



SUMMER - 2013 EXAMINATION

Subject Code: 17207

Model Answer Applied Science (Physics)

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Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
		<p>Important Instructions to examiners:</p> <ol style="list-style-type: none">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.		



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1)	a)	Attempt Any Nine Define Angular Displacement. State Its SI unit. Definition Unit Angular displacement: It is the angle through which the radius vector turns when the particle in circular motion moves from one position to other. OR It is defined as the angle subtended by the radius vector when a particle in circular motion moves from one position to other. Unit The unit of Angular displacement is radians (rad)	1 1	18 2
	b)	Define power. What is SI unit of power? Definition Unit Power: Power is defined as the rate of doing work. OR $\text{Power} = \frac{\text{Work done}}{\text{Time}}$ Unit: The SI unit of power is watt. OR Nm/sec	1 1	2
	c)	What are ultrasonic waves? The sound waves having frequency more than 20kHz are called as ultrasonic waves.	2	2
	d)	What is role of developer in LP testing? The role of developer is to pull out the dye penetrant out of the crack/ defects, on the surface of specimen. Developer thus provides good visibility of cracks.	2	2
	e)	State two important 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	1	2



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1)	e)	(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.		
	f)	Define luminous flux. State it's SI Unit. Definition Unit Definition luminous flux: The amount of light which flows from a source per second is called as luminous flux. The unit of luminous flux is lumen.	1 1	2
	g)	The photoelectric work function of certain metal is 3×10^{-19} Joules. Calculate its threshold frequency. If Planck's constant is 6.625×10^{-34} Js. Formula & substitution Answer with unit Given $w_0 = 3 \times 10^{-19} J$ $h = 6.625 \times 10^{-34} Js$ $\nu_0 = ?$ Formula: $w_0 = h\nu_0$ $\nu_0 = \frac{w_0}{h}$ $\nu_0 = \frac{3 \times 10^{-19}}{6.625 \times 10^{-34}}$ $\nu_0 = 4.528 \times 10^{14} Hz$	1 1	2
	h)	Write the formula for minimum wavelength of X-rays with meaning of each symbol. Formula Meaning of symbol	1 1	2

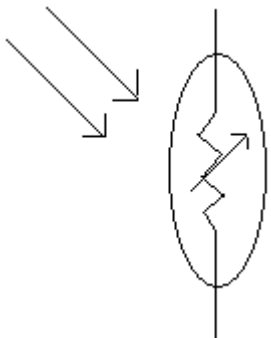


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1)	h)	Formula $\lambda_{\min} = \frac{hc}{eV}$ λ_{\min} = minimum wavelength h = Planck's constant C = Velocity of light e= Charge of electron V = Applied voltage		
	i)	State Newton's second law of motion Newton's second law of motion: The rate of change of momentum of a body is proportional to the applied force and takes place in the direction of the force	2	2
	j)	The luminous intensity of 40 watt tube is 302 candela. Find the luminous flux. Formula & substitution Answer with unit Given Luminous intensity = 302Cd Luminous flux = ϕ =? Formula $\phi = 4\pi \times$ Luminous intensity $\phi = 4\pi \times 302 = 3793.12$ lumen	1 1	2
	k)	State the working principle of LDR & draw its symbol. Principle Symbol Principle of LDR: The electrical resistance of LDR decreases as the intensity of incident light increases. Symbol of LDR 	1 1	2



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Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
1)	1)	<p>Define circular motion. Give two example of it.</p> <p>Definition</p> <p>Any two examples</p> <p>Definition of Circular motion: Circular motion is defined as the motion of a particle along the circumference of circle.</p> <p>Examples:</p> <ul style="list-style-type: none">i) Stone tied at one end of string and whirled around, the other end.ii) Electron revolves around the nucleus of an atomiii) Moon revolving around the earthiv) OR any other relevant examples.	1 1	2



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Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
2)	a)	<p>Attempt any FOUR</p> <p>A stone is thrown with the velocity of 98m/s at an angle of 60° with the horizontal. Find its, Time of flight, Horizontal range and Maximum Height</p> <p>Given v=98m/s $\theta=60^\circ$</p> <p>Time of flight Horizontal range Maximum Height</p> <p>i) To calculate time of flight</p> $T = \frac{2v \sin \theta}{g}$ $T = \frac{2 \times 98 \sin 60}{9.8}$ $T = 17.32 \text{ sec}$ <p>ii) Horizontal range</p> $R = \frac{v^2 \sin 2\theta}{g}$ $R = \frac{98 \times 98 \sin 2 \times 60}{9.8}$ $R = 848.71 \text{ m}$ <p>iii) Maximum Height</p> $H = \frac{v \sin \theta^2}{2g}$ $H = \frac{98 \sin 60^2}{2 \times 9.8}$ $H = 367.50 \text{ m}$	1 1 1 1	16 4



