Name: Enrolment No: R171218043	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

Mid Semester Examination, September/ October 2018

Programme Name: B.Tech CS-CSF, Bigdata, OGI, Devops, AI+ML, OSOS & IOT **Semester** : I
Course Name : PHYSICS **Time** : 02 hrs
Course Code : PHYS1008 **Max. Marks** : 100
Nos. of page(s) : 02

Instructions:
1. **All questions are compulsory.**
2. **Draw suitable diagrams wherever required.**
3. **Your answer should be concise and to the point.**

SECTION A

S. No.		Marks	CO
Q1	Distinguish between a LASER and ordinary light. Define main components required for a LASER process.	7	CO1
Q2	A step index fibre has a core of refractive index 1.5 and a cladding of refractive index 1.47. The diameter of the core of the fibre is 100 μm, and the medium surrounding is air. Determine (a) NA of the fibre (b) angle of acceptance cone (c) limiting value of angle of refraction for the air-core interface for meeting the criteria of total internal reflection (d) Critical angle.	8	CO3
Q3	Demonstrate that the electric field is equal to the negative gradient of scalar potential.	8	CO2
Q4	Planes z = 0 and z = 4 carry current $\mathbf{K} = -10\hat{a}_x$ A/m and $\mathbf{K} = 10\hat{a}_x$ A/m, respectively. Determine **H** at (a) (1,1,1) (b) (0,-3, 10).	7	CO2

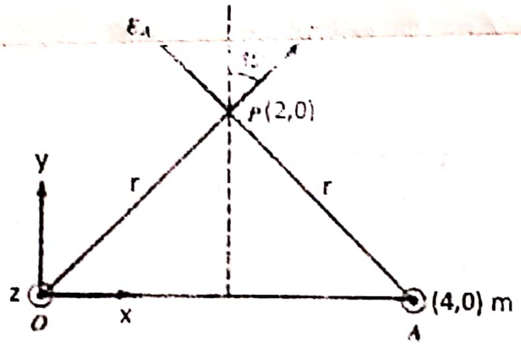
SECTION B (Q5 is having internal choice)

S. No.		Marks	CO
Q5	a. Describe in brief the construction and working of a Ruby LASER along with the energy level diagram. (5) b. The refractive indices of core and cladding of a fiber are 1.465 and 1.460, respectively and the light of wavelength 1.25 μm. is used. What should be the diameter of core for single mode propagation? If the core diameter is given as 50 μm, how many modes can propagate through this fiber? (10) **OR** a. Why a two-level LASER system is not possible? Explain the concept of meta-stable state. (5) b. At what temperature are the rates of spontaneous and stimulated emission equal? Assume λ= 5000 Å. (10)	15	CO1 CO3 CO1 CO3
Q6	a. Explain the construction and reconstruction process in a hologram. (10) b. Compute the attenuation in dB/km, if 15% of the power fed at the launching end of a ½ km fibre is lost during propagation. (5)	15	CO1 CO2

Q7	a. Employing Biot-Savart law, show that the magnetic field due to an infinite straight filamentary conductor is: $$H = \frac{I}{2\pi\rho}\widehat{a_\varphi}$$ (10) b. Suppose the current density in a wire is proportional to the distance from the axis, J= ks (for some constant k). Find the total current in the wire if its radius is 'a'. (5)	15	CO3 CO4

SECTION-C (Q8 is having internal choice)

Q8	a. Evaluate the boundary conditions that must be satisfied by the electric field intensity and the electric flux density for a dielectric-dielectric interface. Where ρ_s = 0, at the interface. **(10)** b. Using Gauss's Law, deduce an expression for electric flux density due to a point charge. (5) c. Given the points $P_1(2,2,-5)$ in Cartesian co-ordinates and $P_2(3,\pi, -2)$ in cylindrical co-ordinates. Find 1. The spherical co-ordinates of P_1. 2. The spherical co-ordinates of P_2. 3. The magnitude of the vector connecting P_1 (tail) to P_2 (head). (10)		CO2 CO3 CO3
	OR		
	a. Derive the electric field intensity due to a surface charge using Coloumbic formulation. (10) b. Prove that the bound volume charge density $\rho_{PV} = -\nabla . P$. (5) c. Two straight nonconducting wires, parallel to the z-axis, pass through points O and A, as shown in figure below. The wires carry equal and uniform charge density 0.2 μC/m. Determine the electric field at point P. (10)	(25)	CO2 CO3 CO3



Values of Constants:

Constant	Standard Values
Planck's Constant (h)	6.63 x 10^{-34} Joule-sec
Permittivity of free space (ε_o)	8.854 x 10^{-12} Farad/meter
Velocity of Light c	3 x 10^{8} m/sec
Boltzmann constant (k_B)	1.38 × 10^{-23} J K^{-1}
Rest mass of an Electron	9.11 x 10^{-31} Kg
Charge of electron	1.6x10^{-19} C