Ref. No.: Ex/IEE/PC/B/T/214/2024

B. INS. & ELEC. ENGINEERING 2ND YEAR 1ST SEMESTER EXAMINATION 2024

ELECTRONIC CIRCUITS

TIME: 3 HOURS **FULL MARKS: 100**

List of Course Outcomes (CO):

CO1: Classify and analyze different types of diode circuits (K2, K4, A1)

CO2: Identify and interpret the importance of biasing in electronic amplifiers (K3, A1)

CO3: Describe and explain the behavior of small signal amplifiers (K2, A1)

CO4: Differentiate and examine feedback circuits of various kinds (K4, A2)

CO5: Explain and analyze the operation of oscillators (K2, K4, A1)

Instructions to the Examinees:

- Each module in the question paper matches up with the corresponding CO
- Attempt **ALL** the questions from **ALL** the modules for the attainment of all the Cos
- Alternative questions (if any) exist within a module, not across the modules
- Different parts of same question should be answered together

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[Turn over

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MODULE 1

ATTEMPT **ANY TWO** QUESTIONS FROM THIS MODULE

1.

(a) Draw the transfer characteristics of an ideal diode. Hence, find out its resistances in different regions of operations.

(b) Find out the output waveform of the circuit shown in Fig. 1. Assume the RC time constant is much greater than the period of the signal.

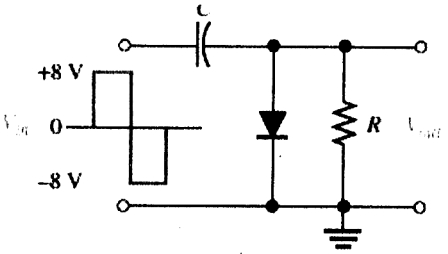

Fig. 1

4+6

2.

(a) In a half-wave rectifier, what will happen if the diode is short-circuited?

(b) Why do we prefer centre-tap circuit to bridge circuit in low voltage applications?

(c) Discuss the importance of PIV in rectifier service.

(d) What type of filter circuit is used after rectification? Why is it used?

(e) Draw the diagram of a negative clipper circuit.

2X5

3.

(a) Design a generic circuit of a voltage regulator and explain its operation briefly.

(b) The voltage regulator is to power a car radio at V_L= 9 V from an automobile battery whose voltage may vary between 11 and 13.6 V. The current in the radio will vary between 0 (off) to 100 mA (full volume). Calculate the value of the current limiting series resistance. Assume that the minimum zener current to be one-tenth of the maximum zener current.

3+7

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MODULE 2

ATTEMPT **ANY THREE** PARTS FROM **Q. NO. 4**

(a) Calculate the terminal voltages of the BJT in Fig. 2.

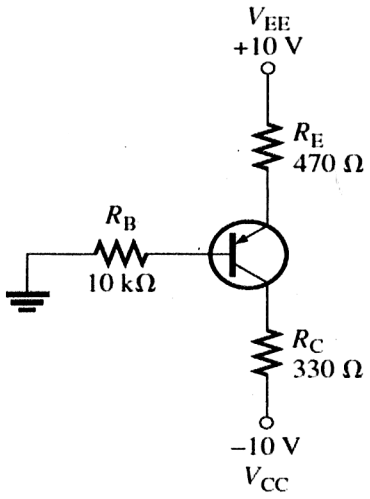

Fig. 2

(b) The circuit in Fig. 3 is subjected to a temperature variation from 0°C to 70°C. The dc current gain decreases by 50 percent at 0°C and increases by 75 percent at 70°C from its nominal value of 110 at 25°C. What are the changes in collector current and collector to emitter voltage over the temperature range of 0°C to 70°C?

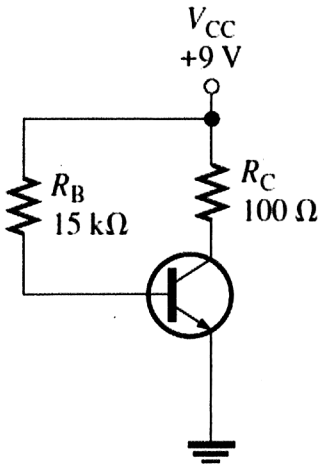

Fig. 3

(c) How can an amplifier circuit with un-bypassed emitter resistor increase the stability? Discuss in light of the notion of feedback.

