tesla at O K. find the critical field at 2 K.

SECTION – B

Answer ALL of the following Questions5 x 10 = 50 Marks

11. Draw the unit cells of all the Bravais Lattices of all the Lattice systems and mention the unit cell parameters for each.

[OR]

Derive the expressions for Form factor and Structure factor . Explain Laue's conditions for the Bright spots in the Xray Diffraction experiments.

12. Derive expressions for the Normal mode frequencies of the vibrations of a Diatomic Linear chain of atoms.

[OR]

Explain the Einstein's theory of variation of Specific heats of solids with Temperature.

13. Explain the Currie – Weiss's theory of Ferromagnetism.

[OR]

Derive the expressions for Electronic and Orientational polarizabilities.

14. Distinguish between Conductors, Semiconductors and Insulators with neat diagrams.

[OR]

Explain the Hall effect with a neat diagram. Derive expression for the Hall coefficient.

15. Explain about the Ferro electric effect and Ferro electric domains. Explain also about P-E Electric Hysteresis loop with a neat diagram.

[OR]

Explain Meissner effect and also explain about Type-I and Type-II superconductors with neat diagrams.

Dr.V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

PHYSICS SYLLABUS UNDER CBCS

For Mathematics Combinations

[2020-21 Batch onwards]

II Year B.Sc.Hons-Physics: IV Semester

CC-10: ESSENTIALS OF ANALOG & DIGITAL SYSTEMS AND APPLICATIONS

Work load:60 hrspersemester **4 hrs/week**

On successful completion of this course, the student will be able to:

CO-1:*To understand the two modes of conduction in Intrinsic & Extrinsic semiconductors*

To understand the Energy level diagrams of both types of semiconductors

To apply the above to understand the working of P-N junction Diode

CO-2 :*To understand the basic aspects of the characteristics of various configurations of the Bi polar Junction Transistors and apply these to understand and work out the analysis of various configurations of single as well as multi stage Amplifiers and also that of RC coupled Amplifiers*

CO – 3 :*To comprehend the working mechanism for the sustained oscillations in RC phase Shift , Hartley's and Colpitts' oscillators and also to get acquainted with some Basic aspects of IC s*

CO – 4 :*To get acquainted with the fundamental aspects of Digital circuits & the basic Aspects of Boolean Algebra and also to know about the simplification of digital Circuits using Boolean algebra*

CO – 5 :*To know about some basic aspects of Arithmetic circuits , Timers and Shift Registers*

Learning Objectives:

1. *To understand the Conduction mechanism in Intrinsic & Extrinsic Semiconductors and use this to understand the conduction mechanism in P-N junction Diode*
2. *To understand the working mechanism of Bipolar Junction Transistors and Amplifiers*
3. *To workout the condition for Sustained oscillations in electronic circuits and use it to understand the working mechanism of some oscillators and also to get acquainted with the basic aspects of IC s*

4. *To enhance understanding about and working out with various fundamental Digital circuits and also the techniques to simplify Digital circuits using Boolean Algebra*
5. *To know about the basic aspects of Arithmetic circuits , Timers and shift Registers*

Skill Component :

Unit –I

1. To get acquainted with Circuit connections
2. To construct various basic electronic circuits

Unit – II

1. To know about the circuit connections and the practicality regarding Transistors
2. To design various basic Amplifier circuits using Transistors

Unit – III

1. To know how to connect and design basic Oscillator circuits
2. To construct basic Integrated circuits

Unit –IV& Unit - V

1. To construct and design various Logic circuits
2. To apply these Logic circuits for various electronic components

PHYSICS-CC - 10: ESSENTIALS OF ANALOG & DIGITAL SYSTEMS AND APPLICATIONS

(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

UNIT- I

1.Semiconductor Diodes: P and N type semiconductors. Energy Level Diagram .Conductivity and Mobility, Concept of Drift velocity. PN Junction Fabrication (Simple Idea). Barrier Formation in PN Junction Diode. Static and Dynamic Resistance. Current Flow Mechanism in Forward and

Reverse Biased Diode. Drift Velocity. Derivation for Barrier Potential, Barrier Width and Current for StepJunction.Current Flow Mechanism in Forward and ReverseBiasedDiode. **(8 Lectures)**

2.Two-terminal Devices and their Applications: (1) Rectifier Diode: Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers, Calculation of Ripple Factor and Rectification Efficiency, C-filter (2) Zener Diode and Voltage Regulation. Principle and structure of (1)LEDs, (2) Photodiode and (3)SolarCell.

(5Lectures)

UNIT- II

3.Bipolar Junction transistors: n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations. Current gains α and β Relations between α and β. Load Line analysis of Transistors. DC Load line and Q-point. Physical Mechanism of Current Flow. Active, Cutoff and SaturationRegions. **(4Lectures)**

4.Amplifiers: Transistor Biasing and Stabilization Circuits. Fixed Bias and Voltage Divider Bias. Transistor as 2-port Network. h-parameter Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance. Current, Voltage and Power Gains. Classification of Class A, B &CAmplifiers , Two stage RC-coupled amplifier and its frequency response ,Effects of Positive and Negative Feedback on Input Impedance, Output Impedance, Gain, Stability, DistortionandNoise. **(9Lectures)**

UNIT- III

5.Sinusoidal Oscillators & CRO: Barkhausen's Criterion for self-sustained oscillations. RC Phase shift oscillator, determination of Frequency. Hartley &Colpittsoscillators ,Block Diagram of CRO. Electron Gun, Deflection System and Time Base. Deflection Sensitivity. Applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency, andPhaseDifference.
(7 Lectures)

6.Integrated Circuits(Qualitative treatment only): Active & Passive components. Discrete components. Wafer. Chip. Advantages and drawbacks of ICs. Scale of integration: SSI, M

SI, LSI and VLSI (basic idea and definitions only). Classification of ICs. Examples of Linear and DigitallCs. **(4 Lectures)**

UNIT- IV

7.Digital Circuits: Difference between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion. BCD, Octal and Hexadecimal numbers. AND, OR and NOT Gates (]realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates and application asParityCheckers. **(6Lectures)**

8.Boolean algebra: De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean Algebra. Fundamental Products. Idea of Minterms and Maxterms. Conversion of aTruth table into Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map. **(6Lectures)**

UNIT- V

9.Arithmetic Circuits: Binary Addition. Binary Subtraction using 2's Complement. Half and Full Adders. Half & Full Subtractors, 4-bitbinaryAdder/Subtractor. **(5Lectures)**

10.Timers: IC 555: block diagram and applications: Astable multivibrator and Monostable multivibrator. **(3Lectures)**

11.Shift registers: Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel- in-Parallel-out Shift Registers (only up to4bits). **(3Lectures)**

Reference Books:

- Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-GrawHill.
- Electronics: Fundamentals and Applications, J.D. Ryder, 2004, PrenticeHall.
- Solid State Electronic Devices, B.G.Streetman&S.K.Banerjee, 6thEdn.,2009, PHILearning
- Electronic Devices & circuits, S.Salivahanan&N.S.Kumar, 3rdEd., 2012, Tata Mc-GrawHill
- OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4thedition, 2000, PrenticeHall
- Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6thEdn., Oxford University Press.
- Electronic circuits: Handbook of design & applications, U.Tietze, C.Schenk,2008,Springer
- Semiconductor Devices: Physics and Technology, S.M. Sze, 2ndEd., 2002, WileyIndia
- Microelectronic Circuits, M.H. Rashid, 2ndEdition, CengageLearning
- Electronic Devices, 7/e Thomas L. Floyd, 2008, PearsonIndia
- Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7thEd., 2011, Tata McGraw
- Fundamentals of Digital Circuits, Anand Kumar, 2ndEdn, 2009, PHI Learning Pvt.Ltd.
- Digital Circuits and systems, Venugopal, 2011, Tata McGrawHill.
- Digital Electronics G K Kharate ,2010, Oxford UniversityPress
- Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer, 2001, PHILearning
- Logic circuit design, Shimon P. Vingron, 2012,Springer.
- Digital Electronics, Subrata Ghoshal, 2012, CengageLearning.
- Digital Electronics, S.K. Mandal, 2010, 1stedition, McGrawHill
- Microprocessor Architecture Programming & applications with 8085, 2002, R.S. Goankar, PrenticeHall.

PHYSICS PRACTICAL-CC- 10 LAB

60 Lectures

1. To measure (a) Voltage, and (b) Time period of a periodic waveform usingCRO.
2. To test a Diode and Transistor using aMultimeter.
3. To design a switch (NOT gate) using atransistor.
4. To verify and design AND, OR, NOT and XOR gates using NANDgates.

- To design a combinational logic system for a specified TruthTable

5. To convert a Boolean expression into logic circuit and design it using logic gateICs.
6. To minimize a given logiccircuit.
7. Half Adder, Full Adder and 4-bit binaryAdder.
8. Half Subtractor, Full Subtractor, Adder-Subtractor using Full AdderI.C.
9. To build Flip-Flop (RS, Clocked RS, D-type and JK) circuits using NANDgates.
10. To study V-I characteristics of PN junction diode, and Light emittingdiode.
11. To study the V-I characteristics of a Zener diode and its use as voltageregulator.
12. Study of V-I & power curves of solar cells, and find maximum power point &efficiency.
13. To study the characteristics of a Bipolar Junction Transistor in CEconfiguration.
14. To study the various biasing configurations of BJT for normal class Aoperation.
15. To design a CE transistor amplifier of a given gain (mid-gain) using voltage dividerbias.
16. To study the frequency response of voltage gain of a RC-coupled transistoramplifier.
17. To design a Wien bridge oscillator for given frequency using anop-amp.
18. To design a phase shift oscillator of given specifications usingBJT.
19. To study the Colpitt`soscillator.
20. To design a digital to analog converter (DAC) of givenspecifications.
21. To study the analog to digital convertor (ADC)IC.

Reference Books:

- Modern Digital Electronics, R.P. Jain, 4thEdition, 2010, Tata McGrawHill.
- Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.
- Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.
- OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4thedition, 2000, PrenticeHall.
- Electronic Principle, Albert Malvino, 2008, Tata Mc-GrawHill.
- Electronic Devices & circuit Theory, R.L. Boylestad& L.D. Nashelsky, 2009,Pearson

Dr. V.S.KRISHNA GOVT. DEGREE COLLEGE (A), VISHAKAPATNAM 2020-2021

MODEL QUESTION PAPER PHYSICS-CC-10

ESSENTIALS OF ANALOG AND DIGITAL SYSTEMS AND APPLICATIONS

TIME: 3 Hours Max. Marks: 75

Section-A

Answer all the following questions. 5X10 = 50

Q 1. a) Write about the fabrication of PN junction and Barrier formation of PN junction diode? Or

b) Discuss about construction and working of a Bridge full wave rectifier?

Q 2. a) Discuss about the I-V characteristics of common emitter (CE) circuit ? Or

b) Explain about two stage RC- Coupled amplifier and its frequency response?

Q 3. a) Explain about the cathode ray oscilloscope (CRO) with a neat block diagram? Or

b) Explain the advantages and drawbacks of integrated circuits?

Q 4. a) Show that NAND and NOR gates as universal gates? Or

b) State and Explain De Morgan's theorems ?

Q 5. a) Explain about construction and working of Half and Full adders? Or

b) Explain about block diagram and working of Astable multivibrator?

SECTION-B

Answer any five of the following questions. 5X5 = 25

Q 6. Write about current flow mechanism in forward and reverse biased diode?

Q 7. Explain how Zener diode acts as a voltage regulator ?

Q 8. Derive the relation between current gains α and β ?

Q 9. Explain fixed bias and voltage divider bias ?

Q10. Explain Barkhausen's Criterion for self-sustained oscillations. ?

Q11. Explain very large scale integrated circuits?

Q12. Write about the XOR and XNOR gates?

Q13. Write about parallel in and parallel out shift registers ?

Dr. V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

□ PHYSICS Hons SYLLABUS (w.e.f. 2020-21)

□ SEMESTER- IV

□ CC – 10 (ESSENTIALS OF ANALOG &DIGITAL SYSTEMS AND APPLICATIONS)

□ BLUE PRINT FOR QUESTION PAPER SETTER

TIME : 3 hrsMax.Marks :75

Sl.No.	UNIT NO. /CHAPTER NO.		SHORT ANSWER QUESTIONS 5 MARKS	ESSAY QUESTIONS 10 MARKS	MARKS ALLOTED TO THE UNIT
1	UNIT I	1.Semiconductor diodes	1	1	30
		2.Two Terminal Devices and their Applications	1	1	
2	UNIT II	3.Bipolar Junction Transistors	1	1	30
		4.Amplifiers	1	1	
3	UNIT III	5.sinusoidal Oscillators & CRO	1	1	30
		6.Integrated Circuits	1	1	
4	UNIT IV	7.Digital circuits	1	1	30
		8.Boolean Algebra	1	1	
5	UNIT V	9.Arithmetic circuits	1	1	30
		10.Timers		1	
		11. Shift Registers	1		
	Total no. of Questions		10	10	
	Total Marks including Choice				150

□ Note: 1.The question paper setters are requested to kindly adhere to the format given in the above table.

□ 2.The question paper setters are also requested to set the questions based on problems (conceptual or numerical) for a total of 20 marks.

