

**R18**

Code No: 151AB

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year I Semester Examinations, December – 2019/January - 2020

ENGINEERING PHYSICS

(Common to CE, ME, MCT, MMT, AE, MIE, PTM)

Time: 3 hours

Max. Marks: 75

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b as sub questions.

**PART - A**

**(25 Marks)**

- 1.a) What are the different types of forces in nature? [2]
- b) Explain simple harmonic motion. Explain the term phase of a simple harmonic oscillator. [2]
- c) Write the characteristics of transverse waves. [2]
- d) Write the principle of superposition of waves. [2]
- e) What is population inversion in a laser? How it is achieved? [2]
- f) Discuss the types of friction. [3]
- g) What are the characteristic elements of a mechanical oscillator? Give their electrical equivalent. [3]
- h) A tuning fork of frequency 1000Hz produces a wave of wavelength 20 cm in air. Calculate the velocity of sound in air. [3]
- i) There are 15000 lines per inch in a grating. What is the maximum number of orders obtained by using light of wavelength  $6000\text{\AA}$ ? [3]
- j) The refractive indices of core and cladding of a step index optical fibre are 1.563 and 1.498 respectively. Calculate the numerical aperture. [3]

**PART - B**

**(50 Marks)**

- 2.a) Derive the expression of  $F=ma$ , in polar coordinates.
  - b) Two particles of masses  $m_1$  and  $m_2$  are interconnected by a light inextensible string which passes over the smooth pulley. If the system is released the particles move. Find the tension in the string? [5+5]
- OR
- 3.a) Obtain rotation matrix of a vector in three dimension.
  - b) A 30Kg block is to be moved up an inclined plane at an angle  $30^\circ$  to the horizontal with a velocity  $5\text{ms}^{-1}$ . If the frictional force retarding the motion is 150N. Find the horizontal force required to move the block up the plane ( $g=10\text{ms}^{-2}$ ). [5+5]
- 4.a) Solve the differential equation of a damped harmonic oscillator.
  - b) Investigate the conditions under which the oscillations are said to be under damped, over damped. [5+5]

OR

- 8R 8R 8R 8R 8R 8R 8R 8R
- 5.a) Obtain the expressions for mechanical impedance and electrical impedance.  
b) Show that the power absorbed by a driven oscillator from the driving force is maximum at velocity resonance. [5+5]

- 8R 8R 8R 8R 8R 8R 8R 8R
- 6.a) Obtain the general wave equation on a string.  
b) Discuss the phenomena of reflection and transmission of transverse wave at the boundary. [5+5]

OR

- 7.a) Obtain Eigen frequencies for standing waves in strings.  
b) Explain the production of standing waves in open pipe and obtain over tone frequencies. [5+5]

- 8R 8R 8R 8R 8R 8R 8R 8R
- 8.a) Describe Young's double slit experiment.  
b) Explain the formation of Newton's rings. Deduce the conditions for bright and dark fringes. [5+5]

OR

- 9.a) Describe the theory and construction and working of Mah-Zehnder interferometer.  
b) Explain with theory the Fraunhofer diffraction due to a single slit and deduce the position of minima and maxima. [5+5]

- 8R 8R 8R 8R 8R 8R 8R 8R
- 10.a) Explain with neat diagram the principle and working of a ruby laser. [5+5]  
b) Write the medical applications of lasers.

OR

- 11.a) Distinguish between step index and graded index fibres with the help of refractive index profile. [5+5]  
b) Explain the advantages of optical fibre communication.

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