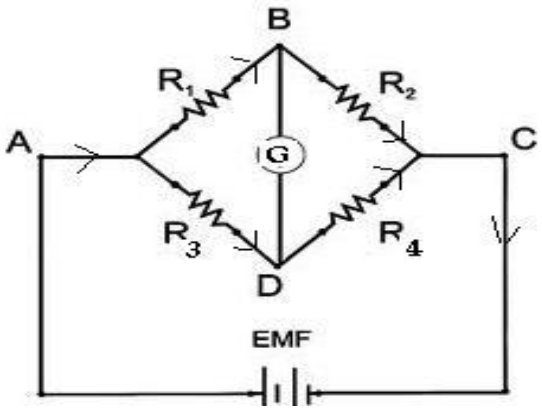
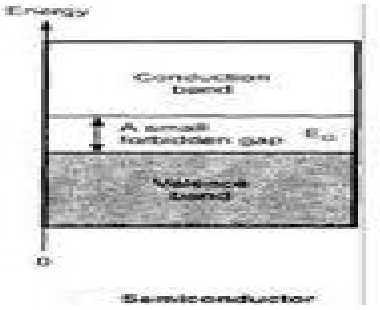
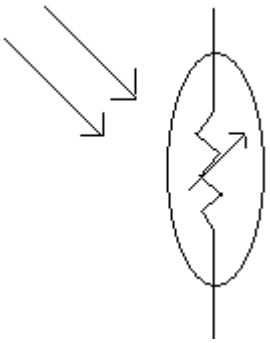
Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
		Important Instructions to examiners 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme. 2) The model answer and the answer written by candidate may vary but the examiner may try to assess 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 of the following:**		**18**
	a)	**State Ohm's law with mathematical equation.**		
		Statement	1	2
		Mathematical equation	1	
		Ohm's law: If physical state of the conductor remains same, the potential difference between two ends of the conductor is directly proportional to the current flowing through it. V = I R		
	b)	**A potentiometer wire of length 2 m has a voltage drop of 0.2 V across it. Find potential gradient.**		2
		Formula & Substitution	1	
		Answer with Unit	1	
		Given: L = 2 m, V=0.2 V, P.G=? We have, P.G = Potential /Length P.G = V / L P.G = 0.2 /2 P.G = 0.1 volt/meter		
	c)	**Draw a neat circuit diagram of Whetstone's Network.**		2
		Diagram with label	2	



Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
1)	d)	**A capacitor of capacitance 5μF is connected to a supply of 10 V. Calculate the charge on the capacitor.**		2
		Formula & Substitution	1	
		Answer with Unit	1	
		Given: $C = 5\mu f = 5\times10^{-6}$ f V=10 V Q=? We have $C = Q / V$ $Q = C \times V$ $Q = 5 \times 10^{-6} \times 10$ $Q = 50 \times 10^{-6}$ C **OR** $Q = 50\ \mu C$		
	e)	**State the values or range of values of energy band gap for conductors, semiconductors and insulators.**		2
		Value of Energy Band gap	2	
		Conductor : No energy gap **Semiconductor :** Approximately 1eV **Insulator :** Greater than 5.5 eV		
	f)	**Draw energy band diagram for semiconductor.**		2
		Neat labeled diagram.	2	
				
	g)	**Draw the symbol of LDR and state its working principle.**		2
		Symbol of LDR	1	
		Working Principle	1	
				

Que. No.	Sub Que.	Stepwise Solution	Marks	Total Marks
1)	g)	**Principle of LDR** When the intensity of incident light increases the resistance of LDR decreases .		2
	h)	**Define :** **(i)Threshold frequency** **(ii)Work function** **Each definition** **Threshold frequency**: The minimum frequency of incident radiation at which emission of photoelectrons starts is called Threshold frequency. **Work function**: The amount of energy required to detach the electron from metal surface is called work function.	1	2
	i)	**State Einstein's photoelectric equation with meaning of all the symbols involved.** **Correct equation** **Meaning of symbol** $K.E = h(\nu - \nu_0)$ $1/2mv^2 = h(\nu - \nu_0)$ Where, K.E =Kinetic energy of ejected electrons. ν = Frequency of photon. ν_0 = Threshold Frequency.	1 1	2
	j)	**"Lasers are specially used for cataract operation". Give appropriate reason.** **Any appropriate reason** Lasers are specially used for cataract operation because of its remarkable properties it is monochromatic source of light, also it has sharp focus, highly intense and unidirectionality.	2	2
	k)	**State two properties of nanoparticles.** **Any two properties.** i) Mechanical property. ii) Structural property. iii) Thermal property. iv) Electric property. v) Magnetic property. vi) Optical property.	2	