Dr. V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

PHYSICS SYLLABUS UNDER CBCS

- **For Mathematics Combinations**
- [2020-21 Batch onwards]
- **II Year B.Sc.Hons-Physics: IV Semester**
- **CC-11: ESSENTIALS OF STATISTICAL MECHANICS & ELECTROMAGNETIC THEORY**

4 hrs/week

- **Work load:60 hrspersemester**

On successful completion of this course, the student will be able to:

CO-1 *:To understand the basic concepts of Classical as well as Quantum statistics and also apply them to understand about three kinds of Distributions based on Distinguishability & Indistinguishability of the identical particles*

CO-2*: To comprehend the experimental aspects of Black body radiation and also will be able to understand the theoretical aspects of Black body radiation using not only the Classical but also the Quantum theory of radiation*

CO-3:*To understand to derive Maxwell's Electromagnetic equations and also understand the introduction of Displacement Current. To understand about the Boundary conditions at interfaces , Poynting theorm and various densities*

CO-4 :*To understand the experimental and theoretical aspects of the Polarization Phenomenon of the Light and also about the phenomenon of optical Rotation exhibited by a Plane polarized light*

CO-5*: To comprehend the fundamental aspects of propagation of EM waves in Bounded media and the basic principles involved in the propagation of a Light signal through an Optical Fiber*

Learning Objectives*:*

1. *To understand the basic concepts of Classical & Quantum Statistics and also Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein distribution of identical particles*
2. *To understand the experimental & the Theoretical aspects of the Classical as well as the Quantum theories of Radiation*
3. *To derive the four Maxwell's Electromagnetic Equations and work out with them to understand many theoretical aspects of Electromagnetic waves and also about Boundary conditions exhibited by Electric & Magnetic field Vectors at an interface between two media*

4. *To understand about the Polarization phenomenon of Light & the phenomenon of Optical Rotation*

5. *To understand about the propagation of the Light through Bounded media and that of a Light signal through an Optical Fiber*

Skill components :

Unit – I :

1. *Work out with the probability distribution functions and calculations using them*
2. *To apply the abstract concepts like Entropy to understand and analyze the daily life applications*

Unit – II :

1. *Learn to do some quick calculations regarding the temperature of the sun using Stefan Boltzmann law*
2. *Apply the Blackbody radiation characteristics to understand the spectral distribution of Radiation from various stars and also apply to make various simple devices to use solar energy*

Unit – III :

1. *Learn to apply the Maxwell's equations for different media and to use the analysis to make some simple devices*
2. *Learn to study the propagation laws of EM radiation in Environment and to analyze the functioning of various devices and equipment in daily life and also to design some simple equipment*

Unit – IV :

1. Apply & analyze the Polarization phenomenon of the light , materials and their properties which affects the Polarization of the light to understand various devices and equipment and also learn to design some simple devices
2. Apply & analyze the phenomenon the phenomenon of Optical rotation of the linearly polarized light to use it to design some simple low cost equipment to measure the concentration of some low cost solutions

Unit – V :

1. Learn to do simple calculations of reflection & transmission coefficients for various media interface and apply them to make various devices involving optical reflection & transmission

2. Enhance the understanding of various applications of Optical Fibers and also learn to analyze and design simple low cost devices using Optical Fibers

PHYSICS-CC - 11: ESSENTIALS OF STATISTICAL MECHANICS & ELECTROMAGNETIC THEORY

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

UNIT- I

1 Classical & Quantum Statistics: Macrostate& Microstate, Elementary Concept of Ensemble, Phase Space, Entropy and Thermodynamic Probability, Maxwell-Boltzmann Distribution Law, Fermi – Dirac Distribution law , Bose – Einstein Distribution law , Partition Function, Thermodynamic Functions of an Ideal Gas, Classical Entropy Expression, **(12Lectures)**

UNIT- II

2.Classical Theory of Radiation: Properties of Thermal Radiation. Blackbody Radiation , Pure temperature dependence. Kirchhoff's law. Stefan-Boltzmann law: Thermodynamic proof. Radiation Pressure. Wien's Displacement law. Wien's Distribution Law. Rayleigh-Jean's Law.UltravioletCatastrophe. **(8Lectures)**

3.Quantum Theory of Radiation: Spectral Distribution of Black Body Radiation. Planck's Quantum Postulates. Planck's Law of Blackbody Radiation: Experimental Verification. Deductionof(1)Wien'sDistributionLaw,(2)Rayleigh-JeansLaw,(3)Stefan-BoltzmannLaw, (4) Wien's Displacement law fromPlanck'slaw. **(6Lectures)**

UNIT- III

4.Maxwell Equations of Electromagnetic Theory: Review of Maxwell's equations. Displacement Current. Vector and Scalar Potentials. Gauge Transformations: Lorentz and Coulomb Gauge. Boundary Conditions at Interface between Different Media. Wave Equations. Plane Waves in Dielectric Media. Poynting Theorem and Poynting Vector. Electromagnetic (EM) Energy Density. Physical Concept of Electromagnetic Field Energy Density, Momentum Density and AngularMomentumDensity. **(10Lectures)**

UNIT - IV

5.Polarization of Electromagnetic Waves: Description of Linear, Circular and Elliptical Polarization. Propagation of E.M. Waves in Anisotropic Media. Symmetric Nature of Dielectric Tensor. Fresnel's Formula. Uniaxial and Biaxial Crystals. Light Propagation in Uniaxial Crystal. Double Refraction. Polarization by Double Refraction. Nicol Prism. Ordinary & extraordinary refractive indices. Production & detection of Plane, Circularly and Elliptically P

olarized Light. Phase Retardation Plates: Quarter-Wave and Half-Wave Plates. Babinet

Compensator and its Uses. Analysis ofPolarizedLight **(10Lectures)**

6.Rotatory Polarization: Optical Rotation. Biot's Laws for Rotatory Polarization. Fresnel's Theory of optical rotation. Calculation of angle of rotation. Experimental verification of Fresnel's theory. Specific rotation. Laurent'shalf-shadepolarimeter. **(3 Lectures)**

UNIT - V

7.EM Waves in Bounded Media: Boundary conditions at a plane interface between twomedia. Reflection & Refraction of plane waves at plane interface between two dielectric media-Laws of Reflection & Refraction. Fresnel's Formulae for perpendicular & parallel polarization cases, Brewster's law. Reflection & Transmission coefficients. Total internal reflection, evanescent waves. Metallic reflection(normalIncidence) **(9Lectures)**

8.Optical Fibres:-Numerical Aperture. Step and Graded Indices (Definitions Only). Single and Multiple Mode Fibres (Concept andDefinitionOnly). **(2 Lectures)**

Reference Books:

- Introduction to Electrodynamics, D.J. Griffiths, 3rdEd., 1998, BenjaminCummings.
- Elements of Electromagnetics, M.N.O. Sadiku, 2001, Oxford UniversityPress.
- Introduction to Electromagnetic Theory, T.L. Chow, 2006, Jones & BartlettLearning
- Fundamentals of Electromagnetics, M.A.W. Miah, 1982, Tata McGrawHill
- Electromagnetic field Theory, R.S. Kshetrimayun, 2012, CengageLearning
- Engineering Electromagnetic, Willian H. Hayt, 8thEdition, 2012, McGrawHill.
- Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, 2010,Springer
- Statistical Mechanics, R.K. Pathria, Butterworth Heinemann: 2ndEd., 1996, Oxford University Press.
- Statistical Physics, Berkeley Physics Course, F. Reif, 2008, TataMcGraw-Hill
- Statistical and Thermal Physics, S. Lokanathan and R.S. Gambhir. 1991, PrenticeHall
- Thermodynamics, Kinetic Theory and Statistical Thermodynamics, Francis W. Sears and Gerhard L. Salinger, 1986,Narosa.
- Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009,Springer
- An Introduction to Statistical Mechanics & Thermodynamics, R.H. Swendsen, 2012, Oxford Univ.Press

Additional Books for Reference

- Electromagnetic Fields & Waves, P.Lorrain&D.Corson, 1970, W.H.Freeman&Co.
- Electromagnetics, J.A. Edminster, Schaum Series, 2006, Tata McGrawHill.
- Electromagnetic field theory fundamentals, B. Guru and H. Hiziroglu, 2004,Cambridge UniversityPress

PHYSICS PRACTICAL-CC 11 LAB

60 Lectures

1. To verify the law of Malus for plane polarizedlight.
2. To determine the specific rotation of sugar solution usingPolarimeter.
3. To analyze elliptically polarized Light by using a Babinet'scompensator.
4. To study dependence of radiation on angle for a simple Dipoleantenna.
5. To determine the wavelength and velocity of ultrasonic waves in a liquid (Kerosene Oil, Xylene, etc.) by studying the diffraction through ultrasonicgrating.
6. To study the reflection, refraction ofmicrowaves
7. To study Polarization and double slit interference inmicrowaves.
8. To determine the refractive index of liquid by total internal reflection using Wollaston's air- film.
9. To determine the refractive Index of (1) glass and (2) a liquid by total internal reflection using a Gaussianeyepiece.
10. To study the polarization of light by reflection and determine the polarizing angle for air-glassinterface.
11. To verify the Stefan`s law of radiation and to determine Stefan'sconstant.
12. To determine the Boltzmann constant using V-I characteristics of PN junctiondiode.

Use C/C^{++}/Scilab/other numerical simulations for solving the problems based on Statistical Mechanics like

13. Computational analysis of the behavior of a collection of particles in a box that satisfy Newtonian mechanics and interact via the Lennard-Jones potential, varying the total number of particles N and the initialconditions:
    - Study of local number density in the equilibrium state (i) average; (ii)fluctuations
    - Study of transient behavior of the system (approach toequilibrium)
    - Relationship of large N and the arrow oftime
    - Computation of the velocity distribution of particles for the system and comparison with the Maxwell velocitydistribution
    - Computation and study of mean molecular speed and its dependence on particlemass
    - Computation of fraction of molecules in an ideal gas having speed near the most probable speed
14. Computation of the partition function $Z(\beta)$ for examples of systems with a finite number of single particle levels (e.g., 2 level, 3 level, etc.) and a finite number ofnon-interacting particles N under Maxwell-Boltzmann, Fermi-Dirac and Bose-Einsteinstatistics:
    - Study of how $Z(\beta)$, average energy $\langle E \rangle$, energy fluctuation ΔE, specific heat at constant volume Cv, depend upon the temperature, total number of particles N and

the spectrum of single particlestates.

- Ratios of occupation numbers of various states for the systems consideredabove
- Computation of physical quantities at large and small temperature T and comparison of various statistics at large and small temperatureT.

15. Plot Planck's law for Black Body radiation and compare it with Raleigh-Jeans Law at high temperature and lowtemperature.
16. Plot Specific Heat of Solids (a) Dulong-Petit law, (b) Einstein distribution function, (c) Debye distribution function for high temperature and low temperature and compare them for these two cases.
17. Plot the following functions with energy at differenttemperatures
    - Maxwell-Boltzmanndistribution
    - Fermi-Diracdistribution
    - Bose-Einsteindistribution

Reference Books:

1.Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.

2.Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4thEdition, reprinted 1985, Heinemann EducationalPublishers

3.A Text Book of Practical Physics, I.Prakash& Ramakrishna, 11thEd., 2011, KitabMahal

4. Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, 2010,Springer

5.Elementary Numerical Analysis, K.E.Atkinson, 3rdEdn. 2007, Wiley IndiaEdition

6.Statistical Mechanics, R.K. Pathria, Butterworth Heinemann: 2ndEd., 1996, Oxford University Press.

7.Introduction to Modern Statistical Mechanics, D. Chandler, Oxford University Press,1987

8.Thermodynamics, Kinetic Theory and Statistical Thermodynamics, Francis W. Sears and Gerhard L. Salinger, 1986,Narosa.

9.Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009,Springer

10.Statistical and Thermal Physics with computer applications, Harvey Gould and Jan Tobochnik, Princeton University Press,2010.

11.Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientificand Engineering Applications: A. VandeWouwer, P. Saucez, C. V. Fernández. 2014Springer ISBN: 978-3319067896Scilab by example: M. Affouf, 2012. ISBN:978-1479203444

12.Scilab Image Processing: L.M.Surhone. 2010, Betascript Pub., ISBN:978-6133459274

Dr. V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A), VISAKHAPATNAM

- **PHYSICS Hons SYLLABUS (w.e.f. 2020-21)**
- **SEMESTER- IV**
- **CC – 11 (ESSENTIALS OF STATISTICAL MECHANICS &ELECTROMAGNETIC THEORY)**
- **BLUE PRINT FOR QUESTION PAPER SETTER**

TIME : 3 hrsMax.Marks :75

Sl.No.	UNIT NO. /CHAPTER NO.		SHORT ANSWER QUESTIONS 5 MARKS	ESSAY QUESTIONS 10 MARKS	MARKS ALLOTED TO THE UNIT
1	UNIT I	1.Classical & Quantum Statistics	2	2	30
2	UNIT II	2.Classical Theory of Radiation	1	1	30
		3.Quantum theory of Radiation	1	1	
3	UNIT III	4.Maxwell's equations of Electromagnetic Theory	2	2	30
4	UNIT IV	5.Polarization of Electromagnetic Waves	1	1	30
		6.Rotatory Polarization	1	1	
5	UNIT V	7.EM waves in Bounded media	1	1	30
		8.Optical Fibers	1	1	
	Total no. of Questions		10	10	
	Total Marks including Choice				150

- Note: 1.The question paper setters are requested to kindly adhere to the format given in the above table.
- 2.The question paper setters are also requested to set the questions based on problems (conceptual or numerical) for a total of 20 marks.

Dr. V.S.KrishnaGovernemnt Degree College (A) , Visakhapatnam

Hons PHYSICS MODEL PAPER FOR IV SEMESTER

ESSENTIALS OF STATISTICAL MECHANICS & ELECTROMAGNETIC THEORY – CC-11

SECTION – A

Answer any FIVE of thefollowing5 x 5=25 Marks

1. State the four postulates of Statistical Mechanics and also state and explain the corollary from these postulates.
2. Derive the relation between the Entropy and the number of Microstates.
3. When a Blackbody is heated the wavelength corresponding to the maximum energy changes from 0.69 μm to 0.5 μm. Estimate by what fraction the Emissive power of the body gets increased.
4. Deduce Wein's and Rayleigh-Jeans distribution laws of Blackbody radiation from that of Planck.
5. A LASER beam of radius 1 mm carries a power of 6 kW. Determine its average Irradiance and the amplitude of its Electric and Magnetic fields.
6. Explain briefly about Electromagnetic Energy and Momentum Densities.
7. Explain briefly about Quarter and Half wave plates.
8. Determine the specific rotation produced by a 1 mm thick quartz plate at a wavelength 0f 396.8 nm.
9. Explain the phenomenon of Total Internal Reflection with neat diagram.
10. Calculate the Numerical Aperture and acceptance angle for an optical fiber with core and cladding refractive indices being 1.48 and 1.45 respectively.

