

Tribhuvan University

2076

Bachelor Level Years. Program "Year/Science & Tech.

Full marks; 100

Time: 3hrs

Physics (Phy.101)

(Mechanics, Thermodynamics and Statistical Physics, Electricity, Magnetism)

New Course

Attempt ALL the questions

1. What do you mean by the Gravitational self energy? Find the expression for gravitational potential and field due to a thin spherical shell and solid sphere. Discuss the difference

OR

Write down equations of motion for a rotating rigid body. Discuss the kinetic energy of rotating and rolling bodies. Find the expression for rotational kinetic energy of a body rolling down an inclined plane

2. Discuss the meaning of radiation pressure and find its expression. Describe the pressure of diffusive radiation and hence state Boltzmann's law.

OR

Discuss the process of liquefaction of Helium and describe its properties. Explain the term critical temperature and find their relations.

3. Give reciprocity theorem of mutual inductances. Find the expressions for self inductance of a toroid and two long parallel wires. (10]

OR

Discuss the behaviour of plane electromagnetic waves in isotropic dielectric and in conducting media. Point out the major differences of its behaviour in the dielectric and conducting media.

4. Explain twisting couple on a cylindrical rod or wire. Find the expression for the work done in a twisting a rod or wire.
5. What do you mean by the Brownian motion? State and explain Einstein's theory of Brownian motion.
6. Discuss Langevin's theory of diamagnetism and paramagnetism.
7. Solve any TWO questions
 - (a) Explain Poisson's equation for gravitational field. b)
 - (b) Explain electron gas in metals.
 - (c) Discuss non conservative forces with examples.
 - (d) Explain reciprocity theorem.
8. Solve all the questions
 - a) Describe the flow of energy in stationary wave.
 - b) Describe Maxwell's distribution law of volocities.
 - c) Explain Helmholtz resonator.

d) Discuss the method of electrical images.

9. Satellite A is 7 times farther from a planet than satellite B. If it takes satellite B 4 weeks to complete a full orbit around the planet, how long will it take satellite A to travel around the planet once?

10. A basketball player who is standing 15 feet away from a basketball hoop is trying to make a basket. If the height of the hoop is 10 feet, and the height at which the player shoot the ball is 6 feet, at what angle and with what speed should the player shoot the ball? 07

11. A spherical satellite orbiting Earth is lighted on one side by the Sun, with intensity 1340 W/m^2 . If the radius of the satellite is 1.00 m, what power is incident upon it? (Note: The satellite effectively intercepts radiation only over a cross section - an area equal to that of a disk, πr^2 .) Calculate the peak electric and peak magnetic field.

12. The filament of a light bulb is cylindrical with length $l = 20 \text{ mm}$ and radius $r = 0.05 \text{ mm}$. The filament is maintained at a temperature $T = 5000 \text{ K}$ by an electric current, The filaments behaves approximately as a black body, emitting radiation isotropically. (a) What is the total power radiated by the filament? (b) At what wavelength does the filament radiate the most power?

13. transformer has 330 primary turns and 1240 secondary turns. The input voltage is 120 V and the output current is 15.0 A. What is the output voltage and input current?

14. With a source voltage of 208-V, frequency of 60 Hz and a LC parallel circuit that has $X_c = 160$ and $X_L = 30$. What would be (a) impedance value be, (b) Current through the capacitor, (c) Current through the inductor, and (d) line current and the impedance

Old Course

Attempt ALL the questions.

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1. Explain twisting couple on a cylindrical rod and wire both. Find the expression for the work done in a twisting a rod and wire. Is there any fundamental differences?

OR

Discuss the theorems of moment of inertia and use it to find moment of inertia of a solid cylinder about its axes, its' central diameter and base (cross-section of its one end), In which case, moment of inertia is high? Discuss.

2. What do you mean by refrigeration and liquefaction? Describe the process of Liquefaction of Helium and give its properties.

OR

What do you mean by the Planck's function? Describe the spectrum of a black body radiation

3. Give reciprocity theorem of mutual inductances. Find the expressions for self inductance of a toroid and two long parallel wires. [10]

OR

Describe reflection and refraction of electromagnetic waves at the interface between two media.

4. Describe the motion of a particle under central force. Give two examples of conservation of angular momentum under central force.

5. How entropy changes in reversible and irreversible process? give principle of increase of entropy as described by second law.

- 6 Find the expression for potential and field due to an electric dipole. [8]

7. Solve any TWO questions

(a) Explain Laplace equation for gravitational field

(b) Discrete Fermi Dirac statistics

(c) Explain the physical meaning of divergence and curl of a vector.

(d) What are the fundamental postulates of statistical mechanics?

8. Solve All the questions

(a) Explain damped harmonic oscillator.

(b) What is the meaning of quality factor in LCR series and parallel circuits.

(c) What do you mean by mode of vibration in stretched string

(d) Describe laws of equipartition of energy.

9. A vessel at rest explodes breaking into three pieces. Two pieces having equal mass fly off perpendicular to one another with the same speed 30 ms. If the third piece has three times the mass of each other piece, find the velocity of each piece.

10. A smooth straight tunnel is bored through the earth and a particle is allowed to move in it from a position of rest. The periodic time of one vibration is ($G = 667 \times 10$ in MKS unit density of the earth 5.6 g/cm^3)

11. The change of specific volume when one gm of water freezes into ice is 0.091 cc . What will be the pressure required to freeze water at (latent heat of ice 80 cal/mole)

12. The Van der Waals' constant for hydrogen are $a = 0.247 \text{ atm litre}^2 \text{ per mole}^2$ and $b = 2.65 \times 10^{-2} \text{ litre per mole}$, find the temperature of inversion

13. A 100 Hz alternating current is flowing in a coil of inductance 7 mH . Calculate the reactance of the coil.

14. A solenoid of infinitely long and 3 cm in diameter. It has 10 layers of windings of 550 turns each and carries a current of 5 A . Calculate the magnetic field intensity at the center of solenoid.

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