22/151

B.Sc. (Part-III) Examination, 2022

PHYSICS

Third Paper

(Solid State Electronics)

Time : Three Hours] *[Maximum Marks : 75*

Note : Attempt questions from **all** sections as per instructions.

Section - A 1½×10=15

1. (i) What is junction breakdown? What are the causes of Avalanche and Zener breakdowns?

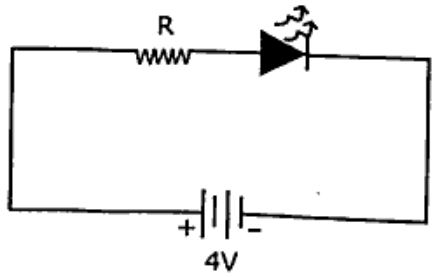
(ii) Plot the variations of charge density electric potential and the electric field across p-n junction, within the depletion layer.

(iii) Explain why the light emitted from LED is incoherent?

(iv) Discuss the effect of increasing negative Gate Voltage on drain current of an n-channel JFET.

(v) State the effect of temperature on the built-in Voltage. A Silicon diode has V_0=0.7 Volt at 25°C. Find V_0 when junction temperature is raised to 100°C.

(vi) In the circuit, find R that keeps the LED safe.



(vii) Explain Early effect.

(viii) What is the advantage of phototransistor over photodiode?

(ix) What is the basic difference between DMOSFET and EMOSFET? Draw their symbols.

(x) What do you mean by regulation? Define Load and line regulations.

Section - B 8×5=40

2. Explain, with neat diagram, how a potential barrier develops across a p-n junction.

A silicon p-n junction diode has $N_A = 10^{17}$ atoms/cm^3, $N_D = 10^{15}$ atoms/cm^3. For Silicon, $n_i = 1\times10^{10}$/cm^3. Calculate the internal potential barrier at 300K.

OR

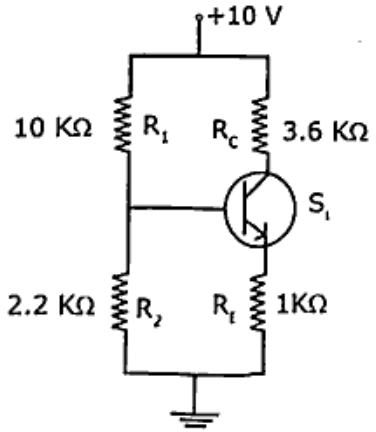
Derive the expression for the depletion (junction) capacitance of a p-n junction. Plot C against bias voltage V_a.

3. With the help of energy band diagram explain work function in metal and semiconductor. Explain how metal-semi conductor junctions achieve rectifying property. Compare V-I characteristic of Schottky barrier diode with that of p-n junction diode.

OR

Why do transistor amplifier circuits need biasing? Discuss the factors that may cause a shift in Q-point.

4. Determine the Q-point of the circuit



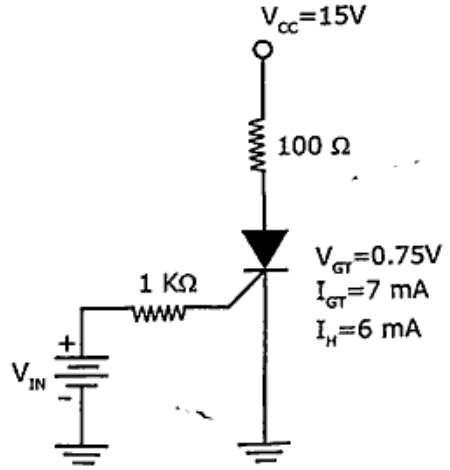
OR

What is meant by Power Amplifier? Develop the expression for the maximum efficiency of a class B power amplifier.

5. With the help of 2-transistor model of SCR, explain how an SCR is turned on and OFF.

OR

In the SCR circuit,



Determine-

(a) Input voltage V_{IN} that triggers SCR.

(b) The supply voltage that turns SCR OFF

6. What are chief sections of a regulated Power Supply. Draw circuit diagram of a Zener regulated Power Supply and discuss the functions of each component.

OR

Discuss briefly the basic construction, operation and characteristics of an n-channel Enhancement MOSFET.

Section - C 10×2=20

7. Draw hybrid equivalent circuit of a CE transistor amplifier and hence obtain expressions for-

(a) Current gain

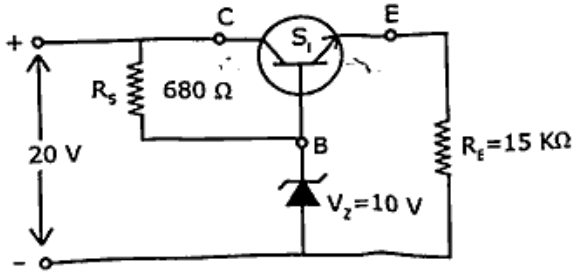
(b) Input impedance and

(c) Voltage gain

8. Derive the expression for the width of depletion layer W_0 in terms of buit-in voltage V_0 and doping densities N_A and N_D.

9. Find the stability factor of an Emitter resistor and Potential Divider Bias transistor amplifier circuit. Discuss its advantages over other biasing methods.

10. In the pass-transistor regulator ,



Find (a) D.C. output voltage

(b) Zener current, if β=100.

11. Write short notes on any **two** :

(a) Photodiodes and their applications

(b) Distortions in amplifiers.

(c) Transistor amplifiers and their D.C. and A.C. equivalent ckts.

(d) UJT and its applications.