

Seat No.: \_\_\_\_\_

Enrolment No. \_\_\_\_\_

# GUJARAT TECHNOLOGICAL UNIVERSITY

B.E. Sem-III Remedial Examination March 2010

Subject code: 131101

Subject Name: Basic Electronics

Date: 09 / 03 / 2010

Time: 3.00 pm – 05.30 pm

Total Marks: 70

## Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

**Q.1 (A)** What is transition capacitance of a p- n junction diode ? For a step graded junction prove that the expression for the transition capacitance of a diode is same as the capacitance of a parallel plate capacitor. **07**

**(B)** How does the designer minimize the percentage variation in  $I_C$  , due to variation in  $I_{CO}$  and  $V_{BE}$  and due to variation in  $\beta$  in transistor amplifier circuit. **07**

**Q.2 (A)** A 230 V , 50 Hz AC voltage is applied to the primary of a 5:1 step down transformer which is used in a bridge rectifier having a load resistor of a value 470  $\Omega$ . Assuming the diodes to be ideal , determine the following **07**

- (a) DC output voltage
- (b) DC power deliver to the load
- (c) Maximum value of output current
- (d) Average value of output current
- (e) RMS value of output current
- (f) Output frequency
- (g) PIV of diode

**(B)** Define **07**

- (a) Drift velocity of electron
- (b) Electric field
- (c) Photovoltaic potential
- (d) Photo excitation
- (e) Photo ionization
- (f) Intensity of electric field
- (g) Reverse recovery time of diode

**OR**

**(B)** Define **07**

- (a) Electron volt
- (b) Potential
- (c) Critical wavelength for semiconductor
- (d) Mean life time of carrier
- (e) Mobility of electron
- (f) Volt equivalent of temperature
- (g) Pinch off voltage of FET

- Q.3 (A)** A bar of silicon 0.2 cm long has a cross sectional area of  $9 \times 10^{-8} \text{ m}^2$ , heavily doped with phosphorus. What will be the majority carrier density resulting from doping if the bar is to have resistance of 2 k $\Omega$  ? Given for silicon at room temperature :

$$\mu_n = 0.14 \text{ m}^2/\text{V-sec}, \mu_p = 0.05 \text{ m}^2/\text{V-sec}, n_i = 1.5 \times 10^{10} / \text{cm}^3, q = 1.602 \times 10^{-19} \text{ C}$$

- (B)** Give minimum four comparisons of following semiconductor devices **06**
- (1) Tunnel diode with conventional diode.
  - (2) LED with conventional diode.
  - (3) LED with photo diode.
- (C)** Prove that current density is proportional to product of charge density , mobility of charge and electric field intensity. **04**

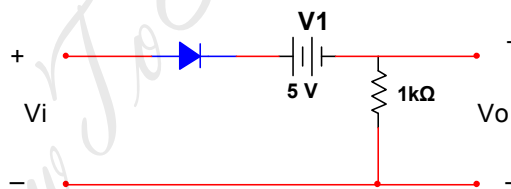
**OR**

- Q.3 (A)** A static resistance of 4  $\Omega$  is observed in an ideal germanium diode at room temperature. The current flowing through the diode is 50mA. If the forward biased voltage is 0.2V , volt equivalent temperature is 26mV , calculate :

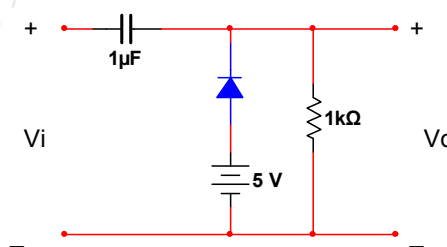
- (i) Reverse saturation current
- (ii) Dynamic resistance of diode

- (B)** Draw output waveform of following circuits. Consider input of 20V (peak to peak), 10kHz sine wave and assume ideal diode. **06**

(i)



(ii)

