Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

III SEMESTER B.Tech (BME) DEGREE END SEM EXAMINATIONS NOVEMBER 2017
SUBJECT: ANALOG ELECTRONICS (BME 2102)
(REVISED CREDIT SYSTEM)
Nov 16th Thursday, 2017, 9 AM to 12 NOON

TIME: 3 HOURS **MAX. MARKS: 100**

Instructions to Candidates:

1. **Answer FIVE full questions.**
2. **Draw labeled diagram wherever necessary**

1. (a) Assume a Si transistor with $\beta = 50,\ V_{BE} = 0.6v,\ V_{CC} = 22.5v,\ R_C = 5.6K.$ It is desired to establish a quiescent point at $V_{CE} = 12v, I_C = 1.5mA \& S \le 3.$ Find $R_E, R_1 \& R_2.$ 8

(b) Derive an expression for the factor that describes the stabilization of collector current against variations in the value of I_{CO}, keeping the values of V_{BE} and β constant. 6

(c) For a collector to base bias circuit with emitter resistance, show that $S = \dfrac{1+\beta}{1+\beta\dfrac{(R_C+R_e)}{(R_C+R_e+R)}}$. R is the resistance connected between collector and base of the transistor. 6

2. (a) A two stage RC coupled amplifier has the following parameters. $h_{fe} = 50, h_{ie} = 1.1K, R_C = 3K, C_e = 50pF \quad R_1 = 50K, R_2 = 50K \& R_e = 2K$ for each stage.

i) What must be the value of C_b in order that the frequency characteristic of each stage be flat within 1 dB down to 10 Hz. 8

ii) Repeat part i) if the overall gain of both stages is to be down 1 dB at 10 Hz.

iii) What is the overall mid band voltage gain?

(b) Express h_{re} & h_{fe} in terms of common collector $h-$ parameters. Graphically determine both the h-parameters. 6

(c) Derive expressions for the overall lower 3 dB frequency and overall upper 3 dB frequency of non-interactive cascaded amplifier. 6

3. (a) i) A transistor amplifier with un bypassed R_e is having an overall trans conductance gain of $-1mA/v$, overall voltage gain of -4 & $D=50$. If find R_e, R_L & R_{if}. 4+4

ii) Draw the approximate small signal model for the common collector transistor amplifier configuration, and determine the expressions for: voltage gain, current gain, input resistance and output resistance.

(b) Analyze a FET source follower circuit to determine the voltage gain with feedback, input resistance with feedback and output resistance with feedback. 6

(c) Design a current series feedback amplifier circuit with the following specifications: Input resistance with feedback 50 KΩ. The following specifications are provided: $BC107, h_{fe}=200, h_{ie}=1K, V_{CE}=5v$ & $I_C=2mA$. 6

4. (a) Draw the model that describes the transistor at high frequencies and determine the expressions for its conductance's. 8

(b) Show that $Z_i=\dfrac{1-5\alpha^2-j\left(6\alpha-\alpha^3\right)}{3-\alpha^2-j4\alpha}$ of the feedback network of FET RC-phase shift oscillator and at the frequency of oscillation $\alpha=\sqrt{6}$ input impedance of the feedback network is $(0.83-j2.7)R$ 6

(c) Design a suitable oscillator circuit that generates oscillations having a frequency of 500 KHz. The stability factor is 6. The specifications provided are: $BC107, V_{CEQ}=5v, I_{CQ}=2mA, h_{fe}=300$ & $h_{ie}=2.2K$. 6

5. (a) i) For a large signal class A power amplifier circuit, calculate input power, output power and efficiency for an input voltage resulting in a base current of 20 mA peak. Determine the power dissipated by the transistor. The specifications provided are: $R_B = 1K, R_L = 30\Omega, \beta = 25 \& V_{CC} = 20v.$ 5+3

ii) To deliver 10 watts from a class B push pull amplifier the collector dissipation maximum power is 4 watts or transistors have to be selected that have collector dissipation of approximately 2 watts each. Mathematically derive the relation between maximum collector power dissipation and maximum output power,

(b) Analyze a common source amplifier circuit with bypass capacitor to obtain expressions for its voltage gain and current gain. What is the effect of source resistance on its voltage gain? 6

(c) i) How different is enhancement MOSFET with respect to depletion MOSFET taking into consideration their output and transfer characteristics? Explain. 4+2

ii) Highlight important features of large signal class AB power amplifier.