WINTER– 16 EXAMINATION
Model Answer **Subject Code:** 17207

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.	Answer	Marking Scheme
1.		**Attempt any NINE of the Following:**	18
	a)	**Define (i) Uniform velocity (ii) Uniform acceleration**	
		Each Definition	**2**
		Uniform velocity: If a body is moving with constant speed in the same direction then it is said to be in uniform velocity.	1
		Uniform acceleration: If the acceleration of body is uniform in magnitude and direction with respect to time is called as uniform acceleration.	
	b)	**Define Kinetic energy write its formula.**	**2**
		Definition	1
		Formula	1
		Kinetic Energy: The energy possessed by a body due to its motion is called as kinetic energy.	
		Formula : $K.E = 1 / 2\ mv^2$	

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1.	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 possess certain vibrations which are used as good massage action in case of muscular pain.	**2** 1
	d)	**State the NDT method to be used for testing if there are cracks on the surface or near the surface of job with appropriate reason.** **Method** **Reason** **Method- LPT(Liquid penetrant Testing** **Reason-** The property of liquid to slip into cracks or discontinuities is used to visualise the defect.	**2** 1 1
	e)	**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.	**2** 1

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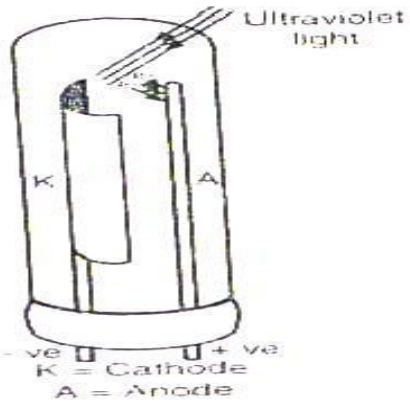
Q. No.	Sub Q.N.	Answer	Marking Scheme
1.	f)	**Define intensity of illumination. State its SI unit.** **Definition** **Unit** **Illumination or intensity of illumination :** The illumination or intensity of illumination at point on a surface is defined as the luminous flux received on unit area of surface around the point. **Unit: -** lumens/meter^2.	**2** 1 1
	g)	**Draw a neat labeled ray diagram of photoelectric cell.** 	**2**
	h)	**Write the formula for minimum wavelength of X-rays with meaning of each symbol involved in it.** **Formula** **Meaning of symbol** $\lambda_{min} = \frac{hc}{eV}$ λ_{min} = minimum wavelength of X - ray h = Planck's constant C = Velocity of light e= Charge of electron V = Applied voltage	**2** 1 1

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Q. No.	Sub Q.N.	Answer	Marking Scheme
1.	i)	**While swimming in water, Newton's third law of motion is followed. Explain**. While swimming in water the force of reaction makes a swimmer to move forward according to Newton's third law of motion. (while swimming a swimmer pushes water backward (action) and water pushes him forward with equal force (reaction))	**2**
	j)	**Which lighting system is preferred in workshops? Why?** Indirect lighting system is preferred in workshop to avoid shadow effect and glaring effects.	**2**
	k)	**An accelerated electron emits a quantum of radiation with frequency 9 x 10^{19} Hz. Calculate energy. (h=6.63x10^{-34} J-sec)** **Formula with substitution** **Answer with unit** **Given** $\upsilon = 9 \times 10^{19}$ Hz h=6.63x10^{-34} J-sec E =? $E = h \times \upsilon$ $E = (6.63\times10^{-34} \times 9 \times 10^{19})$ **$E = 59.67 \times 10^{-15}$ joule.**	**2** 1 1
	l)	**A ball is thrown with a velocity of 50 m/s making an angle of 40 ^{0} with the horizontal. Calculate the range covered by a ball.** **Formula & Substitution** **Answer with Unit** Given V = 50 m/s $\theta = 40^0$ Range =? We have, $\text{Range} = \frac{v^2 \sin 2\theta}{g}$ $= \frac{(50)^2 \sin(2\times40)}{9.81}$ **Range = 251.2 m**	**2** 1 1

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Q. No.	Sub Q.N.	Answer	Marking Scheme
2.		**Attempt any FOUR of the following:**	16
	a)	**Differentiate between Centripetal force and centrifugal force. (any four points)**	**4**
		Each point	1

Centripetal force	**Centrifugal force**
It is the force acting on the particle in U.C.M. which is directed along the radius and towards the center of circular path	It is the force acting on the particle in U.C.M. which is directed along the radius and away the center of circular path
This is real force	This is pseudo(imaginary) force
This force acting towards the center	This force acting away from the center
Required to maintain U.C.M.	This force is required and help to obey Newton's laws of motion in accelerated frame of reference .

b) **A cubical water tank has a side of 2 m each. It is placed with its base 9 m above the ground level. Find the potential energy of the water tank when the tank is full.** — **4**

Each Formula — 1

Each Answer with unit — 1

Given: Side = 2 m , Volume = 2 x2 x 2 =8 m^3, Mass = 8 x 10^3 Kg

Find: P.E. =?