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Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
2)	b)	<p>State work-energy principle and write its mathematical equation giving meaning of each term.</p> <p>Principle</p> <p>Equation</p> <p>Meaning of symbol</p> <p>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. i.e. Work-done = Change in K.E.</p> $(m \times a) \times d = \frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2$ <p>Where, m = Mass of body v_1 = Velocity at initial position v_2 = Velocity at final position a = Acceleration d = Distance between two position</p>	2 1 1	4
	c)	<p>With neat labeled diagram explain piezo-electric method to produce ultrasonic waves.</p> <p>Diagram with label</p> <p>Principle</p> <p>Working</p> <div style="text-align: center;"> <p>The diagram shows a rectangular circuit. On the left side, there is a circle with a tilde symbol (~) inside, labeled 'Electric oscillator circuit'. On the right side, there is a solid black rectangle labeled 'Chief of piezo electric (Quartz crystal)'. The top and bottom wires connect the oscillator to the crystal, and the left and right wires connect the crystal back to the oscillator, forming a closed loop.</p> </div> <p>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.</p> <p>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 produces 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</p>	1 1 2	4

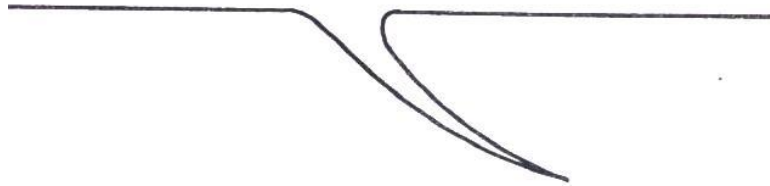


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2)	d)	<p>An automobile travelling at 90km/hr has wheels of 90cm in diameter. What is the angular speed of wheels about the axis?</p> <p>Conversion</p> <p>Formula & substitution</p> <p>Answer with unit</p> <p>Given</p> $v = 90\text{km/hr}$ $v = \frac{90 \times 1000}{60 \times 60} = 25\text{m/s}$ $D = 90\text{cm} = 0.9\text{m}$ $r = 0.45\text{m}$ $w = ?$ $v = rw$ $w = \frac{v}{r}$ $w = \frac{25}{0.45}$ $w = 55.55\text{rad/s}$	1 2 1	4
	e)	<p>With neat diagrams and procedural steps, explain LP testing method.</p> <p>Principle</p> <p>Diagram</p> <p>Procedure</p> <p>Principle: It works on the principle of capillarity</p> <p>Experimental Procedure:</p> <p>1.Surface Penetration: 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.</p> 	1 1 2	4

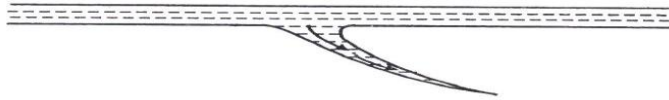

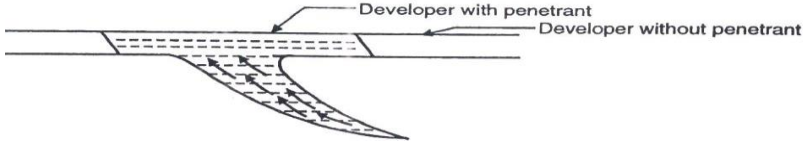
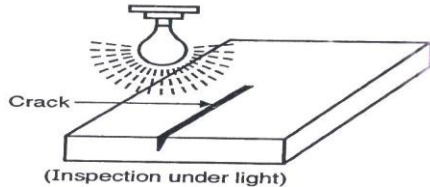


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2)	e)	<p>2. Application of Dye penetrant: Suitable fluorescent dye is mixed in penetrant so that its viscosity remains low. This dye penetrant is applied evenly on specimen. Due to capillary action the penetrant goes into the surface open discontinuities. It takes some time. In general case this 'dwell time' is 20-30 minutes.</p>  <p>3. Excess penetrant removal: After dwell time is over, the excess penetrant is removed from the surface carefully</p>  <p>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.</p>  <p>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.</p>  <p>6. Post cleaning: After inspection the surface of the specimen is cleaned & the specimen can be used for its intended purpose.</p>		



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2)	f)	<p>State applications of ultrasonic testing method.</p> <p>Any Four Applications</p> <ul style="list-style-type: none">i) To detect flaw: flaws in metal, rubber, tyre, concrete, wood composites, plastics componentsii) Rail inspection: Rail tracks are tested on the spot which avoids service failure in trackiii) Air-craft inspection: To detect crackiv) Tunnel inspection: To detect crackv) Bridge inspectionvi) To detect subsurface discontinuitiesvii) To test plant componentviii) Testing: It is used to test casting, forging, welding, fabrication, rolling, heat treatmentix) Monitoring: Monitoring of thermal and atomic power plant, equipment pipe lines and structuresx) On line tube testing: Channel ultrasonic flaw detection with thickness measurement of tube and hence corrosion	4	4