SECTION – B

Answer ALL of the following Questions5 x 10 = 50 Marks

11. Derive an expression for Equilibrium Probability distribution of a system of particles obeying Fermi - Dirac Statistics.

[OR]

Derive an expression for Partition Function of an Ideal gas and also derive Thermodynamic functions from it.

12. Explain Rayleigh – Jean's law of Blackbody Radiation and derive an expression for the Monochromatic Emissive power of the Blackbody Radiation using Rayleigh – Jean's law.

[OR]

Explain Planck's law of Blackbody radiation and derive an expression for the Monochromatic

Emissive power for the Blackbody Radiation using Planck's law.

13. Derive the Normal as well as the Tangential Boundary conditions to be satisfied by the Electric and Magnetic Field vectors of an Electromagnetic wave at the interface of two different Linear Dielectric media.

[OR]

State and prove Poynting's theorm.

14. Explain the construction and the working of Nicol Prism.

[OR]

Explain Fresnel's theory of Optical rotation and explain also about its experimental verification.

15. Derive the Fresnel's expressions for Reflectivity and Transmissivity coefficients for the S-polarization of a monochromatic plane Electromagnetic wave incident at the plane interface between two different Dielectric media.

[OR]

Explain about various types of Optical Fibres and also explain how a light signal is propagated through each of them.

Dr. V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

PHYSICS SYLLABUS UNDER CBCS

- For Mathematics Combinations
- [2020-21 Batch onwards]
- **II Year B.Sc.Hons-Physics: III Semester**
- **MINOR PHYSICS -II:**

  Electromagnetism,Electronics&Nano Materials

- **Work load:60 hrspersemester** **4 hrs/week**

Course outcomes:

On successful completion of this course, the students will be able to:

CO 1 :*To learn to understand & apply the basic laws of Electrostatics , Magnetostatics and also the phenomenon of Electromagnetic Induction*

CO 2 :*To get acquainted with the basics of AC circuits and also about the fundamental aspects of Maxwell's equations & Electromagnetic waves*

CO 3 :*To get with the working and principles involved in devices of Basic Electronics like Filters , Transistors and Amplifiers*

CO 4 :*To understand the elementary aspects of the Digital Electronics*

CO 5 :*To know about the properties & various preparation methods of Nano materials and about the Characterization of the Nano Materials*

Learning Objectives :

1. Apply the basic principles of Electrostatics , Magnetostatics and Electromagnetic Induction
2. Understand and analyze the AC circuits and also to know about the generation of Electromagnetic waves
3. To work practically with the basic Electronic components like Filters , Transistors & Amplifiers
4. To get practical as well as Theoretical exposure about Digital Electronics
5. To get acquainted and apply the basic aspects of Nano Material preparation and Characterization

UNIT -I :

1.Electrostatics and magnetic field

Electric field, potential due to a charge distribution and due to a dipole, electrical potential energy, flux, Gauss's law, electric field in a dielectric, polarization, energy stored in an electric field. Magnetic field due to a current-carrying conductor, Biot Savart law, magnetic force on a

(8 Lectures)

current, Lorentz force

2. Electromagnetic Induction& Magnetism:

Electromagnetic induction, Lenz's law , magnetic properties of matter, para- dia- and ferromagnetism, Hysteresis Curve , Super Para Magnetism , spinning of a magnetic dipole in an external magnetic field.

(4 **Lectures)**

UNIT – II :

3. **Basic aspects of AC Circuits** :Differences between AC & DC currents , Average & RMS values of an AC signal , AC RC circuit , AC LR Circuit , AC LC circuit , LCR series & parallel Resonance circuits , Power factor , Q – factor

(5 **Lectures)**

4. Maxwell's Equations & Electromagnetic waves:

Modification of Ampere's law, equation of continuity and displacement current, Maxwell's equations, wave equation and its plane wave solution, nature of electromagnetic waves, transversality and polarization, propagation of electromagnetic plane waves in dielectric media .

(6 Lectures)

UNIT – III :

5.Electronics:

Half-wave, full-wave and bridge rectifiers, ripple factor, rectification efficiency, filters (series in inductor, shunt capacitator, LC and π sections), voltage regulations, load regulation, Zener diode as voltage regulator. Characteristic curves of bipolar transistors, static and dynamic load line, biasing (fixed and self) of transistor circuit, thermal instability of bias, the black box idea of CE, CB and CC transistor circuits as two-port network, small signal active output, hybrid model of a CE transistor circuit, analysis of a small signal amplifier: its voltage and current gains, negative and positive feedback. Barkhausen's criterion for self-sustaining oscillations, LC and phase shift oscillators.

(15Lectures)

UNIT – IV :

6.Digital electronics:

Number systems (binary, BCD, octal and hexadecimal), 1's and 2's complements. Logic gates,

AND, OR, NAND, NOR, XOR and NXOR. Boolean algebra (Boolean laws and simple expressions), binary adders, half adder, half subtractor, full adder and full subtractor.

(10 Lectures)

UNIT – V :

7.Nano Materials : Classification of Nano Materials (0-D , 1-D , 2-D , 3-D) , Surface to Volume Ratio , Quantum Confinement , Properties of Nano Materials , Methods of Preparation of Nano Materials - Top down approach (Ball mill method ,Electron Beam Lithography) , Bottom Up approach (Sol Gel Method , Electrolysis method , Physical vapor Deposition method , Chemical vapor Deposition method , Sputtering method , Solvo Thermal Method) , Applications of Nano materials (

7 Lectures)

8.Characterization of Nano Materials : Basic aspects of X ray Fluorescence & X ray Diffraction , Construction & working of Transmission Electron Microscope and Scanning Electron Microscope,

Qualitative aspects of Scanning Tunneling Microscope and Atomic Force Microscope.

(5 Lectures)

Recommended Text books/References:

1. Griffiths, D. J. *Introduction to Electromagnetism* 3rd Ed. Prentice-Hall(1999).
2. Malvino, A.P. & Leach, D. P. *Digital Principles and Applications*, Tata McGraw- Hill(2008).
3. Ryder, J. D. *Electronic Fundamentals and Applications: Integrated and Discrete Systems.* 5th Ed. Prentice-Hall, Inc.(2007).
4. Floyd,T.L.&Buchla,D.M.*ElectronicsFundamentals:Circuits,DevicesandApplications* (8th Ed.) Prentice-Hall (2009).
5. A.N.Benerjee and K . Chattopadhyay , *Fundamentals of Nano sciences , EEE limited (2016)*
6. V.Rajendran ,*Engineering Physics , Tata Mcgraw hill publishers (2010)*

MINOR PHYSICS – II PRACTICALS

1. Ballistic Galvanometer: resistance, current sensitivity, charge sensitivity, and critical damping resistance of thegalvanometer.
2. Determination of high resistance by leakagemethod.
3. Determination of mutual inductance by BallisticGalvanometer.
4. Operations and measurements by Cathode Ray Oscilloscope (CRO). Calibration of DC and AC voltages, frequency and phase measurements of asignal.
5. Study of transistor characteristics (CB, CE, CCconfigurations).
6. Study of power supply (rectification factor, voltage and load regulation for C, L, CL and π filters).
7. Study of basic RC coupled amplifier (frequency response and bandwidth).
8. Self-inductance measurement by Owen'sbridge.
9. Measurement of magnetic field by searchcoil.
10. To verify experimentally OR, AND, NOT, NOR, NANDgates.

Dr. V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

□ PHYSICS Hons SYLLABUS (w.e.f. 2020-21)

□ SEMESTER- II

GEC – II (MINOR PHYSICS)

□ BLUE PRINT FOR QUESTION PAPER SETTER

TIME : 3 hrsMax.Marks :75

Sl.No.	UNIT NO. /CHAPTER NO.		SHORT ANSWER QUESTIONS 5 MARKS	ESSAY QUESTIONS 10 MARKS	MARKS ALLOETD TO THE UNIT
1	UNIT I	1.Electrostatics & Magnetic field	1	1	30
		2.Electromagnetic Induction & Magnetism	1	1	
2	UNIT II	3. Basic aspects of AC circuits	1	1	30
		4.Maxwell's equations & Electromagnetic waves	1	1	
3	UNIT III	5.Electronics	2	2	30
4	UNIT IV	6.Digital Electronics	2	2	30
5	UNIT V	7.Nano Materials	1	1	30
		8.Characterization of Nano materials	1	1	
	Total no. of Questions		10	10	
	Total Marks including Choice				150

□ **Note: 1.The question paper setters are requested to kindly adhere to the format given in the above table.**

□ **2.The question paper setters are also requested to set the questions based on problems (conceptual or numerical) for a total of 20 marks.**

DR VS KRISHNA GOVERNMENT DEGREE COLLEGE VISAKHAPATNAM

B.Sc. PHYSICS SYLLABUS UNDER CBCS

III Year B.Sc Physics: V Semester

ELECTIVE -EA-1: LOW TEMPERATURE PHYSICS & REFRIGERATION

(Credits: 04)

Work load: 60 hrs per semester 4 hrs/week

Learning Outcomes:

Students after successful completion of the course will be able to

1. Identify various methods and techniques used to produce low temperatures in the Laboratory.
2. Acquire a critical knowledge on refrigeration and air conditioning.
3. Demonstrate skills of Refrigerators through hands on experience and learns about Refrigeration components and their accessories.
4. Understand the classification, properties of refrigerants and their effects on environment.
5. Comprehend the applications of Low Temperature Physics and refrigeration.

DR VS KRISHNA GOVERNMENT DEGREE COLLEGE VISAKHAPATNAM

B.Sc. PHYSICS SYLLABUS UNDER CBCS

III Year B.Sc Physics: V Semester

ELECTIVE -EA-1: LOW TEMPERATURE PHYSICS & REFRIGERATION

(Credits: 04)

Work load: 60 hrs per semester 4 hrs/week

UNIT-I

PRODUCTION OF LOW TEMPERATURE (10 hrs)

Production of low temperatures-Introduction, Freezing mixtures, Joule-Thomson effect, Regenerative cooling, Different methods of liquefaction of gases, liquefaction of air, Production of liquid hydrogen and nitrogen, *liquefaction of Helium Kapitza method* Adiabatic demagnetization, Properties of materials at low temperatures, Superconductivity

UNIT-II

MEASUREMENT OF LOW TEMPERATURE (10 hrs)

Gas thermometer its correction and calibration. Secondary thermometers, resistance thermometers, thermocouples, Vapour pressure thermometers, Magnetic thermometers, *Electronic thermometers,* Advantages and drawbacks of each type of thermometer.

UNIT-III

PRINCIPLES OF REFRIGERATION (10 hrs)

Introduction to Refrigeration- Natural and artificial refrigeration , Stages of refrigeration, Types of refrigeration - Vapor compression and vapor absorption refrigeration systems, Refrigeration cycle and explanation with a block diagram, Introductory ideas on airconditioning. Refrigerants-Introduction, Ideal refrigerant, Properties of refrigerant, Classification of refrigerants, commonly used refrigerants, Eco-friendly refrigerants, *and effect of refrigerants on ozone layer.*

UNIT-IV

COMPONENTS OF REFIGERATOR (10 hrs)

Refrigerator and its working, Block diagram, Coefficient of Performance (COP), Tons of refrigeration (TR) and Energy Efficiency Ratio (EER), Refrigerator components: Types of compressors, evaporators and condensers and their functional aspects, defrosting in a refrigerator, Refrigerant leakage and detection, *applications of refrigerators.*

UNIT-V

APPLICATIONS OF LOW TEMPERATURE & REFRIGERATION **(10 hrs.)**

Applications of Low temperatures: Preservation of biological material, Food freezing, liquid nitrogen and liquid hydrogen in medical field, Superconducting magnets in MRI- Tissue ablation (cryosurgery) - Cryogenic rocket propulsion system. Applications of refrigeration: Domestic refrigerators, Water coolers, Cold storages, Ice plants, Food preservation methods, Chemical and Process industries, Cold treatment of metals, Construction field, Desalination of water, Data centers.

III. References:

1. Heat and Thermodynamics by Brij Lal &N.Subramanyam, S.Chand Publishers.

2. Thermal Physics by S C Garg, R M Bansal & C K Ghosh, McGrawHill Education, India

3. Heat and Thermodynamics by M MZemansky,McGrawHill Education (India).

4. Low-Temperature Physics by Christian E. & Siegfried H., Springer.

5. Thermal Engineering by S. Singh, S.Pati, Ch:18 Introduction to Refrigeration.

6. The Physics Hyper Text Book. Refrigerators.https://physics.info/refrigerators/

7. Refrigeration and Air Conditioning by Manohar Prasad, New age international (P) limited, New Delhi

8. A course in Refrigeration and Air Conditioning by S.C. Arora and S. Domkundwar, Dhanpatrai and sons, Delhi

9.https://trc.nist.gov/cryogenics/Papers/Review/2017-Low_Temperature_Applications_and_Challenges.pdf

10. https://nptel.ac.in/content/storage2/courses/112105129/pdf/RAC%20Lecture%203.pdf 11. Other Web sources suggested by the teacher concerned and the reading material. https://nptel.ac.in

DR VS KRISHNA GOVERNMENT DEGREE COLLEGE VISAKHAPATNAM
B.Sc. PHYSICS SYLLABUS UNDER CBCS
III Year B.Sc Physics: V Semester
ELECTIVE -EA-1: LOW TEMPERATURE PHYSICS & REFRIGERATION
(Credits: 04)

Work load: 30 hrs per semester 2 hrs/week

Course 6B: Low Temperature Physics & Refrigeration PRACTICAL SYLLABUS (30 Hrs. Max Marks: 50) IV.