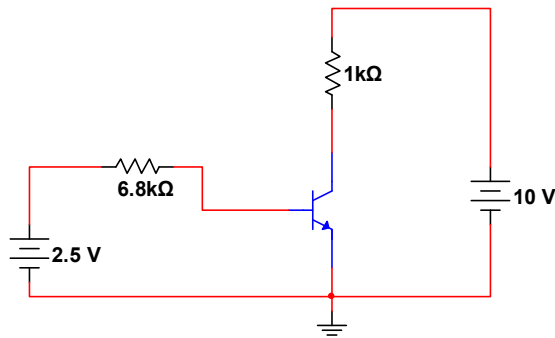


- (C)** Explain the hall effect in semiconductor. How hall effect is considered in measurement of mobility and conductivity? **04**

- Q.4 (A)** Derive relationship between  $\alpha_{dc}$  and  $\beta_{dc}$  of a transistor. **04**

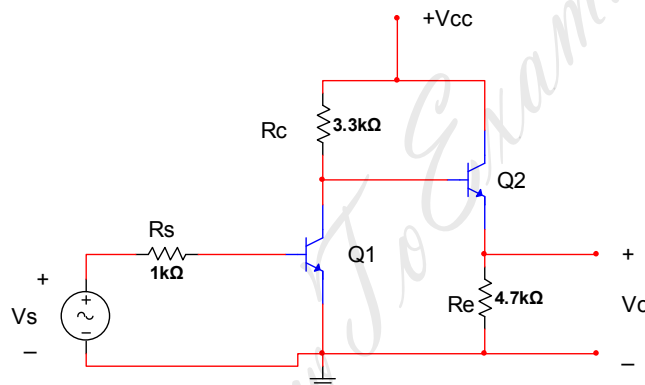
- (B)** Explain any one circuit which is used to improve the input impedance of the amplifier. **06**

- (C) Determine whether or not the transistor in below circuit is in saturation. Assume  $\beta = 50$  and  $V_{CE(sat)} = 0.3V$ ,  $V_{BE} = 0.7V$ . **04**

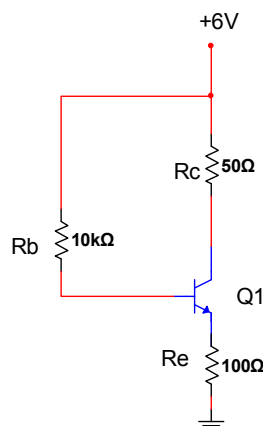


OR

- Q.4 (A)** Compare various transistor amplifier configurations. **04**
- (B)** Draw and explain the input and output characteristics of p-n-p silicon transistor in CB configuration. Indicate cut off, saturation and active regions. **06**
- (C)** Two stage amplifier circuit is mentioned below. Calculate overall voltage gain  $A_v$ . Take  $h_{ie} = 2.2K$ ,  $h_{fe} = 60$ ,  $h_{re} = 2.5 \times 10^{-4}$ ,  $h_{oe} = 2.5 \mu A/V$ ,  $R_c = 3.3 k\Omega$ ,  $R_e = 4.7k\Omega$ ,  $R_s = 1 k\Omega$ ,  $V_{cc} = +12V$ . **04**



- Q.5 (A)** For following circuit, calculate the minimum and maximum value of emitter current when  $\beta$  of transistor varies from 75 to 150. Also calculate the corresponding values of collector to emitter voltage. Take  $V_{BE} = 0.3V$ ,  $R_b = 10k\Omega$ ,  $R_c = 50 \Omega$ ,  $R_e = 100 \Omega$ ,  $V_{cc} = +6V$ . **06**



- (B)** Explain with neat circuit diagram, the working of a transformer coupled class A power amplifier. **04**

- (C) Compare FET with BJT in terms of advantages, disadvantages, construction and operation. 04

OR

- Q.5 (A) Describe briefly the construction and working of p channel enhancement MOSFET. Draw its characteristic and transfer curve. 06

- (B) A class B push pull amplifier supplies power to a resistive load of  $15\Omega$ . The output transformer has a turns ratio of 5:1 and efficiency of 78 %. Assume  $h_{fe} = 25$  and  $V_{cc} = 18V$ . 06

Obtain :

- (a) Maximum power output
  - (b) Maximum power dissipation in each transistor
  - (c) Maximum base current for each transistor.
- (C) Explain the signification of following parameters in evaluating the regulation performance of a DC series regulator 02

(a) Input regulation factor ( Stability factor )  $S_V$

(b) Temperature stability factor ( Temperature coefficient )  $S_T$

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