(d) What is the difference between stiff and non-stiff voltage divider bias? Explain.

3X5

MODULE 3

ATTEMPT **Q. NO. 5 AND ANY ONE** FROM THE REST

5. For the common emitter amplifier shown in Fig. 4, calculate the mid-band gain and 3-dB bandwidth using appropriate graph paper. The transistor's datasheet provides the following: $\beta_{dc} = \beta_{ac} = 100, V_A = \infty, c_\pi = 10\ pF, c_\mu = 1.5\ pF$. Consider appropriate number of frequency points both in the low and high frequency range in drawing the frequency response. Assume $V_T = 25\ mV$.

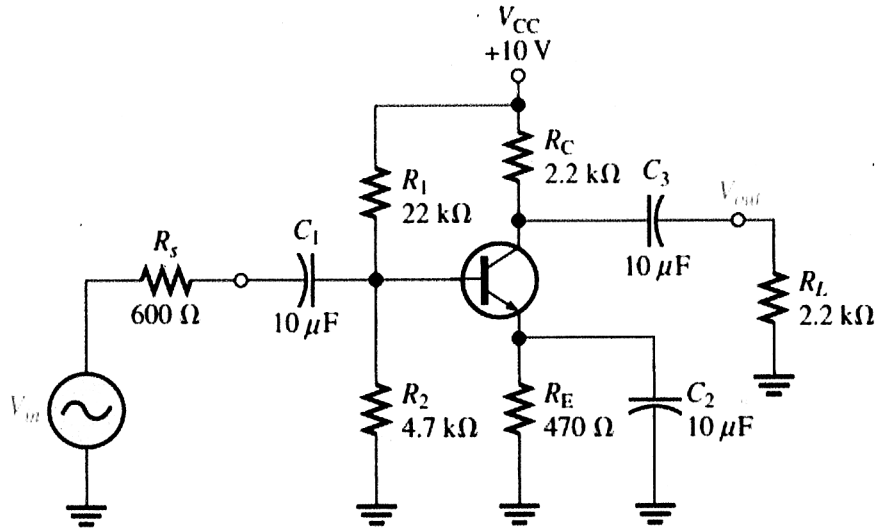

Fig. 4

35

6.

(a) Under which condition, will the slope of AC and DC load line be identical?

(b) Draw one amplifier circuit for which voltage gain remains insensitive to the temperature of the ambience.

(c) Which type of amplifier configuration is used just before the load in an audio amplifier? Justify your answer.

(d) What is the advantage of cascode amplifier over CE or CB amplifier alone?

2+3+2+3

7.

(a) What do you understand by differential signal?

(b) Draw one differential amplifier circuit and calculate the expression of differential voltage gain. Establish the same using half-circuit concept as well.

2+(6+2)

MODULE 4

ATTEMPT **ANY ONE** QUESTION FROM THIS MODULE

8.

(a) Why is it not possible to realize current-shunt feedback using single stage CE amplifier?

(b) Draw the schematic diagram of a feedback amplifier which exhibits current-shunt feedback. Hence calculate the expression of input and output resistance.

2+(4+4)

9. Draw the circuit diagram of a voltage-series feedback amplifier. Hence calculate the expression of voltage gain with & without feedback and feedback factor.

10

MODULE 5

ATTEMPT **ANY ONE** QUESTION FROM THIS MODULE

10. Draw and explain the operation of an RC phase-shift oscillator circuit. Show that the circuit will oscillate at a frequency of $f_0 = \frac{1}{2\pi\sqrt{6}RC}$. Find out the value of the closed-loop gain for sustained oscillation.

10

11.

(a) Draw the generic LC oscillator circuit and hence derive the condition for oscillation.

(b) From the generic oscillation criterion, synthesize Colpitts oscillator circuit.

7+3