Learning Outcomes:

On completion of practical course, student shall be able to

1. List out, identify and handle equipment used in refrigeration and low temperature lab.

2. Learn the procedures of preparation of Freezing Mixtures.

3. Demonstrate skills on developing various Freezing mixtures and materials and their applications in agriculture, medicine and day to day life.

4. Acquire skills in observing and measuring various methodologies of very low temperatures

5. Perform some techniques related to Refrigeration and Freezing in daily life.

DR VS KRISHNA GOVERNMENT DEGREE COLLEGE VISAKHAPATNAM

B.Sc. PHYSICS SYLLABUS UNDER CBCS

III Year B.Sc Physics: V Semester

ELECTIVE -EA-1: LOW TEMPERATURE PHYSICS & REFRIGERATION

(Credits: 04)

Work load: 30 hrs per semester 2 hrs/week

V. Practical (Laboratory) Syllabus: (30 hrs. Max marks: 50))

1. Record the Principles and applications of Refrigerators and Freezers.

2. Measure the temperatures below Melting point of Ice using a thermometer available in the Lab.

3. Make a freezing mixture by adding different salts viz., Sodium chloride, Potassium Hydrate (KOH), Calcium chloride to ice in different proportions and observe the temperature changes.

4. Study the operation of a refrigerator and understand the working of different parts.

5. Study the properties of refrigerants like chlorofluorocarbons-hydrochlorofluoro- carbons and record the lowest temperatures obtained.

6. Consider a simple faulty refrigerator and try to troubleshoot the simple problems by understanding its working.

7. Understand the practical problem of filling the Freon Gas into the Refrigerator.

8. Get the Liquid Nitrogen or Liquid Helium from nearby Veterinary Hospital and measure their temperatures using chromel-alumel thermocouple or mercury thermometer and observe their physical properties like colour, smell etc and precautions to be taken for their safe handling.

9. Preparation of freeze drying food with Dry ice and liquid nitrogen

10. Preparation of freeze drying food with liquid nitrogen

DR VS KRISHNA GOVERNMENT DEGREE COLLEGE VISAKHAPATNAM
B.Sc. PHYSICS SYLLABUS UNDER CBCS
III Year B.Sc Physics: V Semester
ELECTIVE -EA-1: LOW TEMPERATURE PHYSICS & REFRIGERATION
(Credits: 04)

Work load: 30 hrs per semester 2 hrs/week

VI. Lab References:

1. Experimental techniques in low temperature physics by Guy White, PhilipMeeson.

2. Experimental low-temperature physics by A. Kent, Macmillan physical science series

3. Physics and Chemistry at Low Temperatures by Leonid Khriachtchev.
https://www.routledge.com/Physics-and-Chemistry-at-Low-Temperatures/Khriachtchev/p/book/9789814267519

4. Practical Cryogenics .http://research .physics illinois.edu /bezryadin /links/practical%20Cryogenics.pdf

5. Freeze-Drying, 3rd Edition by Peter Haseley, Georg-Wilhelm Oetjen, Wiley (e-Book)

6. Web sources suggested by the teacher concerned.

DR VS KRISHNA GOVERNMENT DEGREE COLLEGE VISAKHAPATNAM
B.Sc. PHYSICS SYLLABUS UNDER CBCS
III Year B.Sc Physics: V Semester
ELECTIVE -EA-1: LOW TEMPERATURE PHYSICS & REFRIGERATION
(Credits: 04)

Work load: 60 hrs per semester 4 hrs/week

VII. Co-Curricular Activities:

(a) Mandatory:(Training of students by teacher in field related skills: (lab:10 + field: 05)

1. For Teacher: Training of students by the teacher in the in the laboratory/field for a total of not less than 15 hours on the techniques/skills of Low Temperature Production, methods used and applications of Low temperatures and refrigeration in day to day life and other applications in medicine and industry.

2. For Student: Student shall (individually) visit (i) a small ice plant or a cold storage plant (ii) Air Conditioner (AC) repair shop or (iii) Refrigerator repair shop to understand the construction, working principle and the trouble shooting of these devices after interacting with the technicians. Or Student shall observe the various thermodynamic processes taking place while working with the refrigerator and observe the leak detection in refrigeration system by different methods, air removal and charging of a refrigeration unit and testing of a refrigeration system to find out the Refrigerating capacity/Ton of refrigeration (TR) and the Power input. Or Student shall identify the refrigerant cylinder by color coding and standing pressure. Or Student shall visit the freezer aisle of a supermarket and observes the bags of different frozen fruits. Student shall write the observations and submit a hand-written Fieldwork/Project work not exceeding 10 pages in the given format to the teacher.

3. Max marks for Fieldwork/Project work: 05.

4. Suggested Format for Fieldwork/Project work: Title page, student details, index page, details of place visited, observations, findings and acknowledgements.

5. Unit tests (IE). (b) Suggested Co-Curricular Activities

1. Training of students by related Factory, industrial experts.

2. Assignments (including technical assignments like identifying tools in Refrigerators, Freezers and their handling, operational techniques with safety and security)

3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).

4. Preparation of videos on tools and techniques in Low Temperatures and applications.

5. Collection of material/figures/photos related to substances used in Freezing Mixtures, their Properties and availability etc., writing and organizing them in a systematic way in a file.

6. Visits to Ice plants and labs in universities, research organizations, private firms, etc.

7. Making your own mini refrigerator at home

8. Build your own water cooler with the materials available at home.

9. Making hand launched liquid nitrogen rockets

10. Experiments with Liquid nitrogen and strawberry/ banana/ lemon/ onion/ mushroom/ egg etc. (To be tried under professional supervision only).

11. Invited lectures and presentations on related topics by field/industrial experts

12. Identification of different Ozone-depleting substances (ODS) that damage the ozone layer in the upper atmosphere.

13. Demonstration to illustrate the greenhouse effect and the role of carbon dioxide as a greenhouse gas using plastic water bottles, flood light lamp, beakers and temperature sensors and observe the temperature changes.
https://edu.rsc.org/experiments/modelling-the-greenhouse-effect/1543.article

Dr V.S.Krishna Govt. Degree College(A), Visakhapatnam

BLUE PRINT (: LOW TEMPERATURE PHYSICS & REFRIGERATION)

IIIB.Sc. Physics- SEM-V/ELECTIVE Course : EA-1

Max Marks-75 Time-3Hrs. Credits:4

			SECTION-A	SECTION-B	
UNIT	S.NO.	TOPIC	ESSAY(10MARKS)	SHORT ANSWER (5MARKS)	TOTAL MARKS
I	1	PRODUCTION OF LOW TEMPERATURE	2	2	30
II	2	MEASUREMENT OF LOW TEMPERATURE	2	2	30
III	3	PRINCIPLES OF REFRIGERATION	2	2	30
IV	4	COMPONENTS OF REFIGERATOR	2	2	30
V	5	APPLICATIONS OF LOW TEMPERATURE & REFRIGERATION	2	2	30
		TOTAL QUESTIONS	10	10	150

[Note: Question Paper setters are instructed to add Numerical Problems (each of 4 marks) with a maximum weightage of 16 marks cither in Section-A or Section-B covering all the five units in the syllabus]

DR VS KRISHNA GOVERNMENT DEGREE COLLEGE VISAKHAPATNAM
B.Sc. PHYSICS MODEL QUESTION PAPER UNDER CBCS
III Year B.Sc Physics: V Semester
ELECTIVE -EA-1: LOW TEMPERATURE PHYSICS & REFRIGERATION
(Credits: 04)

TIME: 3 Hrs. **Max.Marks: 75**

SECTION-A

Answer all the following questions. 5X10 = 50

Q 1. a) Explain about the Joule-Thomson cooling effect?

Or

b) Discuss about adiabatic demagnetization method?

Q 2. a) Discuss about the Gas thermometer its correction and calibration?

Or

b) Explain advantages and drawbacks of each type of thermometer?

Q 3. a) Explain about vapour compression and vapour absorption refrigeration systems?

Or

b) Write about the Refrigeration cycle and explain with a block diagram?

Q 4. a) Discuss about different types of compressors in refrigeration?

Or

b) Explain about different types condensers and their functional aspects?

Q 5. a) Explain about Superconducting magnets in MRI?

Or

b) Explain about Cryogenic rocket propulsion system?

SECTION-B

Answer any five of the following questions. 5X5 = 25

Q 6. Write about different types of freezing mixtures?

Q 7. Explain properties of materials at low temperatures?

Q 8. Write about vapour pressure thermometers?

Q 9. Explain about Magnetic thermometers?

Q10. Explain properties of Ideal refrigerant ?

Q11.Write about Eco-friendly refrigerants?

Q12. Write about the Coefficient of Performance (COP) of a refrigerator?

Q13. Write about defrosting in a refrigerator?

Q14. Write about the preservation of biological material?

Q15. Write about Food preservation methods?

III Year B.Sc.-Physics Program: V Semester

PHYSICS ELECTIVE-EA-2: NANO MATERIALS AND APPLICATIONS

Work load: **60 hrs./ Semester** **4 hrs./ Week**

COURSE OBJECTIVES

The syllabus introduces the basic concepts and principles to understand nanomaterials. Various nanomaterials synthesis/ growth/ preparation methods and characterization techniques are discussed to explore the field. The effect of dimensional confinement of charge carries on the electrical, optical and structural properties are also discussed. The concept of micro- and nano- electro mechanical systems (MEMS and NEMS) and important applications areas of nanomaterials are discussed.

COURSE LEARNING OUTCOME

At the end of the course the student is expected to possess the following concepts:

- In the Nano systems and its implications in modifying the properties of materials at the nanoscale.
- Concept of Quantum confinement, 3D,2D,1D and 0D nanostructure with examples.
- Different synthesis techniques including top down and bottom-up approaches.
- Characterization of nanostructured materials using X-ray diffraction (XRD), electron microscopy (SEM & TEM), Atomic Force Microscopy (AFM) and Scanning Tunneling Microscopy (STM).
- Optical properties of nanostructured materials, modification of band gap, excitonic confinement.
- Applications of nanostructured materials in making devices namely MEMS, NEMS and other heterostructures for solar cell and LEDs.
- The student will synthesize nanoparticles by different chemical routs and characterize them in the laboratory using the different techniques he has learnt in the theory.

BROAD CONTENTS OF THE COURSE

- Nanoscale Systems
- Synthesis of Nanostructure Materials
- Characterization
- Optical Properties
- Applications of Nanomaterials

SKILLS TO BE LEARNED

- Develop basic understanding of nanostructured materials.
- Learn the synthesis and characterization of nanostructured materials.
- Understanding the optical properties of nanostructured materials.
- Basics of electron transport phenomenon.
- Lean to understand the functioning of various analytical techniques:
- XRD, SEM, TEM, STM, AFM etc.

- Application of nanoparticles in various fields like:
- LED, Solar Cells
- Single Electron Transform Devices
- Magnetic Data Storage
- Micro-electrochemical Systems (MEMS)
- Nano- electrochemical Systems (NEMS)

DETAILED CONTENTS OF THE COURSE

UNIT-I **(15 Lectures)**

NANOSCALE SYSTEMS: Length scales in physics, Nanostructures: 0D, 1D, 2D and 3D nanostructures (nanodots, nanowires, nanorods, thin films), Band structure and density of states of materials at nanoscale, Size Effects in nano systems, Quantum confinement: Applications of Schrodinger equation- Infinite potential well, potential step, potential box, quantum confinement of carriers in 3D, 2D, 1D, 0D nanostructures and its consequences.

UNIT-II **(10 Lectures)**

SYNTHESIS OF NANOSTRUCTURE MATERIALS: Top down and bottom-up approach with examples. Ball milling. Physical vapor deposition (PVD): Thermal evaporation, E-beam evaporation, Pulsed Laser deposition. Chemical vapor deposition (CVD), chemical reduction, Sol-Gel., Electron deposition. Spray pyrolysis. Hydrothermal synthesis. MBE growth of quantum dots. Biological methods- Synthesis using micro organisms and bacteria, Synthesis using plant extract.

UNIT-III **(10 Lectures)**

CHARACTERIZATION TECHNIQUES: XRD, Optical Microscopy, SEM, TEM, AFM, XPS, Scanning Tunneling Microscopy and PL characterization techniques for nano materials.

UNIT-IV **(10 Lectures)**

OPTICAL PROPERTIES: Optical properties by IR and Raman Spectroscopy, Concept of dielectric constant for nanostructures, Quasi-particles and excitons. Excitons in direct and indirect band gapsemiconductor nanocrystals. Quantitative treatment of quasi- particles and excitons. **Radiative processes:** General formalization-absorption, emission and luminescence. Optical properties of heterostructures and nanostructures.

UNIT-V **(15 Lectures)**

APPLICATIONS OF NANOMATERIALS: Applications of nanoparticles, quantum dots, nanowires and thin films for photonic devices (LED, solar cells). Single electron transfer devices (no derivation). CNT based transistors. Nanomaterial Devices: Quantum dots heterostructure lasers, optical switching and optical data storage. Magnetic quantum well; magnetic dots - magnetic data storage. Micro Electromechanical Systems (MEMS), Nano Electromechanical Systems (NEMS).

Text Books

1. C.P. Poole, Jr. Frank J. Owens, Introduction to Nanotechnology (Wiley India Pvt. Ltd.).

2. S.K. Kulkarni, Nanotechnology: Principles & Practices (Capital Publishing Company).
3. K.K. Chattopadhyay and A. N. Banerjee, Introduction to Nanoscience and Technology (PHI Lear. Pvt. Ltd.)

Reference Books

1. Richard Booker, Earl Boysen, Nanotechnology (John Wiley and Sons).
2. M. Hosokawa, K. Nogi, M. Naita, T. Yokoyama, Nanoparticle Technology Handbook (Elsevier, 2007).
3. Introduction to Nanoelectronics, V.V. Mitin, V.A. Kochelap and M.A. Stroscio, 2011, Cambridge Univ. Press.
4. Bharat Bhushan, Springer Handbook of Nanotechnology (Springer-Verlag, Berlin, 2004).

