SUMMER– 17 EXAMINATION

Model Answer **Subject Code:** 17102

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 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.*

Q. No.	Sub Q.N.	Answer	Marking Scheme
1.		**Attempt any NINE of the Following:**	**18**
	a)	**Define deforming force and restoring force.**	**2**
		Each Definition	1
		Deforming force: It is an external unbalanced force which changes the shape or size of body.	
		Restoring Force: It is the internal force developed in body which regains the body to its original dimension.	
	b)	**Distinguish between tensile stress and tensile strain**	**2**
		Any two points	2

Tensile stress	Tensile strain
1. It is the ratio of applied force to the cross sectional area	1. It is a ratio of change in lenghth to the original length.
2. SI unit is N/m^2	2. It has no SI unit
3. Tensile stress $= \frac{mg}{\pi r^2}$	3. Tensile Strain= $= \frac{l}{L}$

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Q. No.	Sub Q.N.	Answer	Marking Scheme
1.	c)	**State pressure depth relation of a fluid with the meaning of each term in it.** **Equation** **Symbol meaning** $P= h\rho g$ Where, P= Pressure, h= height of the column, ρ= density of given liquid, g= acceleration due to gravity	**2** 1 1
	d)	**Obtain the expression for viscous force by Newton's Law of Viscosity.** According to Newton's Law of Viscosity, Viscous force (F) acting on layer of liquid is directly proportional to the surface area (A) of the layer in contact. $F \alpha A$---------------(1) Also, is directaly proportional to the velocity gradient (dV/dX) between the layer. $F \alpha \frac{dV}{dX}$-----------------(2) Combaining equation 1 & 2, We get, $F= \eta A \frac{dV}{dX}$	**2**
	e)	**Name the types of intermolecular force in liquid.** Cohesive Force Adhesive force	**2**
	f)	**Define Kelvin Scale of Temperature.** In this scale the lower fixed point is 273 ^{O}K and upper fixed point is 373 ^{O}K. And it is then divided into 100 equal parts, each part is called as Degree Kelvin.	**2**
	g)	**State general gas equation with the meaning of each term in it.** $PV = RT$ Where, P= Pressure of a gas, V= Volume of a gas, R= Universal gas constant, T= Absolute Temperature	**2**
	h)	**What is the value of temperature at which ideally the pressure of the gas becomes zero?** The value of temperature at which ideally the pressure of the gas becomes zero is given by -273 ^{O} C = 0 ^{O} K.	**2**

Q. No.	Sub Q.N.	Answer	Marking Scheme
1.	i)	**Give the relation between velocity, wavelength and frequency of wave.** The relation between velocity, wavelength and frequency of wave is given by $V = n\lambda$	**2**
	j)	**Calculate the velocity of wave, if time period and wavelength of wave are 2 ms and 68 cm respectively.**	**2**
		Formula and substitution	1
		Answer with Unit	1
		We have, $V = n\lambda$ But, $n = \frac{1}{T}$ $V = \frac{\lambda}{T} = 68 \times 10^{-2} / 2 \times 10^{-3} =$ **340 m/s**	
	k)	**State two examples of stationary wave.**	**2**
		Each example 1. Wave formed on sonometer wire 2. Wave formed in air column of resonance tube 3. Wave formed on stretched string at both ends.	1
	l)	**Define resonance.** **Resonance:** The natural frequency of the body matches with forced frequency, then body vibrate with large amplitude is called as resonance.	**2**

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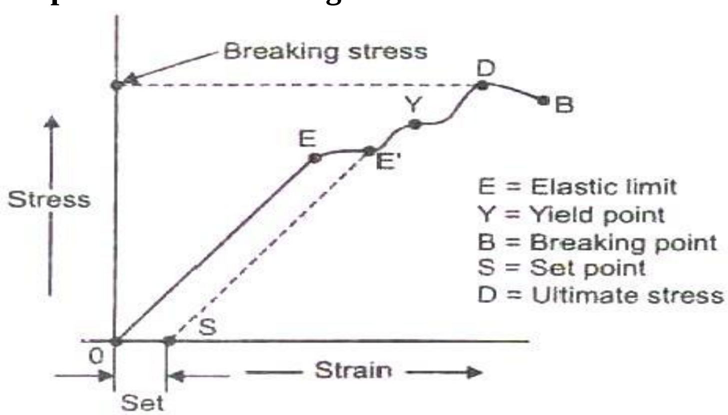
Q. No.	Sub Q.N.	Answer	Marking Scheme
2.		**Attempt any FOUR of the following:**	**16**
	a)	**Calculate the Young's modulus of wire, if the wire of length 3.14 m, radius 2 mm, extends by 5 mm, when a force of 10 N is applied to it.**	**4**
		Formula and substitution.	2
		Answer with unit.	2
		Given : Radius(r) = 2 mm = 2 x 10^{-3} m Original length(L) =3.14 m Extended length(l) = 5 mm = 5 x 10^{-3} m Force (F) = 10 N Young's modulus(Y) =? **Formula:-** $Y = \frac{FL}{\Pi r^2 l}$ Y = 10 x 3.14 / 3.14(2 x $10^{-3})^2$ x (5 x 10^{-3}) **Y = 5 x 10^8 N/m^2**	
	b)	**Obtain the relation between stress and strain for a wire under continuously increasing load with the help of neat labeled diagram.**	**4**
			
