Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
		Important Instructions to examiners: 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme. 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate. 3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills). 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn. 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer. 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding. 7) For programming language papers, credit may be given to any other program based on equivalent concept.		

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
1		Attempt any **Nine** of the following:		17
	a)	State Elasticity and Plasticity property.		
		Each definition-	1	2
		Elasticity: Elasticity is defined as a property of the body by virtue of which it tends to regain its original shape or size on removal of deforming forces.		
		Plasticity: Plasticity is defined as a property of the body by virtue of which it does not regain its original shape or size on removal of deforming forces.		
	b)	Give relation between Bulk modulus of elasticity and compressibility.		
		Compressibility is the reciprocal of Bulk modulus of elasticity. OR Compressibility = 1/ Bulk modulus	2	2
	c)	What is atmospheric pressure? State S.I. unit of pressure.		
		Atmospheric pressure-		
		Unit-	1	
		Atmospheric pressure: The pressure exerted by the atmosphere is called Atmospheric pressure. OR Atmospheric pressure at a point is the weight of the air column of unit cross sectional area and height extending up to top of the atmosphere.	1	2
		S.I. Unit of pressure is N/m^2 or Pascal.		

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
1)	d)	A rain drop with radius 0.2 mm is falling through air with terminal velocity v. Calculate v if coefficient of viscosity of air is 1.8×10^{-4} Ns/m^2 and viscous force is 0.14 dyne. **Formula and substitution-** **Answer with unit-** **Given:** $r = 0.2$ mm $= 0.2 \times 10^{-3}$m. $\eta = 1.8 \times 10^{-4}$ Ns/m^2. $F = 0.14$ dyne $= 0.14 \times 10^{-5}$N. $V = ?$ Formula: $F = 6\pi\eta rv$ $\therefore \quad v = \frac{F}{6\prod \eta r v}$ $\therefore \quad v = \frac{0.14\times10^{-5}}{6\times3.14\times1.8\times10^{-4}\times0.2\times10^{-3}}$ $\therefore \quad v = \frac{0.14\times10^{-5}}{6.78\times10^{-7}}$ $\therefore \quad v = 0.0206 \times 10^2$m/s $\therefore \quad v = 2.06$ m/s	1 1	2

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
1)	e)	Define surface tension.Write down its S.I. unit. **Defination-** **Unit-** Defination: The force acting per unit length of an imaginary line drawn to surface of liquid. OR The surface tension is defined as the property of liquids by virtue of which the surface of a liquid is under constant tension due to the tendency to contract and occupy minimum surface area. S.I. unit of surface tension is N/m	1 1	2
	f)	What is Kelvin-scale of temperature? State absolute zero. **Kelvin-scale of temperature-** **Absolute zero-** **Kelvin-scale of temperature:** In this scale, the lower fixed point is 273^0K and upper fixed point is 373^0K and it is then divided into 100 equal parts, each part called as degree Kelvin. **Absolute zero-** Absolute zero temperature = 0^o A = – 273^o C	1 1	2

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
1)	g)	Define the two principal specific heats of gas **Each definition-** **Specific heat of a gas at constant volume-** Specific heat of a gas at constant volume is defined as the amount of heat required to increase the temperature of unit mass of a gas by one degree at constant volume. **Specific heat of a gas at constant pressure-** Specific heat of a gas at constant pressure is defined as the amount of heat required to increase the temperature of unit mass of a gas by one degree at constant pressure.	1	2
	h)	Define isothermal change and adiabatic change. **Each definition-** **Isothermal change :** The process in which volume of a gas changes keeping its temperature constant is called isothermal change. **Adiabatic change :** The process in which volume of a gas changes with change in temperature is called Adiabatic change.	1	2

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
1)	i)	Define phase angle and Epoch in S.H.M. **Each definition-** **Phase angle**: - The angle which gives position , direction & displacement of the particle in S.H.M.at any instant is known as phase angle. **Epoch** : - Initial phase angle or starting phase is known as epoch.	1	2
	j)	State one example each of Longitudinal wave and Transverse wave. **One Example of each type** **Longitudinal wave:-** E.g. Sound wave , waves set in organ pipe, waves set in Kundt's tube etc. **Transverse wave :** - E.g. Light waves, electromagnetic waves , vibrations produced by stretched string of sitar, guitar, violin , sonometer etc	1	2

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
1	k)	**State how stationary wave is formed.** When progressive waves travelling through a medium are incident on a rigid surface, they are reflected with a phase change of 'π' radians. The reflected waves have same amplitude and wavelength as the incident waves, but opposite direction. Due to superposition of these two waves the resultant disturbance produced in the medium is called stationary waves or standing waves. **OR** Stationary waves are produced when two exactly identical progressive waves (having same amplitude, same wavelength and same speed) travelling through a medium along the same path in exactly opposite directions, interfere with each other.	2	2
	l)	**Give condition for 'Resonance effect' in sound.** **Condition for 'Resonance effect':-** When the frequency of the external periodic force applied to a body is exactly equal to(matches) natural frequency of body, the body vibrates with maximum amplitude, then resonance effect takes place.	2	2
2		Attempt any **Four** of the following:		16
	a)	Define i) Yield point ii) Ultimate stress iii) Breaking stress iv) Factor of safety in Elasticity. **Each definition**	1	4