PHYSICS ELECTIVE-EA-2 (Practical): NANO MATERIALS LABORATORY

Work load: **30 hrs./ Semester** **2 hrs./ Week**

COURSE OBJECTIVES

The objective of this laboratory component is to give hand on experience in synthesis and characterizationof nanomaterials. Analysis of the characterization and data interpretation are also objectives of this course.

COURSE LEARNING OUTCOME

- To get the knowledge of development of nanomaterials.
- To acquire an understanding basics of characterization techniques and analysis of data.

SKILLS TO BE LEARNED

- Development of nanomaterials.
- Characterization of Nanomaterials.

LIST OF EXPERIMENTS

1) Determination of the Band Gap of Semiconductor Nanoparticles.
2) Synthesis of metal nanoparticles by chemical route.
3) Synthesis of semiconductor nanoparticles.
4) Synthesis of metal oxide nanoparticles by chemical route.
5) Synthesis of metal oxide nanoparticles by Sol-gel method.
6) Determination of band gap from the absorption spectra using Tauc's plots..
7) XRD pattern of nanomaterials and estimation of particle size.
8) To study the effect of size on color of nanomaterials.
9) To prepare SW-CNTs with other materials.
10) Growth of quantum dots by thermal evaporation.
11) Surface Plasmon study of metal nanoparticles by UV-Visible spectrophotometer.

Text Books

1. S.K. Kulkarni, Nanotechnology: Principles & Practices (Capital Publishing Company).
2. K.K. Chattopadhyay and A.N. Banerjee, Introduction to Nanoscience & Technology (PHI Learn.).

Reference Books

1. C.P. Poole, Jr. Frank J. Owens, Introduction to Nanotechnology (Wiley India Pvt. Ltd.).
2. Richard Booker, Earl Boysen, Nanotechnology (John Wiley and Sons).

ASSESSMENT: MARKING SCHEME Total Marks: **50**

- **Internal assessment:** 10 marks
- **End term examination:** 40 marks (laboratory exam. will be conducted at the semester end).
  - Laboratory Notebook: 10 Marks

- Experimental work and data analysis: 10 Marks
- Presentation and Viva voce: 20 Marks.

Dr. V.S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM

BSC. PHYSICS Program

SEMESTER- V

ELECTIVE EA – 2 (NANO MATERIALS AND APPLICATIONS)

BLUE PRINT FOR QUESTION PAPER SETTER

TIME: 3 Hrs. Max. Marks: 75

S. No.	UNIT NO./ CHAPTER NO.		SHORT ANSWER QUESTIONS (5 Marks)	ESSAY QUESTIONS (10 Marks)	MARKS ALLOETD TO THE UNIT	
1	UNIT-I	NANOSCALE SYSTEMS	2	2	30	
2	UNIT-II	SYNTHESIS OF NANOSTRUCTURE MATERIALS	2	2	30	
3	UNIT-III	CHARACTERIZATION TECHNIQUES	1	2	25	
4	UNIT-IV	OPTICAL PROPERTIES	1	2	25	
5	UNIT-V	APPLICATIONS OF NANOMATERIALS	2	2	30	
	Total no. of Questions		8	10		
	Total Marks including Choice				140	

Note:

1.The question paper setters are requested to kindly adhere to the format given in the above table.

2. The question paper setters are requested to follow revised Bloom's Taxonomy model while preparing Question paper.

3.The question paper setters are also requested to set the questions in the following way:

a. 75 % of Questions - Memory and Understanding based

b. 20 % of Questions – Application, Analysis and Skill based

c. 5 % of Questions – Creativity and Evaluation based

Dr. V.S. Krishna Govt. degree College(A), Visakhapatnam

MODEL QUESTION PAPER

(NANO MATERIALS AND APPLICATIONS)

III B.Sc. Physics Program: SEM-V / ELECTIVE EA-2

Time: 3 Hrs **Max. Marks: 75**

SECTION – A

Answer all Questions of the following **[5 X 10 = 50]**

1. (a) Derive an expression for allowed energy values and the corresponding wave functions for a particle in infinite potential well of 1D nanostructures.

]OR[

)b(Derive an expression for allowed energy values and the corresponding wave functions for a particle in one-dimensional potential box of nanostructures?

2. (a) Explain Top down and bottom-up approaches.

]OR[

(b) Discuss Sol-Gel synthesis route?

3. (a) Describe the X-Ray Diffraction (XRD) technique to estimate the lattice parameter of nanomaterials?

[OR]

)b(Discuss the Scanning Electron Microscopy (SEM) with neat diagram.

4. (a) Explain the direct and indirect band gapsemiconductor nanocrystals?

[OR]

)b(Describe the Optical properties of heterostructures and nanostructures.

5. (a) Discuss optical switching and optical data storage in nanostructures.

[OR]

(b) Explain Nano Electromechanical Systems (NEMS).

SECTION – B

Answer any FIVE Questions

6. Define density of states of 0D, 1D, 2D and 3D nanomaterials.
7. Explain the concept of Quantum confinement.
8. Explain the Pulsed Laser deposition method.
9. Discuss Hydrothermal method.
10. Explain the Concept of dielectric constant for nanostructures.
11. Write a short note on Optical Microscopy.
12. Write any five Applications of nanoparticles.
13. What is photonic device. Explain with example.

DR VS KRISHNA GOVERNMENT DEGREE COLLEGE
VISAKHAPATNAM
B.Sc. PHYSICS SYLLABUS UNDER CBCS
III Year B.Sc Physics: V Semester
ELECTIVE EA-3 : COMMUNICATION ELECTRONICS
((Elective), Credits: 04)

Work load: 60 hrs per semester 4 hrs/week

COURSE OBJECTIVES:

- This paper aims to describe the concepts of electronics in communication and communication techniques based on Analog Modulation, Analog and digital Pulse Modulation.
- Communication and Navigation systems such as GPS and mobile telephony system are also introduced.
- This paper will essentially connect the text book knowledge with the most popular communication technology in real world.

COURSE LEARNING OUTCOME :

At the end of the course the student is expected to have an idea/concept of the following,

- Electromagnetic spectra and different frequency bands.
- Modulation, different types of modulation and about super heterodyne receivers.
- Concept of sampling, sampling theorem and multiplexing.
- Digital transmission, encoding and decoding.
- Satellite communication including uplinking and downlinking.
- Mobile communication/telephony and concepts of cell telephony.
- 2G, 3G, 4G and 5G (Quantitative).
- Apply the theory that they have learned in the theory class to gain hands on experience in building modulation and demodulation circuits; Transmitters and Receivers for AM and FM. Also to construct TDM, PAM, PWM, PPM and ASK, PSK and FSK modulator and verify their results.

BROAD CONTENTS OF THE COURSE:

- Electromagnetic spectra and different frequency bands.

- Modulation, different types of modulation and super heterodyne receivers.
- Sampling, sampling theorem and multiplexing.
- Digital transmission, encoding and decoding.
- Satellite communication
- Mobile communication/telephony and concepts of cell telephony.
- 2G, 3G, 4G and 5G (Quantitative).

SKILLS TO BE LEARNED:

- Learn the skills to understand the basic concepts of communication.
- Learn the techniques of different types of modulation of electromagnetic signals like
    - Amplitude Modulation
    - Frequency Modulation
    - Phase Modulation
    - Analog Pulse Modulation Digital Pulse Modulation
- Learn basics of satellite communication.
- Learn concepts and application of mobile telephony system.

DR VS KRISHNA GOVERNMENT DEGREE COLLEGE
VISAKHAPATNAM
B.Sc. PHYSICS SYLLABUS UNDER CBCS
III Year B.Sc Physics: V Semester
ELECTIVE EA-3 : COMMUNICATION ELECTRONICS
((Elective), Credits: 04)

Work load: 60 hrs per semester 4 hrs/week

DETAILED CONTENTS OF THE COURSE:

UNIT-I

Introduction to communication – means and modes. Need for modulation. Block diagram of an electronic communication system. Brief idea of frequency allocation for radio communication system in India (TRAI). Electromagnetic communication spectrum, band designations and usage. Channels and base-band signals. Concept of Noise, signal-to-noise (S/N) ratio.

(8 Lectures)

UNIT-II

Analog Modulation: Amplitude Modulation, modulation index and frequency spectrum. Generation of AM (Emitter Modulation), Amplitude Demodulation (diode detector), Concept of Single side band generation and detection. Frequency Modulation (FM) and Phase Modulation (PM), modulation index and frequency spectrum, equivalence between FM and PM, Generation of FM using VCO, FM detector (slope detector), Qualitative idea of Super heterodyne receiver. **(12 Lectures)**

UNIT-III

Analog Pulse Modulation: Channel capacity, Sampling theorem, Basic Principles-PAM, PWM, PPM, modulation and detection technique for PAM only, Multiplexing.

(7 Lectures)

Digital Pulse Modulation: Need for digital transmission, Pulse Code Modulation, Digital Carrier Modulation Techniques, Sampling, Quantization and Encoding. Concept of Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), and Binary Phase Shift Keying (BPSK). **(8 Lectures)**

UNIT-IV

Mobile Telephony System – Basic concept of mobile communication, frequency bandsused in mobile communication, concept of cell sectoring and cell splitting, SIM number, IMEI number, need for data encryption, architecture (block diagram) of mobile communication network, idea of GSM, CDMA, TDMA and FDMA technologies, simplified block diagram of mobile phone handset, 2G, 3G and 4G concepts (qualitative only).

(7 Lectures)

UNIT-V

Satellite Communication– Introduction, need, Geosynchronous satellite orbits, geostationary satellite advantages of geostationary satellites. Satellite visibility, transponders (C - Band), path loss, ground station, simplified block diagram of earth station. Uplink and downlink. **(8 Lectures)**

GPS navigation system (qualitative idea only)

REFERENCE BOOKS:

1. Electronic Communications, D. Roddy and J. Coolen, Pearson Education India.
2. Advanced Electronics Communication Systems- Tomasi, 6th edition, Prentice Hall.
3. Electronic Communication systems, G. Kennedy, 3rd Edn., 1999, Tata McGraw Hill.
4. Principles of Electronic communication systems – Frenzel, 3rd edition, McGraw Hill
5. Communication Systems, S. Haykin, 2006, Wiley India
6. Electronic Communication system, Blake, Cengage, 5th edition.
7. Wireless communications, Andrea Goldsmith, 2015, Cambridge University Press.

DR VS KRISHNA GOVERNMENT DEGREE COLLEGE
VISAKHAPATNAM
B.Sc. PHYSICS SYLLABUS UNDER CBCS
III Year B.Sc Physics: V Semester
ELECTIVE EA-3 : COMMUNICATION ELECTRONICS
((Elective), Credits: 04)

Work load: 30 hrs per semester 2 hrs/week

COURSE OBJECTIVES:

This is the laboratory component of the course on Communication Electronics (PHY DE 364P). The coruse objective is to Familiarize the students with basic analog communication systems. Integrate theory with experiments so that the experiments so that the students appreciate the knowledge gained from the theory course, e.g., amplitude and frequency modulation, pulse modulation.

COURSE LEARNING OUTC OME

After studying this course, the students shall be able to:

- Learn in depth concept modulation and how it is practically done in communication systems.

SKILLS TO BE LEARNED:

Get the practical idea about different ways of pulse modulation techniques

LIST OF EXPERIMENTS:

1) To design an Amplitude Modulator using Transistor
2) To study envelope detector for demodulation of AM signal
3) To study FM - Generator and Detector circuit
4) To study AM Transmitter and Receiver
5) To study FM Transmitter and Receiver
6) To study Time Division Multiplexing (TDM)
7) To study Pulse Amplitude Modulation (PAM)
8) To study Pulse Width Modulation (PWM)
9) To study Pulse Position Modulation (PPM)
10) To study ASK, PSK and FSK modulators

REFERENCE BOOKS:

1. Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A.Miller,1994, Mc-Graw Hill
2. Electronic Communication systems, G. Kennedy, 1999, Tata McGraw Hill.
3. Electronic Communication system, Blake, Cengage, 5th edition

ASSESSMENT: MARKING SCHEME

Total Marks: 50

Internal assessment: 10 marks

End term examination: 40 marks

(laboratory exam. will be conducted at the semester end).

- Laboratory Notebook: 10 Marks
- Experimental work and data analysis: 10 Marks
- Presentation and Viva voce: 20 Marks

Dr. V.S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM

BSC. PHYSICS SYLLABUS

SEMESTER- V / ELECTIVE EA-3

(COMMUNICATION ELECTRONICS)

BLUE PRINT FOR QUESTION PAPER SETTER

TIME: 3 Hrs. Max. Marks: 75

S. No.	UNIT NO./ CHAPTER NO.		SHORT ANSWER QUESTIONS (5 Marks)	ESSAY QUESTIONS (10 Marks)	MARKS ALLOETD TO THE UNIT	
1	UNIT-I	**INTRODUCTION TO COMMUNICATION**	2	2	30	
2	UNIT-II	**ANALOG MODULATION**	2	2	30	
3	UNIT-III	**ANALOG PULSE MODULATION**	2	2	30	
4	UNIT-IV	**SATELLITE COMMUNICATION**	1	2	25	
5	UNIT-V	**MOBILE TELEPHONY SYSTEM**	1	2	25	
	Total no. of Questions		8	10		
	Total Marks including Choice				140	

Note:

1.The question paper setters are requested to kindly adhere to the format given in the above table.