Que. No.	Sub Que.	Stepwise Solution	Marks	Total Marks
1)	l)	**What are carbon nanotubes?** **Explanation** **Carbon nanotubes:** Carbon nanotubes are allotrope of carbon. They take the form of cylindrical carbon molecules and have novel properties that make them potentially useful in a wide variety of application in nanotechnology, electronics,optics and other fields of material science.	2	2

Que. No.	Sub Que.	Stepwise Solution	Marks	Total Marks
2)		**Attempt any FOUR of the following:**		**16**
	a)	**Calculate the resistance of wire of length 50 cm and cross section area of 0.02 x 10^{-6} m^2**		4
		(Given-specific resistance of the wire=3.5 × 10^{-7} Ω-m)		
		Formula and substitution	2	
		Answer with unit	2	
		Given :		
		L = 50cm = 0.5m		
		A = 0.02 x $10^{-6}$$m^2$		
		ρ = 3.5 x 10^{-7}Ωm		
		$\rho = \frac{(R \times A)}{L}$		
		$R = \frac{(L \times \rho)}{A}$		
		$R = \frac{(0.5 \times 3.5 \times 10^{-7})}{0.02 \times 10^{-6}}$		
		R = 8.75 Ω		
	b)	**i) State and explain the principle of potentiometer.**		4
		ii) Give any two uses of potentiometer.		
		Statement and explanation	2	
		Any two uses	2	
		i)Principle of Potentiometer		
		The fall of potential is directly proportional to the length of conducting wire.		
		$V \propto L$ **OR**		
		The potential difference between two points of conductive wire is directly proportional to the length/distance between the two points.		
		ii) Uses of potentiometer.		
		a) To determine internal resistance of cell.		
		b) Compare EMF of two cells.		
		c) Measure P.D. between two points in the circuit.		

SUMMER – 2016 EXAMINATION

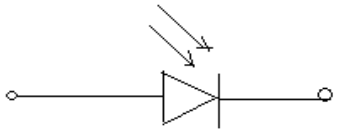
Subject Code: 17210 **Model Answer**

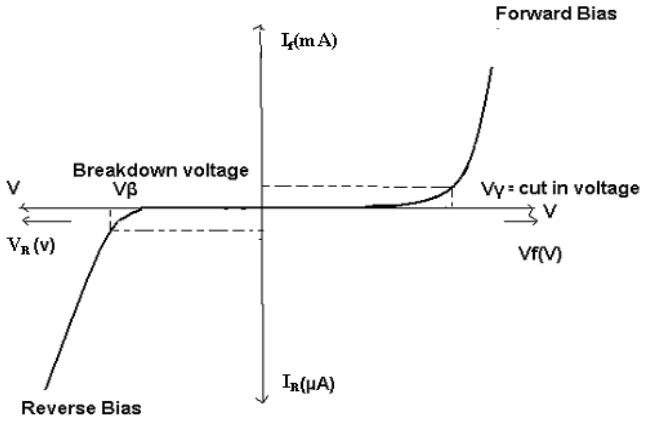
Que. No.	Sub Que.	Stepwise Solution	Marks	Total Marks
2)	c)	**The capacitance of parallel plate capacitor is with a certain dielectric medium between the plates of capacitor .Find the capacitance of capacitor if** **i) the distance between the two plates is double; and** **ii) the area of plate is halved.** **Each formula and substitution** **Answer with unit** Formula for capacity of parallel plate capacitor $\therefore C = \varepsilon_0 k \frac{A}{d}$ ----------**(**1) Let C be original capacity. C_n be new capacity when distance between two plates is double (i) $d_n=2d$ As C α (1/d). C=K/d K= proportionality constant $C_n=K/2d$ $C_n/C = (K/2d) / (K/d)$ $C_n/C = 1/2$ $C_n = C/2$	 2 2	4

