SUMMER – 2013 EXAMINATION

Subject Code: 17202 **Model Answer Applied Science (Physics)**

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)	**State equations of motion for motion under gravity. State meanings of symbols used.**		
		Any two equations of motion with meanings		
		i. $v = u+gt$	2	2
		ii. $s=ut+1/2gt^2$		
		iii. $v^2 = u^2+2gs$		
		iv. $v = u - gt$		
		v. $s = ut - 1/2gt^2$		
		vi. $v^2 = u^2-2gs$		
		Where, u = Initial velocity, v= final velocity, t= time s= distance travelled, g = gravitational acceleration.		
	b)	**A car of mass 900kg is moving with a velocity of 36km/hr. Find momentum of the car.**		
		Formula	1	
		Answer with unit	1	2
		Given m = 900kg		
		v= 36 km/hr= $\frac{36\times1000}{60\times60}=10m/s$		
		Momentum = mXv = 900X10		
		Momentum = 9000 kg-m/s		
	c)	**State one example each of law of inertia and law of action reaction**		
		one example each of law of inertia	1	
		one example each law of action reaction	1	2
		i) Law of Inertia examples • A car moving with uniform velocity continues its motion until we apply breaks • A book kept on table, remains at rest until we apply force ii) Law of action reaction examples • A swimmer pushes water backward and water pushes him forward with equal force • When we hit the ball on wall, it bounces back because of reaction • ***Any relevant examples***		

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1)	d)	**Define projectile motion, uniform circular motion** **Each Definition** i. Projectile motion – Projectile motion is the motion of a body thrown (projected) in air at an angle θ (less than 90^0) with the horizontal ii. Uniform circular motion - Uniform circular motion is defined as a motion of a particle along the circumference of circle with constant speed.	1	2
	e)	**Draw neat labeled diagram of piezo-electric oscillator for production of ultrasonic waves.** **Diagram with label**  	2	2
	f)	**State Seebek effect** **Statement** When two dissimilar metals are joined together, so that two junctions are formed & if one junction is heated and other is cooled (if temperature difference is maintained) then electric current flows through it i.e. emf is generated. This effect is known as Seebek effect.	2	2
	g)	**Define neutral temperature, inversion temperature.** **Each definition** **Neutral temperature –** In thermocouple the temperature at which the emf is maximum is called inversion temperature **Inversion Temperature:** In thermocouple the temperature at which the emf becomes zero and changes its sign (becomes negative) is call inversion temperature.	1	2

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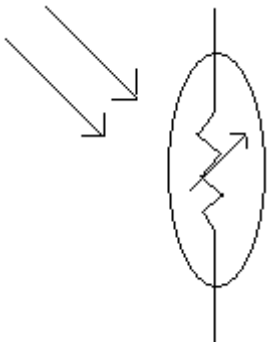
1)	h)	**State any two characteristics of photoelectric effect.** **Any two characteristics** • A metal emits electrons only when the incident (light) radiation has frequency greater than critical frequency (υ_0) called threshold frequency. Threshold frequency different for different metals. • Photoelectric current is directly proportional to intensity of light and independent of frequency. • The velocity of photoelectron is directly proportional to the frequency of light. • For a given metal surface, stopping potential is directly proportional to the frequency and is not dependent on intensity light. • The rate of emission of photoelectrons from the photocathode is independent of its temperature i.e. photoelectric emission is different from thermionic emission. • The process is instantaneous.	2	2
	i)	**Draw a symbol of LDR and state its principle** **Symbol** **Principle** **Symbol of LDR**  **Principle of LDR:** The electrical resistance of LDR decreases as the intensity of incident light increases.	1 1	2

