Total No. of printed pages = 4

EI 181303

Roll No. of candidate | | | | | | | | | |

25/2/22 2021

B.Tech. 3rd Semester End-Term Examination

EE, IE

ANALOG ELECTRONICS

(New Regulation & New Syllabus)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Question No. 1 is compulsory. Answer either Part (a) or (b) from the rest.

1. Fill in the blanks : $(10 \times 1 = 10)$

(a) If the current in an intrinsic conductor for an applied voltage of 5V, is 10 µA at 30°C, the current that would flow at 20°C for the same applied voltage will be _______.

(b) The Base Current for a PNP transistor is 40 µA, while the Collector Current is 20 mA. The value of β for the transistor is _______.

(c) The r-parameter Model of a BJT is derived from __________ model.

(d) A JFET is operating in __________ region when the Drain-Source voltage $V_{OS} < V_P$.

(e) Voltage-Series Negative Feedback applied to an OPAMP results in __________ configuration of an OPAMP amplifier.

Answer True or False

(f) Simple Shunt Capacitor Filter results in the reduction of ripple completely.

(g) A transistor is always operated in the Active Region for amplifiers.

(h) VMOS is most suitable for a Power Switch.

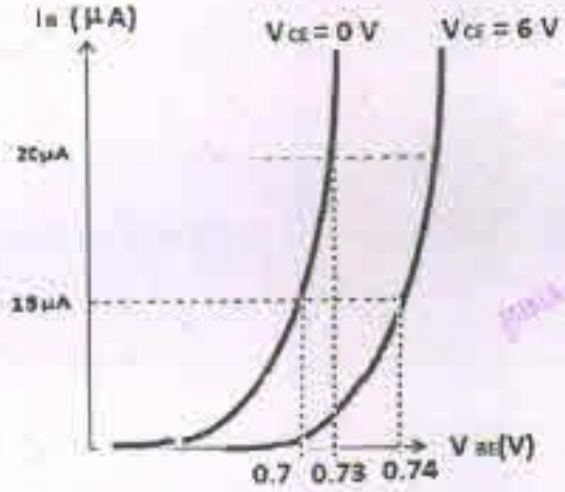
(i) OPAMPS are always operated in the Inverting Mode.

(j) Active Filers with OPAMP always show the best results.

[Turn over

2. (a) Derive the Shockley's Equation for current flow in a P-N Junction and justify the shape of the V-I Characteristics. (15)

(b) (i) Calculate h_{ie} and h_{re} from the input characteristics of a transistor shown in the figure. All the required data are available in the sketch. (7)

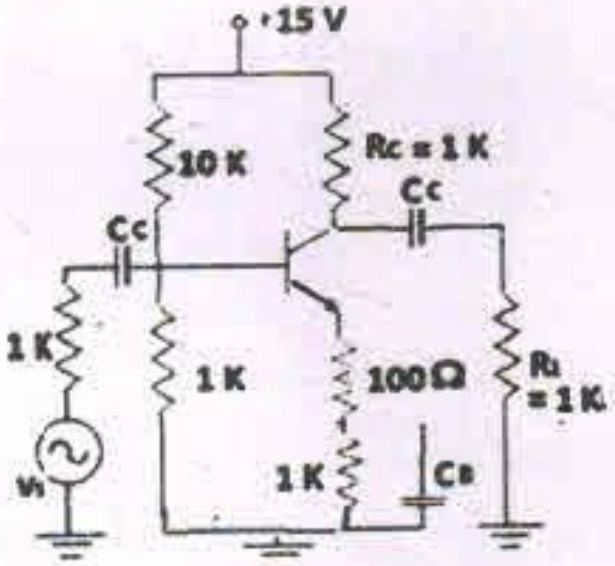


(ii) Sketch the DC Load line, locate the 0-Point and calculate the stability factor of a Voltage-Divider biasing circuit of a Si NPN transistor with the following component values:

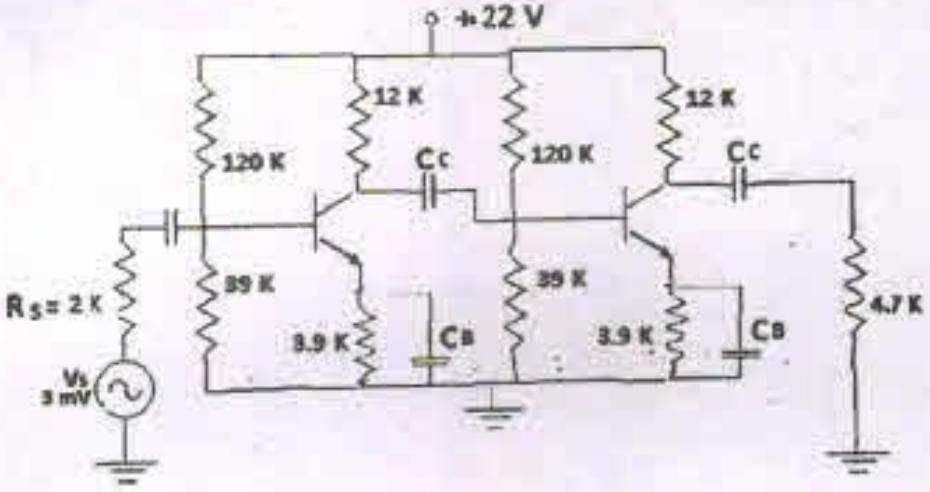
$R_C = 2K$, $R_E = 1.5K$, $R_1 = 15K$, $R_2 = 2K$.