Base of the tank is 9m. therefore center of the tank is (9+1)m away from the ground.

Therefore h = 10 m

P.E. = mgh

P.E. = 8 x 10^3 x 9.8 x 10

P.E. = 784.8 x 10^3 J

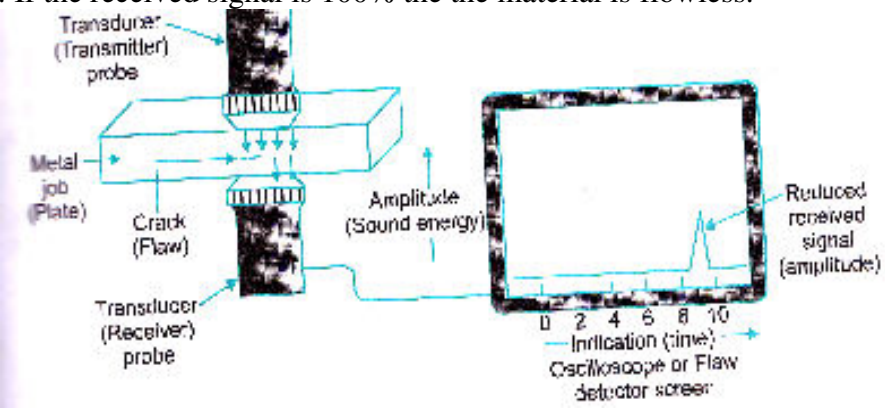
c) **Explain ultrasonic testing method with the help of principle and experimental procedure.** — **4**

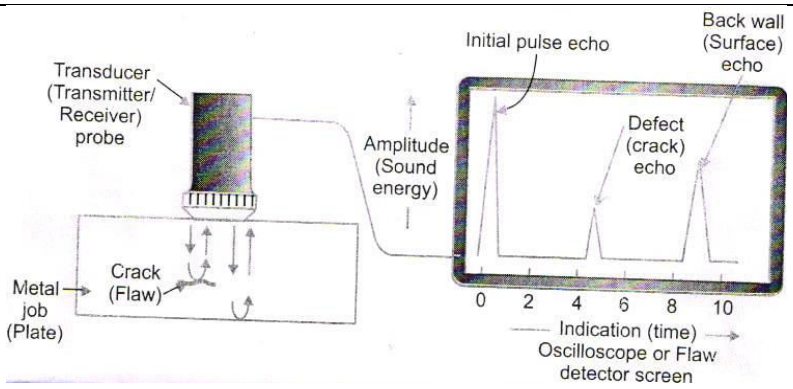
Principle — 1

Each Diagram and Explanation — 1 ½

Principle:-

When ultrasonic are introduced into a material it gets reflected, transmitted, scattered from surface or flow.

Q. No.	Sub Q.N.	Answer	Marking Scheme
2.	c)	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.  **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	