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1)	j)	**State any two properties of X-rays.** **Any two properties** i. They are electromagnetic waves of very short wavelength ii. They travel with speed of light. iii. They affect photographic plates. iv. They produce fluorescence in many substances. v. They can be reflected or refracted under certain conditions. vi. They are not deflected by magnetic or electric field. vii. They have high penetrating power. viii. They produce photoelectric effect. ix. They are invisible to eyes. x. X-ray kill some form of animal cell	2	2
	k)	**State formula for minimum wavelength of X-rays also state the meanings of symbols used in it.** **Formula** $\lambda_{min} = \frac{hc}{eV}$ **Meaning of symbol** λ_{min} = minimum wavelength of X - ray h = Planck's constant C = Velocity of light e= Charge of electron V = Applied voltage	1 1	2
	l)	**State any four properties of LASER.** **Any four properties** **Properties** i) **The light is coherent:** The light with waves, all exactly in same phase. ii) **The light is monochromatic:** The light whose waves all have the same frequency or wavelength. iii) **The light is unidirectional:** The light produces sharp focus. iv) **The beam is extremely intense:** The light has extreme brightness	4	4

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2)		**Attempt Any FOUR**		16
	a)	**Define: i) Work ii) Power** **iii) Potential Energy iv) Kinetic Energy**		
		Each definition	01	04
		Definition of Work: Work is defined as product of force acting on a body and displacement produced. **Definition of Power:** Power is defined as rate of doing work **Definition of P.E.:** The energy possessed by a body due to its position is called potential energy. **Definition of K.E.:** The energy possessed by a body by virtue of its motion is called kinetic energy.		

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2)	b)	**Define centripetal force, centrifugal force, also state two examples of each.** **Each Definition** **Two example of each** **Centripetal force –** It is defined as the force acting along the radius towards the centre of the circular path, which keeps the particle in uniform circular motion. OR Centripetal force is the force acting on a particle performing uniform circular motion which is along the radius and towards the center of circular path. **Example** i) **If a stone tied at one end of string and whirled:** Tension in the string plays the role of centripetal force ii) **In case of electron revolving around the nucleus:** The electrostatic force of attraction between electron and proton plays the role of centripetal force iii) **In case of moon revolving around the earth:** The gravitational force of attraction between earth and moon plays the role of centripetal force. **Centrifugal force –** It is defined as the force acting on a particle performing uniform circular motion which is directed away from centre and along the radius of the circular path. OR A particle performing uniform circular motion experiences force which is along the radius and away from the centre is called Centrifugal force. **Example** i) Person sitting in merry go round or giant wheel, experience outward pool ii) Motor cyclist driving in a artificial death well in a circus experiences outward pull because of his high speed.	 1 1	 4

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2)	c)	**State any four properties of ultrasonic waves** **Each Property** i) Frequency of these sound waves is more than 20kHz ii) 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) Travel with constant speed through a homogeneous medium. x) Posses certain vibrations which are used as good massage action in case of muscular pain.	1	4
	d)	**State any four criteria for selection of NDT method** **Each 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 equipments available for testing vi) Total cost required to test the material.	1	4
	e)	**State any four applications of ultrasonic testing.** **Each Application** i) To detect flaw: flaws in metal, rubber, tyre, concrete, wood composites, plastics components ii) Rail inspection: Rail tracks are tested on the spot which avoids service failure in track iii) Air-craft inspection: To detect crack iv) Tunnel inspection: To detect crack v) Bridge inspection vi) To detect subsurface discontinuities vii) To test plant component	1	4

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2)	e)	viii) Testing: It is used to test casting, forging, welding, fabrication, rolling, heat treatment ix) Monitoring: Monitoring of thermal and atomic power plant, equipment pipe lines and structures x) On line tube testing: Channel ultrasonic flaw detection with thickness measurement of tube and hence corrosion		
	f)	**A scooter has initial velocity 4m/s. If accelerates for 9 seconds at the rate of 0.3 m/s². Calculate final velocity & distance travelled during this time.**		4
		i)Final velocity	1	
		Formula	1	
		Answer with unit		
		ii)Distance travelled		
		Formula	1	
		Answer with unit	1	
		Given u=4m/s, t=9s, a=0.3m/s² Required v=? & s=? **i)** Fin**al velocity** v=u+at v=4+9X0.3 v=6.7 m/s **ii)** Fin**al velocity** s= ut + 1/2at² s= 4X9 +0.5X0.3X9X9 s= 48.15 m		

