GOVERNMEN T DEGREE COLLEGE, PORUMAMILLA

DEPARTMENT OF PHYSICS

OBJECTIVES & LEARNING OUTCOMES

I Semester- Mechanics

The purpose of the course is to provide an understanding of the basic relations of vector analysis, to demonstrate practical applications of vector analysis and to train the student in problem formalization and in methods of solution.

The course objectives are examined; the student should be able to:

- Explain the characteristics of vector and scalar valued functions and master these in calculations.
- Provide a physical interpretation of the gradient, divergence, curl and related concepts.
- Carry out differentiation and integration of vector valued functions in Cartesian, cylindrical and spherical geometry.
- Transform vector valued functions between different coordinate systems.
- Use nabla operations for simplification of vector analytical expressions.
- Give an account of important vector field models of nature.
- Solve the Laplace and Poisson equations for simple cases.

Basic learning outcomes of

1) The application basic science systematization thought excavation, the evaluation, the diagnosis project question, and plans and carries out ability of the special study and the solution.
2) Have independent research, collection the data, standard problem take into analytical the identification acquire conclusion, and have development innovation and compose the ability of professional thesis.
3) Usage mathematics engineering realm is related analysis and design software, explanation data with independently solves the ability of problem.
4) Effectively communicate, expression integrity, leadership management, team cooperation division of labor and moderate integration of ability.
5) Has mathematical and the project professional field self-study, the innovation ponder and ability of the sustained development.
6) Have international machine and aviation of control to develop trend and technique ability.
7) Comprehend a professional and social responsibility.

Students completing this course shall

- Be able to read current literature
- Be proficient with basic concepts in continum mechanics of solids, including of strain, internal force, stress and equilibrium in solids.
- Be able to characterize materials with elastic constitutive relations.
- Be able to use analytical techniques to predict deformation, internal force and failure of simple solids and structural components.

- Be able to apply principles of continum mechanics to design a structure or component to achieve desired performance under realistic constraints.

Wave motion: The goal is to develop an awareness and understanding of wave motion.

Objectives:

- Study waves on strings and other transverse waves.
- Delineate what happens when a wave motion effects.
- Develop an understanding of resonance and standing waves, on a string for example.
- Explain longitudinal waves.
- Solve many types of problems involving wave motion.

Learning outcomes of simple harmonic motion:

- Define SHM and illustrate it with a variety of examples.
- Analyse SHM in terms of potential and kinetic energy.
- Describe effects of damping, forced vibrations and resonance.
- Interpret and use algebraic and graphical representation of SHM.
- Relate SHM to circular motion.
- Solve quantitative problems involving SHM.

II Semester- Waves & Oscillations

The goal is to develop knowledge and an understanding of vibratory motion.

Objectives:

- Develop an understanding of vibrating systems such as springs.
- Study the special case known as simple harmonic motion, and relate it to sinusoidal variations.
- Solve problems involving pendulums and many other vibrating bodies.`
- Consider forced vibrations.

A) Course objectives

(i) To understand the fundamentals of vibration theory.

(ii) To be able to mathematically model real – world mechanical vibration problems.

(iii) To use computer software programs to investigate and understand vibration problems.

B) Learning outcomes

Upon completion of this course the student will be able to:

I. Apply Newton's equation of motion and energy methods to model basic vibrating mechanical systems.

II. Model reciprocating and oscillatory motions of mechanical systems.

III. Model undamped and damped mechanical systems and structures.

IV. Model free and harmonically forced vibrations.

V. Model single and multi-degree of freedom systems.

VI. Perform and verify computer simulations employing time integration and modal analysis of discrete vibrating systems.

This course contributes to the assessment of the following program (Student) outcomes:

· An ability to apply knowledge of mathematics, science and engineering.
· An ability to identify, formulate and solve engineering problems.

III Semester-Optics

On successful completion of each element of this module, the learner will be able to: Optics

- Draw and use snapshot and history graphs for analysing waves.
- Analyse waves and solve problems based on wavelength, period, displacement, amplitude, speed, phase and phase difference.
- Use the wave equation to solve numerical and conceptual problems
- Explain and solve problems based on coherence and coherence length
- Explain and solve problems based on wave superposition.
- Explain Huygen's Principle
- Describe what happens when waves pass through a single slit, Young's double slit experiment, and a diffraction grating. Solve problems based on them.
- Derive the position of bight and dark fringes in Young's double slit experiment. Solve problems based on it.
- Derive the intensity profile of bight and dark fringes in Young's double slit experiment. Solve problems based on it.
- Describe diffraction gratings and solve problems using the diffraction grating equation.
- Solve problems based on the equation describing single slit fringes, Young's double slit fringes, and a diffraction grating fringes.
- Explain and solve problems based on coherence and coherence length
- Describe the Michelson Interferometer and show how constructive and destructive interferences occurs.
- Briefly explain Fresnel and Fraunhofer Diffraction
- Explain what is meant by polarisation and Malus's Law and solve problem based on them. Explain how a polarising filter works.
- Explain and describe the basis of a monochromator
- Explain and describe the basis of a spectrometer.

