SUMMER– 17 EXAMINATION

17202

Model Answer **Subject Code:**

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 i) uniform velocity ii) uniform acceleration.**	**2**
		Each Definition	1
		Uniform velocity:- If a body covers equal displacement in equal interval of time, then it is called uniform velocity. **OR** If a body is moving with constant speed in the same direction, then it is said to be uniform velocity. **Uniform acceleration:-** If the acceleration of a body is uniform in magnitude and direction w.r.t. time then it is called uniform acceleration. **OR** If change in velocity of a body is constant in every equal interval of time then it is called uniform acceleration.	

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Q. No.	Sub Q.N.	Answer	Marking Scheme
1.	b)	**State Newton's third law of motion. Give one example.** **Law** **Example** **Newton's third law of motion:** It states that to every action, there is always equal and opposite reaction. **Example-** Action: A rocket pushes out exhaust… Reaction: The exhaust pushes the rocket forward. **Any other relevant example**	**2** 1 1
	c)	**Calculate the work done when a 50 kg bag is lifted from ground and kept on table with height 95 cm.** **Formula with substitution** **Answer with unit** Given:- m = 50 kg g = 9.8 m/s^2 height = h = 95 cm = 0.95 m Workdone = mgh Work done = 50 x 9.8 x 0.95 **Work done = 465.5 J**	**2** 1 1
	d)	**Define i) centripetal force ii) centrifugal force** **Each Definition** **Centripetal force –** It is defined as the force acting along the radius towards the center of the circular path, which keeps the particle in uniform circular motion. **OR** Centripetal force is the force acting on a particle performing uniform circular motion which is along the radius and towards the center of circular path. **Centrifugal force –** It is defined as the force acting on a particle performing uniform circular motion which is directed away from center and along the radius of the circular path. **OR** A particle performing uniform circular motion experiences force which is along the radius and away from the center is called Centrifugal force.	**2** 1
	e)	**State piezoelectric effect.** **Piezoelectric effect:** When the electric field is applied across the crystal its dimensions changes and when alternating P.D. is applied across crystal then the crystal sets into elastic vibrations.	**2**

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Q. No.	Sub Q.N.	Answer	Marking Scheme
1.	f)	**Define neutral temperature, inversion temperature.** **Each definition** **Neutral temperature** – In thermocouple the temperature at which the emf is maximum is called inversion temperature. **Inversion Temperature:** In thermocouple the temperature at which the emf becomes zero and changes its sign (becomes negative) is called as inversion temperature.	**2** 1
	g)	**State Seebek effect** When two dissimilar metals are joined together, so that two junctions are formed & if one junction is heated and other is cooled (if temperature difference is maintained) then electric current flows through it i.e. emf is generated. This effect is known as Seebek effect.	**2**
	h)	**Define i) Threshold wavelength** **ii) Threshold frequency** **Each Definition** **Threshold Wavelength:** It is the maximum wavelength of incident light at which emission just begins. **Threshold Frequency:** It is the minimum frequency of incident light at which emission just begins.	**2** 1
	i)	**State Einstein's photoelectric equation with meaning of symbol used.** **Equation** **meaning** Einstein's photoelectric equation $$\frac{1}{2}mv^2 = h(\upsilon - \upsilon_0)$$ **Where** m – mass of electron v – velocity of electron h – Planck's constant υ - frequency of radiation υ_0 - Threshold frequency	**2** 1 1

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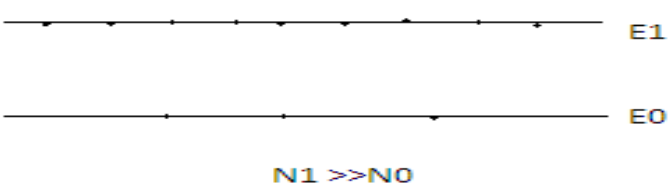
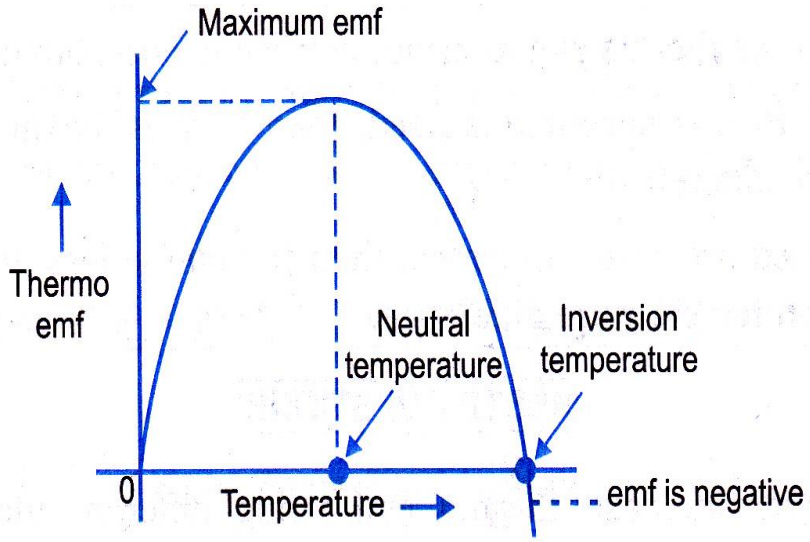
Q. No.	Sub Q.N.	Answer	Marking Scheme
1.	j)	**State any two scientific applications of X-rays.** **Any two applications** **Scientific Applications**: i. . X – rays are used to study structure of crystal and alloy ii. . X – rays are used to chemical analysis and for determination of atomic number of chemical elements. iii. . X – rays are used to study structure of substances like cellulose , rubber and plastic. iv. . X – rays are used for identification of chemical elements present in the solution. v. . X – rays are used for analysis of structure of organic molecules.	**2** 2
	k)	**State any two properties of X-rays.** **Any two properties** i. They are electromagnetic waves of very short wavelength. ii. They travel with speed of light. iii. They affect photographic plates. iv. They produce fluorescence in many substances. v. They can be reflected or refracted under certain conditions. vi. They are not deflected by magnetic or electric field. vii. They have high penetrating power. viii. They produce photoelectric effect. ix. They are invisible to eyes. x. X-ray kill some form of animal cell	**2** 2
	l)	**Explain population inversion.** Normally the population of lower energy level (ground state) is higher than higher energy level (excited state) but to produce stimulated emission population of higher energy level (excited state) should be greater than lower energy level (ground state). Making population of higher energy level (excited state) more than lower energy level (ground state) is called as population inversion. It is achieve by different methods like optical pumping, chemical reaction, etc.  	**2**

