WINTER-19 EXAMINATION

Subject Name: Applied Science **Model Answer** Subject Code: 17207

Important Instructions to examiners:

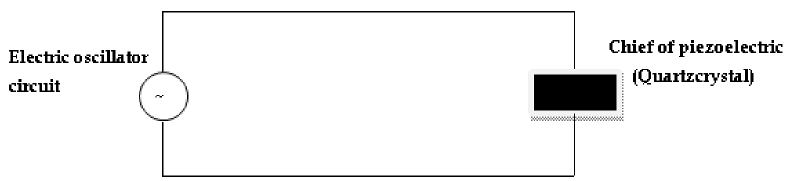
1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling 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.

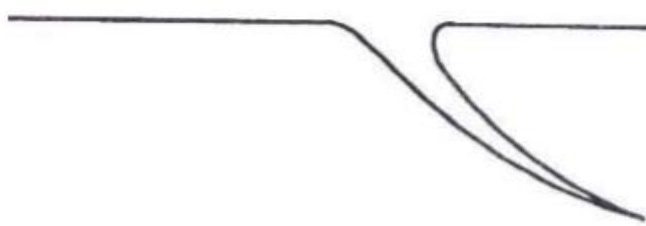
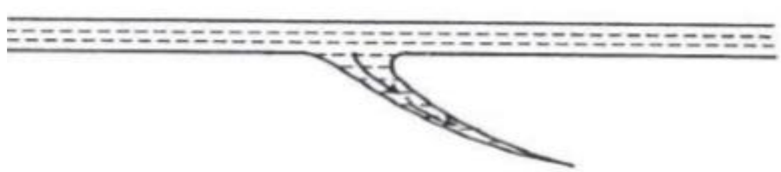
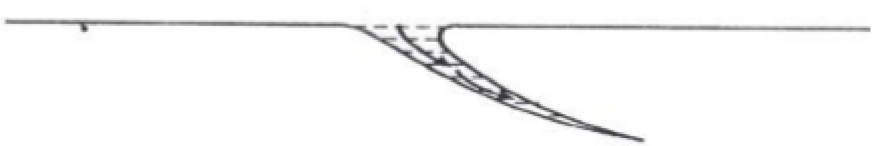
Q. No.	Sub Q. N.	Answers	Marking Scheme
1		**Attempt any NINE of the following :**	**18**
	a)	**Define i) Linear velocity ii) Angular velocity**	**2**
		Each definition	1
		Linear velocity:- It is the rate of change of position of an object that is traveling along a straight path. **Angular velocity: -** The rate of change of angular displacement with respect to time is called as angular velocity.	
	b)	**State Newton's third law of motion with examples.**	**2**
		Law	1
		Example	1
		Law:-It states that for every action, there is always an equal and opposite reaction. **Example:-** A swimmer pushes the water back (action) and water pushes him forward (reaction). **Any other relevant examples.**	
	c)	**Define ultrasonic waves.** **Ultrasonic waves:-** The sound waves having frequency more than 20kHz are called as ultrasonic waves.	**2**

