SUMMER– 18 EXAMINATION

Subject Name: Basic Physics **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 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.

Q. No.	Sub Q. N.	Answers	Marking Scheme
1.		**Attempt any NINE of the following:**	**18**
	a)	**Define the term i) Ultimate stress ii) Factor of safety.**	**2**
		Each definition	1
		i) Ultimate Stress:- It is defined as the ratio of maximum load that the specimen (system) can withstand to original cross-sectional area of specimen.	
		ii) Factor of Safety:- It is defined as the ratio of ultimate stress to working stress.	
	b)	**State Hooke's Law of elasticity. Define Elastic limit.**	**2**
		Statement	1
		Definition	1
		Hooke's Law:- Within elastic limit, stress is directly proportional to strain.	
		Elastic limit: -It is the maximum value of the stress upto which the body shows elasticity.	
	c)	**State the effect of temperature and adulteration on viscosity of liquid.**	**2**
		Each effect.	1
		Temperature: The viscosity of liquid is inversely proportional to the temperature of the liquid.	
		Adulteration: When adulteration of soluble substance is added to the liquid its viscosity goes on increasing.	

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1.	d)	**Calculate the pressure at a depth 12 m inside the water. (density of water = 1000 kg/m^3)** **Formula and substitution** **Answer with unit** **Given:** h = 12 m ρ = 1000 kg /m^3 P =? We have, P = h ρ g P = 12 x 1000 x 9.8 **P = 117600 Pa OR P = 117600 N/m^2**	**2** 1 1
	e)	**Define surface tension. State its S.I. unit.** **Definition** **Unit** **Definition:-** 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 :-** N/m	**2** 1 1
	f)	**Define absolute zero temperature and one calorie** **Each definition** **Absolute zero temperature:-** The temperature at which both pressure and volume of gas become theoretically zero is called absolute zero temperature. **Calorie:** The amount of heat is required to increase the temperature of 1gm of water by 1^{0}C is called calorie.	**2** 1
	g)	**Define specific heat of a gas at constant pressure and at constant volume.** **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.	**2** 1

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Q. No.	Sub Q. N.	Answers	Marking Scheme
1.	h)	**Define isothermal and Adiabatic process.** **Each definition** **Isothermal process:-** The process in which volume of a gas changes keeping its temperature constant is called isothermal change. **Adiabatic process:-** The process in which volume of a gas changes with change in temperature is called Adiabatic change.	**2** 1
	i)	**The velocity of wave is 300 m/s. If the frequency of vibration of wave is 300 Hz. Calculate the wavelength.** **Formula and substitution** **Answer with unit** Given : Required: v =300 m/s λ =? n = 300 Hz $v = n\lambda$ $\lambda = v / n$ $\lambda = 300 / 300$ **λ = 1 m.**	**2** 1 1
	j)	**Define amplitude and periodic time of a vibrating particle.** **Each definition** **Amplitude (a):-** The maximum displacement of particle from its mean position on either side is called amplitude. **Periodic time:-** The time taken by a wave to complete one oscillation is called periodic time.	**2** 1
	k)	**State two characteristics of stationary waves**. **Any two characteristics** **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 $\lambda/4$.	**2** 2

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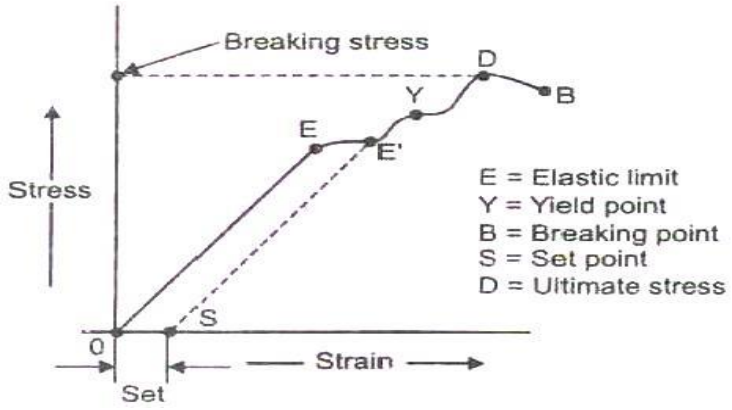
Q. No.	Sub Q. N.	Answers	Marking Scheme
1.	l)	**Define Resonance. Give its one example.**	**2**
		Definition	1
		One example	1
		Definition: When the frequency of the external periodic force applied to a body is exactly equal to (matches) natural frequency of body, the body vibrates with maximum amplitude, the effect is known as resonance.	
		Examples: 1) Bridge may collapse in earth quake if forced frequency of earth quake becomes equal to the natural frequency of the bridge.	
		2) Use of musical instruments like flute, harmonium, sitar, violin, guitar.	
		3) Radio receiver set.	
		Any Relevant examples may consider.	
2.		**Attempt any FOUR of the following:**	**16**
	a)	**Calculate Young's modulus of elasticity for a wire having length 1.5 m and diameter 5 mm, if the wire elongates by 2 mm when subjected to a load of 10 N.**	**4**
		Formula and substitution	2
		Answer with unit	2
		Given : L = 1.5 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	
		We have	
		$Y = FL / \pi r^2 l = (10 \times 1.5) / (3.14 \times (2.5 \times 10^{-3})^2 \times 2 \times 10^{-3})$	
		$Y = 0.3821 \times 10^9$ N / m^2	
	b)	**Explain behavior of wire under continuously increasing load using stress strain diagram.**	**4**
		Neat labeled diagram	2
		Explanation	2



