Time: 1h

FM-10

Answer any two questions from the following:

2x5=10

1. Find the average energy per unit volume of a progressive wave.

   Prove that $\psi = A\ \text{expi}(\omega t - kx)$ is a solution of the wave equation moving along +x direction.

2. Derive the equation of the resultant motion for the superposition of N numbers of simple harmonic motions having the same amplitude A and the same angular frequency ω, but equal successive phase difference δ. Obtain the expression of resultant amplitude and phase angle.

3. Three simple harmonic motions of the same frequency act on a particle simultaneously in the same direction. Their amplitudes 1.0, 1.5, and 2.0 cm respectively. The phase angle of the second with respect to the first is 60°, and that of the third with respect to the second is 30°. Obtain the resultant amplitude and phase angle relative to the first.
   The displacement equation for a transverse plane wave at any instant is
   $$y(x,t)=0.\ 03\sin(3\pi t - 0.03\pi x)$$
   where x and t are in metres and seconds. Calculate the wavelength, frequency and velocity of the wave and also the phase difference between two particles 0.05m apart at the same instant.