

This question paper contains 4 printed pages.

3257

Your Roll No.....

B.Tech. (M) / I

J

(Part Time)

PAPER II - PHYSICS I

(EME - 102)

Time : 3 hours

Maximum Marks : 70

*(Write your Roll No. on the top immediately
on receipt of this question paper.)*

Attempt any five questions.

All questions carry equal marks

Assume missing data suitably, if any.

1. a) What do you mean by 'time dilation' ? Obtain the necessary relation and hence explain the concept of 'twin paradox'. 05
- b) Obtain Einstein mass-energy relation and explain its significance. 05
- c) A rocket of length 100m takes off from the ground. At what speed will an observer on the ground, observe its length to be 99m ? 04
- 2 a) Define monochromaticity and estimate its value for laser light and ordinary light. Which of these two lights is more monochromatic ? 04
- b) What is 'population inversion' ? Why it is essential for the working of laser ? Name the process employed for achieving population inversion and its various methods briefly describing them. 06

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- c) In output of a laser has a pulse duration of 30ms and average output power of 5W per pulse. How much energy is released per pulse and how many photons does each pulse contain? (Take $\lambda = 6000\text{\AA}$) 04
- 3 a) What do you mean by 'magnetostriction'? Explain how this effect can be utilized for the production of ultrasonic waves. Briefly discuss any three important applications of ultrasonic waves. 08
- b) Differentiate between conductors, semiconductors and insulator on the basis of band theory of solids. How conductivity is dependent on temperature in these three types of solids. 06
- 4 a) Define 'interference' and mention the conditions required for the production of sustained interference patterns. 04
- b) Obtain the conditions for brightness and darkness in Newton's rings experiment for the reflected light. Mention any two applications of Newton's rings experiment. 07
- c) A non - reflecting coating for the incident light of wavelength 5500\AA is to be deposited. If the refractive index of the coating material is 1.35, what should be the minimum thickness of the coating? 03
- 5 a) Differentiate between Fresnel and Fraunhofer Diffraction. 03

HOTS

- b) Define resolving power and chromatic resolving power. Obtain an expression for the chromatic resolving power of a diffraction grating and draw important inferences from the expression. 08
- c) What is the highest order spectrum which may be seen with monochromatic light of wavelength 5000\AA by means of a diffraction grating with 5000 lines/cm? 03
- 6 a) What do you mean by 'double refraction'? Explain why glass does not show double refraction but calcite crystal does? 04
- b) Explain how nicol prism can be used to obtain plane polarised light. How another nicol prism can be used to analyse the so produced light? Discuss. 06
- c) What is a quarter wave plate? What should be its thickness for a light of wavelength 5890\AA if $\mu_E = 1.553$ and $\mu_o = 1.544$? 04
- 7 a) What is photoelectric effect? Write Einstein relation for photoelectric effect and explain how the laws of photoelectric effect can be explained using this relation. 07
- b) What are the characteristics of simple harmonic motion? Show that the total energy in S.H.M remains constant throughout and is independent of both displacement and time. 07

8. Write short notes on any FOUR of the followings :

- (i) Nuclear fusion and fission
- (ii) Nuclear Reactor
- (iii) X - rays : production and properties
- (iv) Electron microscope
- (v) Michelson - Morley Experiment,
- (vi) Polarimeters.

$$3.5 \times 4 = 14$$