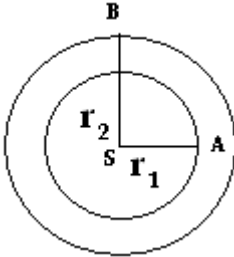


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3)	a)	<p>Attempt any FOUR</p> <p>A hall with a volume of 1000m³ has a sound absorbing surface of area of 400m². If the average absorption coefficient of the hall is 0.2 sabines, What is the reverberation time of the hall.</p> <p>Formula & substitution</p> <p>Answer with unit</p> <p>Given V=1000m³ s=400m² a=0.2 Sabine t=?</p> <p>Formula</p> $t = \frac{0.164V}{as}$ $t = \frac{0.164 \times 1000}{0.2 \times 400}$ $t = 2.05 \text{ sec}$	2 2	16 4
	b)	<p>State inverse square law of illumination and explain it with diagram.</p> <p>Statement of law</p> <p>Diagram</p> <p>Explanation with equation</p> <p>Inverse square law of luminance:</p> <p>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."</p> $E \propto 1/r^2$ <p>Let 'S' be a point source which is emitting light in all directions and Q be the amount emitted in unit time. Let, A and B spherical surfaces with center S. r₁- radius of surface A & r₂- radius of surface B</p> 	1 1 2	4



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3)	b)	<p>The intensity of illumination E_1 on surface is given by</p> $E_1 = \frac{Q}{\text{area of A}}$ $E_1 = \frac{Q}{4\pi r_1^2}$ <p>Similarly, the intensity of illumination E_2 on surface B is given by,</p> $E_2 = \frac{Q}{\text{area of B}}$ $E_2 = \frac{Q}{4\pi r_2^2}$ $\therefore E_2 = \frac{r_1^2}{r_2^2}$ $\therefore E_2 \propto \frac{1}{r^2}$ <p>This is known as inverse square law</p>		
	c)	<p>State any four applications of photocells</p> <p>Each Application</p> <p>i) Photoelectric cell is used in lux-meter to measure the intensity of light.</p> <p>ii) It is used to switch on and off automatically the street lights.</p> <p>iii) It is used for automatic control of traffic signals</p> <p>iv) It is used in recording and reproduction of sound during shooting of a film.</p> <p>v) Photoelectric cells are used in television sets, fire alarms.</p> <p>vi) It is used in detecting flaws in metals</p> <p>vii) Photoelectric cell is used in Burglar alarm.</p> <p>viii) <i>OR any relevant application.</i></p>	1	4
	d)	<p>Find the minimum wavelength of X-rays produced by an X-ray tube operated at 1000kV [Given $h=6.63 \times 10^{-34}$Js, $e=1.6 \times 10^{-19}$C and $c = 3 \times 10^8$ m/s]</p> <p>Formula & substitution</p> <p>Answer with unit</p> <p>Given</p> <p>$V=1000\text{kV}=1000 \times 10^3\text{V}$</p> <p>$h = 6.63 \times 10^{-34}\text{Js}$</p> <p>$e=1.6 \times 10^{-19}\text{C}$</p> <p>$c = 3 \times 10^8 \text{ m/s}$</p> <p>$\lambda_{\min} = ?$</p>	2 2	4



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3)	d)	$\lambda_{\min} = \frac{hc}{eV}$ $\lambda_{\min} = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{1.6 \times 10^{-19} \times 1000 \times 10^3}$ $\lambda_{\min} = 124 \times 10^{-4}$ $\lambda_{\min} = 0.0124 A^0$ <p>OR</p> $\lambda_{\min} = \frac{1240 A^0}{V}$ $\lambda_{\min} = \frac{1240}{1000 \times 10^3}$ $\lambda_{\min} = 0.0124 A^0$		
	e)	<p>Explain the various factors affecting the architectural acoustics of a building and their remedy.</p> <p>Any 4 factors with explanation and remedy</p> <p>Factor affecting architectural acoustics:</p> <ul style="list-style-type: none">i) Echo: The echo is defined as the same sound heard again after an interval of $1/10^{\text{th}}$ second due to reflection of the original sound from a surface which is at a distance greater than 16.5m from the source of soundii) 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.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 sidev) 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 typewriters etc.	4	4



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3)	f)	<p>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.</p> <p>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</p> <p>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.</p> <p>Define the following: Uniform velocity, Uniform acceleration, Uniform retardation and Angular acceleration Each definition</p> <p>i) Uniform Velocity: If a body covers equal distances in equal interval of time in a particular direction, then it is said to be having uniform velocity. OR If a body covers equal displacement in equal interval of time, then it is said to be in uniform velocity. OR If a body is moving with constant speed in the same direction then it is said to in uniform velocity.</p> <p>ii) Uniform acceleration: If acceleration of a body is uniform in magnitude and direction with respect to time then it is called uniform acceleration. OR If a change in velocity of body is constant in every equal interval of time then it is called uniform acceleration.</p> <p>iii) Uniform Retardation: If the acceleration of body is negative and uniform in magnitude and direction with respect to time then it is it is called uniform retardation.</p> <p>iv) Angular acceleration: The rate of change of angular velocity with respect to time is called as angular acceleration</p>	1	4