Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
		Important Instructions to the 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 the candidate and those in the 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 the model answer. 6) In case of some questions credit may be given by judgment 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**:		18
	a)	**State the effect of any two factors on Elasticity of material.**		2
		Two factor	2	
		Factors affecting elasticity: i) **Effect of stress**: As the stress on the body increase , elasticity of the body decreases gradually. ii) **Effect of temperature**: Generally a rise in temperature shows decrease in elastic properties of the metals. iii) **Effect of hammering and rolling** : Hammering and rolling increases elastic properties of crystals. iv) **Effect of annealing**: Annealing process results in decrease in elastic properties. v) **Effect of impurities** : Addition of impurity increases elastic properties		
	b)	**Calculate stress if a load of 10 N is attached to the lower end of the wire of radius 1mm.**		2
		Formula	1	
		Answer with unit	1	
		Given: Required: F = 10 N Stress = ? $r = 0.5 \times 10^{-3}$ m $\text{Stress} = F / \text{area} = F / \pi r^2$ $\text{Stress} = 10 / 3.14 \times (0.5 \times 10^{-3})^2$ $\text{Stress} = 1.273 \times 10^{7}\ N/m^2$		

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Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
1)	c)	**Define velocity gradient and state its SI unit.**		2
		Definition	1	
		SI unit	1	
		Velocity gradient: It is defined as the ratio of change in velocity of the layer to change in distance from fixed layer.		
		Unit --- per seond OR 1 / sec		
	d)	**Calculate the pressure of water having density 1000 kg/ m^3 at a depth of 20 m inside the water.(g – 9.8 m /s^2)**		2
		Formula	1	
		Answer with unit	1	
		Given : Required:		
		ρ = 1000 kg / m^3 P = ?		
		h = 20 m		
		g = 9.8 m /s^2		
		$P = h \rho g$		
		P = 20 x 1000 x 9.8		
		P = 196000 Pa		
	e)	**Give two examples of capillary action.**		2
		Each example of capillarity	1	
		(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.		

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
1)	f)	**Define i) kcal ii) Absolute zero** **Each definition** **Kcal:** One kilocalorie of heat is defined as the amount of heat energy required to increase the temperature of one kilogram of water through 1^0 C. **Absolute zero** : It is defined as the temperature at which the pressure and volume of the gas theoretically becomes zero.	1	2
	g)	**Explain why C_p is greater than C_v ?** **Proper explanation** C_v is the specific heat of gas at constant volume. It is utilized only to increase the **temperature** of the gas only. **But** C_p is the specific heat of a gas at constant pressure. It is utilized by two way i.e. To increase the temperature of the gas and to maintain constant pressure (i.e. increase in volume) Therefore C_p is greater than C_v .	2	2

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
1)	h)	**Define specific heats of gas at constant pressure and volume.**		2
		Each definition-	1	
		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.		
	i)	**The velocity of wave is 300 m /s and wavelength is100 cm. Calculate its frequency**.		2
		Formula	1	
		Answer with unit	1	
		Given : Required:		
		v =300 m/s n =?		
		λ = 100 cm – 100 x 10^{-2} m		
		$v = n\lambda$		
		$n = v / \lambda$		
		$n = 300 / 100 \times 10^{-2}$		
		n = 300 Hz		

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
1)	j)	**Define Transverse Wave and Longitudinal Wave.**		
		Each definition	1	2
		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.		
		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.		
	k)	**State two characteristics of stationary waves**.		2
		Any two characteristics	2	
		Characteristics : i) It is superposition of two progressive waves moving in opposite direction in a medium. ii) There is no transfer of energy in a medium. iii) Nodes and antinodes are formed successively. iv) Nodes are the points on the wave whose displacement is zero. v) Antinodes are the points on the wave whose displacement is maximum. vi) The distance between two successive nodes or antinodes is $\lambda/2$. vii) The distance between two successive nodes and antinodes is $\lambda/4$.		

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
1	l)	**Define Resonance.**		2
		Definition	2	
		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, the effect is known as resonance		
		Attempt any Four of the following:		
2				**16**
	a)	**Find the weight attached to the lower end of a wire having length 150 cm, radius 0.3 mm and extension produced is 0.6 mm if Young's modulus of wire is 2 x 10^{11} N/m^2.**		4
		Formula	1	
		Substitution and Calculation	1	
		Answer with unit	2	
		Given: Required :		
		L = 150 cm = 150 x 10^{-2} m W = F = Mg = ?		
		r = 0.3 mm = 0.3 x 10^{-3} m		
		l = 0.6 mm = 0.6 x10^{-3} m		
		Y = 2 x 10^{11} N		