Q. No.	Sub Q. N.	Answers	Marking Scheme
2.	b)	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. **EE'** Portion is curved towards strain axis this shows that increase in strain is more, than increase in stress. In this region stress is not proportional to strain. Between any point E and E' if all load is removed then some permanent elongation / Expansion / increase in length takes place in the wire this is called set. When wire is again loaded, a new straight line SE' is obtained which obey Hooke's law. Some portion after the point Y is almost parallel to strain axis this shows that strain increases without increase in stress just like wire flows. This is called plastic flow. The point at which the plastic flow begins is called yield point. Point D is called ultimate stress here wire becomes thin and finally it breaks at point B.	
	c)	**State Newton's law of viscosity. Hence define co-efficient of viscosity. State its S.I. unit.** **Statement** **Definition** **Unit** **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**	**4** 2 1 1
	d)	**Distinguish between streamline and turbulent flow of liquid. (Any four points).** **Four points**	**4** 4

Q. No.	Sub Q. N.	Answers	Marking Scheme
2.	d)		

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) **i) Define Cohesive force and Adhesive force** — **2**

Each definition — 1

i) Cohesive force: - It is the force of attraction between two molecules of same substance.

ii) Adhesive force: - It is the force of attraction between two molecules of different substance.

ii) Define capillarity. Give its any two examples. — **2**

Definition — 1

Two examples — 1

Capillarity: - The rise or fall of a liquid inside the capillary is called as capillarity.

Examples

(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.

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Q. No.	Sub Q. N.	Answers	Marking Scheme
2.	f)	**Find the amount of heat conducted in one hour by a window pane of dimension 60 cm x 30 cm and thickness 3mm, if the difference between temperatures is 5^0C and K = 0.0002 k cal / m ^{0}C-sec.**	**4**
		Formula and substitution	2
		Answer with unit	2
		Given:- Q= ? t = 1 hr = 60 x 60 sec. = 3600 sec. A = 60 cm x 30cm = 1800 cm^2 = 1800 x 10^{-4} m^2 d = 3 mm = 3 x 10^{-3} m $(\theta_1 - \theta_2) = 5\ ^0C$ K = 0.0002 k cal / m ^{0}C-sec We have, $Q = (K \times A \times (\theta_1 - \theta_2) \times t) / d$ $Q = (0.0002 \times 1800 \times 10^{-4} \times 5 \times 3600) / 3 \times 10^{-3}$ **$Q = 2160 \times 10^{-1}$ J = 216 J**	
3.		**Attempt any FOUR of the following:**	**16**
	a)	**State any two applications of conduction and radiation**.	**4**
		Any two applications each	2
		Applications of conduction:- 1) Bad conductor of heat is used as insulators. E.g. glass , thermo Cole , sawdust etc. 2) The calorimeters are kept in wooden box. 3) The coils of heavy duty transformers are kept in oil to protect it from excessive heat. 4) Thermos flax contain double walled glass vessel with vacuum to maintain the constant temperature. 5) Flame of Safety lamps is covered with good conducting material. 6) Thermal insulator is used to prevent heat loss to the environment.	
		Applications of radiation:- 1. White or light coloured are preferred in summer. 2. Heat radiators in car, machines are painted black. 3. Aeroplanes and ships are painted white. 4. High absorbing power of water vapour is a natural gift. 5. The polished surface of space craft reflect most of the heat radiated from sun. 6. Base of the cooking utensils is made black. 7. Inactivation of HIV by application of heat radiations. 8. Teapots has bright shining surface.	
	b)	**Volume of certain quantity of gas at NTP is 12 litres. What will be the pressure exerted by the same quantity of gas when enclosed in a gas cylinder of capacity 10 litres at 273^0 C.**	**4**