2. The question paper setters are requested to follow revised Bloom's Taxonomy model while preparing Question paper.

3.The question paper setters are also requested to set the questions in the following way:

a. 50% of Questions - Memory and Understanding based

b. 30 % of Questions – Application, Analysis and Skill based

c. 20 % of Questions – Creativity and Evaluation based

Dr. V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

Semester-wise Revised Syllabus under CBCS,
Course Code:
Four-year B.Sc. PHYSICS Program
Domain Subject: **Physics**
IIIYear B. Sc. Physics(Mains) – Semester – V
ELECTIVE EB-1 : Solar Energy and Applications
Credits: 04
Max Marks: 75

****

I. Learning Outcomes: After successful completion of the course, the student will be able to:
1. Understand Sun structure, forms of energy coming from the Sun and its measurement.
2. Acquire a critical knowledge on the working of thermal and photovoltaic collectors.
3. Demonstrate skills related to callus culture through hands on experience
4. Understand testing procedures and fault analysis of thermal collectors and PV modules.
5. Comprehend applications of thermal collectors and PV modules.

II. Syllabus: *(Total Hours: 90 including Teaching, Lab, Field Training, Unit tests etc.)*

Unit - I: BASIC CONCEPTS OF SOLAR ENERGY (10hrs)

Sun Structure,Spectral distribution of solar radiation, Solar constant , zenith angle and Air-Mass, standard time, local apparent time, equation of time, direct, diffuse and total radiations. Pyrheliometer - working principle, direct radiation measurement, Pyrometer-working Principle,***Sunshine recorder***, diffuse radiation measurement, Distinction between the two meters.

Unit - II: SOLAR THERMAL COLLECTORS (10hrs)

Solar Thermal Collectors-Introduction, Types of Thermal collectors, Flat plate collector – liquid heating type, Energy balance equation and efficiency, Evacuated tube collector, collector overall heat loss coefficient, Definitions of collector efficiency factor, collector heat-removal factor and collector flow factor, Testing of flat-plate collector, solar water heating system, natural and forced circulation types. Concentrating collectors, ***Parabolic trough collector*** Solar cookers, Solar dryers, Solar desalinators.

Unit - III: FUNDAMENTALS OF SOLAR CELLS (10hrs)

Semiconductor interface, Types, homo junction, hetero junction and Schottky barrier, advantages and drawbacks, ***Conversion of Solar energy into electricity, Photo Voltaic effect, Solar photovoltaic cell and its working principle,*** equivalent circuit, output parameters, conversion efficiency, quantum efficiency, Measurement of I-V characteristics, series and shunt resistance, their effect on efficiency, Effect of light intensity, inclination and temperature on efficiency

Unit -IV: TYPES OF SOLARCELLS AND MODULES (10 hrs)

Types of solar cells, Crystalline silicon solar cells, I-V characteristics, poly-Si cells, Amorphous silicon cells, Thin film solar cells-CdTe/CdS and CuInGaSe2/CdS cell configurations, structures, advantages and limitations, Multi junction cells – Double and triple junction cells,***Dye sensitized solar cell***. PV Module fabrication steps, Modules in series and parallel, Bypass and blocking diodes

Unit – V: SOLAR PHOTOVOLTAIC SYSTEMS (10hrs)

Types of solar PV systems [Grid Connected ,Stand-alone Systems,Hybrid Systems], Energy storage in PV systems, Energy storage modes, electrochemical storage, Batteries, Primary and secondary, Solid-state battery, Molten solvent battery, lead acid battery and dry batteries, Mechanical storage – Flywheel, Electrical storage – Super capacitorIII.

References:

1. Solar Energy Utilization by G. D. Rai, Khanna Publishers
2. Solar Energy- Fundamentals, design, modelling and applications by G.N. Tiwari, Narosa Publications, 2005.
3. Solar Energy-Principles of thermal energy collection & storage by S.P. Sukhatme, Tata Mc-Graw Hill Publishers, 1999.
4. Science and Technology of Photovoltaics, P. Jayarama Reddy, CRC Press (Taylor & Francis Group), Leiden &BS Publications, Hyderabad, 2009.
5. Solar Photovoltaics- Fundamentals, technologies and applications, Chetan Singh Solanki, PHI Learning Pvt. Ltd.,
6. Web sources suggested by the teacher concerned and the college librarian including reading material.

(a) https://courses.edx.org/c4x/DelftX/ET.3034TU/asset/solar_energy_v1.1.pdf
(b) https://www.sku.ac.ir/Datafiles/BookLibrary/45/John%20A.%20Duffie,%20William%20A.%20Beckman(auth.)-Solar%20Engineering%20of%20Thermal%20Processes,%20Fourth%20Edition%20(2013).pdf

ELECTIVE EB-2 : Solar Energy and Applications – Practical (lab) work

(30 hrs, Max Marks:50)

Learning Outcomes : On successful completion of this practical course, student shall be able to:

1. List out and identify various components of solar thermal collectors and systems, solar photovoltaic modules and systems.
2. Learn the procedures for measurement of direct, global and diffuse solar radiation, I - V characteristics and efficiency analysis of solar cells and modules.
3. Demonstrate skills acquired in evaluating the performance of solar cell / module in connecting them appropriately to get required power output.
4. Acquire skills in identification and elimination of the damaged panels without affecting the output power in a module / array.
5. Perform procedures and techniques related to general maintenance of solar thermal and photovoltaic modules.

Practical (Laboratory) Syllabus: (30 hrs) (Max.50 Marks)

1. Measurement of direct radiation using pyrheliometer.
2. Measurement of global and diffuse radiation using pyranometer.
3. Evaluation of performance of a flat plate collector
4. Evaluation of solar cell / module efficiency by studying the I – V measurements.
5. Determination of series and shunt resistance of a solar cell / module.
6. Determination of efficiency of two solar cells / modules connected in series.
7. Determination of efficiency of two solar cells / modules connected in parallel.

8. Study the effect of input intensity on the performance of solar cell / module.
9. Study the influence of cell / module temperature on the efficiency.
10. Study the effect of cell / module inclination on the efficiency.

Lab References:

1.Solar Photo voltaic- Alab training manual, C.S. Solanki et al., Foundation Books Publishers, 2012.
2. Laboratory Manual on Solar thermal experiments, HP Garg, TC Kandpal, Narosa Publishing House 2000.
3. Web sources suggested by the teacher concerned.
https://renewablelab.niu.edu/experiments/solarPanel
Development of simple solar hot water collector:
https://www.youtube.com/watch?v=WP8H5IOTwYU
https://www.instructables.com/Solar-Water-Heater-From-Scratch/

Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

Semester-wise Revised Syllabus under CBCS

Course Code: III Year B. Sc.(Hons) – Semester – V

ELECTIVE EB-2: Solar Energy and Applications

Credits: 04

BLUE PRINT FOR QUESTION PAPER SETTER

TIME : 3 hrs

Max.Marks :75

Sl.No.	UNIT NO. /CHAPTER NO.		SHORT ANSWER QUESTIONS 5 MARKS	ESSAY QUESTIONS 10 MARKS	MARKS ALLOTTED TO THE UNIT
1	UNIT I	BASIC CONCEPTS OF SOLAR ENERGY	2	2	30
2	UNIT II	SOLAR THERMAL COLLECTORS	2	2	30
3	UNIT III	FUNDAMENTALS OF SOLAR CELLS	1	2	25
4	UNIT IV	TYPES OF SOLARCELLS AND MODULES	2	2	30
5	UNIT V	SOLAR PHOTOVOLTAIC SYSTEMS	1	2	25
	Total no. of Questions		8	10	
	Total Marks including Choice				140

- **Note:**
- 1.The question paper setters are requested to kindly adhere to the format given in the above table.

2. The question paper setters are requested to follow revised Bloom's Taxonomy model while preparing Question paper.

3.The question paper setters are also requested to set the questions in the following way:

a. 75 % of Questions - Memory and Understanding based

b. 20 % of Questions – Application, Analysis and Skill based

c. 5 % of Questions – Creativity and Evaluation based

Dr. V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A), VISAKHAPATNAM

Semester-wise Revised Syllabus under CBCS, 2020-21

IV Year B. Sc. Physics (Mains) – Semester – V

ELECTIVE EB-2: Solar Energy and Applications

(Elective), Credits: 04]

MODEL QUESTION PAPER COMMON FOR ALL CORE THEORY COURSES

Time : 3 hrs *Max marks : 75*

SECTION-A

(Essay Type Questions) *Marks* : 5x10M = 50M

Answer All questions with internal choice from each Unit

1. A] Explain the following: I] Solar constant , ii]zenith angle and iii] Air-Mass, & iv] standard time, local apparent time 2+2+2+4

OR

B.] Explain the construction and working of Pyrheliometer?

2.A] Explain the construction and working of liquid heating type Flat plate collector ?and Also write advantages and disadvantages ? 6+4

OR

B] Explain natural and forced circulation types solar water heating system? 5+5

3.A] What is solar cell? And explain briefly about photovoltaic effect? 3+7

OR

B.] Explain the following:I]Solar cell I-V characteristics and ii]shunt resistance 6+4

4. A]What is thin film solar cells? And explain about CdTe/CdS thinfilm solar cell? 3+7

OR

B.] Explain the Bypass diode and Blocking diode? 5+5

5. A] Explain the types of solar pv systems?

OR

C.] Explain the costruction and working of Lead Acid battery?

SECTION-B

(Short Answer Type Questions)

Marks : 5x5M = 25M

Answer any five out of the following ten questions

6. Draw and explain about Sun structure?
7. Define and explain about direct, diffuse and total radiations?
8. Explain construction and working of Solar desalinator?
9. Write Short note on Evacuated tube Collectors?
10. Explain the following:I] Homojunction and ii] Heterojunction
11. Discuss the steps involved to fabricate PV Module?
12. What are poly-Si cells
13. Write short note on energy storage modes?

Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

B.Sc. Honors PHYSICS SYLLABUS UNDER CBCS

ELECTIVE – EB-2

RENEWABLE ENERGY AND ENERGY HARVESTING

[For Mathematics Combination only]

III Year B.Sc.-Physics, Semester V

Work load:60 hrs per semester 4 hrs/week

Course Objectives

- To impart knowledge and hands on learning about various alternate energy sources to teach the ways ofharvesting energy using wind, solar, mechanical, ocean, geothermal energy etc. To review the working ofvarious energy harvesting systems which are installed worldwide.

Course Learning Outcome

- The students are expected to learn not only the theories of the renewable sources of energy, but also to have hands-on experiences on them wherever possible. Some of the renewable sources of energy which should be studied here are: (i) off-shore wind energy, (ii) tidal energy, (iii) solar energy, (iv) biogas energy and (v) hydroelectricity.All these energy sources should be studied in detail.
- Learn about piezoelectricity, carbon- captured technologies like cells, batteries.
- The students should observe practical demonstrations of (i) training modules of solar energy, windenergy etc., (ii) Conversion of vibration into voltage using piezoelectric materials, (iv) conversion ofthermal energy into voltage using thermoelectric modules.

UNIT I: 1.Global Energy Scenario &Indian energy scenario:

Classification of energy resources,conventional energy resources,advantages,disadvantages, Origin and time scale of fossil fuels,Energy flow diagram to earth, Conventional energy sources, Role of energy in economic development and social transformation.Global Energy consumption in various sectors, projected energy consumption for the next century, Exponential increase in world's energy consumption,impact of exponential rise in energy usage on global economy. energy resources available in India- coal, oil, natural gas, nuclear and hydroelectric power,wind,solar, OTEC etc.,

Energy as a factor limiting growth, Need for use of renewable energy sources. **(12 hours)**

UNIT II: 2.Solar energy

Solar energy, its importance, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solarcooker, solar green houses,Solar power plants, Solar cell, Types of solar cells, photovoltaic effect,Solar module and array, Components of PV system, Applications of solar PV systems. **(12 hours)**

UNIT III: 3.Wind Energy

Introduction, Principle of wind energy conversion, Components of wind turbines, Operation and characteristics of a wind turbine,wind-electric generator power plant, Advantages and disadvantages of wind mills, Applications of wind energy. **(6 hours)**

4. Hydrogen Energy:

Hstory of hydrogen energy - Hydrogen production methods - Electrolysis of water, Hydrogen storage options – Compressed and liquefied gas tanks, Metal hydrides; Hydrogen safety - Problems of hydrogen transport and distribution - Uses of hydrogen as fuel. **(6 hours)**

UNIT IV:

5.Ocean Energy:

Introduction, Principle of ocean thermal energy conversion, Tidal power generation, Tidal energy technologies, Energy from waves, Wave energy conversion, Wave energy technologies, advantages and disadvantages. Closed and open type OTEC -advantages and disadvantages.

(7 hours)

6.Geothermal Energy: Introduction ,Important aspects of geothermal energyStructure of earths interior,Energy of earth-heat flux,Earthquake and volcanoes,geothermal system hot spring structure,geothermal resources,advantages,disadvantages and applications **(6 hours)**

UNIT V:

7.Bio-energy

Energy from biomass – Sources of biomass – Environmental effects of biomass,Conversion of biomass – biomass gasification – Introduction of biogas,Aerobic and anaerobic digestion – bio gas applications,advantages of biogas production, factors affecting generation of biogas, Biogas plants-Floating dome type(KVIC-type)&Fixed dome type(Deenabandu model),Production of biofuels-ethanol,methanol,biodiesel and producer gas.power generation from land fill gas(LFG)and liquid waste. (11 hours)

Dr. V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

III B.Sc PHYSICS (MAINS)

SEMESTER- V /ELECTIVE EB-2

RENEWABLE ENERGY AND ENERGY HARVESTING

BLUE PRINT FOR QUESTION PAPER SETTER

TIME : 3 hrs

Max.Marks :75

Sl.No.	UNIT NO. /CHAPTER NO.		SHORT ANSWER QUESTIONS 5 MARKS	ESSAY QUESTIONS 10 MARKS	MARKS ALLOTTED TO THE UNIT
1	UNIT I	1.Global Energy Scenario &Indian energy scenario:	2	2	30
2	UNIT II	2.Solar energy:	1	2	25
3	UNIT III	3.Wind Energy:	1	1	30
		4.Hydrogen Energy:	1	1	
4	UNITIV	5.Ocean Energy:	1	1	30
		6.Geothermal Energy	1	1	
5	UNIT V	7.Bio-energy	1	2	25
	Total no. of Questions		8	10	
	Total Marks including Choice				140

Note:

1.The question paper setters are requested to kindly adhere to the format given in the above table.