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
2)	a)	**Formula** $Y = F.L / A.l$ $F = \pi r^2 l\, Y / L$ $F = 3.14 \times (0.3 \times 10^{-3})^2 \times 0.6 \times 10^{-3} \times 2 \times 10^{11} / 150 \times 10^{-2}$ $F = 22.60$ N $W = 22.60$ N		
	b)	**Define** **i) Elastic limit ii) Yield point** **iii) Poisson's ratio iv) Factor of safety .** **Each definition** **i)Elastic limit: -**It is the maximum value of the stress upto which the body shows elasticity. **ii) Yield point :-** The point at which plastic flow begins is called yield point Y. **iii) Poisson's ratio :** It is defined as the ratio of lateral strain to longitudinal strain. **iv)Factor of Safety :** It is defined as the ratio of ultimate stress to working stress. .	1	4

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
2	c)	**State Newton's law of viscosity and hence define coefficient of viscosity. Give it's SI unit.**		4
		Statement	2	
		Definition	1	
		Unit	1	
		Newton's law of viscosity: The viscous force (F) developed between two liquid layers is **i.** directly proportional to surface area of liquid layer, (A) i.e. [F α A] **ii.** directly proportional to Velocity Gradient, (dv/dx) i.e. [F α (dv/dx)]		
		Coefficient of viscosity: "Coefficient of viscosity of a liquid is defined as the viscous force developed between two liquid layers of unit surface area & unit velocity gradient." **SI unit of Coefficient of viscosity is N-s/m^2**		
	d)	**Distinguish between streamline and turbulent flow (four points).**		4
		Four points	4	

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
2)	d)	(table below)		

Stream line flow	Turbulent flow
The path of every particle is same	The path of every particle is different
The velocity of particle is constant in magnitude and direction	The velocity of particle at each point is not constant
Flow is regular	Flow is irregular
No circular currents or eddies are developed	Random circular currents called vertices are developed
The liquid flows steadily	The flow becomes turbulent after critical velocity.
e.gThe flow of liquid through pipe, water flow of river in summer etc.	e.g flow of river in flood, water fall etc.
$V < V_c$	$V > V_c$
R < 2000	R > 3000

e) **A capillary tube of diameter 0.2 mm is dipped in a liquid of density 0.9 x 10^3 kg / m^3 and angle of contact 24^0 . If the liquid rises by 41 mm in the tube , find the surface tension of liquid.** — Total Marks: 4

Formula — 1

Substitution and Calculation — 1

Answer with unit — 2

Given : Required:

$r = 0.1 \times 10^{-3}$ m $T = ?$

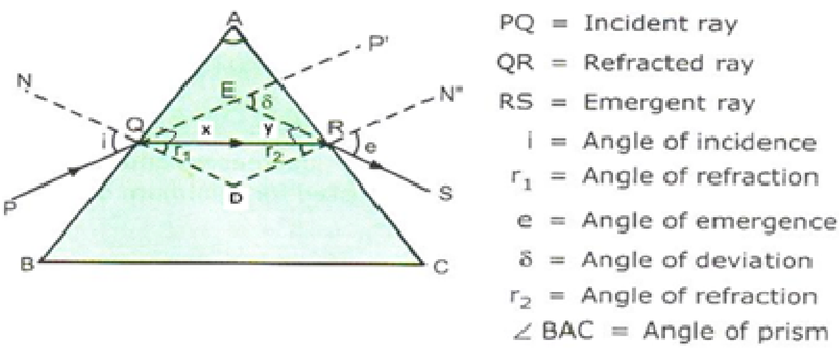
$\rho = 0.9 \times 10^3$ kg / m^3

$\theta = 24^0$

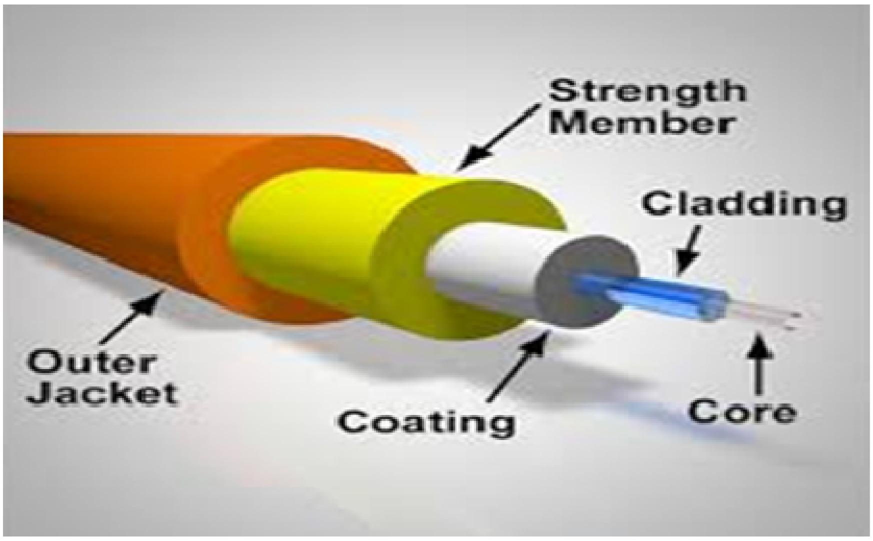
$h = 41 \times 10^{-3}$ m

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
2)	e)	$T = rh\rho g / 2\cos\theta$ $T = 0.1 \times 10^{-3} \times 41 \times 10^{-3} \times 0.9 \times 10^{3} \times 9.8 / 2\cos 24$ $T = 0.019$ N/m		
	f)	**State the three ways in which heat is transferred from one place to another. Give one example of each.**		4
		Three ways	1	
		One examples of each	1	
		Three ways of heat transfer : **Conduction** **Convection** **Radiation** **Examples** **Conduction** Heat sink in electronic circuits, Safety lamp, Ice box etc. **Convection** Formation of trade winds, Room ventilation system, monsoons etc. **Radiation** Use of white clothes, Heat radiators in car, In activation of HIV etc.		

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
3)		**Attempt any four of the following.**		16
	a)	**State any four applications of conduction**.		4
		Any four applications i) Bad conductor of heat is used as insulators. E.g. glass , thermo Cole , sawdust etc. ii) The calorimeters are kept in wooden box. iii) The coils of heavy duty transformers are kept in oil to protect it from excessive heat. iv) Thermos flax contain double walled glass vessel with vacuum to maintain the constant temperature. v) Flame of Safety lamps is covered with good conducting material. vi) Thermal insulator is used to prevent heat loss to the environment. Any relevant application can be considered.	4	
	b)	**Volume of certain quantity of gas at NTP is 24 litres. What will be the pressure exerted by the same quantity of gas when enclosed in a gas cylinder of capacity 20 litres at 27^0 C.**		4
		Formula	1	
		Substitution and Calculation	1	
		Answer with unit	2	

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
3)	b)	Given: Required:		
		P_1 = 76 cm of Hg P_2 = ?		
		T_1= 273 ^{0}K		
		V_1= 24 lit.		
		T_2= 273 + 27 = 300 ^{0}K		
		V_2= 20 lit		
		$P_1 V_1 / T_1 = P_2 \mathbf{V}_2 / T_2$		
		$P_2 = P_1 V_1 T_2 / T_1 \mathbf{V}_2$		
		$P_2 = 76 \times 24 \times 300 / 273 \times 20$		
		P_2 = 100.21 cm of Hg		
	c)	**Obtain prism formula.**		4
		Diagram	2	
		Derivation	2	
				
		Consider Δ QDR		
		$r_1 + r_2 + \angle QDR = 180$		

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
3)	**c)**	Consider □ AQDR ∟A + ∟QDR = 180 $r_1 + r_2 +$ ∟QDR = ∟A + ∟QDR ∟A = $r_1 + r_2$ For certain value of ∟i , angle of deviation δ is called angle of minimum deviation δ_m . At this stage ∟i = ∟e and $r_1 = r_2 = r$ Therefore $r_1 + r_2 = 2r = A$, $A= r / 2$ Δ QER $\delta = x + y$ $\delta = (i - r_1) + (e - r_2)$ $\delta = i + e - (r_1 + r_2)$ **At δ = δ** $\mathbf{r_1 = r_2 = r}$ **i = e** , **i = A+ δ_m /2** **r = A /2** By Snell's law **μ = sin i / sin r** By substituting values if i and r in above law we get, $$\mu = \frac{\sin\left(\frac{A+\delta m}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$ **Where,** **μ = refractive index of material of prism.** **A = Angle of prism.** **δm = Angle of minimum deviation**		

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
3)	d)	**1)State the necessary conditions required for propagation of light through optical fibre.**		2
		Each condition	1	
		Conditions :		
		a) Light should travel from denser medium to rarer medium.		
		b) Refractive index of core must be greater than cladding.		
		2) Draw labeled diagram showing structure of optical fibre.		2
		Diagram with labels	2	
				

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
3)	e)	**A particle performing SHM has period of 3 sec. Calculate its acceleration at 2 cm from mean position.**		4
		Formula	1	
		Substitution and Calculation	1	
		Answer with unit	2	
		Given : T= 3 sec. $x = 2\text{ cm} = 2 \times 10^{-2}$ m Required: a = ?		
		$a = \omega^2 x$ $a = (2\pi / T)^2 \cdot x$ $a = (2 \times 3.14 / 3)^2 \cdot 2 \times 10^{-2}$ $a = 0.087\ m/s^2$		
	f)	**Define i) Amplitude ii) Wavelength iii) Frequency iv)Phase** of particle in SHM.		4
		Each definition	1	
		• Amplitude : It is defined as the maximum displacement of the particle from either side of mean position. • Wavelength : It is defined as the distance between two Consecutive Particles which are in the same state of vibration (or between two consecutive crest or trough) .OR It is the distance travelled by the wave in one oscillation. • Frequency : It is defined as the number of oscillation completed in one second. • Phase of particle in SHM: It is quantity which represents the state (position, direction and displacement) of the particle at particular instant performing SHM.		