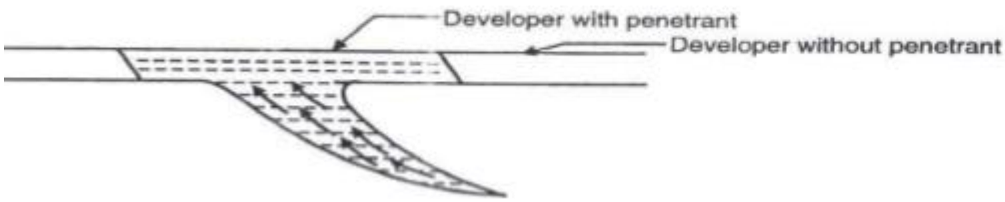
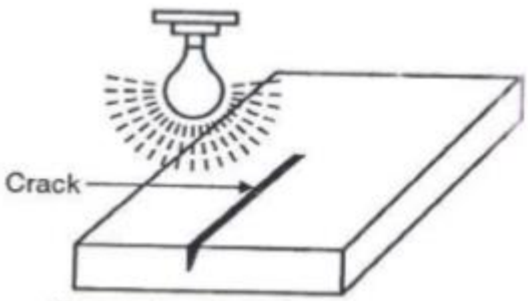
Q. No.	Sub Q. N.	Answers	Marking Scheme
1	d)	**Name any two NDT methods used in industry.** **Any two methods** **Non Destructive Testing methods:-** 1) Liquid penetrant testing (LPT) 2) Ultrasonic testing (UT) 3) Magnetic particle testing (MT) 4) Radiograph testing (RT) 5) Leak testing (LT) 6) Visual testing (VA) 7) Holographic testing (HT) 8) Thermal infra radiography (TR) **Note: Any other relevant method can be considered.**	**2** 2
	e)	**State any two engineering applications of X-rays.** **Any two correct applications** 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. **Note: Any other relevant applications can be considered.**	**2** 2
	f)	**Define luminous intensity. State its SI unit.** **Definition** **Unit** **Luminous intensity:-** It is defined as luminous flux per unit solid angle emitted in that direction. **Unit:-** lumens / steradian or candela.	**2** 1 1
	g)	**State Planck's hypothesis.** **Planck's Hypothesis:** According to Planck's hypothesis energy is not emitted or absorbed continuously but in a discrete units or packets called photon or quanta. The photons are electrically neutral and traveled with speed of light i.e. the radiation considers as shower of photons.	**2** **2**

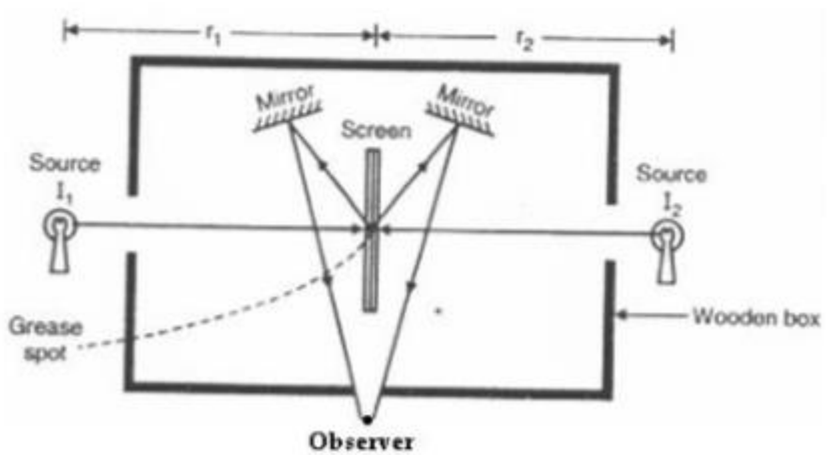
Q. No.	Sub Q. N.	Answers	Marking Scheme
1	h)	**State any two properties of X- rays.** **Any two properties** (1) X-rays are highly penetrating electromagnetic radiations of very short wavelength. (2) X-rays are electrically neutral. (3) X-rays travel with the speed of light. (4) X-rays affects the photographic plate. (5) X-rays are not deflected by electric or magnetic field. (6) X-rays are invisible. (7) They can ionize gases. (8) They cannot be reflected by ordinary mirrors, lenses or by prism. They can be Reflected, refracted and diffracted 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** 2
	i)	**Define kinetic energy. State its SI unit.** **Definition** **SI unit** **Kinetic energy:** The energy possessed by the body due to its motion is called kinetic energy. **S.I.Unit:-** Joule.	**2** 1 1
	j)	**State principle of photometry.** **Principle:-** If two sources of light of illuminating powers I_1 and I_2 are kept at a distances r_1 and r_2 from a screen then the intensities of illumination at a point on the screen due to the two sources are I_1 / r_1^2 and I_2 / r_2^2 respectively.	**2** **2**
	k)	**The energy of photon is 5.28 x 10^{-19} J. Calculate its frequency. (h = 6.625 x 10^{-34} Js)** **Formula with substitution** **Answer with unit** Given $E = 5.28 \times 10^{-19}$ J $h = 6.625 \times 10^{-34}$ Js $\upsilon = ?$ We have $\upsilon = E/h$ $= 5.28 \times 10^{-19} / (6.625 \times 10^{-34})$ $\boldsymbol{\upsilon = 0.796 \times 10^{15}}$ **Hz**	**2** 1 1