1. Interference and diffraction Students should understand the interference and diffraction of waves, so they can: a) Apply the principles of interference to coherent sources in order to:

(1) Describe the conditions under which the waves reaching an observation point from two or more sources will all interfere constructively, or under which the waves from two sources will interfere destructively.

(2) Determine locations of interference maxima or minima for two sources or determine the frequencies or wavelengths that can lead to constructive or destructive interference at a certain point.

(3) Relate the amplitude produced by two or more sources that interfere constructively to the amplitude and intensity produced by a single source.

b) Apply the principles of interference and diffraction to waves that pass through a single or double slit or through a diffraction grating, so they can:

(1) Sketch or identify the intensity pattern that results when monochromatic waves pass through a single slit and fall on a distant screen, and describe how this pattern will change if the slit width or the wavelength of the waves is changed. Objectives for the AP AP Course ® Physics Courses B C

(2) Calculate, for a single-slit pattern, the angles or the positions on a distant screen where the intensity is zero.

(4) Calculate, for a two-slit interference pattern, the angles or the positions on a distant screen at which intensity maxima or minima occur.

(5) Describe or identify the interference pattern formed by a diffraction grating, calculate the location of intensity maxima, and explain qualitatively why a multiple-slit grating is better than a two-slit grating for making accurate determinations of wavelength.
c) Apply the principles of interference to light reflected by thin films, so they can:

(1) State under what conditions a phase reversal occurs when light is reflected from the interface between two media of different indices of refraction.

(2) Determine whether rays of monochromatic light reflected perpendicularly from two such interfaces will interfere constructively or destructively, and thereby account for Newton's rings and similar phenomena, and explain how glass may be coated to minimize reflection of visible light.

IV Semester-Thermodynamics

1) To acquire working knowledge of the zero-th and first law of thermodynamics. Outcomes:

1) Student recognizes the difference between temperature and heat.
2) Student can apply the equipartition theorem and counts correctly the number of degrees of freedom of a thermodynamically system.
3) Student identifies the relationship and correct usage of infinitesimal work, work, energy, heat capacity, specific heat, latent heat, and enthalpy.
4) Student uses some empirical equations of state to compute the final state of thermo dynamical systems such as the ideal gas, the two-level paramagnet, the Einstein solid.

Assignments that demonstrate accomplishment of this outcome:

1) Correct answers on in-class short post-reading quizzes.
2) Participation in class discussion on questions posted prior the lecture.
3) Correct methodology in the calculation of at least 8 out of 15 homework problems related to this objective.
4) Midterm tests and final examination.

Objective 2) To acquire working knowledge of the second law of thermodynamics. Outcomes:

1) Student can compute entropy by counting the number of allowed states for simple systems such as the ideal gas (Sakur-Tetrode equation), the Einstein solid, and the two-level paramagnet.
2) Student identifies the role of the small fluctuations due to unaccounted terms in the Hamiltonian.
3) Student can relate to each other the different statements of the second law of thermodynamics. 4) Student uses the thermodynamical identity to derive the Maxwell relations.

Assignments that demonstrate accomplishment of this outcome:

1) Correct answers on in-class short post-reading quizzes.
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Objective 3) To apply the laws of thermodynamics. Outcomes:
1) Student can compute the value of selected thermodynamical variables at thermal, mechanical, and/or diffusive equilibrium.
2) Student can compute the ef iciency of idealized engines such as the Carnot cycle, the Otto cycle, and the Diessel cycle.

3) Student takes advantage of the Helmholtz free energy and the Gibbs free energy for calculations regarding the available work and/or phase transformations.
4) Student can give a quantitative description of the phase transformation of pure substances. Student can give a qualitative description of the phase transformation of mixtures.
Assignments that demonstrate accomplishment of this outcome:
1) Correct answers on in-class short post-reading quizzes.
2) Participation in class discussion on questions posted prior the lecture.
3) Correct methodology in the calculation of at least 8 out of 15 homework problems related to this objective.
4) Midterm tests and inal examination.

Objective 4) To link thermodynamics to the micro description used in classical Statistical Mechanics. Outcomes:

1) Student can recover the laws of thermodynamics and the equipartition theorem from the statistical description using microstates.
2) Student uses the partition function for calculations about the canonical ensemble.
3) Student uses the appropriate normalization for the Boltzmann factor and the appropriate degeneracies and densities of states.
Assignments that demonstrate accomplishment of this outcome:

1) Correct answers on in-class short post-reading quizzes.
2) Participation in class discussion on questions posted prior the lecture.
3) Correct methodology in the calculation of at least 8 out of 15 homework problems related to this objective.
4) Midterm tests and final examination.