		A graph or diagram of stress and strain is shown as above. **OE** Portion is straight line which indicates that stress is proportional to strain. Therefore the wire obeys Hooke's law up to the point E this point is called elastic limit. i.e. Stress α Strain Stress / Strain = Constant For a wire this constant is called Young's modulus(Y) Y = Stress / Strain **Any relevant answer may be consider.**	

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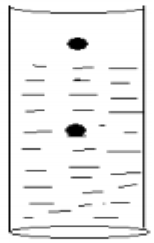
Q. No.	Sub Q.N.	Answer	Marking Scheme
2.	c)	**Describe streamline flow and turbulent flow with an example.**	**4**
		Each Description and example	2
		Stream line flow:- In streamline flow the path of every particle is same. The velocity of particle is constant in magnitude and direction. The liquid flows steadily.V<Vc	
		E.g. The flow of liquid through pipe, water flow of river in summer etc.	
		Turbulent flow:- In turbulent flow the path of every particle is different. The velocity of particle is not constant in magnitude and direction. The liquid flows speedily.V>Vc	
		E.g. Flow of river in flood, water fall etc.	
	d)	**Derive the expression for coefficient of viscosity by Stoke's method.**	**4**
		Consider a metal sphere placed on the surface of liquid taken in glass jar. Its observed that after covering certain distance, metal sphere attains a constant velocity.	
		Metal sphere falling freely through a liquid experiences three forces	
		i) Weight of the metal sphere in the downward direction	
		ii) Force of viscosity in the upward direction.	
		iii) Up thrust force in the upward direction	
		By Archimedes's principle	
		Up-thrust force = Loss of weight of body in liquid = Weight of liquid displaced	
		Since metal sphere falls with constant velocity, the total upward force is equal to the downward force.	
		Total upward force = The downward force	
		[Force of viscosity] + [up thrust force] = weight of the metal sphere	
		[$6\pi\eta rv$] + [Weight of liquid displaced] =[Mass of metal sphere X g]	

Q. No.	Sub Q.N.	Answer	Marking Scheme
2.	d)	 $$[6\pi\eta rv] + \frac{4}{3}\pi r^3 \rho g = \frac{4}{3}\pi r^3 d g$$ $$[6\pi\eta rv] = \frac{4}{3}\pi r^3 d g - \frac{4}{3}\pi r^3 \rho g$$ $$6\pi\eta rv = \frac{4}{3}\pi r^3 g(d-\rho)$$ $$\eta = \frac{\frac{4}{3}\pi r^3 g(d-\rho)}{6\pi rv}$$ $$\eta = \frac{2}{9}\frac{r^2 g(d-\rho)}{v}$$ Where, η = Coefficient of viscosity of liquid r = radius of metal sphere d= density of metal sphere ρ = density of liquid v= terminal velocity	

Q. No.	Sub Q.N.	Answer	Marking Scheme
2.	e)	**Derive the expression for surface tension by capillary rise method.**	**4**
		Diagram	1
		Explanation	2
		Relation	1

Diagram :-

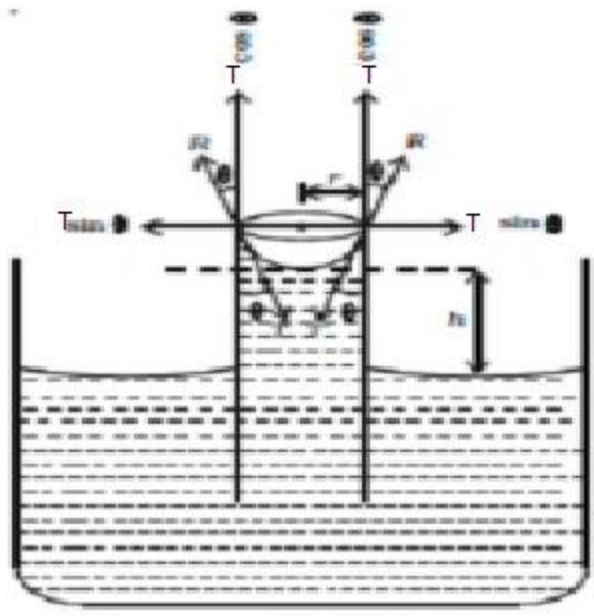


Fig. Surface tension by capillary rise method

Consider a capillary tube immersed in a liquid(water). The water rises due to capillary action. The surface of water in capillary is concave in nature. The force of surface tension T acts along the tangent to the curve at the point of contact. The force of surface tension is resolved in two components.