Given, β=200, $V_{CC} = +12V$ (8)

3. (a) Calculate Voltage Gain, Current Gain, Input Impedance and Power gain of the amplifier circuit shown in the figure below using r-parameter analysis. The circuit uses a Si transistor having $\beta = 200$. (15)

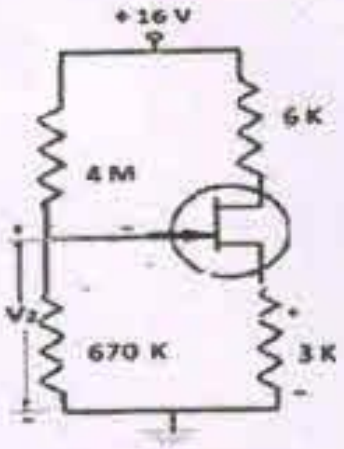


(b) Analyze the amplifier in the circuit shown in the figure below and calculate output voltage and output power. Assume identical transistors with $h_{ie} = 2K$ and $h_{fe} = 100$. (15)



4. (a) (i) An N-Channel JFET has the following parameters. Approximately sketch the Transfer Characteristics and Drain Characteristics of the CS Amplifier shown in the figure and locate the Q-Point.

Given, $Y_{OS} = 40\ \mu S : I_{DSS} = 30\ \ mA : V_p = 6V$. (10)



(ii) In a Voltage Series Negative Feedback system, the Basic Amplifier has a Voltage Gain of $A_V = |40|$, Input Impedance of 3K, Output Impedance of 100Ω and a Bandwidth of 20 KHz. If the applied Feedback is 10% of the output, calculate following quantities for the system; (5)

(1) Voltage Gain;

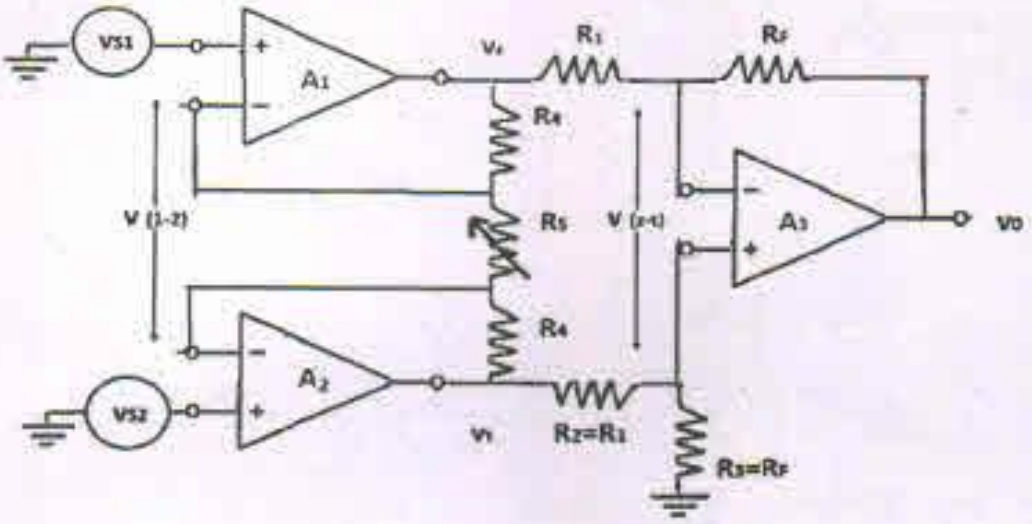
(2) Input Impedance;

(3) Output Impedance;

(4) Band-Width;

(b) Explain in detail, the constructional features and the Working principle of a MOSFET which can be operated in both E-Mode and D-Mode. (15)

5. (a) Show that the circuit shown in the figure below functions as a Difference Amplifier. Show that the Input Impedance at both the input terminals can be equalized. (15)



(b) Design an OPAMP based application to simulate the given differential equation. (15)

$$2\ddot{y} - 14\dot{y} + 8y = 2u_{(t)}$$

With the Initial conditions,

$$\dot{y}_{(0)} = -12 \; ; \; y_{(0)} = 6$$