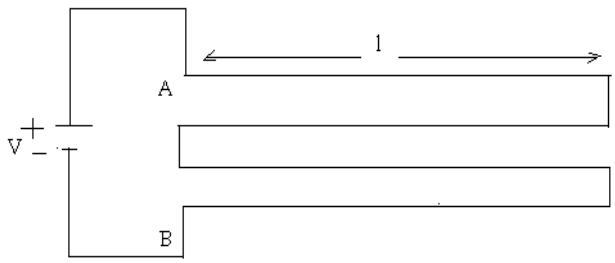
Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
		Important Instructions to examiners: 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme. 2) The model answer and the answer written by candidate may vary but the examiner may try to assess 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)	**Define electric current. State its SI unit.**		
		Definition	1	2
		SI Unit	1	
		Electric Current: The rate of flow of electric charge is called electric current. **Unit** : SI of electric current is Ampere OR A		
	b)	**State the principle of Wheatstone's network.**		2
		Principle	2	
		Statement: In the balanced condition of Wheatstone's network, current flows through the rest of the circuit but does not flow through the galvanometer.		
	c)	**Draw neat labeled diagram of potentiometer.**		2
		Labeled diagram	2	
		 Potentiometer		
	d)	**The plates of condenser are given charge of 5 μC. If the potential difference across the plate is 100 volt .Calculate the capacitance.**		2
		Formula and substitution	1	
		Answer with unit	1	
		Solution : Given : Q=5 μC=5 x 10^{-6} C p.d = V =100 volt C =?		

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
1)	d)	We have $C = \frac{Q}{V}$ $C = \frac{5\times10^{-6}}{100}$ $C = 5\times10^{-8}\ f$		
	e)	**Define :** **(i)Conductor** **(ii)Semiconductor** **Each definition** **Conductor:** It contains large no. of free electrons at room temperature. the valence band and conduction band overlap with each other. **Semiconductor:** A substance for which the forbidden energy gap is relatively small than insulator i.e in order of 1 eV. **OR Any other relevant definition may consider**.	1	2
	f)	**Distinguish between intrinsic and extrinsic semiconductor on The basis of flow of electrons.(Any two points)** **Each point**	1	2

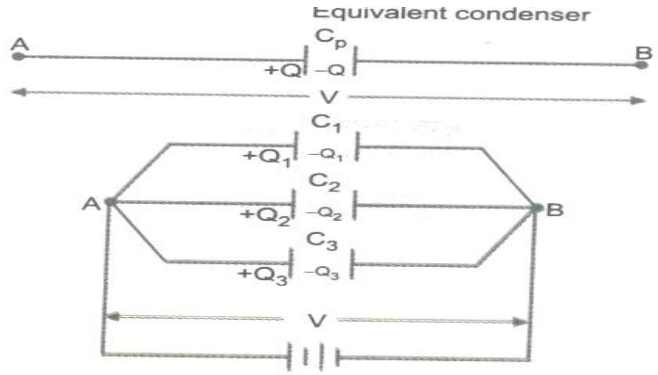
Point	**Intrinsic Semiconductor**	**Extrinsic Semiconductor**
1	No. of electrons is always equals to No. of holes.	No. of electrons are not equals to No. of holes.
2	Conductivity is poor.	Conductivity is higher
3	Current conduction is due to electrons and holes.	Current conduction is due to electrons and holes depending upon types of semiconductor.

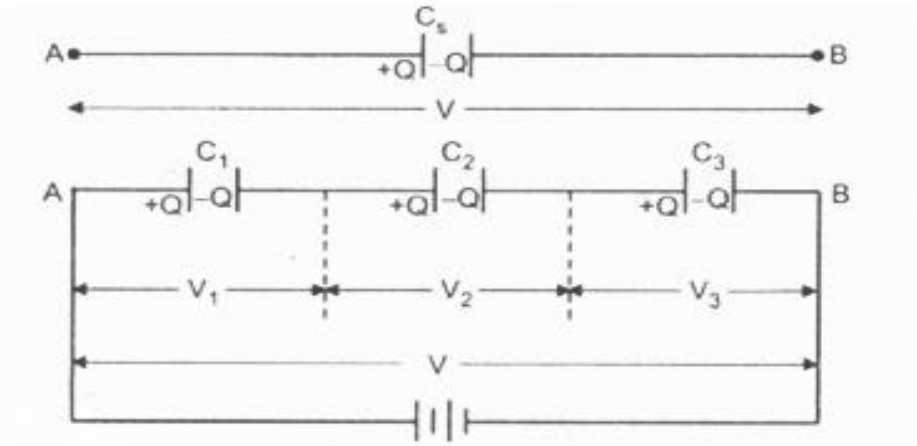
1)	g)	**Define :** **(i)Threshold frequency** **(ii)Work function** **Each definition** **Threshold frequency**: The minimum frequency of incident radiation at which emission of photoelectrons starts is called Threshold frequency. **Work function**: The amount of energy required to detach the electron from metal surface is called work function.	1	2
	h)	**State the principle of production of X-Rays.** **Principle** **Principle:** When fast moving electrons are suddenly stopped then X- rays are produced.	2	2
	i)	**Define:** **(i)Pumping.** **(ii)Life time.** **Each definition** **Pumping:** The process of raising the atoms from lower energy state to higher energy state is called pumping. **Life time:** The time for which atom can stay in excited state is called as life time.	1	2
	j)	**Define:** **(i)Spontaneous emission.** **(ii)Stimulated emission.** **Each definition.** **Spontaneous emission:** When the electron jumps from higher energy state to lower energy state on its own accord, the emission is known as spontaneous emission. **Stimulated emission:** When the electron jumps from higher energy state to lower energy state by triggering, (supplying external energy) the emission is known as stimulated emission.	1	2