Q. No.	Sub Q.N.	Answer	Marking Scheme
2.		Attempt **any four** of the following:	16
	a)	**A bullet of mass 450 gm leaves the barrel of a gun with muzzle velocity of 700 m/s. If the length of barrel is 80 cm, find the impulse and impulsive force.**	**4**
		Formula	1
		Answer with unit	1
		Given:- m = 450 gm = 0.450 kg, u = 0 v = 700 m/s s = 80 cm = 0.80 m Impulse = (mv – mu) = m (v-u) = 0.450 x (700 – 0) **Impulse = 315 Kg.m / s OR N.s** $v^2 = u^2 + 2as$ $a = v^2 – u^2 / 2s = (700)^2 – (0)^2 / (2 \times 0.80)$ $a = 306250\ m/s^2$ Impulsive force = mass x acceleration = 0.450 x 306250 **Impulsive force = 137812.5 N**	
	b)	**Define** **i) Trajectory** **ii) Angle of projection** **iii)Maximum height of projectile** **iv) Time of flight**	**4** 1
		Each definition **Trajectory:** The parabolic path followed by a object in projectile motion is called a trajectory. **Angle of projection:** The angle made by the object with horizontal when it follow the projectile motion is called angle of projection. **Maximum height of projectile:** The maximum distance covered by a projectile along vertical direction is called maximum height of projectile. **Time of flight :** The time taken by the projectile to reach the ground from the time it was projected is called Time of flight. **OR** The time required by the projectile to cover entire trajectory is called time of flight.	

Q. No.	Sub Q.N.	Answer	Marking Scheme
2.	c)	**With neat labeled diagram explain piezo-electric method to produce ultrasonic waves.** **Diagram with label** **Principle** **Working**  **Principle:** When the electric field is applied across the crystal its dimensions changes and when alternating PD is applied across crystal then the crystal sets into elastic vibrations. **Working:** A chip of piezo-electric crystal like quartz is placed between two plates as shown in figure. A suitable oscillator is connected across it. The electric oscillations along the electric axis produce mechanical vibrations along the mechanical axis. The frequency of oscillator is increased. At a particular frequency of oscillator, the oscillator frequency becomes equal to natural frequency of vibration of crystal.Then the crystal sets into resonance vibration and ultrasonic waves are produced.	**4** 1 1 2
	d)	**Write properties of ultrasonic waves.** **Any four property** i) Frequency of these sound waves is more than 20kHz. ii) It has shorter wavelength. iii) They carry high amount of sound energy. iv) The speed of propagation of ultrasonic waves increases with increase in frequency. v) They show negligible diffraction. vi) Ultrasonic waves travel over long distance without considerable loss. vii) Ultrasonic waves undergo reflection and refraction at the separation of two media. viii) If it passed through fluid, then temperature of the fluid increases. ix) They travel with constant speed through a homogeneous medium. x) They posses certain vibrations which are used as good massage action in case of muscular pain.	**4** 4

Q. No.	Sub Q.N.	Answer	Marking Scheme
2.	e)	**State the criteria for selection of NDT method.** **Any four criteria** i)Codes or standard requirement ii)Specification of material to be tested, for example, nature of material, its size and shape iii)Type of disorders to be detected, also depend on nature of disorders. iv)Testing also depends on manufacturing process of material to be tested v)It is also depending on the equipments available for testing vi)Total cost required to test the material.	**4** 4
	f)	**The speed of automobile reduces from45km/hr to 30 km/hr in a distance 264 m. Calculate magnitude if acceleration and time required bringing automobile to rest.** **Each formula** **Each answer with unit** **Given**: u = 45 km/hr = 12.5 m/s , v = 30 km/hr =8.33 m/s , s = 264 m , a= ? , t=? $v^2 = u^2 + 2as$ $a = v^2 – u^2 / 2s = (8.33)^2 – (12.5)^2 / (2 \times 264)$ **$a = - 0.165\ m/s^2$** $a = v – u / t$, $t = v – u / a = (0 – 8.33)/ (-0.164)$ **$t = 25.27\ s$**	**4** 2 2

