Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S3 (S,FE)/S1 (PT)(S) June 2024 (2019 Scheme)/S3 (WP)(R) December 2023 Examination

Course Code: EET205

Course Name: ANALOG ELECTRONICS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions. Each question carries 3 marks Marks

1 Mention the factors affecting stability of operating point of a bipolar junction transistor (3)

2 Why coupling capacitor is used at the input and output sides of a transistor amplifier? Explain. (3)

3 Define short circuit drain current of JFET with a diagram (3)

4 Draw the frequency response curve of CE amplifier showing lower cut-off frequency, upper cut-off frequency and bandwidth and explain each. (3)

5 Explain the Barkhausen's criterion for sustained oscillations. (3)

6 How the crossover distortion is overcome using class AB power amplifier? (3)

7 Compare any six characteristics of ideal and practical Op-Amp. (3)

8 Define and explain CMRR of an op-amp. (3)

9 Draw the input and output voltage waveforms for an op-imp inverting integrator circuit with input as a square wave. (3)

10 Differentiate astable and monostable multivibrators using 555 timer. (3)

PART B

Answer any one full question from each module. Each question carries 14 marks

Module 1

11(a) Determine the operating point values for a potential divider bias of CE amplifier as shown in Fig. 1 and also find the stability factor. Given that V_{BE}=0.7 V and β = 80, V_{CC} = 15 V, R_C = 5 kΩ, R_E = 2 kΩ, R_1 = 20 kΩ, R_2 = 10 kΩ. (9)

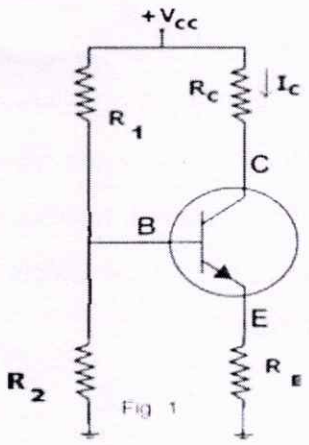

Fig. 1

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(b) With a fixed bias circuit of a transistor, explain how the operating points are fixed? Mention the disadvantages. (5)

12(a) Derive the equations for input impedance, output impedance, voltage gain and current gain of an amplifier in common emitter configuration, with h-parameter model, driving a load resistance r_L. (9)

(b) With the help of a circuit diagram, explain thermistor bias compensation for a BJT. (5)

Module 2

13(a) Explain the operation of an n-channel JFET with a constructional diagram. (5)

(b) Draw the small signal model of common drain amplifier and derive the expression for input and output impedances and voltage gain. (9)

14(a) With the help of constructional diagrams, explain the features and working of n-channel E-MOSFET. (5)

(b) Draw the hybrid pi model of CE amplifier and derive the expression for input impedance, output impedance and voltage gain. (9)

Module 3

15(a) Derive the expression for conversion efficiency of a class B power amplifier. Draw the circuit diagram. Explain the operation. Mention at least one merit and demerit of class B power amplifier. (9)

(b) Draw the circuit diagram of transformer coupled multistage transistor amplifier. Explain the operation. What are the advantages? (5)

16(a) With the circuit diagram explain the operation of Wein bridge oscillator. Derive the expression for frequency of oscillation. (7)

(b) Draw the circuit diagram and explain the operation of Colpitts transistor LC Oscillator. Derive the expression for frequency of oscillation. (7)

Module 4

17(a) Draw the circuit diagram and derive the voltage gain equation of non-inverting op-amp in closed loop. Also draw the output voltage waveform for a sinusoidal input voltage. Design a non-inverting amplifier with closed loop voltage gain of 9. Assume feedback resistance as 10 kΩ. (8)

(b) Obtain the output voltage equation for an op-amp with inputs of (i) differential mode (b) common mode (6)

18(a) Design an Op-Amp circuit with a feedback resistance of 15 kΩ to get $Vo = -(3V_1 + 2V_2 + 0.5V_3 + 5V_4)$. where V_1, V_2, V_3, V_4 and Vo respectively are the four inputs and one output voltages. Draw the circuit diagram with designed values. (8)

(b) Derive the voltage equation of a difference amplifier using op-amp along with circuit diagram. (6)

Module 5

19(a) Draw the circuit diagram and waveforms of a triangular wave generator using op-amps. Derive the expression for time period in terms of passive elements. (7)

(b) With the circuit diagram and waveforms of Schmitt trigger using op-amp, explain the hysteresis action by the relevant equations. (7)

20(a) Derive the expression for output voltage of amplifier using op-amp which gives differentiated input voltage as its output. Draw a neat circuit diagram and representative input and output waveforms. (5)

(b) Draw the functional circuit diagram of astable multivibrator using 555 timer IC? Determine the positive pulse width, negative pulse width, total time period and duty ratio for an astable multivibrator using 555 timer IC. Given that R_A=6.8 kΩ, R_B=4.7 kΩ and C=0.1μF. (9)