SUMMER– 17 EXAMINATION

17207

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 <u>NINE</u> of the Following:**	**18**
	a)	**Define angular velocity and state its SI unit.**	2
		Definition	1
		Unit	
		Angular velocity:- The rate of change of angular displacement with respect to time is called as angular velocity.	
		S.I.Unit:- rad/s	
	b)	**State work-energy principle.**	2
		Work-energy principle:	
		It states that the work done by a system of forces acting on a body between any two points is equal to the change in kinetic energy of a body between these same two points.	

Q. No.	Sub Q.N.	Answer	Marking Scheme
1.	c)	**State any two properties of ultrasonic waves.**	**2**
		Any two properties	2
		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 possess certain vibrations which are used as good massage action in case of muscular pain.	
	d)	**State any two points of criteria for selection of NDT method.**	**2**
		Any two points	2
		Criteria for selection:-	
		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.	
	e)	**Write the formula for minimum wavelength of X-rays with meaning of each symbol.**	**2**
		Formula	1
		Meaning of symbol	1

$$\lambda_{\min} = \frac{hc}{eV}$$

$\lambda_{\min}$ = minimum wavelength of X - ray
h = Planck's constant
C = Velocity of light
e= Charge of electron
V = Applied voltage

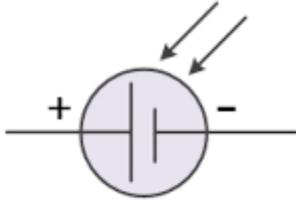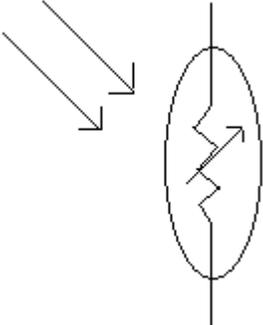| Q. No.	Sub Q.N.	Answer	Marking Scheme
1.	f)	**State inverse square law of photometry.** **Statement :-** "The intensity of illumination of a surface due to a point source of light is inversely proportional to the square of distance of the surface from the source." i.e. $E \propto 1/r^2$	**2**
	g)	**The photoelectric work function of certain metal is 3 x 10^{-19} J. Calculate its threshold frequency If Planck's constant is 6.625 X 10^{-34}Js.** **Formula & substitution** **Answer with unit** Given : $w_0 = 3 \times 10^{-19}$ J $h = 6.62 \times 10^{-34}$ Js $v_0 = ?$ $$w_0 = h\, v_0$$ $$V_0 = \frac{w_0}{h}$$ $$V_0 = \frac{3 \times 10^{-19}}{6.62 \times 10^{-34}}$$ $$v_0 = 0.453 \times 10^{15} \text{ Hz}$$	**2** 1 1
	h)	**What are X-rays? Write any one property of X-rays.** **Definition** **Any one property** X-rays are the electromagnetic waves of very short wavelength. **Properties** (1) X-rays are highly penetrating electromagnetic radiations of very short wavelength. (2) X-rays are electrically neutral. (3) X-rays travel with the speed of light. (4) X-rays affects the photographic plate (5) X-rays are not deflected by electric or magnetic field. (6) X-rays are invisible. (7) They can ionize gases. (8) They produce fluorescence effect. (9) X-ray kills some animal cells.	**2** 1 1

Q. No.	Sub Q.N.	Answer	Marking Scheme
1.	i)	**Why does the gun recoil, when a bullet is fired from a gun? Explain.** **Explanation: -** According to Newtons third law of motion 'For every action there is always equal and opposite reaction.' So when the bullet is fired from gun it moves in forward direction (Action) and its reaction is gun moves in backward direction that is recoil of gun.	**2**
	j)	**Define luminous intensity and state its SI unit.** **Definition** **Unit** **Luminous intensity:-** It is defined as luminous flux per unit solid angle emitted in that direction. **S.I.Unit:- candela or lumens/steradian**	**2** 1 1
	k)	**Draw the symbols of photoelectric cell and LDR.** **Each symbol** **Photoelectric cell:-** **LDR:-** 	**2** 1