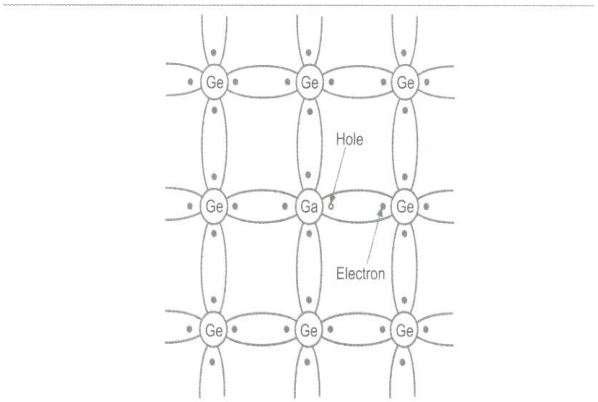
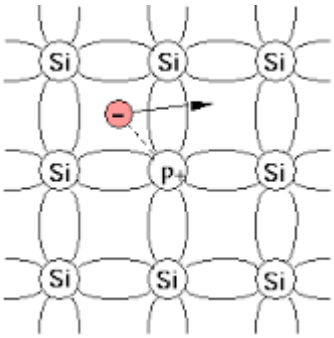
WINTER – 2015 EXAMINATION

Subject Code: 17210 **Model Answer** Page No: 05/12

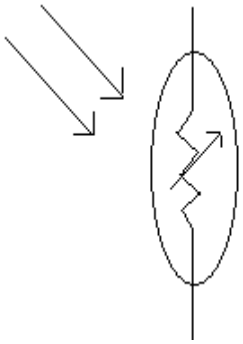
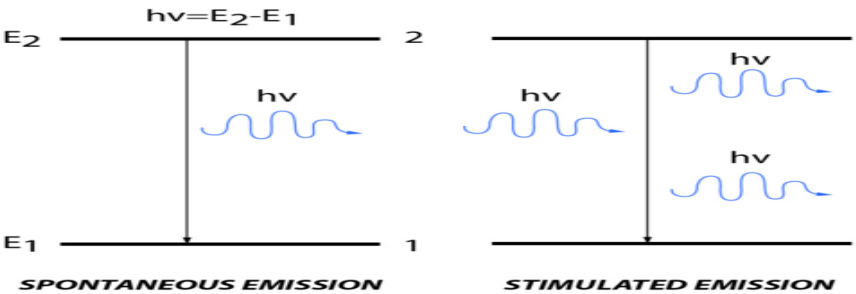
Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
1)	k)	**What is nanotechnology? Define nanoparticles.** **Each definition** **Nanotechnology:** The branch of engineering that deals with things smaller than 100 nm is called as nanotechnology. **Nanoparticles:** The particle having the size in the range from 0.2 nm to 100 nm is called as nanoparticle.	1	2
	l)	**State two methods of synthesis of nanoparticles.** **Any two methods** (i)Physical method. (ii)Chemical method. (iii)Biological method. (iv)Hybrid method. (v)Mechanical Vapour deposition method. (vi)Colloidal Method. (vii)Sol-gel method. (viii)Ball milling method. (ix)Melt mixing method. (x)PVD (Physical Vapour Deposition) method. (xi)Sputtering Method.	2	2

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
2)		**Attempt any Four of the following:**		**16**
	a)	**Write the four factors affecting the resistance of a conductor**.		4
		Each factor	1	
		Factors affecting the resistance of a conductor: - 1.Physical state of a conductor 2.Length of a conductor 3.Area of cross section of a conductor 4.Resistivity of a conductor		
	b)	**In a potentiometer arrangement a cell of emf 1.25 volt gives a balancing point of 35 cm length of wire. If a cell is replaced by another cell and the balance shifts to 63 cm , what is the emf of second cell?**		4
		Formula with substitution	2	
		Answer with unit	2	
		$E_1 / E_2 = L_1/L_2$ $E_2 = E_1.L_2 /L_1$ $E_2 = 1.25 \times 63 / 35$ **$E_2 = 2.25$ V**		
	c)	**Draw the circuit diagram and symbols of** **i) Condensers in parallel** **ii) Condensers in series**		4
		Each circuit diagram and symbol i) Condensers in parallel	2	
				

