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(CBCS)

(3rd Semester)

ELECTRONICS

(Electronic Devices and Amplifiers)

Full Marks : 75

Time : 3 hours

Simple calculator may be used in this paper

(PART : A—OBJECTIVE)

(Marks : 25)

The figures in the margin indicate full marks for the questions

SECTION—A

(Marks : 10)

Put a Tick (✓) mark against the correct answer in the brackets provided : 1×10=10

1. The constant region of JFET lies between

- (a) cut-off and saturation ()
- (b) cut-off and pinch-off ()
- (c) 0 and I_{DSS} ()
- (d) pinch-off and breakdown ()

2. A MOSFET uses the electric field of a/an _____ to control the channel current.

- (a) capacitor ()
- (b) battery ()
- (c) generator ()
- (d) inductor ()

- 3.** The intrinsic stand-off ratio of a UJT lies between
- (a) 0.15 and 0.82 ()
 - (b) 0.15 and 0.28 ()
 - (c) 0.51 and 0.82 ()
 - (d) 0.28 and 0.51 ()
- 4.** The control element of an SCR is
- (a) cathode ()
 - (b) anode ()
 - (c) cathode supply ()
 - (d) gate ()
- 5.** In a class—A amplifier, conduction extends over 360° because Q-point is
- (a) located on load line ()
 - (b) located near saturation point ()
 - (c) centered on the load line ()
 - (d) located at cut-off point ()
- 6.** Crossover distortion occurs in which of the following amplifiers?
- (a) Class—A ()
 - (b) Class—AB ()
 - (c) Class—C ()
 - (d) Push-pull ()
- 7.** The main use of an emitter follower is as
- (a) power amplifier ()
 - (b) impedance matching device ()
 - (c) low-input impedance circuit ()
 - (d) follower of base signal ()

8. The smallest of the h -parameter of a transistor is
- (a) h_i ()
 (b) h_r ()
 (c) h_o ()
 (d) h_f ()
9. An inverting amplifier has $R_f = 2 \text{ M}$ and $R_i = 5 \text{ k}$. Its scale factor is
- (a) 400 ()
 (b) 401 ()
 (c) 10^3 ()
 (d) 1000 ()
10. The output of a particular op-amp increases 8 V in 12 s. The slew rate is
- (a) 90 V/ s ()
 (b) 0.67 V/ s ()
 (c) 1.5 V/ s ()
 (d) 24 V/ s ()

SECTION—B

(Marks : 15)

Answer the following questions :

3×5=15

1. What are the differences between a JFET and a bipolar transistor?

OR

The following readings were obtained experimentally from a JFET :

V_{GS}	0 V	0 V	- 0.2 V
V_{DS}	7 V	15 V	15 V
I_D	10 mA	10.25 mA	9.65 mA

Determine (a) a.c. drain resistance, (b) transconductance and (c) amplification factor.

2. Explain firing and triggering in SCR.

OR

Explain intrinsic standoff ratio and interbase resistance of UJT.

3. Explain with a neat diagram, how the transformer load helps to achieve high-efficiency impedance matching in a power amplifier.

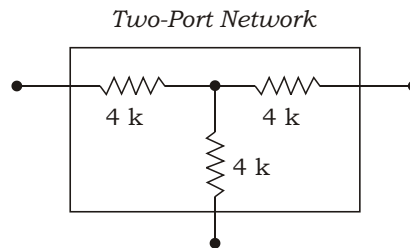
OR

How are the power amplifiers classified on the basis of mode of operation?

4. In an RC-coupled amplifier, the output voltage is 5 volts for a sinusoidal input of 5 mV. Determine the absolute voltage gain and the decibel voltage gain.

OR

Find the h -parameter for the two-port network shown below :



5. Derive the expression for voltage gain of an operational amplifier in non-inverting and inverting modes.

OR

Define the terms 'slew rate' and 'CMRR' of an op-amp.