Q. No.	Sub Q.N.	Answer	Marking Scheme
1.	l)	**A bullet is fire with a velocity of 300 m/s in a direction making an angle of 30^0 with the horizontal. Calculate the time of flight.**	**2**
		Formula with substitution	1
		Answer with unit	1
		Given,	
		Velocity = 300 m/s	
		$\theta = 30^0$	
		T = ?	
		$$T = \frac{2v \sin \theta}{g}$$	
		T = 2 x 300 sin 30/ 9.8	
		T = 30.612 sec.	
2.		**Attempt any FOUR of the following:**	**16**
	a)	**Write any four applications of centrifugal force.**	**4**
		Each application	**1**
		Application of centrifugal force:	
		1) Banking of curved road.	
		2) Centrifuge machine.	
		3) Drive in a washing machine.	
		4) Centrifugal governor.	
		5) Centrifugal pump.	
		6) Centrifugal Blower.	
	b)	**Define impulse. If a body of mass 200 kg changes its velocity from 144 km/hr to 36 km/hr, calculate the impulse acting on the body.**	**4**
		Definition	1
		Formula	1
		Answer with unit	2
		Impulse-	
		Impulse is defined as change in momentum of a body or object.	
		Given	
		m = 200 kg	
		v= 36 km/hr = 10 m/s	
		u= 144 km/hr = 40 m/s	
		Impulse = Change in Momentum	
		= mv – mu	
		= (200 x 10) –(200 x 40)	
		= 2000 – 8000	
		= - 6000 kg m/s or Ns	

Q. No.	Sub Q.N.	Answer	Marking Scheme
2.	c)	**Explain production of ultrasonic waves by piezoelectric method with the help of neat diagram.**	**4**
		Diagram with label	1
		Principle	1
		Working	2
		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 along the perpendicular axis.	
		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.	
	d)	**A flywheel of radius 4 cm rotating at 800 rpm accelerates to 2000 rpm in 10 minutes. Calculate linear acceleration and angular acceleration of flywheel.**	**4**
		Each Formula & Substitution	2
		Each Answer with unit	2
		Given: radius $(r) = 4$ cm $= 4 \times 10^{-2}$ m	
		$n_0 = 800 /60 = 13.33$ rps $n_1 = 2000 / 60 = 33.33$ rps	
		$t = 10$ min. $= 600$ s	
		$\alpha = ?$	
		$a = ?$	
		$\alpha = w_1 - w_0 / t$	
		$\alpha = 2 \pi (n_1 - n_0) / t$	
		$\alpha = 2 \times 3.14 \times (33.33 - 13.33) / 600$	
		$\boldsymbol{\alpha = 0.209 \text{ rad/s}^2}$	
		$a = r \alpha$	
		$a = 4 \times 10^{-2} \times 0.209$	
		$\boldsymbol{a = 0.836 \times 10^{-2} \text{ m/s}^2}$	

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2.	e)	**(i) Draw a neat labeled diagram of Bunsen's photometer.** **(ii) State any two factors affecting the indoor lighting.** **Diagram** **Any two factors** **Factors affecting indoor lighting.** 1) Efficiency of the source 2) Utilization factor 3) Maintenance factor 4) Space to height ratio 5) Glare effect	**4** 2 2
	f)	**Compare between LPT and UT method on the basis of principle of Working, advantages, disadvantages and probing medium.** **Each point**	**4** 1
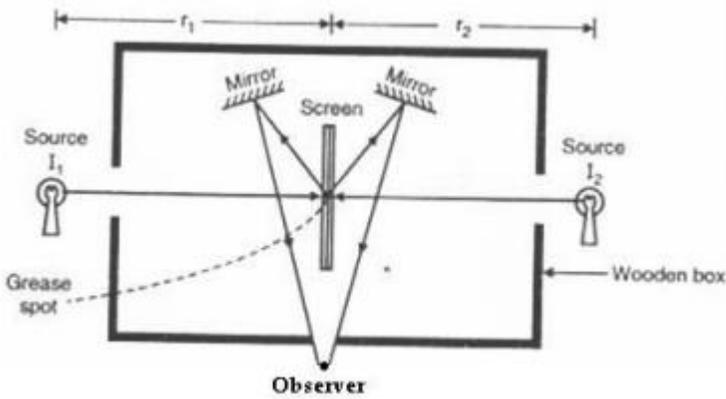
Point	LPT	UT
Principle of Working	Capillary action	Reflection ,Transmission, scattering of Ultrasonics from disorder
Advantages	Easy & economical, Detection of defects open to surface.	Detection of internal defects.
Disadvantages	Not useful for highly porous material.	Cannot be used without couplant.
Probing medium	Penetrant	Ultrasonics