Q. No.	Sub Q. N.	Answers	Marking Scheme
1	l)	**A bullet is fired with the velocity of 300 m/s in the direction making an angle of 40^0 with horizontal. Calculate maximum height reached.** **Formula & Substitution** **Answer with Unit** Given v = 300 m/s $\theta = 40^0$ Range =? We have Height (H) = $(v \sin \theta)^2 / 2g$ $= (300 \times \sin 40^0)^2 / (2 \times 9.8)$ = 1897.2 m.	**2** 1 1
2		**Attempt any Four of the following:**	**16**
	a)	**Define** **i) Projectile motion ii) Circular motion** **iii) Angle of projection iv) Trajectory** **Each definition** **i) Projectile motion:-** Projectile motion is the motion of a body thrown in air at an angle θ with the horizontal. **OR** Projectile motion is the motion of a body thrown in air making some angle θ with the horizontal, moving freely under gravity. **ii) Circular motion:-** Circular motion is defined as the motion of a particle along the circumference of circle. **iii) Angle of projection:-**It is defined as angle made by the velocity of projection with the horizontal at the original point. **iv) 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.	**4** 1
	b)	**A man pulls a hand roller on a cricket pitch with a force of 150 N inclined at an angle of 45^0 to the horizontal. Find the work done in pulling the roller over a pitch of 20 m long.** **Formula with substitution** **Answer with unit** Given, Force (F) = 150 N $\theta = 45^0$ Displacement (s) = 20 m Work done = ?	**4** 2 2

Q. No.	Sub Q. N.	Answers	Marking Scheme
2	b)	We have, Work done = (F cos θ) x s = (150 x cos 45^0) x 20 **Work done = 2121.3 J**	
	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.	**4** 1 1 2
	d)	**A body moves along a circular path of radius 60 cm at 3 revolutions / sec. Calculate its linear speed and acceleration of body.** **Formula & substitution** **Answer with unit** **Given:** r = 60 cm = 0.6 m , n = 3 v = ? a = ? v = rω = r (2πn) v = 0.6 x 2 x 3.14 x 3 v = 11.31 m/s. **a = (v-u) / t** =11.3 /1 =11.3 m/s^2	**4** 2 2

Q. No.	Sub Q. N.	Answers	Marking Scheme
2	e)	**State the criteria for selection of NDT methods. State any four points.**	**4**
		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 equipment's available for testing. vi) Total cost required to test the material.	4
	f)	**Explain LPT method with the help of principle, diagram and experimental procedure.**	**4**
		Principle	1
		Diagram	2
		Procedure	1
		Principle: It works on the principle of capillarity. **Experimental Procedure:** **1.Surface Preparation:** Initially the surface of the specimen is cleaned. Because the presence of flakes, dirt, grease etc on the surface of work piece prevents penetrant to be slip into the cracks. This gives wrong information.  **2. Application of Dye penetrant:** Suitable fluorescent dye is mixed in penetrant so that its viscosity remains low. This dye penetrant is applied evenly on specimen. Due to capillary action the penetrant goes into the surface open discontinuities. It takes some time. In general case this "dwell time" is 20-30 minutes  **3. Excess penetrant removal:** After dwell time is over, the excess penetrant is removed from the surface carefully 	

Q. No.	Sub Q. N.	Answers	Marking Scheme
2	f)	**4.Application of developer:** A thin layer of developer is applied over the surface. The role of developer is to pull the trapped penetrant out of the crack this provides good visibility of crack.  **5.Inspection & evaluation of defects:** Surface of the specimen is seen under white light or ultraviolet or laser light. The crack can be visualized under light.  (Inspection under light)	
3	a)	**Attempt any four of the following** **State the factors affecting acoustical planning of building. Explain how they are to be adjusted for good acoustics.** **Factors affecting** **Explanation** **Factor affecting acoustical planning:** **i)Echo:** The echo is defined as the same sound heard again after an interval of 1/10th second due to reflection of the original sound from a surface which is at a distance greater than 16.5m from the source of sound. Keeping distance less than 16.5m or by covering wall with sound absorbing material echo can be avoided. **ii) Reverberation:** It is the persistence of sound due to multiple reflections in a hall even after the source of sound is cut-off. Reverberation creates confusion & affects the quality of sound. Proper reverberation time can be adjusted by providing sound absorbing material in the hall. **iii) Reverberation time:** The time for which sound persists in a hall even after the source of sound is cut off is called as reverberation time. Reverberation time should be adjusted properly.	**16** **4** 2 2