(PART : B—DESCRIPTIVE)

(Marks : 50)

The figures in the margin indicate full marks for the questions

1. (a) Explain the construction and working of a JFET. 6
(b) State and explain JFET parameter. Also establish the relationship between them. 4

OR

- 2.** (a) Give the constructional details and working of depletion-type MOSFET. Also show its output characteristics. 6+2=8
- (b) Write down any four applications of FET. 2
- 3.** (a) Explain the working of SCR from its equivalent circuit. Also write forward and reverse characteristics of SCR. 5+2=7
- (b) Explain 90° phase control in SCR. 3

OR

- 4.** (a) Explain the construction and operation of UJT. Also write its advantages. 4+2=6
- (b) What is a rectifier? Explain with a diagram how semiconductor diode can be used as a half-wave rectifier. 1+3=4
- 5.** (a) Define heat sink. Prove that the maximum collector efficiency of transformer-coupled class—A power amplifier is 50%. 1+2=3
- (b) Briefly explain how to eliminate crossover distortion in class—B push-pull amplifier. A transformer-coupled load class—B push-pull amplifier uses two transistors rated 8 W each. What is the maximum power output that can be obtained at the load? 2+2=4
- (c) What is thermal runaway? With a block diagram, explain all the stages of a practical power amplifier. 1+2=3

OR

- 6.** (a) For the optimally-biased transformer-coupled class—A amplifier connected to a 12 V battery, if the maximum collector current change is 100 mA, find the power transferred to a 5 Ω loud speaker if it is (i) directly connected to the collector and (ii) transformer coupled for maximum power transference. Also find the turn ratio of the transformer. 3

(b) Mention the features of power amplifier. How does it differ from voltage amplifier? 2+1=3

(c) Explain the working principle of a tuned amplifier circuit. Why are class—C power amplifiers not used for audio-frequency work but suitable for RF amplifier? 3+1=4

7. (a) What is a two-port network? For a two-port network, derive the general formula of h -parameter for (i) current gain, (ii) voltage gain, (iii) input impedance and (iv) output impedance. 4

(b) Show the transistor amplifier in CE arrangement. The h -parameters of transistor are as under :

$$h_{ie} = 1500 \quad ; \quad h_{fe} = 50 \quad ; \quad h_{re} = 4 \times 10^{-4} \quad ; \quad h_{oe} = 5 \times 10^{-5}$$

Find (i) a.c. input impedance of the amplifier, (ii) voltage gain and (iii) output impedance. 3

(c) Explain with supporting diagram, how an auto-transformer can be used as both step-up and step-down transformer. 3

OR

8. (a) With a neat diagram and relevant frequency response, explain the working of RC-coupled amplifier. What are its advantages and disadvantages? 2+2=4

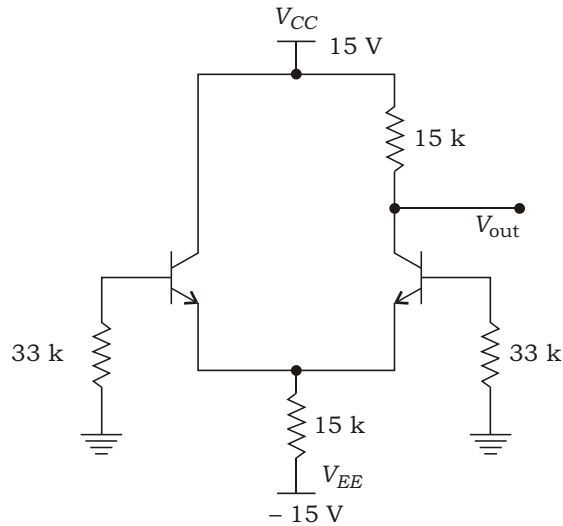
(b) In an amplifier, the maximum voltage gain is 2000 and occurs at 2 kHz. It falls to 1414 at 10 kHz and 50 kHz. Find (i) bandwidth, (ii) lower cut-off frequency and (iii) upper cut-off frequency. 3

(c) Sketch the frequency response of a transformer-coupled amplifier. Explain with circuit diagram, why it is used in the final stage of a multistage amplifier. 2+1=3

9. (a) List the characteristic of an ideal op-amp. Explain the concept of virtual ground. 3+1=4

(b) Define common-mode and differential-mode signals. Describe a two-transistor terminology of basic operational amplifier. 2+2=4

- (c) The transistors shown below are identical with $\beta_{dc} = 100$. Find the output voltage : 2



OR

10. (a) Explain clearly how op-amp can be used as (i) subtractor, (ii) integrator, (iii) differentiator and (iv) voltage follower circuit. 2×4=8
- (b) Determine the output voltage for the summing amplifier shown below : 2

