ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination   Winter Semester, A.Y. 2019-2020
Course No.: EEE 4383   Time: 90 Minutes
Course Title: Electronic Devices and Circuits   Full Marks: 75

There are 4 (four) questions. Answer **any 3 (three)** questions. All questions carry equal marks. Marks in the margin indicate full marks. Programmable calculators are not allowed. Do not write on this question paper. Assume suitable value for any missing data.

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1. a) Draw the detailed transfer characteristics of a pn junction diode composed of Ge, Si and   07
        GaAs in the same graph and indicate different regions in the diagram.

    b) Write down a comparative analysis on the characteristics of BJT and FET.   07

    c) Determine I_D and V_D for the circuit in Fig. 1(c) with $V_{DD} = 5$ V and $R = 1.1$ kΩ using the   07
        iterative analysis method. Assume the diode current is 1.5 mA at a voltage of 0.7 V.

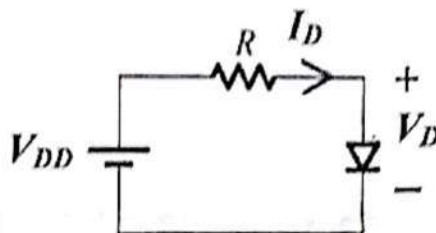Fig. 1(c)

    d) What is the purpose of DC biasing in BJT?   04

2. a) Design a full wave rectifier and draw the input and output waveshapes for this circuit.   05

    b) Draw the majority and minority carrier concentrations profile of an npn transistor in the   07
        forward active mode. Explain the different currents generated due to the flow of these
        carriers and their relations.

    c) Draw the V_{CB}-I_C characteristics of an npn transistor fed with a constant emitter current I_E.   07
        Explain the conditions for reaching the saturation for this transistor. What happens to I_C
        in saturation?

    d) What is Q-point? Describe the significance of biasing in case of fixing a Q-point and its   06
        effect on amplification in a common-emitter connection for small signals.

3. a) What is Shockley's equation? Draw the transfer characteristics of an n-channel JFET.   06

    b) Define the static and dynamic resistance of a diode.   05

    c) What is a virtual ground? What are the characteristics of an ideal op-amp?   06

d) For the circuit in Fig. 3(d), $I_{DSS} = 6$ mA and $V_P = -3$ V, calculate the values of I_{DQ}, V_{GSQ}, 08 V_D and V_S. Also draw the graph for Q-point.
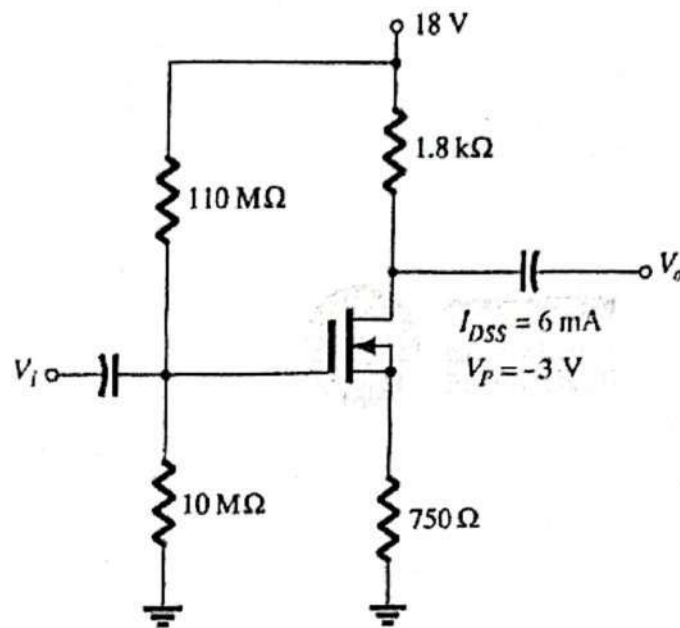

Fig. 3(d)

4. a) For the circuit in Fig. 4(a), calculate the values of I_E, I_B, V_E, V_B, I_C and V_C. 08

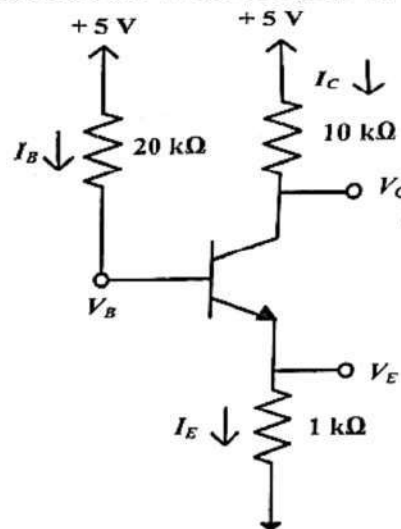Fig. 4(a)

b) Implement the expression $Vo = -5u + 1.5v + 3.3x + 7y - 11z$ using op-amps. 06

c) Explain the mode of operation of a PN junction diode under the forward and reverse bias 06 conditions.

d) What are α and β for a BJT. Derive the expression by which α and β are related to each 05 other.