WINTER – 2014 EXAMINATION

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
		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.		

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
1)		**Attempt any Nine**		18
	a)	**Define linear velocity and angular velocity.**		
		Each Definition	1	2
		Linear velocity:-Linear velocity is the velocity of an object moving in a straight line when its direction does not changes. OR **Angular velocity:-**The rate of change of angular displacement with respect to time is called as angular velocity.		
	b)	**Define impulse.state its SI unit.**		
		Definition	1	
		Unit	1	2
		Impulse: It is defined as change in momentum. OR It is defined as product of large force on a body and very small time for which force acts. Unit of impulse in kg.m/s OR N-s		
	c)	**State any two properties of ultrasonic waves**		
		Each 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.	1	2

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1)	d)	**List the four names of N.D.T. methods used in industries.** **Each method** **NDT methods:** 1) Liquid penetrant testing (LPT) 2) Ultrasonic testing (UT) 3) Magnetic particle testing (MT) 4) Radiograph testing (RT) 5) Leak testing (LT) 6) Visual testing (VA) 7) Holographic testing (HT) 8) Thermal infra radiography (TR) **Note: Any other relevant factors can be considered.**	½	2
	e)	**State any two engineering applications of X-rays.** **Each application** 1) X- rays are used to detect the cracks in the body of aero plane or motor car. 2) X- rays are used to detect the manufacturing defects in rubber tyres or tennis ball in quality control. 3) X – rays are used to detect flows or cracks in metal jobs. 4) X- rays are used to distinguish real diamond from duplicate one. 5) X- rays are used to detect smuggling gold at airport and docks (ship) yard. 6) X-rays are used to detect cracks in the wall. 7) X- ray radiography is used to check the quality of welded joints. **Any other relevant application.**	1	2
	f)	**Define intensity of illumination. State its SI unit.** **Definition** **Unit** **Illumination or intensity of illumination :** The illumination or intensity of illumination at point on a surface is defined as the luminous flux received on unit area of surface around the point. **Unit:-**lumens/meter^2.	1 1	2

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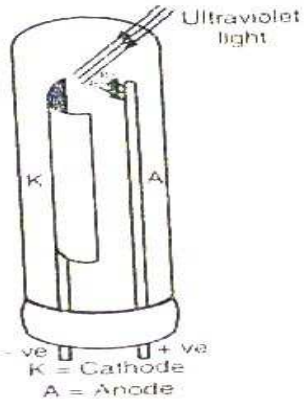
1)	g)	**Draw a neat labeled ray diagram of photoelectric cell.**  	2	2
	h)	**State any two properties of X-rays.** **Each property** (1) X-rays are highly penetrating electromagnetic radiations of very short wavelength. (2) X-rays are electrically neutral. (3) X-rays travel with the speed of light. (4) 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 cannot be reflected by ordinary mirrors, lenses or by prism. They can be reflected, refracted, detracted by crystals under certain conditions. (9) They show interference and polarization like light. (10) They produce fluorescence effect. (11) X-ray kills some animal cells.	1	2
	i)	**State Newton's third law of motion with examples.** **Law** **Example** **Law:-**It states that for every action, there is always an equal and opposite rection. **Example:-** A swimmer pushes the water back (action) and water pushes him forward(rection). **Any otherrelavant examples.**	1 1	2

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Subject Code: 17207 **Model Answer**

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1)	j)	**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. $E \alpha 1/r^2$	2	2
	k)	**The photoelectric work function of a metal is 5eV. Calculate its threshold frequency.(h = 6.63 × 10^{-34} Js)** **Formula and substitution** **Answer with unit** Given: $W_0 = 5eV$ $= 5 \times (1.6 \times 19^{-19})$ J $\square_0 = ?$ We have, $W_0 = h\square_0$ $\square_0 = \frac{W_0}{h}$ $= \frac{(5\times1.6\times10^{-19})}{(6.63\times10^{-34})}$ $= 1.2066 \times 10^{15}$ Hz.	1 1	2
	l)	**A bullet is fired with a velocity of 250 m/s in the direction making an angle of 45 ^{0} with horizontal. Calculate its range.** **Formula & Substitution** **Answer with Unit** Given V = 250 m/s $\theta = 45^0$ Range =? We have $\text{Range} = \frac{v^2 \sin 2\theta}{g}$ $= \frac{(250)^2 \times \sin(2\times45)}{9.8}$ = 6371.04 m.	1 1	2