Component of T along horizontal = T sin θ

Component of T along vertical = T cos θ

The horizontal components which are equal and opposite cancel each other.

In equilibrium total upward force = downward force

2π r T cos θ = Weight of excess liquid in tube

= mass of excess liquid x g

= V x d x g

$2\pi r T \cos\theta = \pi r^2 hdg$

$$\mathbf{T = rhdg / 2\cos\theta}$$

Where, r = radius of capillary

h = rise of water in capillary

d = density of liquid

θ = angle of contact

Q. No.	Sub Q.N.	Answer	Marking Scheme
2.	f)	**Calculate the coefficient of thermal conductivity ,if the temperature difference between the faces of aluminum plate is 12 ^oC when 100Kcal of heat is absorbed by the plate in 30 minutes.(Given : thickness of plate is 3 mm and area of plate is 10 cm^2).**	**4**
		Formula with substitution	2
		Answer with unit	2
		Given : $(\theta_1-\theta_2) = 12\ ^oC$, Q =100 Kcal ,d =3mm=$3x10^{-3}$m, A= 10 cm^2= $10x10^{-4}\ m^2$, t=30 min=30x60 sec Find : K=? $Q = KA(\theta_1-\theta_2)t/ d$ $K= Qd/A(\theta_1-\theta_2)t$ $= 100x3x10^{-3}/10 \times 10^{-4} \times 12 \times 30 \times 60$ **K= 0.0139 Kcal/m ^{o}Cs**	
3.		**Attempt any FOUR of the following:**	**16**
	a)	**Explain conduction, convection and radiation. Give one example of each.**	**4**
		Each explanation	1
		Three examples	1
		Conduction: 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.E.g. Heat sink in electronic circuits, Safety lamp, Ice box. **Convection:** 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. E.g. Formation of trade winds, Room ventilation system, monsoons etc. **Radiation:** 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. E.g. Use of white clothes, Heat radiators in car, In activation of HIV etc.	
	b)	**Distinguish between isothermal process and adiabatic process.**	**4**
		Any four point	**4**

Q. No.	Sub Q.N.	Answer	Marking Scheme
3.	b)		

ISOTHERMAL PROCESS	ADIABETIC PROCESS
volume & pressure changes at constant temperature	volume & pressure changes at changing temperature
Gas is filled in a good conductor of heat	Gas is filled in a bad conductor of heat.
Transfer of heat takes place.	There is no transfer of heat.
Volume changes are made slowly	Volume changes are made rapidly
Gas obeys Boyle's law i.e. PV= constant	Gas does not obeys Boyle's law Here PV^{γ} = constant
Expansion of gas takes place	Compression of gas takes place
Ex. Boiling of water	Ex. Bursting of cycle tyre

c) (i)**State prism formula with meanings of symbols used.** — **4**

(ii)**Define total internal reflection and critical angle.**

(i) Formula — 1

Meaning — 1

Prism formula-

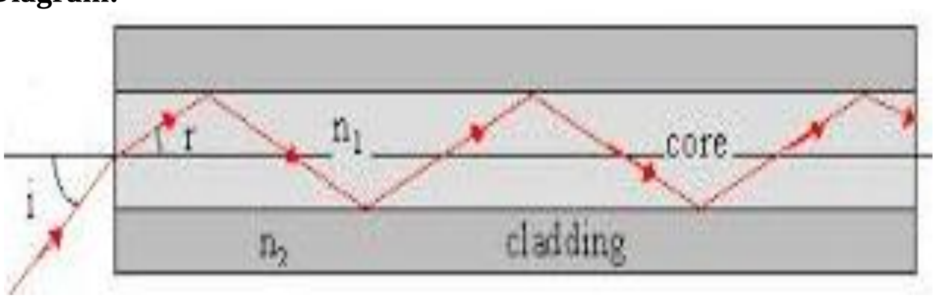
$$\mu = \frac{\sin\left(\frac{A+\delta m}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$

Where,

μ = refractive index of material of prism.