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
2)	a)	i) **Yield point** :- The point on stress-strain curve at which plastic flow begins is called yield point Y. ii)**Ultimate Stress :** It is defined as the ratio of maximum load that the specimen (system) can withstand to original cross-sectional area of specimen. iii) **Breaking stress** : The maximum stress at which the wire breaks is called breaking stress. iv)**Factor of Safety :** It is defined as the ratio of ultimate stress to working stress.		
	b)	Calculate Young's modulus of elasticity for a wire having length 100 cm & diameter 5 mm. The wire elongates by 2 mm when subjected to a load of 10 N. **Formula** **Substitution and Calculation** **Answer with unit** **Given:** L = 100 cm = 1 m D = 5 mm r = D/2 = 5/2 = 2.5 mm = 2.5×10^{-3} m l = 2 mm = 2×10^{-3} m F = 10 N	1 1 2	4

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
2	b)	**Formula** $Y = \frac{F.L}{\prod r^2 l}$ $Y = \frac{10 \times 1}{3.14 \times (2.5 \times 10^{-3})^2 \times 2 \times 10^{-3}}$ $Y = 0.254 \text{ X } 10^9$ $Y = 2.54 \text{ X } 10^8 \text{ N/m}^2.$		
	c)	State significance of Reynold's number in viscosity. **Significance :** (1) When R is less than 2000 → Liquid flow is streamline. (2) When R is between 2000 to 3000 → Liquid flow is unstable. (3)When R is greater than 3000 → Liquid flow is turbulent.	4	4
	d)	State (i) Pascal's Law and (ii) Archimedes Principle. **Pascal's Law-** **Archimedes Principle-**	2 2	4

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
2)	d)	**Pascal's Law-** Pascal's law states that, in an enclosed liquid, if pressure is applied at any part of the liquid, then this change of pressure is transmitted undiminished to every portion of the liquid and to the walls of its container. **Archimedes Principle-** It states that when a solid insoluble body is immersed completely or partly in a liquid, it loses its weight and loss of weight of the body is equal to the weight of displaced liquid.		
	e) i)	Give two examples of capillarity phenomenon. **Each example of capillarity** (1) Oil rises up to the end of wick of lamp due to capillarity. (2) The water and minerals sucked by roots reaches upto leaves of tree or plant due to capillarity. (3) A blotting paper absorbs ink due to capillarity. (4) Rise of ink through pen nib. **Note: Any relevant examples should be considered.**	1	2
	ii)	State the effect of temperature and contamination on surface tension of liquid. **Effect of temperature** **Effect of contamination**	1 1	2

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
2)	e) ii)	**Effect of Temperature on Surface tension:** The Surface tension of the liquid depends on temperature. Surface tension decreases with increases in temperature. $\text{Surface tension} \propto \frac{1}{\text{temperature}}$ **Effect of contamination** In most of the liquid Surface tension decreases with increase in contamination. $\text{Surface tension} \propto \frac{1}{\text{Contamination}}$		
	f)	A window pane with glass material has dimension 100 cm x 50 cm x 5mm.Amount of heat conducted in one hour is Q. Calculate Q if the temperature difference is 5^0C between outside and inside.(K for glass = 1W/m/^{0}K).		
		Formula	1	
		Substitution and Calculation	1	
		Answer with unit	2	4
		Given: $A = 100 \text{ cm} \times 50\text{cm} = 5000 \text{ cm}^2 = 5000 \times 10^{-4} \text{ m}^2$ $d = 5\text{mm} = 5 \times 10^{-3} \text{ m}$ $t = 1 \text{ hr} = 60 \times 60 \text{ sec.} = 3600 \text{ sec.}$ $(\theta_1 - \theta_2) = 5^0\text{C}$ $K = 1\text{W/m/}^0\text{K}$		
		Formula $Q = \frac{KA(\theta_1 - \theta_2)t}{d}$		