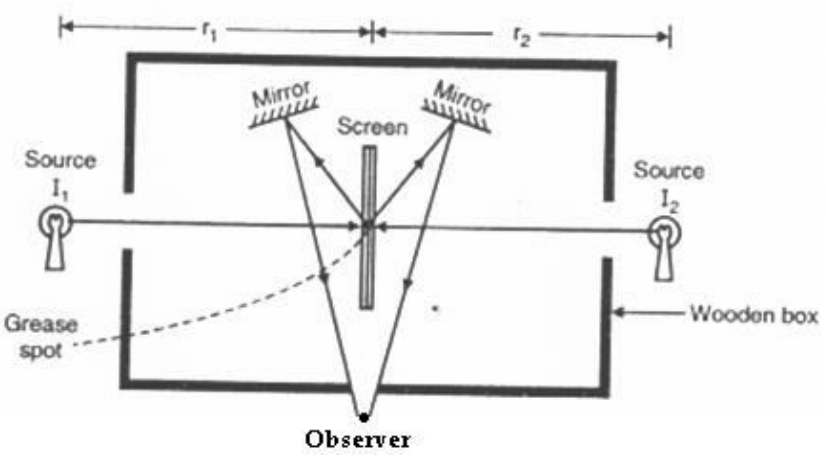
Q. No.	Sub Q.N.	Answer	Marking Scheme
2.	c)		
	d)	**In case of uniform circular motion. If radius vector of 90 cm subtends an angle of π/3 radian in 3 sec. calculate angular velocity and linear velocity.** **Each Formula** **Each answer with unit** Given: r = 90 x 10^{-2} m , θ = π/3 radian , t = 3 sec. Find: ω =? v =? **i) ω = θ/t = π/3 /3 = π /9 = 180 /9 = 20 rad/sec.** **ii) v = rω = 90 x 10^{-2} x 20 = 18 m/s**	**4** 1 1
	e)	**What is NDT? State any three advantages.** **Definition** **Any three Advantages** **NDT: Testing of the material without distructing it is called non destructive testing.** **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.	**4** 1 3

Q. No.	Sub Q.N.	Answer	Marking Scheme
2.	f)	**Explain production of ultrasonic waves by piezoelectric method.** **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	**4** 1 1 2
3.		**Attempt any <u>FOUR</u> of the following:**	**16**
	a)	**State conditions for good acoustics of an auditorium.** **Any four condition** 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. There should be no resonance within the building. 9. The sound produced should be clear & should be uniformly distributed through out the hall. **Any other relevant requirement.**	**4** 4

Q. No.	Sub Q.N.	Answer	Marking Scheme
3.	b)	**Explain principle, construction and working of Bunsen's photometer.** **Principle** **Construction** **Working**	**4** 1 1 ½ 1 ½

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

$$\frac{I_1}{I_2} = \frac{r_1^2}{r_2^2}$$



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.

Q. No.	Sub Q.N.	Answer	Marking Scheme
3.	c)	**State any four characteristics of photoelectric effect.** **Any four characteristics** 1) A metal emits electrons only when the incident (light) radiation has frequency greater than critical frequency (υ_0) called threshold frequency. Threshold frequency is different for different metals. 2) Photoelectric current is directly proportional to intensity of light and independent of frequency. 3) The velocity of photoelectron is directly proportional to the frequency of light. 4) For a given metal surface, stopping potential is directly proportional to the frequency and is not dependent on intensity light. 5) The rate of emission of photoelectrons from the photocathode is independent of its temperature i.e. photoelectric emission is different from thermionic emission. 6) The process is instantaneous.	**4** 4
	d)	**The energy of X-ray spectrum is 3.3 eV. Find its frequency. (Given h= 6.63 x 10^{-34}J-sec and 1eV = 1.6 X 10^{-19} J)** **Formula** **Answer with unit** **Given: E =**3.3 eV =3.3 x 1.6 X 10^{-19}, h= 6.63 x 10^{-34}Js Find: υ =? $E = h\upsilon$ $\upsilon = E / h = 3.3 \times 1.6 \times 10^{-19} / 6.63 \times 10^{-34}$ **$\upsilon = 7.96 \times 10^{14}$ Hz**	**4** 2 2
	e)	**The volume of a hall is 9000 m^3 and reverberation time is 1.8 seconds. If the absorption surface of the hall has area 5000 m^2, determine the coefficient of absorption.** **Formula with substitution** **Answer with unit** Given: V=9000 m^3 t=1.8 sec $\Sigma S = 5000\ m^2$ a=? Formula : $t = \frac{0.164\ V}{\Sigma as}$	**4** 2 2

Q. No.	Sub Q.N.	Answer	Marking Scheme
3.	e)	$a = \frac{0.164 \times V}{t \ \Sigma s}$ $= \frac{0.164 \times 9000}{1.8 \times 5000}$ **a=0.164 0.W.U**	
	f)	**A car has initial velocity of 5 m/s. It accelerates for 10 second at rate of 2.5 m/s^2. Determine the final velocity and distance travelled during this time.** **Each Formula** **Each answer with unit** **Given:** u = 5 m/s , a = 2.5 m/s^2 , t = 10 s **Find :** v =? , s = ? v = u + at = 5 + 2.5 x10 = 30 m . s = ut + ½ at^2 = 5x10 + ½ (2.5x100) **s = 175 m**	**4** 1 1