SUMMER – 2016 EXAMINATION

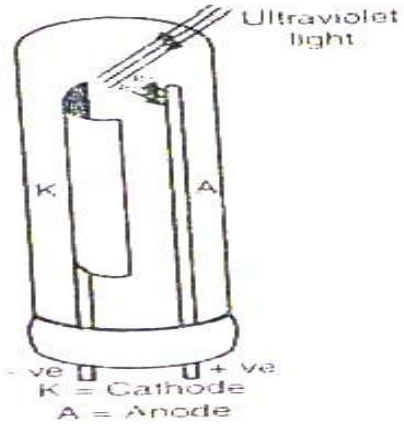
Subject Code: 17210 **Model Answer**

Que. No.	Sub Que.	Stepwise Solution	Marks	Total Marks
2)	c)	(ii) $A_n = A/2$ As $C \alpha A$ $C = K_1 \times A$ K_1 =proportionality constant $C_n = K_1 \times (A/2)$ $C_n/C = K_1 \times (A/2) / (K_1 \times A)$ $C_n = C/2$		
	d)	**Three condensers of capacitance 2.2µF, 3.6µF and 5.6 µF are connected in parallel across 75 V supply. Find equivalent capacitance and the charge flowing through each condenser.** **Formula and substitution** **Answer with unit** Given: $C_1 = 2.2 \times 10^{-6}$ F $C_2 = 3.6 \times 10^{-6}$ F $C_3 = 5.6 \times 10^{-6}$ F $V = 75$ V $Q = ?$ For parallel combination $C_p = C_1 + C_2 + C_3$ $= 2.2 \times 10^{-6} + 3.6 \times 10^{-6} + 5.6 \times 10^{-6}$ $C_p = 11.4 \times 10^{-6}$ F $Q_1 = C_1 \times V = 2.2 \times 10^{-6} \times 75$, $Q_1 = 165 \times 10^{-6}$ C $Q_2 = C_2 \times V = 3.6 \times 10^{-6} \times 75$, $Q_2 = 270 \times 10^{-6}$ C $Q_3 = C_3 \times V = 5.6 \times 10^{-6} \times 75$, $Q_3 = 420 \times 10^{-6}$ C	2 2	4

Que. No.	Sub Que.	Stepwise Solution	Marks	Total Marks
2)	e)	**Draw the symbol and state the principle of photodiode. State it's any two applications.** **Symbol of Photodiode** **Principle** **Any two applications** Symbol of Photodiode  **Principle of the photodiode:** When light is incident on suitably arranged semiconductor diode, then it produces current in the circuit. Light energy → Electrical energy **Application of photodiode** 1. It is used as light sensor in remote controlled television set. 2. It is used as light sensor in remote controlled air conditioner 3. It is used as object counter to count object, cards etc. 4. It is used as smoke detector. 5. It is used as encoder. 6. It is used as position sensor. **Note: Any relevant applications can be given credit.**	1 1 2	4

Que. No.	Sub Que.	Stepwise Solution	Marks	Total Marks
2)	f)	**Plot and explain the I-V characteristics of p-n junction diode.** **I -V characteristics.** **Each Explanation**  **Forward Bias Characteristic: -** If external voltage is increased from zero onwards , initially the forward voltage is increased and values of currents are recorded and the graph is plotted as shown above. Initially for increase in voltage there is no corresponding increase in current. Above barrier potential current increases rapidly and diode starts conducting current. **Reverse Bias Characteristics: -** As the reverse biased voltage is increased , at critical voltage V_{BR} the reverse current through the diode increases sharply. The corresponding voltage is called breakdown voltage	2 1	4

Que. No.	Sub Que.	Stepwise Solution	Marks	Total Marks
3)		**Attempt any FOUR of the following:**		**16**
	a)	**Explain with diagram the working principle of photoelectric cell. Give its two applications.**		4
		Diagram	1	
		Working	1	
		Application	2	