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2)		**Attempt any Four of the following:**		16
	a)	**Define** **i) Trajectory ii) Angle of projection** **iii) Time of flight iv) Range of projectile.** **Each definatition** **i) Trajectory :-**The path along which projectile moves is called trajectory. **OR** It is also defined as the path traced by an object in projectile motion. **ii) Angle of projection:-**It is defined as angle made by the velocity of projection with the horizontal at the original point. **iii) Time of flight:-**The total time in which projectile covers the entire trajectory is called as time of flight. **iv) Range of projectile:-**The total horizontal distance covered by a projectile is called as range.	1	4
	b)	**A freely falling body of mass 15 kg is at a distance of 20 m above the ground, it has a downward velocity of 12 m/s** **Calculate: i) Potential energy ii) Kinectic energy** **iii) Total energy of the body with respect to ground level.** Given:- mass (m) = 15 kg height (h) = 20 m velocity(v) = 12 m/s We have, Potential energy = mgh = 15 x 9.8 x 20 = 2940 J. Kinetic energy = ½ mv^2 = ½ x 15 x $(12)^2$ = 1080 J. Total energy = Potential energy + Kinectic energy. = 4020 J.		4

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2)	c)	**Explain piezoelectric method for production of 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 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.	1 1 2	4
	d)	**A train crosses a tunnel in 20 sec. At the entry of tunnel, velocity is 72 km/hr and at the exit of tunnel, velocity becomes 36 km/hr. find length of the tunnel.** **Formula and conversion** **Answer with unit** Given, t = 20 sec. u = 72 km/hr $u = \frac{72 \times 1000}{60 \times 60}$ u = 20 m/s. v = 36 km/hr. $v = \frac{36 \times 1000}{60 \times 60}$ v = 10 m/s Length of tunnel = Distance covered = s = ? We have,	2 2	4

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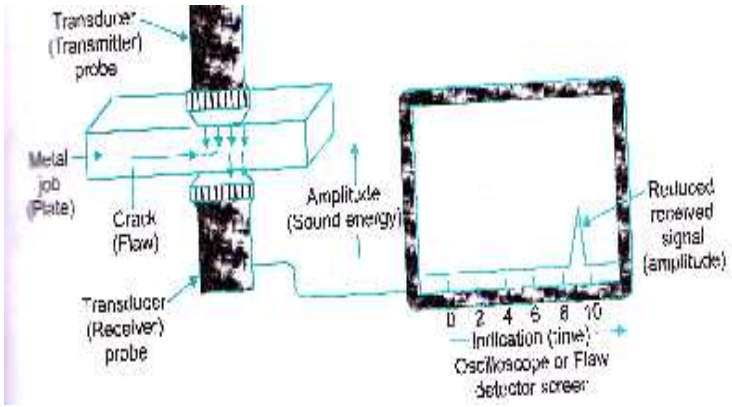
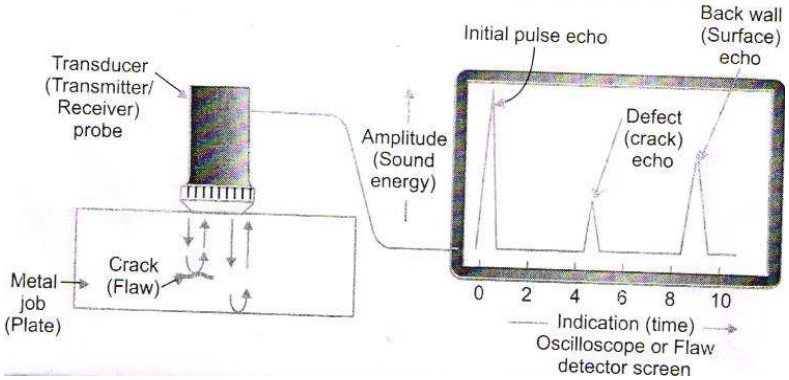
2)	d)	$a = \frac{v-u}{t} = \frac{10-20}{20}$ $a = -0.5\ m/s^2$ Now, $v^2 = u^2 + 2as$ $s = \frac{v^2-u^2}{2a} = \frac{(10)^2-(20)^2}{2\times(-0.5)}$ s = 300 m. **Length of tunnel = s = 300 m**		
	e)	**Explain ultrasonic testing method with the help of principle and experimental procedure.** Principle Diagram and Explanation **Principle:-** When ultrasonic are introduced into a material it gets reflected, transmitted , scattered from surface or flow. There are two tyes of UT methods. 1)Transmission UT method. 2) Pulse Echo UT method. **Transmission UT method:-** **Procedure:-** In this method two different tranducers are used, one acting as a transmitter and other acting as a receiver. The transmitter convers electrical pulse into sound signal. This sound pulse travels through the material. the receiver on opposite side receives these sound signals and converted into electrical pulse. This signal pulse sent to CRT screen. This screen displays amplitude on Y axis and time on X axis. If the signals are not received by receiver it indicates that there is crack in the material, complete lack of signal indicates that flow or crack is very large enough to reflect completely. If the received signal is 100% the the material is flowless.	1 3	4