2. The question paper setters are requested to follow revised Bloom's Taxonomy model while preparing Question paper.

3.The question paper setters are also requested to set the questions in the following way:

a. 75 % of Questions - Memory and Understanding based

b. 20 % of Questions – Application, Analysis and Skill based

c. 5 % of Questions – Creativity and Evaluation based

B.SC. PHYSICS-ELECTIVE - : EB-3/ Atmospheric Physics

(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

COURSE OBJECTIVES:

1. To get acquainted with the general composition and the structure of Earth's Atmosphere and to know about the formation of winds and cyclones.
2. To work out with the fundamental dynamic equations due to rotation of the Earth and apply these to study various circulations and vortices of the winds.
3. To gain knowledge regarding the formation and the propagation of various waves in Atmosphere.
4. To learn about various aspects of RADAR and LIDAR and their applications.
5. To know about formation and detection of Aerosols using LIDAR.

LEARNING OUTCOMES :

1. To know about the general composition and the structure of Earth's Atmosphere and to know about the formation of winds and cyclones.
2. To work out with the fundamental dynamic equations due to rotation of the Earth and apply these to study various circulations and vortices of the winds.
3. To get acquainted with the knowledge regarding the formation and the propagation of various waves in Atmosphere.
4. To gain knowledge about various aspects of RADAR and LIDAR and their applications.
5. To comprehend about the formation and detection of Aerosols using LIDAR.

B.Sc. PHYSICS – ELECTIVE - :EB-3- ATMOSPHERIC PHYSICS / SYLLABUS

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

UNIT – I

General features of Earth's atmosphere: Thermal structure of the Earth's Atmosphere, Ionosphere, Composition of atmosphere, Hydrostatic equation, Potential temperature, Atmospheric Thermodynamics, Greenhouse effect and effective temperature of Earth, Local UGC Document on LOCF Physics 190 winds, monsoons, fogs, clouds, precipitation, Atmospheric boundary layer, Sea breeze and land breeze. Instruments for meteorological observations, including RS/RW, meteorological processes and different systems, fronts, Cyclones and anticyclones, thunderstorms. (12 Lectures)

UNIT – II

Atmospheric Dynamics: Scale analysis, Fundamental forces, Basic conservation laws, The Vectorial form of the momentum equation in rotating coordinate system, scale analysis of equation of motion, Applications of the basic equations, Circulations and vorticity, Atmospheric oscillations, Quasi biennial oscillation, annual and semi-annual oscillations, Mesoscale circulations, The general circulations, Tropical dynamics. (12 Lectures)

UNIT – III

Atmospheric Waves: Surface water waves, wave dispersion, acoustic waves, buoyancy waves, propagation of atmospheric gravity waves (AGWs) in a nonhomogeneous medium, Lamb wave, Rossby waves and its propagation in three dimensions and in sheared flow, wave absorption, non-linear consideration (12 Lectures)

UNIT – IV

Atmospheric Radar and Lidar: Radar equation and return signal, Signal processing and detection, Various type of atmospheric radars, Application of radars to study atmospheric phenomena, Lidar and its

applications, Application of Lidar to study atmospheric phenomenon. Data analysis tools and techniques. (12 Lectures)

UNIT – V

Atmospheric Aerosols: Spectral distribution of the solar radiation, Classification and properties of aerosols, Production and removal mechanisms, Concentrations and size distribution, Radiative and health effects, Observational techniques for aerosols, Absorption and scattering of solar radiation, Rayleigh scattering and Mie scattering, Bouguert-Lambert law, Principles of radiometry, Optical phenomena in atmosphere, Aerosol studies using Lidars. (12 Lectures)

Reference Books:

- Fundamental of Atmospheric Physics – Murry L Salby; Academic Press, Vol 61, 1996
- The Physics of Atmosphere – John T. Houghton; Cambridge University press;3rd edn. 2002.
- An Introduction to dynamic meteorology – James R Holton; Academic Press, 2004
- Radar for meteorological and atmospheric observations – S Fukao and KHamazu, Springer Japan, 2014

B.Sc. PHYSICS – ELECTIVE - :EB-3/ ATMOSPHERIC PHYSICS / SYLLABUS (Credits: Theory-04, Practicals-02)

PRACTICALS- Atmospheric Physics (List of practicals)

Atmospheric Physics 60 Lectures

Scilab/C++ based simulations experiments based on Atmospheric Physics problems like

1. Numerical Simulation for atmospheric waves using dispersion relations (a) Atmospheric gravity waves (AGW) (b) Kelvin waves (c) Rossby waves, and mountain waves
2. Offline and online processing of radar data (a) VHF radar, (b) X-band radar, and (c) UHF radar
3. Offline and online processing of LIDAR data
4. Radiosonde data and its interpretation in terms of atmospheric parameters using vertical profiles in different regions of the globe.
5. Handling of satellite data and plotting of atmospheric parameters using radio occultation technique
6. Time series analysis of temperature using long term data over metropolitan cities in India – an approach to understand the climate change

Reference Books:

- Fundamental of Atmospheric Physics – Murry L Salby; Academic Press, Vol 61, 1996
- The Physics of Atmosphere – J.T. Houghton; Cambridge Univ. Press; 3rd edn. 2002.
- An Introduction to dynamic meteorology – James R Holton; Academic Press, 2004
- Radar for meteorological and atmospheric observations – S Fukao and K Hamazu, Springer Japan, 2014

Dr. V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

- **B.SC. PHYSICS SYLLABUS**
- **SEMESTER- V**
- **ELECTIVE – EB-3/ (Atmospheric Physics)**
- **BLUE PRINT FOR QUESTION PAPER SETTER**

TIME : 3 hrs **Max.Marks :75**

Sl.No.	UNIT NO. /CHAPTER NO./ TITLE		SHORT ANSWER QUESTIONS 5 MARKS	ESSAY QUESTIONS 10 MARKS	MARKS ALLOTED TO THE UNIT
1	UNIT I	General features of Earth's atmosphere	2	2	30
2	UNIT II	Atmospheric Dynamics	2	2	30
3	UNIT III	Atmospheric Waves	2	2	30
4	UNIT IV	Atmospheric Radar and Lidar	2	2	30
5	UNIT V	Atmospheric Aerosols	2	2	30
	Total no. of Questions		10	10	
	Total Marks including Choice				150

Note:

1.The question paper setters are requested to kindly adhere to the format given in the above table.

2. The question paper setters are requested to follow revised Bloom's Taxonomy model while preparing Question paper.

3.The question paper setters are also requested to set the questions in the following way:

a. 75 % of Questions - Memory and Understanding based

b. 20 % of Questions – Application, Analysis and Skill based

c. 5 % of Questions – Creativity and Evaluation based

B.SC. PHYSICS-ELECTIVE - : EC-1 -APPLIED DYNAMICS

(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

COURSE OBJECTIVES:

1. To get acquainted with the basic aspects of Dynamical systems
2. To get a basic understanding about Dynamical systems of various areas (Biology, Chemistry etc)
3. To know about Chaos and Fractals at a basic level.
4. To learn some aspects of Logistic Maps and chaos in Non-linear systems.
5. To comprehend with the basics of Fluid Dynamics.

LEARNING OUTCOMES:

6. 1. To know about the basic aspects of Dynamical systems
7. To get acquainted with the Dynamical systems of various areas (Biology, Chemistry etc)
8. To know about Chaos and Fractals at a basic level.
9. To understand some basic aspects of Logistic Maps and chaos in Non-linear systems.
10. To comprehend with the basics of Fluid Dynamics.

B.SC. PHYSICS- ELECTIVE :EC-1 - ANALYTICAL DYNAMICS -SYLLABUS

(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

UNIT – I

Introduction to Dynamical systems:

Definition of a continuous first order dynamical system. The idea of phase space, flows and trajectories. Simple mechanical systems as first order dynamical systems : the free particle, particle under uniform gravity, simple and damped harmonic oscillator. Sketching flows and trajectories in phase space; sketching variables as functions of time, relating the equations and pictures to the underlying physical intuition.

(11 lectures)

UNIT – II

Other examples of dynamical systems:

In Biology -Population models e.g. exponential growth and decay, logistic growth, species competition, predator-prey dynamics, simple genetic circuits In Chemistry: Rate equations for chemical reactions e.g. auto catalysis, bistability In Economics: Examples from game theory. Illustrative examples from other disciplines. Fixed points, attractors, stability of fixed points, basin of attraction, notion of qualitative analysis of dynamical systems, with applications to the above examples. Computing and visualizing trajectories on the computer using software packages. Discrete dynamical systems. The logistic map as an example.

(15 Lectures)

UNIT – III

Introduction to Chaos and Fractals:

Examples of 2-dimensional billiard, Projection of the trajectory on momentum space. Sinai Billiard and its variants. Computational visualization of trajectories in the Sinai Billiard. Randomization and ergodicity in the divergence of nearby phase space trajectories, and dependence of time scale of divergence on the size of

obstacle. Electron motion in mesoscopic conductors as a chaotic billiard problem. Other examples of chaotic systems; visualization of their trajectories on the computer. : Fractals in nature – trees, coastlines, earthquakes, etc. Need for fractal dimension to describe self-similar structure. Deterministic fractal vs. self-similar fractal structure. Fractals in dynamics – Serpinski gasket and DLA. **(12 Lectures)**

UNIT – IV

Chaos in nonlinear finite-difference equations- Logistic map:

Dynamics from time series. Parameter dependence- steady, periodic and chaos states. Cobweb iteration. Fixed points. Defining chaos- aperiodic, bounded, deterministic and sensitive dependence on initial conditions. Period- Doubling route to chaos. Nonlinear time series analysis and chaos characterization: Detecting chaos from return map. Power spectrum, autocorrelation, Lyapunov exponent, correlation dimension. **(8 Lectures)**

UNIT-V

Elementary Fluid Dynamics:

Importance of fluids, Fluids in the pure sciences, Fluids in technology. Study of fluids: Theoretical approach, experimental fluid dynamics, computational fluid dynamics. Basic physics of fluids: The continuum hypothesis-concept of fluid element or fluid parcel; Definition of a fluid- shear stress; Fluid properties- viscosity, thermal conductivity, mass diffusivity, other fluid properties and equation of state; Flow phenomena- flow dimensionality, steady and unsteady flows, uniform & non-uniform flows, viscous & inviscid flows, incompressible & compressible flows, laminar and turbulent flows, rotational and irrotational flows, separated & unseparated flows. Flow visualization - streamlines, path lines, Streak lines.

(14 Lectures)

Reference Books

- Nonlinear Dynamics and Chaos, S.H. Strogatz, Levant Books, Kolkata, 2007
- Understanding Nonlinear Dynamics, Daniel Kaplan and Leon Glass, Springer.
- An Introduction to Fluid Dynamics, G.K.Batchelor, Cambridge Univ. Press, 2002
- Fluid Mechanics, 2nd Edition, L. D. Landau and E. M. Lifshitz, Pergamon Press, Oxford, 1987.

B.SC. PHYSICS PRACTICAL LAB: APPLIED DYNAMICS

60 Lectures Laboratory/Computing and visualizing trajectories using software such as Scilab, Maple, Octave, XPPAUT based on Applied Dynamics problems like

1. To determine the coupling coefficient of coupled pendulums.
2. To determine the coupling coefficient of coupled oscillators.
3. To determine the coupling and damping coefficient of damped coupled oscillator.
4. To study population models e.g. exponential growth and decay, logistic growth, species competition, predator-prey dynamics, simple genetic circuits.
5. To study rate equations for chemical reactions e.g. auto catalysis, bistability.
6. To study examples from game theory.

7. Computational visualization of trajectories in the Sinai Billiard.

8. Computational visualization of trajectories Electron motion in mesoscopic conductors as a chaotic billiard problem.

9. Computational visualization of fractal formations of Deterministic fractal.

10. Computational visualization of fractal formations of self-similar fractal.

11. Computational visualization of fractal formations of Fractals in nature – trees, coastlines, earthquakes.

12. Computational Flow visualization - streamlines, pathlines, Streaklines.

Reference Books:

- Nonlinear Dynamics and Chaos, Steven H. Strogatz, Levant Books, Kolkata, 2007
- Understanding Nonlinear Dynamics, Daniel Kaplan and Leon Glass, Springer.
- An Introduction to Fluid Dynamics, G.K.Batchelor, Cambridge Univ. Press, 2002
- Fluid Mechanics, 2nd Edn, L.D.Landau & E.M. Lifshitz, Pergamon Press, Oxford, 1987
- Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific and Engineering Applications: A. Vande Wouwer, P. Saucez, C. V. Fernández. 2014 Springer ISBN: 978-3319067896
- Scilab by example: M. Affouf, 2012, ISBN: 978-1479203444
- Scilab Image Processing: L.M.Surhone. 2010, Betascript Pub., ISBN: 978-6133459274

Dr. V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

- **B.SC. PHYSICS SYLLABUS**
- **SEMESTER- V**
- **ELECTIVE -EC-1 / (Analytical Dynamics)**
- **BLUE PRINT FOR QUESTION PAPER SETTER**

TIME : 3 hrs **Max.Marks :75**

Sl.No.	UNIT NO. /CHAPTER NO./ TITLE		SHORT ANSWER QUESTIONS 5 MARKS	ESSAY QUESTIONS 10 MARKS	MARKS ALLOTED TO THE UNIT
1	UNIT I	Introduction to Dynamical systems	2	2	30
2	UNIT II	Other examples of dynamical systems	2	2	30
3	UNIT III	Introduction to Chaos and Fractals	2	2	30
4	UNIT IV	Chaos in nonlinear finite-difference equations- Logistic map	2	2	30
5	UNIT V	Elementary Fluid Dynamics	2	2	30
	Total no. of Questions		**10**	**10**	
	Total Marks including Choice				**150**

Note:

1.The question paper setters are requested to kindly adhere to the format given in the above table.