Q. No.	Sub Q.N.	Answer	Marking Scheme
3.		**Attempt any FOUR of the following:**	**16**
	a)	**State any four requirements of good acoustics of building.**	**4**
		Any four requirements	4
		1. The sound produced should be heard at all points in the hall sufficiently loudly.	
		2. The sound produced should not overlap.	
		3. There should not be focusing of sound.	
		4. There should not be any dead spot or silence zones in the hall.	
		5. The reverberation time should have proper value.	
		6. The echelon effect should be absent.	
		7. The external sound should not enter the hall.	
		8. The sound produced should be clear & should be uniformly distributed through out the hall.	
		Any other relevant requirement.	
	b)	**Write any four advantages of NDT method.**	**4**
		Any four advantages	4
		Advantages of non-destructive testing	
		1. Rapid inspection of each & every component is possible.	
		2. 100 % examination of material or production is possible.	
		3. NDT methods can be automated to lower their costs.	
		4. Testing is possible on shop, floor because of portable equipments; this controls the equality of further production.	
		5. Permanent record of testing can be made during the testing process.	
		6. The destructed parts can be separated in the early stages of manufacturing. This saves the time & production cost.	
		7. Higher accuracy, reliability & repeatability in the test result can be obtained.	
		Any other relevant requirement.	
	c)	**With the help of neat labeled diagram, explain construction and working of photoelectric cell.**	**4**
		Diagram	**1½**
		Construction	**1½**
		Working	**1**

Q. No.	Sub Q.N.	Answer	Marking Scheme
3.	c)	Ultraviolet light K = Cathode A = Anode **Construction:-** It consists of evacuated glass bulb containing cathode and anode. The semi cylindrical cathode coated with photosensitive material from inner side. The anode is the platinum rod. The cathode is connected to negative terminal and anode is connected to positive terminal of battery. **Working:-** When light is allowed to fall on cathode it emits Photoelectrons. These photoelectrons are attracted by anode. The photoelectric current flows through the circuit &millimeter Shows the deflection. In this way the light energy is converted into electrical energy.	
	d)	**The volume of room is 1500 m³. The wall area of room is 260m², the floor is 140 m² and the ceiling area is 140 m². The sound absorption coefficients are 0.03, 0.8 and 0.06 for wall, ceiling and floor respectively. Calculate the reverberation time.** **Formula with substitution** **Answer with unit** Given: $V = 1500 \text{ m}^3$ $S_w = 260 \text{ m}^2$ $a_w = 0.03$ $S_f = 140 \text{ m}^2$ $a_f = 0.06$ $S_c = 140 \text{ m}^2$ $a_c = 0.8$ $t = ?$ $t = 0.164 \, V / \sum aS$ $t = 0.164 \, V / a_w \cdot S_w + a_f \cdot S_f + a_c \cdot S_c$ $t = 0.164 \times 1500 / (260 \times 0.03) + (140 \times 0.8) + (140 \times 0.06)$ **t = 1.9188 sec.**	**4** 2 2

Q. No.	Sub Q.N.	Answer	Marking Scheme
3.	e)	**State application of X-rays in scientific and engineering fields (any two each).** **Any two applications in each field**	**4** 2
		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.	
		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.	
		vi. X-rays are used to detect cracks in the wall	
		vii. X- ray radiography is used to check the quality of welded joints.	
	f)	**A vehicle covers 60 m in 3rd second and 100 m in 7th second during its motion. Calculate its initial velocity and acceleration.** **Two formula** **Two Answers with unit** Solution:	**4** 2 2
		Given: $S_3 = 60$ m , $S_7 = 100$ m	
		Required: a =? u = ?	
		$$S_n = u + a/2 \ (2n-1)$$	
		$$S_3 = u + a/2 \ (2 \times 3 - 1)$$	
		$$60 = u + 5a/2 \qquad ....(1)$$	

Q. No.	Sub Q.N.	Answer	Marking Scheme
3.	f)	$S_7 = u + a/2\ (\ 2x\ 7\ -\ 1\ )$ $100 = u + 13a/2$ …………(2) Subtracting eq^n (1) from eq^n (2) $100 - 60 = 13a/2 - 5a/2$ $40 = 4a$ **$a = 10\ m/s^2$** Putting above value in eq^n (1) $60 = u + 5\ x\ 10\ /2$ **$u = 35\ m/s$**	