Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

THIRD SEMESTER B. TECH DEGREE EXAMINATION (S), FEBRUARY 2023
ELECTRICAL AND ELECTRONICS ENGINEERING
(2020 SCHEME)

Course Code: **20EET205**

Course Name: **Analog Electronics**

Max. Marks: **100** **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. With neat diagrams, explain the DC load line in a transistor and significance of Q point.
2. With the help of a circuit diagram and relevant equations, show that fixed bias is not stable against temperature variations.
3. With necessary graph, explain the transfer characteristics of JFET.
4. Draw the frequency response characteristics of RC coupled amplifier and explain why does the gain of the transistor amplifier vary with frequency?
5. Draw the circuit diagram of a two stage direct coupled transistor amplifier. Mention its advantages and applications.
6. State and explain Barkhausen's criteria.
7. Define CMRR and Slew rate.
8. Design a 3-input summing amplifier using Op-Amp having gains of 2,3 and 5 respectively for each input.
9. Draw the circuit diagram of a Schmitt trigger. Describe the term regenerative comparator.
10. Explain the effect of slew rate of Op-Amp on waveform generation.

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Explain the diode compensation techniques adopted in transistor amplifier for reducing the drift of operating point. (6)
    b) Design a voltage divider bias circuit to operate from a 18V supply in which bias conditions are to be $V_{CE} = V_E = 6V$ and $I_C = 1.5$ mA. β=90. Also calculate the stability factor S. (8)

OR

12. a) Derive the expressions for current gain, input impedance, voltage gain and output impedance using complete h parameter equivalent circuit of CE amplifier. (10)

b) A CE amplifier has the h parameters given by h_{ie} = 1000 Ω, h_{re} = 2×10^{-4}, h_{fe}=50, h_{oe}=25 μʊ. If both the load and source resistances are 1kΩ, find: i) current gain and ii) voltage gain. (4)

MODULE II

13. a) Explain the construction and operation of Enhancement type MOSFET with neat diagrams. (8)

b) Draw the high frequency hybrid pi model of common emitter transistor and explain the significance of each parameter. (6)

OR

14. a) With neat circuit diagram and equivalent circuit, explain the common drain JFET amplifier and derive the expression for input impedance, voltage gain and output impedance. (10)

b) For a JFET connected in voltage divider biasing circuit, calculate I_D and V_{DS} for the given parameters. V_{GS} = 3V, V_{DD} = 24V, R_1= 910 kΩ, R_2 = 110 kΩ, R_D = 22 kΩ, R_S = 1.1 kΩ, I_{DSS} = 10 mA and pinch off voltage of the JFET is 3.5V. (4)

MODULE III

15. a) Prove that the class B push pull amplifier has higher efficiency than transformer coupled class A amplifiers. (10)

b) Why negative feedback is utilized in amplifiers? Explain how various parameters of an amplifier gets modified by negative feedback? (4)

OR

16. a) An amplifier having an input resistance 4kΩ has a voltage gain of 200. If a series negative feedback with β=0.01 is introduced, determine the value of input resistance of the feedback amplifier. If the amplifier in its open loop configuration had cut off frequencies f_L= 2kHz and f_H= 500kHz before the feedback path was added, formulate the new bandwidth of the circuit? (7)

b) With the help of a neat circuit diagram, explain RC phase shift oscillator using BJT. Derive the equation for the frequency of oscillation. (7)

MODULE IV

17. a) Compare the characteristics of ideal Op-Amp and practical Op-Amp. (6)

b) Draw the circuit diagram and derive the voltage gain equation of non-inverting amplifier. Design a non-inverting amplifier with gain of 6. (8)

OR

18. a) What are the features of an instrumentation amplifier? Derive the expression for output voltage of an instrumentation amplifier. (10)

b) A differential amplifier has a gain of 100. A common input of 5mV is applied to both terminals, which result in an output of 18mV. Determine common mode gain and CMRR. (4)

MODULE V

19. a) List the limitations of an ideal integrator? Draw and explain a circuit which overcome the errors of ideal integrator. (7)

b) With the help of neat circuit diagram and waveforms, explain how triangular wave can be generated using Op-Amp. (7)

OR

20. a) Draw the internal diagram of 555 timer IC and explain its operation as astable multivibrator. Derive the expression for frequency of oscillation. (10)

b) Determine the output frequency and duty cycle of the 555 astable multivibrator for C=0.01μF, R_A=2kΩ and R_B= 200kΩ. (4)

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