<table>
<tr><th>Que. No.</th><th>Sub. Que.</th><th>Stepwise Solution</th><th>Marks</th><th>Total Marks</th></tr>
<tr><td>3)</td><td></td><td>Attempt Any Four</td><td></td><td>16</td></tr>
<tr><td></td><td>a)</td><td>Distinguish between Peltier effect and Joules effect
Any Four points
<table>
<tr><th>S. No</th><th>Peltier effect</th><th>Joules effect</th></tr>
<tr><td>1</td><td>When electric current flows through a junction of two metals of thermocouple, then heat is generated at one end and heat is absorbed at the other end.</td><td>When electric current flows through conductor then it get heated</td></tr>
<tr><td>2</td><td>One junction gets heated and other get cooled</td><td>heat is produced through out the conductor</td></tr>
<tr><td>3</td><td>Heat generated or absorbed is small</td><td>Heat generated is large</td></tr>
<tr><td>4</td><td>This effect is reversible</td><td>This effect is irreversible</td></tr>
<tr><td>5</td><td>Amount of heat generated depends on pair of metals and current through it.</td><td>Amount of heat generated depends on value of resistance, current, time</td></tr>
<tr><td>6</td><td>e.g. thermocouple</td><td>e.g. electric heater, electric iron</td></tr>
</table></td><td>4</td><td>4</td></tr>
<tr><td></td><td>b)</td><td>Calculate amount of heat generated when current of 1.5A flows for 15 min. through resistive coil of 15Ω (J=4180 J/kcal)

Formula
Substitution
Answer with unit

Given: I = 1.5 A, t=15min=15X60=900s
R=15Ω, J= 4180 J/kcal
Required: H=?
$$H = \frac{I^2 Rt}{J}$$
$$H = \frac{1.5 \times 1.5 \times 15 \times 900}{4180}$$
$$H = 7.266 kcal$$</td><td>1
1
2</td><td>4</td></tr>
</table>

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3)	c)	**Find maximum kinetic energy of photoelectron ejected from surface of metal of light having frequency 1.2X10^{15}Hz (Given λ_0=4000A^0)**		
		Two formulae with substitution	2	
		Two answers with unit	2	4
		$KE = h\ \upsilon - \upsilon_0$ $\because c = \upsilon_0 \lambda_0$ $\therefore \upsilon_0 = \frac{c}{\lambda_0}$ $\upsilon_0 = \frac{3\times10^8}{4000\times10^{-10}}$ $\upsilon_0 = 7.5\times10^{14}\,Hz$ $KE = h\ \upsilon - \upsilon_0$ $KE = 6.63\times10^{-34}\ \ 1.2\times10^{15} - 7.5\times10^{14}$ $KE = 6.63\times10^{-34}\ \ 1.2\times10^{15} - 0.75\times10^{15}$ $KE = 2.98\times10^{-19}\,J$		
	d)	**State any two engineering and two medical applications of X-rays.**		
		Engineering Application (Any two)	2	
		Medical Application (Any two)	2	4
		Engineering Application of X- Rays 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.		

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3)		**Medical Application of X- Rays:** i) X – Rays are used in surgery to detect bone fractured. ii) X- Rays are used to cure skin diseases and destroy tumours. iii) X – Rays are used to cure diseases like cancer X – Rays are used to detect bullets position inside the body.		
	e)	**State any four application of LASER each application.** **Each Application** i. Lasers are used for engraving and embossing of printing plates. For example- number plate, name plate etc., ii. Lasers are used in cutting, drilling and welding metals. iii. Lasers are used in holography iv. Lasers are used in computer printers v. Lasers are used for 3D, Laser scanners vi. Lasers are used in controlled heat treatment vii. Lasers are used for data transfer through optical fiber from one computer to other viii. Lasers are used to find flaws or defect in material.	1	4
	f)	**A fly wheel starting from rest attains a speed of 1200 rpm in 1 minute. Calculate angular acceleration.** **Formula & Substitution** **Answer with unit** **Given** $w_0 = 0$ $w = 2\pi n = \frac{2\times 3.14\times 1200}{60} = 125.6$ $\alpha = \frac{w - w_0}{t}$ $\alpha = \frac{125.6 - 0}{60}$ $\alpha = 2.09 \approx 2.1 rad/s^2$	2 2	4