<table>
<tr><th>Que. No.</th><th>Sub. Que.</th><th>Stepwise Solution</th><th>Marks</th><th>Total Marks</th></tr>
<tr><td>2)</td><td>f)</td><td>$Q = \frac{1 \times 5000 \times 10^{-4} \times 5 \times 3600}{5X10^{-3}}$
$Q = 1.8 \times 10^{6}$ J</td><td></td><td></td></tr>
<tr><td>3)</td><td></td><td>Attempt any four of the following</td><td></td><td>16</td></tr>
<tr><td></td><td>a)</td><td>Distinguish conduction, convection and radiation process.
Any four points-
<table>
<tr><th>conduction</th><th>convection</th><th>radiation</th></tr>
<tr><td>1. It is the process of transfer of heat from a part of a body at higher temperature to a part of body at lower temperature without actual movement of particles.</td><td>1. It is the process of transfer of heat from a part of a body at higher temperature to a part of body at lower temperature with actual movement of particles.</td><td>1. It is the process of transfer of heat from a body at higher temperature to a body at lower temperature without necessity of intervening medium</td></tr>
<tr><td>2 If metal rod is heated at one end, its other end gets heated.</td><td>2. Heating of water in a beaker.</td><td>2. Heat from sun reaches the earth.</td></tr>
<tr><td>3. Material medium is essential.</td><td>3. Material medium is essential.</td><td>3. Material medium is not essential.</td></tr>
<tr><td>4. Metal rod itself acts as a medium.</td><td>4. Liquid itself acts as a medium.</td><td>4.Medium may be present like air or no medium. i.e. vacuum.</td></tr>
</table></td><td>4</td><td>4</td></tr>
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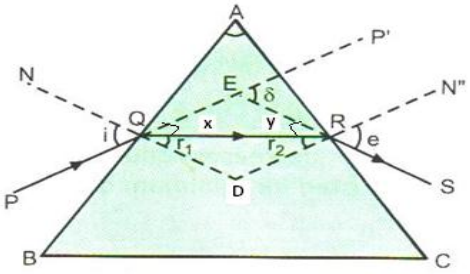
Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
3)	a)			

5.It has applications like-Heat sink in electronic circuits, Safety lamp, Ice box etc.	5. It has applications like-Formation of trade winds, Room ventilation system, monsoons etc.	5. It has applications like-Use of white clothes, Heat radiators in car, In activation of HIV etc.

	b)	State Boyle's law, Charle's law and Gay-Lussac's law. Write general gas equation. **Each law-** **Equation-** **Boyle's law: -** For fixed mass of a gas, temperature of a gas remaining constant, its pressure is inversely proportional to its volume. **Charle's Law**: For fixed mass of a gas, pressure of a gas remaining constant, its volume is directly proportional to its absolute temperature.	1 1	4

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
3)	b)	**Gay Lussac's Law: -** For fixed mass of a gas, volume of a gas remaining constant, its pressure is directly proportional to its absolute temperature. **Equation-** $PV = RT$ Where, P = Pressure. V = Volume. R = Universal gas constant. T = Temperature.		
	c)	For a step index optical fiber fractional change of refractive index is 0.0005.If core refractive index is 1.5, calculate the numerical aperture of the optical fiber. **Formula** **Substitution and Calculation** **Answer with unit** **Given** $\mu_{core} = 1.5$ $\mu_{clad} = 1.5\text{-}0.0005 = 1.4995$ $N_A = ?$.	1 1 2	4

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
3)	c)	**Formula –** $N_A = \sqrt{\mu^2_{core} - \mu^2_{clad}}$ $N_A = \sqrt{(1.5)^2 - (1.4995)^2}$ $N_A = \sqrt{2.25 - 2.2485}$ $N_A = \sqrt{1.5 \times 10^{-3}}$ $N_A = 10^{-2}\sqrt{15}$ $N_A = 3.87 \times 10^{-2}$		
	d)	Draw a neat labeled ray diagram for refraction in case of prism. State the Prism formula. **Diagram with label-** **Prism formula with notation-** **Diagram**  PQ = Incident ray QR = Refracted ray RS = Emergent ray i = Angle of incidence r_1 = Angle of refraction e = Angle of emergence δ = Angle of deviation r_2 = Angle of refraction ∠ BAC = Angle of prism	2 2	4

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
3)	d)	**Prism formula-** $\mu = \frac{\sin\left(\frac{A+\delta m}{2}\right)}{\sin\left(\frac{A}{2}\right)}$ Where, μ = refractive index of material of prism. A = Angle of prism. δ_m = Angle of minimum deviation.		
	e)	Define Progressive wave. State types of Progressive wave. Define the types. **Each definition-** **Naming of types-** **Progressive wave-** The wave which continuously travels in a given direction is called progressive wave. **Types of Progressive wave-** i) Transverse wave. ii) Longitudinal wave. i) **Transverse Wave: -** The wave in which the direction of vibration of particles of material medium is perpendicular to the direction of propagation of wave is called transverse wave.	1 1	4

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
3)	e)	**ii) Longitudinal Wave: -** The wave in which the direction of vibration of particles of material medium is parallel to the direction of propagation of wave is called longitudinal wave.		
	f)	In resonance experiment the resonance occur for fundamental mode with frequency of tuning fork 512 Hz. If the length of air column is 15.5 cm., calculate the velocity of sound neglecting the end correction. **Formula** **Substitution and Calculation** **Answer with unit** **Given** n = 512 Hz. L = 15.5 cm.= 15.5 x 10^{-2}m V =? **Formula –** V = 4nL V = 4 x 512 x 15.5 x 10^{-2} V = 31744 x 10^{-2} m/s V = 317.44 m/s	1 1 2	4