

Code : 041401

B.Tech 4th Semester Examination, 2017

Basic Electronics

Time : 3 hours

Full Marks : 70

**Instructions :**

- (i) There are **Nine** Questions in this Paper. All questions carry equal marks.
- (ii) Attempt **Five** questions in all.
- (iii) **Question No. 1 is Compulsory.**
- (iv) The marks are indicated in the right-hand margin.

1. Choose the correct alternatives for any seven of the following;

7×2

(A) The junction capacitance of a linearly graded junction varies with the applied reverse voltage (V) as

- (i) V
- (ii)  $V^{-1/3}$
- (iii)  $V^{-1/2}$
- (iv)  $V^{-1/4}$

(B) Reverse saturation current in a silicon PN junction diode is doubled for every

- (i) 10°C increase in temperature
- (ii) 5°C increase in temperature

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- (iii) 2°C increase in temperature
- (iv) 1°C increase in temperature

(C) A rectifier is used to

- (i) convert ac to dc
- (ii) convert dc to ac
- (iii) convert high voltage to low voltage
- (iv) convert low voltage to high voltage

(D) Polarity of dc output voltage of a half wave rectifier can be reversed by reversing

- (i) transformer primary
- (ii) the diode
- (iii) transformer secondary
- (iv) none of these

(E) When a transistor operates in active region, it behaves as

- (i) a closed switch
- (ii) an open switch
- (iii) an amplifier
- (iv) none of these

(F) If the Q-point of a transistor lies at \_\_\_\_\_, the negative part of input signal is clipped at output.

- (i) near saturation point
- (ii) near cut-off point
- (iii) middle of active region

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(iv) anywhere of the load line

(G) Trans-conductance of JFET is measured in

- (i) mhos or siemens
- (ii) ohms
- (iii) volts
- (iv) amperes

(H) The threshold voltage of an enhancement pMOS transistor is

- (i) less than zero volt
- (ii) equal to zero volt
- (iii) greater than zero volt
- (iv) none of these

(I) In a common-emitter amplifier, the unbiased emitter resistance provides

- (i) voltage-series feedback
- (ii) voltage-shunt feedback
- (iii) current-series feedback
- (iv) current shunt feedback

(J) An ideal OP-AMP has

- (i) infinite voltage gain
- (ii) zero output impedance
- (iii) infinite signal bandwidth
- (iv) all of these

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2. (a) What is a forward biased and reverse biased diode? How is the width of the space charge region and barrier height affected in forward biased and reversed diode. 8
- (b) What is the relation between current and voltage in a PN junction diode? Explain each term involved in that relation. The reverse saturation current of a silicon PN junction diode is  $10\mu\text{A}$  at the temperature 300 K. Determine the forward bias voltage to be applied across the PN junction to obtain a current of about 100 mA. 6
3. (a) Explain depletion layer capacitance and diffusion capacitance of a PN junction diode in detail. How do these capacitances vary with respect to applied bias voltage across a silicon PN-junction diode? 7
- (b) A silicon has a doping density of acceptors  $N_A = 4 \times 10^{18} / \text{cm}^3$  in the P-type region and a doping density of donors  $N_D = 3 \times 10^{15} / \text{cm}^3$  in the N-type region. Assume  $n_i = 2.5 \times 10^{10} / \text{cm}^3$  at room temperature of 300 K and the dielectric constant of silicon as 11.7. Determine the built in potential and the total space charge (depletion layer) width at 300 K. 7
4. (a) What is ripple factor? Why ripple factor is so important in power supply? Derive the expression of ripple factor of a full wave rectifier using centre-tap transformer. 2+2+4

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- (b) A single phase full wave rectifier circuit consists of four diodes, a  $250\Omega$  load resistance and it is fed from a 15V, 50 Hz ac power supply. The forward resistance of each diode is  $25\Omega$ . Determine the dc output voltage, dc load current and efficiency. 6
5. (a) What is a bipolar junction transistor (BJT)? Why are these transistors called bipolar devices? What are the different configuration of BJT? 6
- (b) Derive the relation between  $\alpha$  and  $\beta$  of a BJT. 4
- (c) The collector current of a transistor is 100 mA and is  $\beta$  is 75. Calculate the value of base current and emitter current. 4
6. (a) What are the different types of biasing? Derive the expression for stability factor of self bias circuit. 3+5
- (b) A voltage divider bias circuit of a BJT is shown in Fig.-1 below. Determine the emitter current and collector-to-emitter voltage. Calculate the collector potential  $V_c$ . Assume  $V_{BE} = 0.65$  and  $\beta = 75$ . 6

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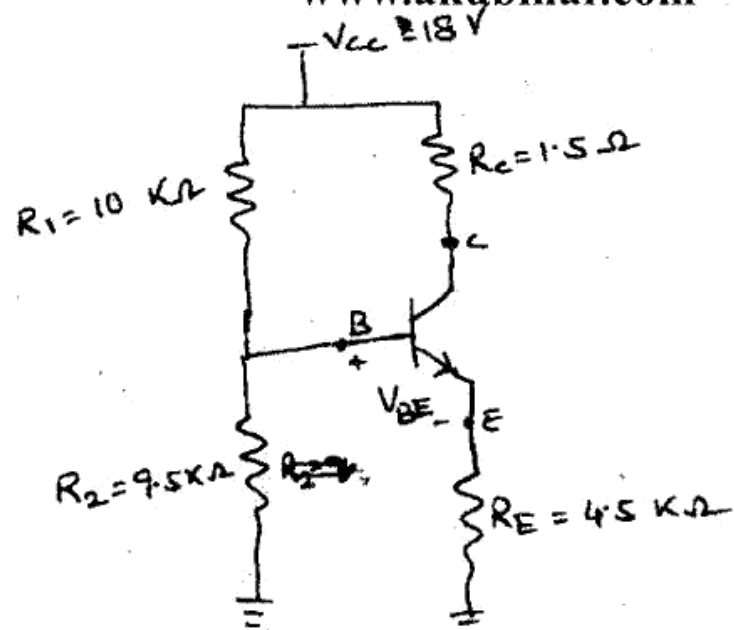


Fig.-1

7. (a) Discuss the construction and working principle of a P-channel enhancement type MOSFET with diagrams and draw the device characteristics. 8
- (b) In an N-channel JFET,  $I_{DSS} = 12 \text{ mA}$ ,  $V_p = -6 \text{ V}$ . Find the minimum value of  $V_{DS}$  for pinch off operation. Determine the value of drain current at  $V_{GS} = -3 \text{ V}$ . 6
- 8 (a) Draw the circuit diagram of an integrator using opamp and explain its operation. If a square wave voltage signal is applied at the input of an integrator then draw its out in same time scale of input signal. 2+5+2

- (b) Draw the circuit diagram of a non-inverting summing amplifier using opamp and determine the output voltage. 5

9. Write short notes on the following: 2×7

- (i) Photo diode  
(ii) Unijunction Transistor

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