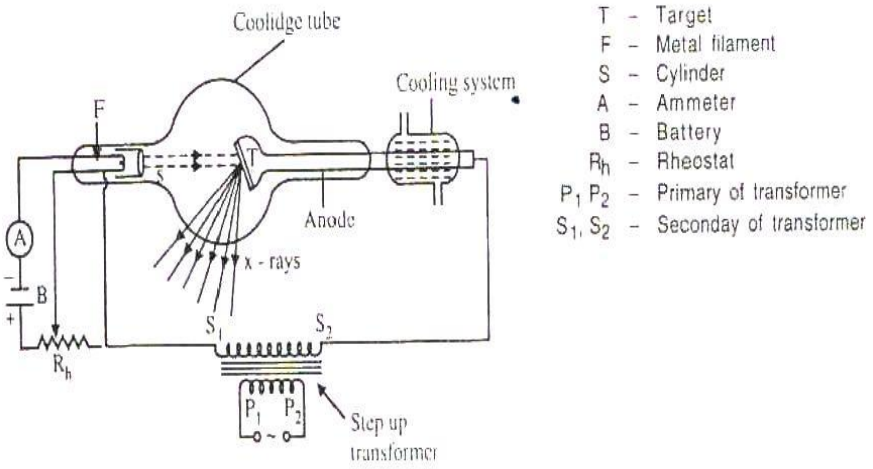
Working:

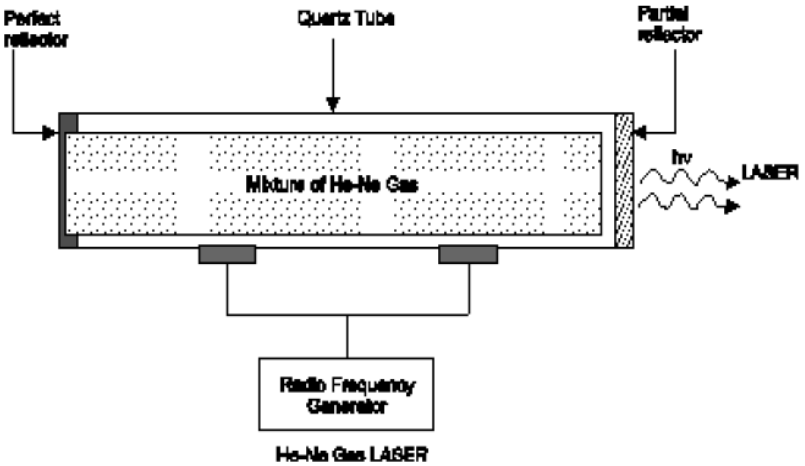
When light is allowed to fall on cathode it emits Photoelectrons. These photoelectrons are attracted by anode. The photoelectric current flows through the circuit &millimeter Shows the deflection.

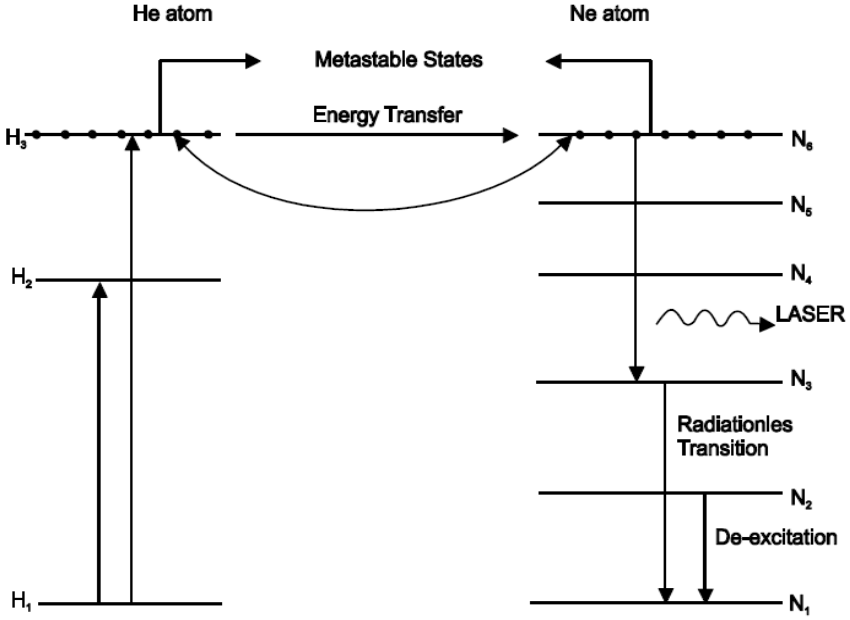
Applications

1) It is used in Lux-meter.
2) It is used for automatic control of traffic signals.
3) It is used to switch on and off automatically the street lights.
4) It is used in recording and reproduction of sound during shooting of film.
5) They are used in television sets, fire alarms.
6) It is used in bulgar alarm.

