Instructions: i) All the answers must be in the same order.
ii) Scientific calculators are allowed.

Section-A

Answer all the questions **5x1M=5M**

1. Sound travels fastest in ( )
   a) Vacuum **b)** Air **c)** Water **d)** Steel
2. Two strings P and Q, made of the same material, have equal lengths. The cross section area of P is half that of Q while the tension on P is twice that on Q. The ratio of velocities of transverse waves in P and Q is ( )
   a) $\sqrt{2}:1$ **b)** $1:\sqrt{2}$ **c)** 2:1 **d)** 1:2
3. Find the change in focal length of a convex lens of focal length 20cm when it is immersed in water. The refractive index of glass and water are 3/2 and 4/3 respectively. ( )
   a) 60 cm **b)** 80cm **c)** 20cm **d)** no change
4. A concave mirror gives an image three time as large as the object placed at a distance of 20 cm from it. For the image to be real, the focal length should be (with sign convention) ( )
   a) +15cm **b)** -15cm **c**)+30cm **d)** -30cm
5. The phenomenon used in optical fibers for transmission of light energy is ----------

Section-B

Answer any two questions **2x5M= 10M**

6.a) What is Doppler effect? Obtain an expression for the apparent frequency of sound heard when the source is in motion with respect to an observer at rest.**(3M)**

b) Rocket is moving at a speed of 198 m/s towards a stationary target. while moving it emits a wave of 1500Hz.Calculate the frequency of sound as detected by the target. (Speed of sound in air is 330m/s)**(2M)**

7.a) Derive an expression for Lens maker's formula.**(3M)**

b) The distance between two point sources of light is 24 cm. where should you place a converging lens, of focal length 9 cm, so that the images of both sources are formed at the same point.**(2M)**

8.a) Explain the formation of stationary waves in an open pipe. Derive the expressions for first three harmonics.**(3M)**

b) Two sitar strings **A** and **B** playing the note 'Ga' are slightly out of tune and produce beats of frequency 6Hz. The tension in the string **A** is slightly reduced and the beat frequency is found to reduce to 3Hz. If the original frequency **A** is 324Hz. What is the frequency of **B**?**(2M)**

All the best