Objective5) To introduce advanced topics related to Quantum Statistical Mechanics. Outcomes:

1) Student uses either Fermi-Dirac or Bose-Einstein statistics according to the spin of the particles.
2) Student gets acquainted with advanced topics such as the Fermi energy of a system of noninteracting Fermions and its relation to the chemical potential.
3) Student can derive Planck's law of blackbody radiation.

Assignments that demonstrate accomplishment of this outcome:

1) Correct answers on in-class short post-reading quizzes.
2) Participation in class discussion on questions posted prior the lecture.

SEMESTER - V Paper-V-Electricity & Electronics

The subject aims to provide the student with:

An understanding of basic abstractions on which analysis and design of electrical and electronic circuits and systems are based, including lumped circuit, digital and operational amplifier abstractions.

The capability to use abstractions to analyze and design simple electronic circuits.

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The capability to use abstractions to analyze and design simple electronic circuits.

An understanding of how complex devices such as semiconductor diodes and field-effect transistors are modeled and how the models are used in the design and analysis of useful circuits.

The capability to design and construct circuits, take measurements of circuit behavior and performance, compare with predicted circuit models and explain discrepancies.

Learning Outcomes:

Students will: Learn how to develop and employ circuit models for elementary electronic components, e.g., resistors, sources, inductors, capacitors, diodes and transistors; Become adept at using various methods of circuit analysis, including simplified methods such as series-parallel reductions, voltage and current dividers, and the node method; Appreciate the consequences of linearity.

Develop the capability to analyze and design simple circuits containing non-linear elements such as transistors using the concepts of load lines, operating points and incremental analysis; Learn how the primitives of Boolean algebra are used to describe the processing of binary signals and to use electronic components.

As building blocks in electronically implementing binary functions; Learn how the concept of noise margin is used to provide noise immunity in digital circuits; Be introduced to the concept of state in a dynamical physical system and learn how to analyze simple first and second order linear circuits containing memory elements.

SEMESTER - V Paper-VI-Modern Physics

By successfully completing this course a student should be able to:

General

1. Define the major 20th century developments in Physics.
2. Compare and contrast Modern Physics with Classical Physics.
3. State the fundamental tenets of the Theory of Special Relativity.
4. Apply Special Relativity to the solution of problems involving time dilation, length contraction, simultaneity, relativistic momentum, and relativistic energy.
5. Define the experimental basis of the Quantum Theory of Matter.
6. Command elementary and intermediate quantum methods.
7. Apply quantum methods in the solution of problems involving atomic spectra, blackbody radiation, the photoelectric effect, X-ray emission, the structure of the atom, and onedimensional potentials.
8. Quantitatively defend the assertions of Modern Physics theories.
9. Perform experimental work with atomic and subatomic particles and photons.
10. Communicate scientific ideas and physical concepts in writing clearly and effectively.
11. Define and explain at least 5 areas of cutting edge 21st century Physics and its relation to Modern Physics theories developed in the 20th century. Experimental
12. Organize & assemble modern physics laboratory experiments.
13. Explain in own words how specific modern physics experiments work.
14. Perform data acquisition using assembled experiment.
15. Engage in experimental troubleshooting with teaching assistants.
16. Maintain a laboratory notebook with detailed entries on everything performed in the lab. Analysis of Experimental Data
17. Distinguish between theoretical predications & experiment measurements.
18. Identify sources of error and fluctuations in data obtained in laboratory activities.
19. Organize the data obtained in the laboratory activities in the form of tables.
20. Construct graphs using graph paper and pencil based on data presented in tables.

21. Construct graphs using computers based on data presented in tables.

22. Distinguish between trends and fluctuations in data presented in graphs.

23. Distinguish between random errors and systematic errors in an experiment.

24. Identify the elements of theory of errors and statistical treatment of data that are essential for interpretation of modern physics experiments.

25. Apply principles of theory of errors and statistical treatment of data to analyze experimental uncertainties.

26. Analyze, interpret, and draw conclusions from data and corresponding uncertainties presented in graphs.

27. Perform curve fitting to graphical data exhibiting various relationships and interpret the physical meaning of fitting parameters.
28. Explain the difference between values predicted by a theory and values measured in an experiment in light of the experimental uncertainties.

29. Evaluate the possible reasons for disagreement between predicted and measured values. Written Scientific Communication

30. Analyze and apply rubrics to written scientific documents prepared by others.

31. Write laboratory reports with organized and logical flow of ideas containing: Title, Introduction, Objective of Experiments, Method Used, Results and Discussion, Conclusions, and Cited References.

Objectives for the Course:

Atomic energy levels Students should understand the concept of energy levels for atoms, so they can:

a) Calculate the energy or wavelength of the photon emitted or absorbed in a transition between specified levels, or the energy or wavelength required to ionize an atom.

b) Explain qualitatively the origin of emission or absorption spectra of gases.