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
2)	c)	ii)Condensers in series:-  		
	d)	**Two condensers of capacitances 0.5 µF and 1.5 µF are connected in series. If potential difference of 12 volt is applied across them.Calculate the resultant capacitance and charge on each condenser.** **Each Formula with substitution** **Each Answer with unit** $1/C_s = 1/C_1 + 1/C_2 = 1/.5 + 1/ 1.5 = 4/1.5$ $\mathbf{C_s} = 1.5/4 = \mathbf{0.375\ \mu F}$ In series combination charge is same on each condenser. $\mathbf{C_s} = Q/V$ $Q = \mathbf{C_s \times V = 0.375 \times 10^{-6} \times 12}$ $Q = \mathbf{4.5 \times 10^{-6}\ F}$	2 2	4
	e)	**Define:** **i) Conduction band** **ii) Forbidden band** **iii) Valance band** **iv) Doping** **Each definition** i) **Conduction band:** The energy band containing conducting electrons is called conduction band.	1	4

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
2)	e)	**ii)Forbidden band :** The energy gap between conduction band and valance band is called forbidden band. **iii)Valance band :** The energy band containing valance electrons is called valance band. **iv)Dopping:** The process of adding impurities in pure semiconductor is called dopping.		
	f)	**Draw the structure of P- type and N-type material** **Each structure.** **P- type material :**  **N- type material :**  	2	4

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
3)		**Attempt any four of the following:**		16
	a)	**Define** **i)P-N junction diode** **ii) Depletion layer** **iii)Forward bias** **iv)Reverse bias of P-N junction diode** **Each definition** i)**P-N junction diode**: It is a semiconductor device in which half of its region is P-type and other half is N-type. ii) **Depletion layer**: The region where free electrons and free holes are absent is called depletion layer. iii) **Forward bias**: If the positive terminal of external battery is connected to p – side and negative terminal is connected to n-side of p-n junction diode, it is said to be forward bias. iv) **Reverse bias of P-N junction diode**: If the positive terminal of external battery is connected to n – side and negative terminal is connected to p-side of p-n junction diode, it is said to be reverse bias. **OR Any other relevant definition may consider.**	1	4
	b)	**Give four applications of photoelectric cell.** **Any four applications:** i) It is used in Lux-meter ii)It is used for automatic control of traffic signals iii)It is used to switch on and off automatically the street lights. iv)It is used in recording and reproduction of sound during shooting of film. v)It is used in television sets, fire alarms vi)It is used in Exposure meter.	4	4
	c)	**Define photo resistor. State its symbol and its two applications.** **Definition** **Symbol** **Two applications** **Definition:** It is a type of semiconductor whose electrical resistance decreases as the intensity of incident light increases.	1 1 2	4

<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>c)</td><td>Symbol:
 
Applications:
i) It is used for automatic lighting control.
ii)It is used in the street light control.
iii)It is used in photocopy machine to control density of toner.
iv)It is used in security alarm.
v)It is used in camera for Exposure meter.</td><td></td><td></td></tr>
<tr><td></td><td>d)</td><td>Differentiate between spontaneous and stimulated emission of light with diagram.
Three point of difference
Diagram
<table>
<tr><th>Spontaneous emission</th><th>Stimulated emission</th></tr>
<tr><td>Excited atoms comes to ground state on its own accord</td><td>Excited atoms comes to ground state after interaction with incident photon.</td></tr>
<tr><td>Radiations are in random direction , phase and wavelength</td><td>Radiations are coherent , monochromatic and in same direction.</td></tr>
<tr><td>Independent of outside circumstances</td><td>Dependent of outside circumstances</td></tr>
<tr><td>No metastable state exist</td><td>Metastable state exist</td></tr>
<tr><td>Number of photons emitted are less</td><td>Number of photons emitted are more</td></tr>
</table>

</td><td>3
1</td><td>4</td></tr>
</table>

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
3)	e)	**i) State any two properties of X-rays.** ii) **State any two engineering applications of X-rays.** **Any two properties** **Any two engineering applications** **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. **Applications:** i)X- rays are used to detect the cracks in the body of aero plane 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 flows 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.	 2 2	4

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
3)	f)	**Explain- nanotechnology is used in space and defence.** **Appropriate explanation** **Nanotechnology:** The branch of engineering that deals with things smaller than 100 nm is called as nanotechnology. **Nanoparticles:** The particle having the size in the range from 0.2 nm to 100 nm is called as nanoparticle. Nanomaterials are having very amazing properities .They are tough and light weight, so conventional materials used for space and defence applications are now replaced by nanomaterials. e.g. light weight suits , jackets made up of areogels are widely used for space and defence applications. **OR any relavent applications in space and defence**.	4	4