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
2)	e)	 **Pulse Echo UT method:-** **Procedure:-** In this case only one transducer is used. This transducer acts as transmitter as well as receiver. Initially transducer acts as transmitter it electrical energy into sound energy. This sound pulse travels through the material and reflected by crack or opposite wall and return back. Now the transducer acts as receiver. The received sound energy is converted into electrical pulse. This signal pulse sent to CRT screen. This screen displays amplitude on Y axis and time on X axis. Some sound is transmitted through material and some sound is reflected from the first surfaces and gives a pulse which indicates the initial pulse. The electrical transmission pulse triggers a sound pulse at the probe crystal. At the same time this voltage pulse is fed to the input of CRT is called initial pulse as shown in following diagram. 		

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2)	f)	**State the factors on which selection of NDT method depends.** **Each factor** 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.	1	4
3)		**Attempt any four of the following:**		16
	a)	**State conditions for good acoustics of an auditorium.** **Any four** **Requirements of good acoustics:** 1. The sound produced should be clear & should be uniformly distributed through out the hall. 2. The sound produced should be heard at all points in the hall sufficiently loudly. 3. The sound produced should not overlap. 4. There should not be focusing of sound. 5. There should not be any dead spot or silence zones in the hall. 6. The reverberation time should have proper value. 7. The echelon effect should be absent. 8. The external sound should not enter the hall. 9. There should be no resonance within the building. **Any other relevant requirement.**	4	4
	b)	**Explain principle, construction and working of Bunsen's photometer.** **Principle** **Diagram** **Construction** **Working** **Principle :** If two source of light of illuminating powers I_1& I_2 are kept at a distance r_1 and r_2 from a screen then the intensities of illumination at a point on the screen due to two source are $\frac{I_1}{I_2} = \frac{r_1^2}{r_2^2}$	1 1 1 1	4