2. The question paper setters are requested to follow revised Bloom's Taxonomy model while preparing Question paper.

3.The question paper setters are also requested to set the questions in the following way:

a. 75 % of Questions - Memory and Understanding based

b. 20 % of Questions – Application, Analysis and Skill based

c. 5 % of Questions – Creativity and Evaluation based

BSC. PHYSICS ELECTIVE-EC-2: NUCLEAR AND PARTICLE PHYSICS

hrs./ Week

Work load: **60 hrs./ Semester**

COURSE OBJECTIVES

The objective of the course is to impart the understanding of the sub atomic particles and their properties. It will emphasize to gain knowledge about the different nuclear techniques and their applications in different branches Physics and societal application. The course will focus on the developments of problem-based skills.

COURSE LEARNING OUTCOME

- Learn the ground state intrinsic properties of a nucleus.
- Know about the nuclear models and their roles in explaining the ground state properties of the nucleus –(i) the liquid drop model (ii) the shell model.
- Learn about the process of radioactivity, the radioactive decay law, the emission of alpha, beta and gamma rays.
- Learn the basic aspects of nuclear reactions, the Q-value of such reaction and its derivation from conservation laws, The reaction cross-sections.
- Learn some basic aspects of interaction of nuclear radiation with matter- interaction of gamma ray by photoelectric effect, Compton scattering and pair production, energy loss due to ionization, Cerenkov radiation.
- Learn about the basic features of nuclear radiations.
- Gain knowledge on the basic aspects of particle Physics – the fundamental interactions, elementary and composite particles, the classifications of particles.

BROAD CONTENTS OF THE COURSE

General properties of nuclei
Nuclear models
Radioactive decays
Nuclear reactions
Interaction of nuclear radiation with matter
Elementary particles and their properties

SKILLS TO BE LEARNED

Skills to describe and explain the properties of nuclei and derive them from various models of nuclear structure.

To understand, explain and derive the various theoretical formulation of nuclear disintegration like α decay, β decay and γ decays.

Develop basic understanding of nuclear reactions and decays with help of theoretical formulate and laboratory experiments.

Skills to develop basic understanding of the interaction of various nuclear radiation with matter in low and high energy.

Develop basic knowledge of elementary particles as fundamental constituent of matter, their properties, conservation laws during their interactions with matter

SYLLABUS OF THE COURSE

UNIT-I

(12 Lectures)

General Properties of Nuclei: Constituents of nucleus and their Intrinsic properties: shape, mass, radii, charge, density (matter density), average binding energy and its variation with mass number, main features of binding energy curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excites states.

UNIT-II

(12 Lectures)

Radioactivity decay: (a) Alpha decay: basics of α-decay processes, theory of α-emission, Gamow Theory, Geiger Nuttall law. (b) β -decay: energy kinematics for β decay, positron emission, electron capture, neutrino hypothesis. (c) Gamma decay: Gamma rays' emission & kinematics, internal conversion.

UNIT-III

(12 Lectures)

Nuclear Models: Liquid drop model approach, semi empirical mass formula and significance of its various terms, condition of nuclear stability, Fermi gas model (degenerate fermion gas, nuclear symmetry potential in Fermi gas), evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model, residual interaction, concept of nuclear force and its properties.

UNIT-IV

(6 Lectures)

Nuclear Reactions: Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate, reaction cross section, Concept of compound and direct Reaction, resonance reaction.

Interaction of Nuclear Radiation with matter:

(6 Lectures)

Energy loss due to ionization (Bethe-Block formula), Cerenkov radiation. Gamma ray interaction through matter, photoelectric effect, Compton scattering, pair production, neutron interaction with matter.

UNIT-V

(12 Lectures)

Particle physics: Particle interactions; basic features, Types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons.

Text Books

Introductory nuclear Physics by Kenneth S. Krane (Wiley India Pvt. Ltd., 2008).
Concepts of nuclear physics by Bernard L. Cohen. (Tata Mcgraw Hill, 1998).
Introduction to the physics of nuclei & particles, R.A. Dunlap. (Thomson Asia, 2004).

Reference Books

Introduction to High Energy Physics, D.H. Perkins, Cambridge Univ. Press.
Introduction to Elementary Particles, D. Griffith, John Wiley & Sons
Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi
Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde (IOP- Institute of Physics Publishing, 2004).
Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000).
Physics and Engineering of Radiation Detection, Syed Naeem Ahmed (Academic Press, Elsevier, 2007).
Theoretical Nuclear Physics, J.M. Blatt & V.F.Weisskopf (Dover Pub.Inc., 1991).

BSC. PHYSICS ELECTIVE-EC-2 (Practical): NUCLEAR AND PARTICLE PHYSICS

Work load: **30 hrs./ Semester** **2 hrs./ Week**

LIST OF EXPERIMENTS

Nuclear Physics Experiments (Minimum Six)

1. Gamma ray spectrometer calibration
2. Strength and energy of the unknown γ-ray source
3. Mass Attenuation coefficient for γ -ray.
4. Fermi-Kurie Plot
5. G.M. Counters – Characteristics and dead time
6. The Beta ray spectrum & Feathers's analysis
7. G.M. counter: Inverse square law verification, Linear absorption coefficient & scattering factor determination.
8. Dosimeter: - Inverse square law verification & Linear absorption coefficient determination.
9. MCA calibration using Gamma ray Sources.
10. MCA: Strength and energy of the unknown γ -ray source.

ASSESSMENT: MARKING SCHEME

Total Marks: **50**

Internal assessment: 10 marks
End term examination: 40 marks (laboratory exam. will be conducted at the semester end).
Laboratory Notebook: 10 Marks
Experimental work and data analysis: 10 Marks
Presentation and Viva voce: 20 Marks.

Dr. V.S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM

BSC. PHYSICS Program

SEMESTER- V

ELECTIVE EC – 2 (NUCLEAR AND PARTICLE PHYSICS)

BLUE PRINT FOR QUESTION PAPER SETTER

TIME: 3 Hrs. Max. Marks: 75

S. No.	UNIT NO./ CHAPTER NO.		SHORT ANSWER QUESTIONS (5 Marks)	ESSAY QUESTIONS (10 Marks)	MARKS ALLOETD TO THE UNIT	
1	UNIT-I	General Properties of Nuclei	2	2	30	
2	UNIT-II	Radioactivity decay	1	2	25	
3	UNIT-III	Nuclear Models	1	2	25	
4	UNIT-IV	Nuclear Reactions	1	1	30	
		Interaction of Nuclear Radiation with matter	1	1		
5	UNIT-V	Particle physics	2	2	30	
	Total no. of Questions		8	10		
	Total Marks including Choice				140	

Note:

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c. 5 % of Questions – Creativity and Evaluation based

Dr. V.S. Krishna Govt. degree College(A), Visakhapatnam

MODEL QUESTION PAPER

(NUCLEAR AND PARTICLE PHYSICS)

III B.Sc. Physics : SEM-V / EC-2

Time: 3 Hrs **Max. Marks: 75**

SECTION – A

Answer all Questions of the following **[5 X 10 = 50]**

1. (a) Explain the following: 1. Mass, 2. Radii, 3. Charge, 4. Matter density and 5. Average binding energy.

]OR[

)b(Describe the main features of binding energy curve and N/A plot?

2. (a) Explain the Gamow theory of α-decay process?

]OR[

(b) Discuss positron emission, electron capture and neutrino hypothesis in β -decay.

3. (a) Explain the Liquid drop model of an Atomic nucleus?

[OR]

)b(Explain the Shell model of Atomic Nuclei.

4. (a) Derive an equation for the Q-value of the nuclear reaction. Also mention the types of Reactions.

[OR]

)b(Explain the photoelectric effect, Compton scattering and pair production.

5. (a) Discuss the following Conservation Laws: parity, baryon number, Lepton number with examples.

[OR]

(b) Explain the concept of quark model.

SECTION – B

Answer any FIVE Questions [5 X 5 = 25]

6. Describe the electric quadrupole moment.
7. Explain the nuclear excites states.
8. Discuss the Geiger Nuttall law.
9. Write any five properties of nuclear forces.
10. What are the types of nuclear reactions.
11. Explain the Cerenkov radiation.
12. Write a short note on elementary particles.
13. Explain the Law of conservation of Isospin.

B.SC. PHYSICS-ELECTIVE - : EC-3
ADVANCED MATHEMATICAL PHYSICS-I
(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

COURSE OBJECTIVES:

1. To get acquainted with the basic aspects of Linear Vector Spaces.
2. To get a basic understanding about Matrices.
3. To know and work out the problems involving the applications of the Matrices.
4. To learn some elementary aspects of Cartesian Tensors as well as that of tensorial formulation of Analytical Solid Geometry
5. To comprehend with the basics of General Tensors.

LEARNING OUTCOMES:

1. To know about the basic aspects of Linear Vector Spaces.
2. To get acquainted with Matrices and their operations.
3. To know and work out the problems involving the applications of the Matrices.
4. To understand some basic aspects of Cartesian Tensors as well as that of tensorial formulation of Analytical Solid Geometry.
5. To comprehend with the basics of General Tensors.

The emphasis of the course is on applications in solving problems of interest to physicists. Students are to be examined on the basis of problems, seen and unseen.

UNIT -I

Chapter – I :

Linear Vector Spaces: Abstract Systems. Binary Operations and Relations. Introduction to Groups and Fields. Vector Spaces and Subspaces. Linear Independence and Dependence of Vectors. Basis and Dimensions of a Vector Space. Change of basis. Homomorphism and Isomorphism of Vector Spaces. Linear Transformations. Algebra of Linear Transformations. Non-singular Transformations. Representation of Linear Transformations by Matrices. (10 Lectures)

UNIT-II

Chapter -II

Matrices: Addition and Multiplication of Matrices. Null Matrices. Diagonal, Scalar and Unit Matrices. Upper-Triangular and Lower-Triangular Matrices. Transpose of a Matrix , Rank of a Matrix, Linear Simultaneous equations, Symmetric and Skew-Symmetric Matrices. Conjugate of a Matrix. Hermitian and Skew-Hermitian Matrices. Singular and Non-Singular matrices. Orthogonal and Unitary Matrix. Trace of a Matrix. Inner Product. (10 Lectures)

UNIT-III

Chapter- III

Matrix Applications : Eigen-values and Eigenvectors. Cayley- Hamilton Theorem. Diagonalization of Matrices. Solution of Coupled Linear Ordinary Differential Equations. Functions of a Matrix (10 Lectures)

UNIT-IV

Chapter -IV

Cartesian Tensors: Transformation of Co-ordinates. Einstein's Summation Convention. Relation between Direction Cosines. Tensors. Algebra of Tensors. Sum, Difference and Product of Two Tensors. Contraction. Quotient Law of Tensors. Symmetric and Anti-symmetric Tensors. Invariant Tensors : Kronecker and Alternating Tensors. Association of Antisymmetric Tensor of Order Two and Vectors. Vector Algebra and Calculus using Cartesian Tensors : Scalar and Vector Products, Scalar and Vector Triple Products. Differentiation. Gradient, Divergence and Curl of Tensor Fields. Vector Identities.
(10 Lectures)

Chapter-V

Tensorial Formulation of Analytical Solid Geometry : Equation of a Line. Angle Between Lines. Projection of a Line on another Line. Condition for Two Lines to be Coplanar. Foot of the Perpendicular from a Point on a Line. Rotation Tensor (No Derivation). Isotropic Tensors. Tensorial Character of Physical Quantities. Moment of Inertia Tensor. Stress and Strain Tensors : Symmetric Nature. Elasticity Tensor. Generalized Hooke's Law.

(10 lectures)

UNIT-V

Chapter-VI

General Tensors: Transformation of Co-ordinates. Minkowski Space. Contravariant & Covariant Vectors. Contravariant, Covariant and Mixed Tensors. Kronecker Delta and Permutation Tensors. Algebra of Tensors. Sum, Difference & Product of Two Tensors. Contraction. Quotient Law of Tensors. Symmetric and Anti-symmetric Tensors. Metric Tensor. (10 Lectures)

Reference Books:

- Mathematical Tools for Physics, James Nearing, 2010, Dover Publications
- Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, and F.E. Harris, 1970, Elsevier.
- Modern Mathematical Methods for Physicists and Engineers, C.D. Cantrell, 2011, Cambridge University Press
- Introduction to Matrices and Linear Transformations, D.T. Finkbeiner, 1978, Dover Pub.
- Linear Algebra, W. Cheney, E.W.Cheney&D.R.Kincaid, 2012, Jones & Bartlett Learning • Mathematics for Physicists, Susan M. Lea, 2004, Thomson Brooks/Cole
- Mathematical Methods for Physicis& Engineers, K.F.Riley, M.P.Hobson, S.J.Bence, 3rd Ed., 2006, Cambridge University Press

Dr. V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

□ B.SC. PHYSICS SYLLABUS

□ SEMESTER- V

□ ELECTIVE – EC-1/ (Advanced Mathematical Physics - I)

□ BLUE PRINT FOR QUESTION PAPER SETTER

TIME : 3 hrsMax.Marks :75

Sl. No.	UNIT NO. /CHAPTER NO./ TITLE			SHORT ANSWER QUESTIONS 5 MARKS	ESSAY QUESTIONS 10 MARKS	MARKS ALLOTED TO THE UNIT
1	UNIT-I	Chapter -1	**Linear vector Spaces**	2	2	30
2	**UNIT-II**	**Chapter-2**	**Matrices**	2	2	30
3	**UNIT-III**	**Chapter-3**	**Matrix Applications**	2	2	30
4	**UNIT-IV**	**Chapter-4**	**Cartesian Tensors**	1	1	15
		Chapter-5	**Tensorial Formulation of Analytical solid Geometry**	1	1	15
5	**UNIT-V**	**Chapter-6**	**General Tensors**	2	2	30
	Total no. of Questions			**10**	**10**	
	Total Marks including Choice					**150**

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□