Note: Any relevant application may be consider.

Que. No.	Sub Que.	Stepwise Solution	Marks	Total Marks
3)	b)	**Explain the production of X-rays using Coolidge tube with a neat labeled diagram.** **Diagram** **Explanation**  **Principle:** When fast moving electrons are suddenly stopped then X- rays are produced. **Working:** When the cathode is heated by electric current it produced electron due to thermionic emissions. The beam of electron is then focused on the anode (target). The electrons from cathode are accelerated by applying of high voltage between cathode & anode using step up transformer. When these fast moving electrons are suddenly stopped by tungsten anode, they lose their kinetic energy and x rays are produced from the target. Some amount of Kinetic energy is converted to large amount of heat. By controlling the filament current, the thermionic emission of electron hence intensity of X- rays can be controlled.	2 2	4

Que. No.	Sub Que.	Stepwise Solution	Marks	Total Marks
3)	c)	**Find the minimum wavelength and maximum frequency of X-rays produced by an X-ray tube operating at 80kV. (Given h=6.63 X 10^{-34}Js, e =1.6 X 10^{-19}C and c =3 X 10^{8} m/s)**		4
		Each formula	2	
		Each answer with unit	2	
		Given V = 80kV = 80 X 10^{3}V h = 6.63 X 10^{-34} Js e = 1.6 X 10^{-19}C c = 3 X 10^{8} m/s We have, $\lambda_{min} = \frac{hc}{eV}$ $\lambda_{min} = \frac{(6.63\times10^{-34})(3\times10^{8})}{(1.6\times10^{-19})(80\times10^{3})}$ $\lambda_{min} = 0.155 \text{ x } 10^{-10}$ m. $\lambda_{min} = 0.155\ A^{0}$ $f = \frac{c}{\lambda_{min}}$ $f = \frac{(3\times10^{8})}{(0.155\times10^{-10})}$ $f = 19.354 \text{ x } 10^{18}$ Hz.		
	d)	**Explain with help of neat labeled diagram, the working of He-Ne Laser**		4
		diagram	2	
		working	2	
		 He-Ne Gas LASER		

Que. No.	Sub Que.	Stepwise Solution	Marks	Total Marks
3)	d)	**Working:** (1) When electric discharge is produced in the tube, He and Ne gas atoms are excited. Some excited levels of helium are close to some excited levels of neon. Therefore these excited helium atoms collide with excited atoms of neon and transfer the energy to neon atoms. (2) The actual lasing action is done by neon atoms. The neon atoms with extra energy from helium atom are forced to jump in ground state by emitting a photon. This produces the LASER light. The newly emitted photon triggers the next neon atom and increases the radiations. (3) Thus coherent, monochromatic, unidirectional LASER is produced by He-Ne gas LASER The energy level diagram of He-Ne LASER is shown below. 		
	e)	**State any four engineering applications of LASER.** **Four 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.	4	4

Que. No.	Sub Que.	Stepwise Solution	Marks	Total Marks
3)	f)	**State any four applications of nanotechnology in field of Engineering.** **Any four applications** **Applications of nanotechnology in engineering field.** 1. **Data storage system –** Semiconductor material in the form of film can be deposited on substrate to form the chip. 2. **Use of nonmaterial in energy sector** – The conventional energy sources like coal, fuel are depleting day by day, thus use of alternative energy source is inevitable. 3. **Application in automobiles-** High mechanical strength material but light in weight can be produced by using nanotechnology. Nan painting materials can be used to get uniform layer of coating on the vehicle body. 4. **Application in consumer goods –** Nanotechnology has wide applications in cosmetics, domestic's products and textiles. Using nonmaterial fiber, one can get comfort of cotton clothes. **Note :Any other relevant application**	4	4