Name: Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

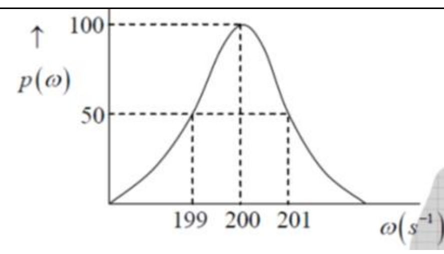
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Online End Semester Examination, Dec 2020

Course: Physics — Semester : III
Program: B.Tech Mechanical Engineering — Time : 03 hrs.
Course Code: PHYS 2022 — Max. Marks: 100

Quantity	Values
Magnetic Constant (Vacuum Permeability) (μ_0)	1.25×10^{-6} N·A^{-2}
Electric Constant (Vacuum Permittivity) (ε_0)	8.85×10^{-12} F·m^{-1}
Elementary Charge	1.60×10^{-19} C

SECTION A

1. Section A is consist of six questions and each question of 5 marks.
2. All the questions are compulsory

S. No.		Marks	CO
Q.1	If two SHMs are represented by equations $y_1 = 5\,sin\left\{3\pi t + \frac{\pi}{6}\right\}$ and $y_2 = 5\left[sin\{3\pi t\} + \sqrt{3}\cos\{3\pi t\}\right]$, find the ratio of their amplitudes. [a] $\frac{1}{2}$ [b] $\frac{2}{3}$ [c] $\frac{3}{4}$ [d] $\frac{4}{5}$	5	CO1
Q.2	The graph shows the power resonance curve of a certain mechanical system, which is, drives by a force of constant magnitude but variable frequency ω. What will be the quality factor of the system?  [a] 50 [b] 100 [c] 150 [d] 200	5	CO1
Q.3	The amplitude of a damped oscillator becomes half in one minute. The amplitude after 3 minute will be $\frac{1}{X}$ times the original, where X is (a) 2×3 (b) 2^3 (c) 3^2 (d) 3×2^2	5	CO1
Q.4	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. [a] 14 [b] 15 [c] 16 [d] 17	5	CO4

Q.5	A light of wavelength 500nm is incident normally on a single slit. It is observed that the central band spreads out at 30° on each side of the incident light direction. Find the width of the slit. [a] 10^{-4} m [b] 10^{-5} m [c] 10^{-6} m [d] 10^{-7} m	5	CO4
Q.6	A laser beam has a power of 100 mW. It has an aperture of 10 mm and wavelength of 14400 Å. A beam is focused with a lens of focal length 0.1 m. Calculate the intensity of image. [a] 48.2 x 10^7 W/m^2 [b] 4.82 x 10^7 W/m^2 [c] 48.2 x 10^6W/m^2 [d] 4.82 x 10^6 W/m^2	5	CO5

SECTION B

1. Section B containing five questions and each of 10 marks.
2. All the questions are compulsory.

Q.1	[a] Write the Fresnel's equations. Give it physical significance also. **[b]** Calculate the coefficient of reflection and transmission at a boundary (interface) of two media in normal incidence.	5+5= 10	CO3
Q.2	**[a]** Define the phase and group velocity. Find the relation between Phase and Group Velocity for dispersive and non-dispersive medium. **[b]** The phase velocity of ripples on a liquid surface is $\sqrt{\frac{2\pi S}{\rho\lambda}}$, where S is the surface tension and ρ is the density of the liquid. Find the group velocity of the ripples.	5+5= 10	CO2
Q.3	**[a]** Explain the effect of pressure, temperature, density, humidity on velocity of sound. **[b]** Find the temperature at which sound travels in hydrogen with the same velocity as in oxygen at 1000°C. Assume the ratio of specific heats to be the same for the two gases. Molecular weights of oxygen and hydrogen are 32 and 2 respectively.	5+5= 10	CO2
Q.4	Write the Fermat is Principle and explain it with at least one example. Derive the laws of reflection and refraction by using Fermat's principle.	10	CO3
Q. 5	**[a]** Explain the Ruby laser and He-Ne laser with the energy level diagrams. Write any two applications of lasers in science and engineering. **[b]** The transition between which is responsible for emission of photons of wavelength 6928 A°. Assume the transition temperature to be 18 K.	5+5= 10	CO5
	SECTION-C		

	1. Section C is consists of one question of 20 marks. 2. In section C, choice is also given.		
Q. 1	**[a]** Derive the expression for the dispersive power and resolving power of the diffraction grating. Explain the dependence of these powers on various parameters of the grating? **[b]** A thin glass sheet of refractive index 1.5 is placed in the path of one interfering wave in the Fresnel's biprism. 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. **OR** **[a]** In relation to plane transmission grating having 5000 lines per cm, answer the following [i] The longest wavelength of light for which spectrum can be observed [ii] The highest order of spectrum that can be observed with light of wavelength 6000A [iii] If opaque spaces are exactly two times the transparent spaces, which order of the spectra shall be missing? [iv] If 90% of grating space is covered, what shall happen to spectrum? **[b]** Explain the interference by division of amplitude. A soap film of refractive index of 1.33 is illuminated with light of different wavelengths at an angle of 45^0. Find the thickness of the soap film for complete dark fringe with the light of wavelength of 589 nm.	10+10 = 20	CO4