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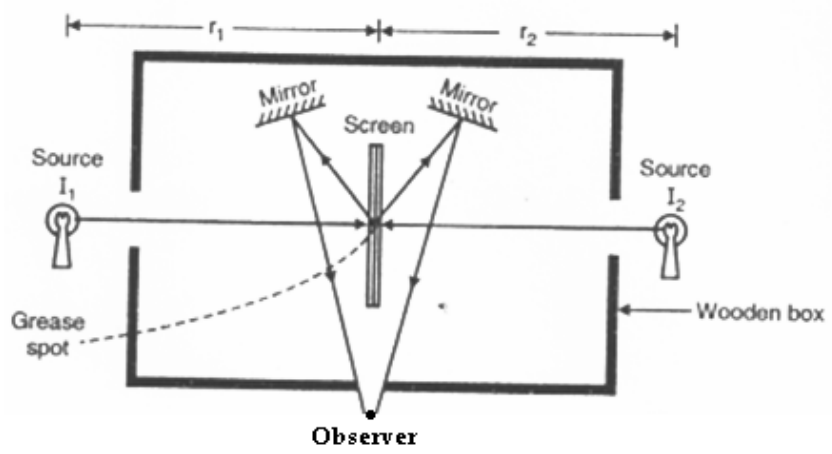
3)	b)			
		Construction- It consists of a white paper called screen with a grease spot at its center. This screen is mounted centrally in a wooden box. The grease spot is easily differentiated from rest of the screen because most of the light transmits through grease spot than the rest of the screen. Two mirrors are adjusted in inclined position on either side of the screen such that both sides of the screen can be seen at a time. The box is provided with two co-axial windows. The box is mounted on a vertical stand of adjustable height. An observer can watch the screen through central window. **Working:** The two sources of intensity I_1& I_2 are placed at a distance r_1& r_2 from the screen respectively. Position of source are adjusted such that image of the grease spot seen in two mirrors is equally bright. Then the luminous intensities of 2 sources can be compared using relation $$\frac{I_1}{I_2}=\frac{r_1^2}{r_2^2}$$ The same procedure is repeated by changing the position of two sources.		
	c)	**Define i) Threshold frequency ii) Threshold wavelength iii) Stoping potential iv) Potoelectric work function** **Each definition** **Threshold frequency:** It is the minimum frequency of incident light at which emission just begins.	1	4

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3)	c)	**Threshold wavelength:** It is the maximum wavelength of incident light at which emission just begins. **Stoping potential:-** It is the negative potential at which photoelectric current becomes zero. **Photoelecrtic work function:-**Photoelecrtic work function of a metal is the energy required to detach (seprate) the electron from metal.		
	d)	**Find the minimum wavelength and mximum frequency of X-rays produced by tube working on 50kV.** **[Given h=6.62 X10^{-34}Js, e=1.6X10^{-19}C and c =3X10^{8} m/s) Each formula** **Each answer with unit** Given V=50kV=50X10^{3}V h = 6.63X10-^{34}Js e=1.6X10^{-19}C c =3X10^{8} m/s We have, $\lambda_{min} = \frac{hc}{eV}$ $\lambda_{min} = \frac{(6.62\times10^{-34})(3\times10^{8})}{(1.6\times10^{-19})(50\times10^{3})}$ $\lambda_{min} =$ **0.248 x 10^{-10} m.** $\lambda_{min} =$ **0.248 A^{0}** $f = \frac{c}{\lambda_{min}}$ $f = \frac{(3\times10^{8})}{(0.248\times10^{-10})}$ $f =$ **120 x 10^{17} Hz.**	1 1	4
	e)	**A leature hall has a total surface absorption equivalent to 180 sabine. The reverberation time is 3.30 sec., find volume of the hall.** **Formula and substitution** **Answer with unit**	2 2	4

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3)	e)	Given: $A = \sum aS = 180$ sabine $t = 3.30$ sec. $V = ?$ We have, $t = \frac{0.164V}{\Sigma aS}$ $V = \frac{t \times \sum aS}{0.164}$ $V = \frac{3.30 \times 180}{0.164}$ $V = 3621.95\ m^3$.		
	f)	**i) State the formula for distance travelled by a body during n^{th} second in rectilinear motion with meaning of each symbol.** **Formula** **meaning** Distance travelled in n^{th} second, $s^n = u + \frac{a}{2}(2n - 1)$ Where, s = Distance travelled in n^{th} second. u = Initial velocity.	1 1	2
		ii) State the three equation of motion when a body is freely falling under gravity with meaning of each symbol. **Formula** **meaning** $v = u + gt$ $s = ut + \frac{1}{2}gt^2$ $v^2 = u^2 + 2gs$ Where, u = Initial velocity. v = Final velocity. t = Time taken by particle to change velocity from u to v s = Distance travelled in time t. g = Gravitational acceleration.	1 1	2