Q. No.	Sub Q.N.	Answer	Marking Scheme
3.		Attempt **any four** of the following:	**16**
	a)	**Explain variation of thermo emf. with temperature using characteristics curve .**	**4**
		Diagram	2
		Explanation	2
			
		For a given thermocouple , the temperature of one junction is placed at 0^0C and temperature of other junction is increased by providing heat. The emf generated is measured with the help of millivoltmeter. Emfs e_1, e_2, e_3,……for different temperatures t_1, t_2, t_3,…… are recorded and the graph is plotted. It is observed that as the temperature difference between two junctions increases, emf also increases and reaches to maximum value and thereafter emf decreases, becomes zero and reverses its sign.	
	b)	**Compare peltier effect and Joule's effect.**	**4**
		Any four point	4

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

S. No	Peltier effect	Joules effect
1	When electric current flows through a junction of two metals of thermocouple, then heat is generated at one end and heat is absorbed at the other end.	When electric current flows through conductor then it get heated
2	One junction gets heated and other get cooled	heat is produced through out the conductor
3	Heat generated or absorbed is small	Heat generated is large
4	This effect is reversible	This effect is irreversible
5	Amount of heat generated depends on pair of metals and current through it.	Amount of heat generated depends on value of resistance, current, time
6	e.g. thermocouple	e.g. electric heater, electric iron

c) **Threshold wavelength of silver is 3200 A^0. Calculate the maximum energy in eV of photoelectrons emitted when it is exposed to ultra violet light of wavelength 2200 A^0.** — **4**

Formula with substitution — 2

Answer with unit — 2

Given

$\lambda_0 = 3200\ A^0 = 3200 \times 10^{-10}$ m

$\lambda = 2200\ A^0 = 2200 \times 10^{-10}$ m

$h = 6.63 \times 10^{-34}$ Js

$c = 3 \times 10^8$ m/s

Q. No.	Sub Q.N.	Answer	Marking Scheme
3.	c)	$E = hc\left(\frac{1}{\lambda} - \frac{1}{\lambda_0}\right)$ $E = (6.63 \times 10^{-34})(3 \times 10^{8})\left(\frac{1}{2200 \times 10^{-10}} - \frac{1}{3200 \times 10^{-10}}\right)$ $E = 2.75 \times 10^{-19}$ J $E = 2.75 \times 10^{-19} / 1.6 \times 10^{-19}$ **E = 1.72 eV**	
	d)	**State engineering and scientific applications of X-rays.**	**4**
		Any two applications in each field	2
		Engineering Application: i. X- rays are used to detect the cracks in the body of aero plane or motor car ii. X- rays are used to detect the manufacturing defects in rubber tyres or tennis ball in quality control iii. X – rays are used to detect flaws or cracks in metal jobs. iv. X- rays are used to distinguish real diamond from duplicate one v. X- rays are used to detect smuggling gold at airport and docks (ship) yard. X-rays are used to detect cracks in the wall vii. X- ray radiography is used to check the quality of welded joints.	
		Scientific Applications: i)X – rays are used to study structure of crystal and alloy ii)X – rays are used to chemical analysis and for determination of atomic number of chemical elements. iii)X – rays are used to study structure of substances like cellulose , rubber and plastic. iv) X – rays are used for identification of chemical elements present in the solution. v) X – rays are used for analysis of structure of organic molecules.	

Q. No.	Sub Q.N.	Answer	Marking Scheme
3.	e)	**Write properties of LASER** **Each property** i) **The light is coherent:** The light with waves, all exactly in same phase. ii) **The light is monochromatic:** The light whose waves all have the same frequency or wavelength. iii) **The light is unidirectional:** The light produces sharp focus. **iv)The beam is extremely intense:** The light has extreme brightness.	**4** 1
	f)	**A pulley starting from rest with acceleration 0.5 rad/s^2. What will be its speed in r.p.m. at the end of 2 minutes? If the pulley is retarded after this and comes to rest in 3 minutes, find the retardation.** **Formula** A**nswer with unit** **Given:** i) $\omega_0 = 0$, $\alpha = 0.5$ rad/s^2 , t = 2 min= 120 s, $\omega_{rpm} = ?$ ii)t = 3 min = 180 s , $\omega = 0$, $\alpha = ?$ $\omega = \omega_0 + \alpha t = 0 + (0.5 \times 120)$ **ω = 60 rad/sec** **$\omega = 60 \times 60 / 2\pi = 572.88$ rpm** $\alpha = \omega - \omega_0 / t = (0-60) / 180$ **α = - 0.33 rad/s^2**	**4** 1 1