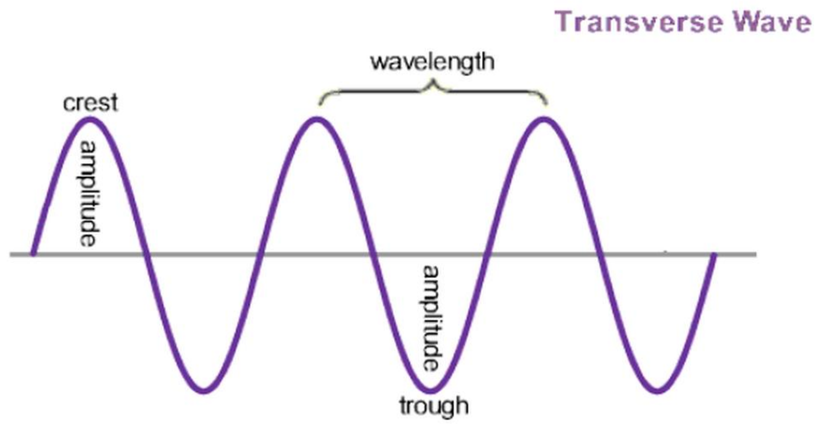
A = Angle of prism.

δ_m = Angle of minimum deviation.

Q. No.	Sub Q.N.	Answer	Marking Scheme
3.	c)	(ii) **Each definition** **Total internal reflection:** The process in which light travels from denser medium to rarer medium and when angle of incidence is greater than critical angle, instead of refraction total light if reflected in the same medium. **Critical angle:** The angle of incidence at which refracted ray moves along the interface. OR The angle of incidence at which angle of refraction is 90 ^{0}.	1
	d)	**With neat labeled diagram , explain the principle and propagation of light wave through optical fibre.** **Principle** **Diagram** **Explanation** **Principle:** It works on the principle of total internal reflection. **Diagram:**  **Explanation :** Fig. shows a thin fiber optic cable. A beam of light is focused as shown. The angle of incidence is greater than critical angle. Therefore T.I.R.takes place. The beam flows zigzag path as shown in the fig.and emerge out from other end. During this, the angle of incidence is equal to angle of reflection. Due to this the light rays entering at different angles will take different paths through the cable.Therefor some light paths will be longer and some will be shorter.	**4** 1 1 2

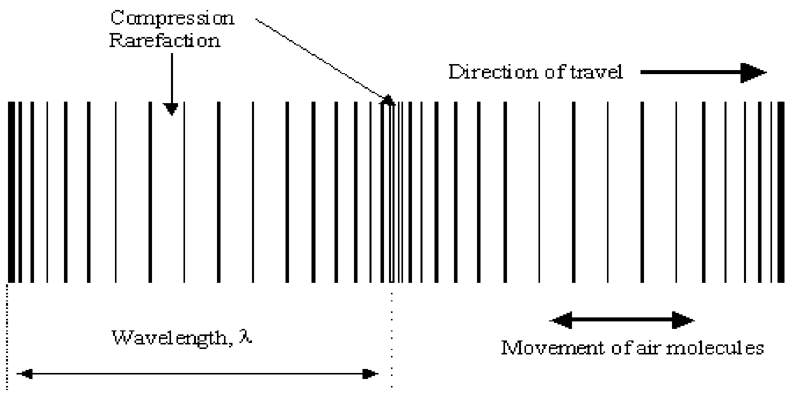
Q. No.	Sub Q.N.	Answer	Marking Scheme
3.	e)	**Describe transverse wave and longitudinal wave .Give one example of each.** **Each description with example and diagram.**	**4** 2

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.
It travels in the form of alternate crest and trough. It travels through solid only.



Ex. Light wave, Electromagnetic wave, vibration produced in sitar, guitar, violin, sonometer, etc.

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.
It travels in the form of alternate compression and rarefaction. It travels through solid,liquid and gases.



Ex. Sound wave, waves set in organ pipe and kundts tube, etc.

Q. No.	Sub Q.N.	Answer	Marking Scheme
3.	f)	**(i) State the formula to calculate velocity of sound by resonance tube method.** **(ii)Define free vibrations and forced vibrations.**	**4**
		(i) Formula with meaning of symbols. $v = 4n\,(0.3D + l)$ v=velocity of sound in air. D = Diameter of tube. l = resonating length.	2
		(ii) Each definition **Free vibrations:** The vibrations performed by a body when only once disturbed from its equilibrium position and vibrates with a natural frequency are called free vibrations. **Forced vibrations**: When a body is continuously disturbed by a periodic force, then the particle cannot vibrate with its natural frequency but it starts vibrating with the frequency of periodic force. These vibrations are called forced vibrations.	1