END TERM EXAMINATION

FIRST SEMESTER [B.TECH] JANUARY 2024

Paper Code: BS-105	*Subject: Applied Physics-I*
Time: 3 Hours	*Maximum Marks: 60*

Note: Attempt five questions in all including Q.No.1 which is compulsory. Select one question from each unit. Symbols have their usual meanings. Assume missing data, if any.

Q1 Attempt all questions:

a) Show that work done for a perfect gas can be given by $W = Cv(T_i - T_f)$ for adiabatic process. [2]

b) Distinguish between displacement and conventional current. [2]

c) Find the resultant of superposition of two waves $Y_1 = 2 \sin \omega t$ and $Y_2 = 5 \sin(\omega t + 30^0)$. Symbols have their usual meanings. [2]

d) At what speed will an object of length 100 cm be measured as 50 cm to an observer at rest. [2]

e) Explain the difference between spatial and temporal coherence. [2]

f) Why the grating of large number of lines are preferred? [2]

UNIT-1

Q2 a) Prove that the entropy of an ideal gas remains constant in a reversible process. But it is increases in an irreversible process. [6]

b) State first law of thermodynamics and show that heat and work are path functions but their difference is a point function. [4]

c) Discuss continuum model of thermodynamics. [2]

Q3 a) Prove that the efficiency of a Carnot's engine depends only upon the two temperatures between which it works. [6]

b) What are the limitations of first law of thermodynamics. State second law of thermodynamics. [4]

c) A Carnot's refrigerator absorbs heat from water at 0^0 C and rejects it at room temperature 37^0 C. Calculate the amount of work required to convert 10 kg water at 0^0 C into ice at same temperature [latent heat of ice = 3.4×10^5 J/kg]. Also find the coefficient of performance of the refrigerator. [2]

UNIT-II

Q4 a) Prove that the speed of plane electromagnetic wave in isotropic dielectric is less than the speed of electromagnetic wave in free space. Also prove the orthogonality of E, H and k. [6]

b) Set up continuity equation and discuss its physical significance. [4]

c) Calculate the magnitude of pointing vector at the surface of the sun. Given that power irradiated by the sun = 3.8×10^{26} watt and radius of sun = 7×10^8 m. [2]

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Q5 a) Write maxwell's equation in integral and differential forms. Discuss in brief the physical meaning of each of these. Also derive Maxwell's third equation in differential form. [6]

b) Derive velocity and energy in SHM. Also give graphical representation of it. [4]

c) Calculate the skin depth for 3 MHz electromagnetic wave through copper. [given conductivity $\sigma = 6\times10^{7} mho/m$, $\mu = 4\pi\times10^{-7} Henry/m$]. [2]

UNIT-III

Q6 a) Explain the formation of fringes in Newton's ring experiment. Give its application to find out wavelength of light. [6]

b) Explain the phenomena of double refraction. Describe the working principle of a Nicol prism. How is Nicol prism used to produce circularly polarised light. [4]

c) Draw a labelled ray diagram depicting interference by biprism. [2]

Q7 a) Derive an expression for intensity of diffracted light in Fraunhofer diffraction at a single slit. [6]

b) Explain with a series of neat well labelled diagrams the functioning of the retarding plates: (i) Half wave plate (ii) Quarter wave plate. [4]

c) Each slit has a width of 0.15 mm and distance between their centre is 0.75 mm. What are the missing order. [2]

UNIT-IV

Q8 a) Describe Michelson Morley experiment. Explain its main conclusions. [6]

b) Using Lorentz transformation equations, prove that "Moving clocks appear to go slow". [4]

c) Deduce the expression $E=mc^2$. [2]

Q9 a) Discuss Einstein's transition probabilities and derive the relation between Einstein's A and B coefficients. [6]

b) Describe the working of He-Ne LASER, explain its energy level diagram. [4]

c) What is optical pumping? How does it help in achieving population inversion in a LASER. [2]

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