Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End term Examination, Oct 2019

Programme Name: B.Tech Mechanical Engineering — Semester : III
Course Name : Physics — Time : 03 hrs
Course Code : PHYS 2022 — Max. Marks: 100
Nos. of page(s) : 02

	SECTION A (20 marks) **All question of section A are compulsory**		
S. No.		**Marks**	**CO**
Q.1	Two interfering waves having intensities *x* and *y* meet at a point with time difference 3*T*/2. What will be the resultant intensity at that point?	4	CO4
Q.2	What do you mean by resolving power of a grating? Write the Rayleigh's criterion for limit of resolution.	4	CO4
Q.3	What do you understand by coherent sources? Discuss why two independent sources of light can never be coherent.	4	CO4
Q.4	Define the main components of laser.	4	CO5
Q.5	A plane diffraction grating has 5000 lines/cm & is used in normal incidence of light. If the width of the opaque part be double that of the clear part in the grating, then which orders of the spectrum will be absent?	4	CO1
	SECTION B (40 marks) **Q.6, Q.7 and Q.8 are compulsory while Q.9 has an internal choice**		
Q.6	[a] State the Fermat's principle and explain it with example. [b] Write the Fresnel equations. Explain the Brewster's angle and total internal reflection.	5+5= 10	CO3
Q.7	[a] The width of the single slit is 0.14mm. It is illuminated normally by monochromatic light and diffraction bands are seen on a screen placed 2m away. It is observed that the second dark band is 1.6 cm from the center of the central bright band. Calculate the wavelength of light? [b] Find the maximum order of spectrum visible in a diffraction grating for normal incidence of light wavelength 600nm and grating has 3000 lines per inch.	5+5= 10	CO4
Q.8	Define the Transverse impedance. Prove that $T = \rho v^2$. where T is the constant tension, ρ is the linear density and v is the transverse velocity in the string.	10	CO2
Q.9	What do you mean by interference of light? Derive the expression for the diameter of n^{th} bright and dark ring in Newton's ring experiment immersed in a liquid of refractive index 'μ'.	10	CO4

	OR [a] The distance between two slits is 0.12mm and the distance of the screen from the slits is 1.2 m. The wavelength of light used is 600nm. Find the fringe width of fringes formed on the screen. [b] A thin glass sheet of refractive index 1.5 is placed in the path of one interfering wave in the Fresnel's bi-prism. It is observed that the central bright fringe moves to the position occupied by the third bright fringe without the glass sheet. The wavelength of light waves is 580 nm. Find the thickness of glass sheet.		
SECTION-C (40 marks) **Q.10 is compulsory while Q.11 has an internal choice.**			
Q.10	[a] Explain the spontaneous and stimulated emission of radiation. Obtain a relation between Einstein's coefficients A and B. [b] Calculate the ratio of the population of two energy states of Ruby Laser, the transition between which is responsible for emission of photons of wavelength 6928 A^0. Assume the transition temperature to be 18 K. [c] Define the laser and explain the two applications of Laser beam.	10+5+ 5=20	CO5
Q.11	[a] Calculate the power loss in damped oscillator. A particle is oscillating under a damping force, show that the average power loss is given by $P = \frac{E}{\tau}$, where E is the average energy and τ is the relaxation time. [b] Discuss overdamping, critical damping and underdamping. Define relaxation time of a damped oscillator. If ω_0 is the natural frequency and τ is the relaxation time, prove that the quality factor is given by $Q = \omega_0 \tau$. **OR** [a] A particle executes simple harmonic motion, then estimate the following (i) what fraction of total energy is kinetic and what frication is potential when displacement is one half of the amplitude (ii) at what displacement the kinetic and potential energies are same? [b] Explain the simple harmonic motion with two examples. If two SHMs are represented by equations $y_1 = 5[\sin\{2\pi t+(\pi/6)\}]$ and $y_2 = 5[\sin(3\pi t)+\sqrt{3}\cos(3\pi t)]$, find the ratio of their amplitudes.	10+10	CO1