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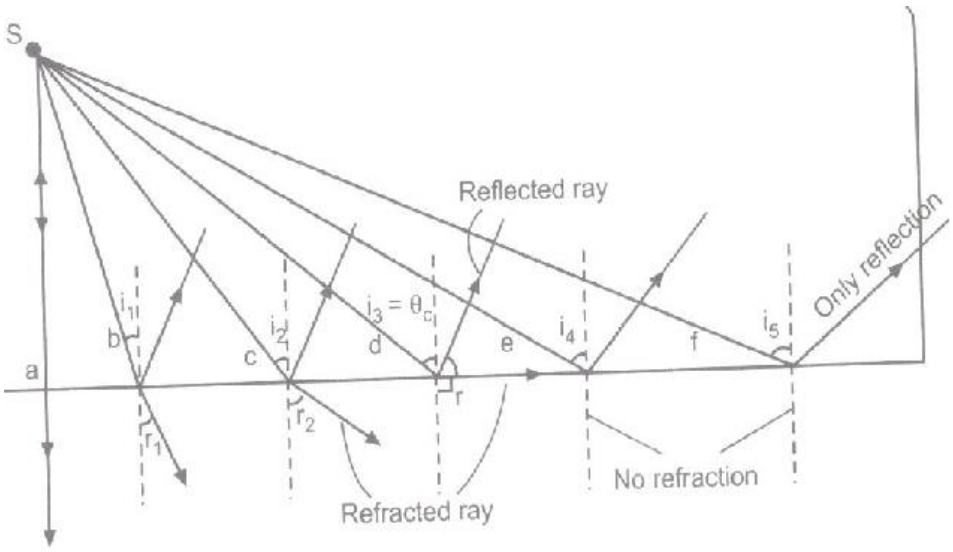
Q. No.	Sub Q. N.	Answers	Marking Scheme
3.	b)	**Formula and substitution** **Answer with unit** **Given:-** Given: Required: P_1 = 76 cm of Hg P_2 = ? T_1= 273 ^{0}K T_2= 273 + 273 = 546 ^{0}K V_1= 12 lit. V_2= 10 lit We have $P_1 V_1 / T_1 = P_2 V_2 / T_2$ $P_2 = P_1 V_1 T_2 / T_1 V_2$ P_2 = (76 x 12 x 546) / (273 x 10) **P_2 = 182.4 cm of Hg**	2 2
	c)	**Explain Total internal reflection with neat diagram. Hence define the term critical angle.** **Diagram** **Explanation** **Definition**  **Explanation:-** Consider light rays from a point source S in optically denser medium (glass) fall on the surface, on the other side of which is less optically denser medium (air) as shown above. For the rays a, b, c there are both reflection and refraction taking place at interface.	**4** 1 2 1

Q. No.	Sub Q. N.	Answers	Marking Scheme
3.	c)	For ray d, the angle of refraction is 90 ^{0} which means that the refracted ray runs along interface. **For the rays e, f …. there angle of incidence is larger than θ_c there is no refraction and only reflection takes place i.e. T.I.R. (Total internal reflection).** Thus as the angle of incidence 'i' is increased a situation is reached at which the refracted ray points along the surface and angle of refraction is 90 ^{0}. **For the angle of incidence larger than this critical angle θ_c no refracted ray exits and all the light is reflected.** **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.	
	d)	**i) State prism formula with meaning of each term.** **Formula** **Meaning** **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.	**2** 1 1
		ii) Define Numerical Aperture and Acceptance angle. **Each definition** **Numerical Aperture (NA):** The sine of maximum acceptance angle is called as numerical aperture. **Acceptance Angle (θa):** The maximum value of external incident angle for which light will propagate in the optical fiber is called as acceptance Angle.	**2** 1

Q. No.	Sub Q. N.	Answers	Marking Scheme
3.	e)	**Distinguish between transverse wave and longitudinal wave. (Any four points)**	**4**
		Any four points	4

Transverse Wave	Longitudinal Waves
The wave in which direction of vibration of particles of material medium is perpendicular to the direction of propagation of wave is called transverse wave.	The wave in which direction of vibration of particles of material medium is parallel to the direction of propagation of wave is called longitudinal wave.
Wave travels in form of alternate crests and trough	Wave travels in form of alternate compressions and rarefactions.
Density and pressure of medium remain same.	Density and pressure of medium remain change.
Wave travels through solid only.	Wave travels through liquids and gases.
e.q. Light wave	e.q. Sound waves

f)

i) A tuning fork of frequency 512 Hz resonates with an air column of length 16cm. The end correction is 0.5 cm. Calculate velocity of sound. **2**

Formula and Substitution 1

Answer with unit 1

Given

n = 512 Hz.

l = 16 cm.= 16×10^{-2} m

e = 0.5 cm = 0.5×10^{-2} m

v = ?

Formula –

$v = 4n (l + e)$

$v = 4 \times 512 \times (16 \times 10^{-2} + 0.5 \times 10^{-2})$

v = 337.92 m/s

v = 33792 cm/s

Q. No.	Sub Q. N.	Answers	Marking Scheme
3.	f)	**ii) Distinguish between free vibrations and forced vibrations. (Any two points)**	**2**
		Any two points	2

Free vibrations	Forced 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.	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.
Examples: Vibrating tuning fork, Concrete bridge, Vibration of air column, etc.	Examples: Tuning fork kept on vibrating engine, Concrete bridge in earth quake, Cricketers hanging ball, etc.
Body vibrates with natural frequency.	Body vibrates with external frequency.