Q. No.	Sub Q. N.	Answers	Marking Scheme
3	a)	**iv) Creep:** Creep occurs because of reflections of sound along a curved surface (dome shape surface). If the source of sound is close to the dome then energy of sound moves along the ceiling without absorption & can be heard distinctly at the other side **v) External noise:** The outside noise can mix up with the sound of speech or music in the hall and create confusion for the audience. This can be decreased by making the hall sound proof and constructing small sound proof cabins for machinery and type- writers etc. **vi) Audience & Upholstered seats:** The sound can be better heard in a hall full of audience than in an empty hall. The human body and clothes, also the foam, cushions (upholstery) affects the acoustics of the hall. **vii) Echelon effect:** Repeated echo occurs when sound is reflected from structures like equidistant staircase; this effect is known as echelon effect. This creates confusion in the sound produced. This effect can be controlled by covering such staircases by sound absorbing materials **viii) Focusing of sound due to dome shaped ceilings:** If auditorium has dome shaped ceilings then sound may concentrate at the centre of the hall. To avoid this, such ceilings are covered by sound absorbing material.	
	b)	**Explain principle, construction and working of Bunsen's photometer.** **Principle** **Diagram** **Construction** **Working** **Principle:-** It works on the principle of photometry. OR If two source of light of illuminating powers I1 & I2 are kept at a distance r1 and r2 from a screen then the intensities of illumination at a point on the screen due to two source are $\frac{I_1}{I_2} = \frac{r_1^2}{r_2^2}$ 	**4** 1 1 1 1

Q. No.	Sub Q. N.	Answers	Marking Scheme
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 I1 & I2 are placed at a distance r1 & r2 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)	**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)	**Calculate the minimum applied voltage required to produce x-rays of 0.51 A^0 wavelengths. (h = 6.634 x 10^{-34} Js, velocity of light = 3 x 10^8 m/s, e = 1.6 x 10^{-19}C)** **Formula & substitution** **Answer with unit** **Given** $\lambda = 0.51\ A^0 = 0.51 \times 10^{-10}$ m V = ? $h = 6.634 \times 10^{-34}$ Js $c = 3 \times 10^8$ m/s $e = 1.6 \times 10^{-19}$C $\lambda = hc / eV$ $V = hc / e\lambda$	**4** 2 2

Q. No.	Sub Q. N.	Answers	Marking Scheme
3	d)	$V = 6.634 \times 10^{-34} \times 3 \times 10^{8} / 1.6 \times 10^{-19} \times 0.51 \times 10^{-10}$ **V = 24389 volt**	
	e)	**An auditorium of volume 6600 m³ has reverberation time 2.2 seconds. If the total absorption surface area in the hall is 3000 m², find the coefficient of absorption.**	**4**
		Formula with substitution	2
		Answer with unit	2
		Given: $V = 6600\ m^3$ $t = 2.2$ sec $\Sigma S = 3000\ m^2$ a=? Formula : $t = \frac{0.164\,V}{\Sigma\, as}$ $a = \frac{0.164 \times V}{t\ \ \Sigma s}$ $a = 0.164 \times 6600 / 2.2 \times 3000$ **a = 0.164 O.W.U**	
	f)	**i) State any two equation of motion for a body falling freely due to gravity along with the symbol meaning.**	**2**
		Any two equation	1
		meaning	1
		$v = u + gt$ $s = ut + 1/2gt^2$ $v^2 = u^2 + 2gs$ Where, u = Initial velocity, v= final velocity, t= time, s = distance travelled, g = gravitational acceleration	
		ii) A motor cycle 60 cm wheel diameter has an angular velocity of 30 rad / sec. calculate its linear velocity.	**2**
		Formula with substitution	1
		Answer with unit	1
		Given: diameter = 60 cm Radius (r) = 30 cm = 30×10^{-2} m $\omega = 30$ rad / sec $v = r \times \omega$ $v = 30 \times 10^{-2} \times 30$ **$v = 900 \times 10^{-2}$ m/s**	