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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

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

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	What is meant by thermal runaway? What all parameters affect the stability of operating point of BJT?	(3)
2	How bias compensation is done in BJT using thermistors?	(3)
3	The data sheet of an N- channel JFET gives the following details. I_{DSS} = 9mA and pinch off voltage, V_P = -4.5V. i) At what value of gate to source voltage V_{GS}, drain current I_D will be equal to 3mA?	(3)
4	Compare the features of FET and BJT.	(3)
5	Differentiate between positive and negative feedback circuits. Why negative feedback is utilized in amplifiers?	(3)
6	State and explain the Barkhausen criterion for sustained oscillation?	(3)
7	What are the ideal characteristics of operational Amplifier?	(3)
8	What is a Voltage follower circuit using OP - Amp?	(3)
9	Draw a practical integrator and explain the purpose of feedback resistance in practical integrator.	(3)
10	Design a comparator using OP-Amp that compares a sinusoidal signal of 5V peak with a fixed dc voltage of 2.5V. Draw corresponding waveforms.	(3)

PART B

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

Module 1

11	(a) Derive the stability factor of a voltage divider biasing circuit of a BJT amplifier.	(6)
	(b) Obtain the operating point set by the voltage divider bias circuit for an NPN CE transistor with β =80 and V_{BE} =0.7 V. Given V_{CC} = 16 V, R_1=62kΩ, R_2=9.1kΩ, R_C=3.9 kΩ and R_E= 680 Ω. Also calculate stability factor, S.	(8)

12 (a) Derive the expressions for voltage gain, current gain and input impedance for BJT in common emitter configuration using h-parameter model. (6)

(b) A transistor in Common Emitter configuration has the following set of h parameters. h_{ie}=1700Ω, h_{re}=1.3 x 10^{-4}, h_{fe} = 50, h_{oe}= 6x10^{-6} ℧. If the ac load resistance r_L seen by the transistor is 2kΩ, calculate (i) input impedance (ii) current gain and (iii) voltage gain. (8)

Module 2

13 (a) Draw and explain the drain and transfer characteristics of JFET. What is meant by I_{DSS} and Pinch-off voltage, V_P? (8)

(b) Explain the construction and working principle of E-MOSFET (6)

14 (a) Draw and explain the voltage divider biasing method of JFET. (6)

(b) In an n- channel JFET, biased by potential divider method, it is desired to fix the operating point at I_D =3mA and V_{DS}= 8V.If V_{DD} =20V, R_1=1MΩ, R_2=500kΩ, find the value of R_S .The parameters of JFET are I_{DSS} = 9mA and V_p=-5V. (8)

Module 3

15 (a)What is the basic principle of R-C phase shift Oscillators? Design an R-C phase shift oscillator to oscillate at 500 Hz. (8)

(b) Draw and explain Colpitts oscillator and derive its frequency of oscillation. (6)

16 (a) With necessary diagrams explain the working of class A transformer coupled amplifier and obtain its maximum conversion efficiency. (8)

(b) Explain different schemes of coupling in multistage amplifiers. Compare their merits and demerits. (6)

Module 4

17 (a) Define the following terms of OP-Amp (8)

(i) CMRR (ii) Slew rate (iii) Input bias current (iv) Output offset voltage

(b) Determine the gain and maximum operating frequency of an inverting amplifier with feedback resistance R_f=100k Ω and input resistance R_1=10k Ω for a sinusoidal input signal of 1volt peak. (take slew rate as 0.5V/μs). (6)

18 (a) Design an OP-Amp circuit to get the output according to the given expression V_o= -[0.2V_1+2V_2+V_3] where V_1, V_2 and V_3 are the inputs to OP-Amp. (6)

(b) What is an instrumentation amplifier? Derive the expression for output voltage of an instrumentation amplifier. (8)

Module 5

19 (a) Draw and explain the operation of a square wave generator using OP-Amp Derive the equation for its output frequency. (8)

(b) In an inverting Schmitt trigger circuit, R_1 = 40 kΩ, R_2 = 10 kΩ (feedback factor $\beta=R_2/(R_1+R_2)$, reference voltage, V_{ref} = 0 V, input voltage, V_i =12 V_{pp} (peak-to-peak) sine wave and saturation voltage are +/- 15 V. Determine threshold voltages V_{UT} and V_{LT} and also draw input and output waveforms. (6)

20 (a) With the help of internal function diagram of IC555, explain its operation as astable multivibrator. Derive the expression for frequency of oscillation. (8)

(b) Design a monostable multivibrator using IC555 to produce a time delay of 10 ms. (6)

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