

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth Semester B.Tech Degree Examination July 2021 (2019 Scheme)

Course Code: ECT202

Course Name: ANALOG CIRCUITS

Max. Marks: 100 | Duration: 3 Hours (ECT202 ANA... p. 1)

PART A

(Answer all questions; each question carries 3 marks)

1. Draw the amplitude and phase responses of an RC Low Pass Filter. Mark the 3dB cutoff frequency point on both. What is the phase difference at cutoff frequency? (ECT202 ANA... p. 1)
2. Explain working of a self bias circuit? (ECT202 ANA... p. 1)
3. Explain the hybrid π parameters of BJT in CE configuration. (ECT202 ANA... p. 1)
4. A CE amplifier with voltage divider biasing has
 $V_{RE} = 1.5V, V_{RC} = 6V, V_{CC} = 15V,$
 $I_{CQ} = 3mA$ and $\beta = 200$. Find R_1, R_2, Q -point.
(ECT202 ANA... p. 1)
5. Three stages of individual RC coupled amplifier having midband gain of 80 with lower cutoff frequency of 100Hz and upper cutoff frequency of 300MHz are cascaded. Find the resultant gain and cutoff frequencies. (ECT202 ANA... p. 1)
6. Compare the small signal equivalent of MOSFET and BJT. (ECT202 ANA... p. 1)
7. In spite of reduction in gain, negative feedback is preferred for amplifiers. Justify the statement. (ECT202 ANA... p. 1)

8. State Barkhausen criteria. How it is achieved in Wienbridge oscillators? (ECT202 ANA... p. 1)
 9. With the help of VI characteristics, explain foldback protection. (ECT202 ANA... p. 1)
 10. Why is class C amplifier highly efficient? Why are they not preferred in audio applications? (ECT202 ANA... p. 1)
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PART B

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

Module - 1

11. a) Design a high pass filter for a cutoff frequency of 5KHz. Plot the frequency response indicating roll off rate in terms of dB/decade and dB/octave. Also, draw output wave form for triangular input at i) 500Hz ii) 5KHz iii) 10KHz (8 marks) (ECT202 ANA... p. 1)

b) Explain the concept of operating point with help of dc and ac load lines. Why is voltage divider biasing superior to other biasing circuits? (6 marks) (ECT202 ANA... p. 2)

OR

12. a) Design a clamper circuit to clamp a $10V_{PP}$ sine wave so that its negative peak is clamped at +2V. Assume diode drop is 0.7V. Draw and explain the output waveform and transfer characteristics. (5 marks) (ECT202 ANA... p. 2)

b) Derive the stability factor ($\frac{\partial I_C}{\partial I_{CO}}$) of a voltage divider bias circuit. (9 marks) (ECT202 ANA... p. 2)

Module - 2

13. a) Derive R_i , R_o , A_I and A_V using hybrid-pi parameters for CE configuration at low and mid frequencies. (10 marks) (ECT202 ANA... p. 2)

b) Define f_T . How can it be measured? (4 marks) (ECT202 ANA... p. 2)

OR

14. a) Design an RC coupled amplifier for a gain of 200, given that $V_{CC} = 15V$ and $I_C = 3.2mA$ and required input impedance is $1.44k\Omega$. Find the lower cutoff frequency of the amplifier. (8 marks) (ECT202 ANA... p. 2)

b) Draw the small signal high frequency CE model of a transistor and give the order of magnitudes of each capacitance and resistance. (6 marks) (ECT202 ANA... p. 2)

Module - 3

15. a) Draw a CS MOSFET amplifier. With the help of small signal equivalent circuit, compute its voltage and current gains. (10 marks) (ECT202 ANA... p. 2)

b) How can you increase the gain of this single stage without additional stages? (4 marks) (ECT202 ANA... p. 2)

OR

16. a) How does cascode attain large bandwidth without compromising on voltage or current gains? (10 marks) (ECT202 ANA... p. 2)

b) For a CS MOSFET amplifier, what is the input capacitance for the following conditions $C_{gs} = 4pF, C_{gd} = 1pF$ and $A_V = -5?$ (4 marks) (ECT202 ANA... p. 2)

Module - 4

17. a) Derive the input resistance, output resistance and gain of voltage series feedback amplifier. Draw an example circuit and derive the same. (10 marks) (ECT202 ANA... p. 2)

b) Design an oscillator to obtain sinusoidal waveform of 1MHz. (4 marks) (ECT202 ANA... p. 2)

OR

18. a) Draw the equivalent circuit of a crystal. Explain crystal

oscillator. Given $L_s = 0.8H,$

$C_s = 0.08pF, R_s = 5k\Omega$ and $C_p = 1pF,$ determine the resonant frequencies. (8 marks) (ECT202 ANA... p. 2)

b) How does negative feedback affect input and output impedances in feedback amplifiers? (6 marks) (ECT202 ANA... p. 2)

Module - 5

19. a) What do you mean by harmonic distortion in a power amplifier? How is it reduced in a push-pull amplifier circuit? (6 marks) (ECT202 ANA... p. 3)

b) Design a simple shunt regulator for an output voltage of 10V, when input varies from 14 to 24V and load current varies from 10mA to 40mA. Assume the Zener voltage stabilizes at a minimum current of 15mA. (8 marks) (ECT202 ANA... p. 3)

OR

20. a) A class-A series fed amplifier has

$$V_{CE(max)} = 20V, V_{CE(min)} = 5V, I_{C(max)} = 8mA \text{ and}$$

$$I_{C(min)} = 2mA.$$

Determine the RMS value of current and voltage.

Also determine the ac power and conversion efficiency given

$$V_{CC} = 25V \text{ and } I_{CQ} = 3mA.$$

(9 marks) (ECT202 ANA... p. 3)

b) What is crossover distortion? How can it be overcome and what compromise do we make in power amplifier performance? (5 marks) (ECT202 ANA... p. 3)
