EL/III/EC/05 **Student's Copy**

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(CBCS)

(3rd Semester)

ELECTRONICS

Paper : EL–301

(Electronic Devices and Amplifiers)

Full Marks : 75

Time : 3 hours

(PART : A—OBJECTIVE)

(*Marks* : 25)

The figures in the margin indicate full marks for the questions

SECTION—A

(*Marks* : 10)

Tick (✓) the correct answer in the brackets provided : 1×10=10

1. The channel of a JFET is between the

(a) gate and drain ( )

(b) drain and source ( )

(c) gate and source ( )

(d) input and output ( )

2. An *n*-channel D-MOSFET with a positive V_{GS} is operating in

(a) the depletion mode ( )

(b) the enhancement mode ( )

(c) cut-off ( )

(d) saturation ( )

3. In an SCR circuit, the angle of conduction can be changed by

(a) changing anode voltage ( )

(b) reverse biasing the gate ( )

(c) changing gate voltage ( )

(d) changing cathode voltage ( )

4. The depletion region of a semiconductor diode is due to

(a) absence of current carriers ( )

(b) reverse biasing ( )

(c) forward biasing ( )

(d) crystal doping ( )

5. The voltage gain of a tuned amplifier is _____ at resonant frequency.

(a) minimum ( )

(b) maximum ( )

(c) half-way between maximum and minimum ( )

(d) zero ( )

6. A class-B push-pull amplifier has the main advantage of being free from

(a) any circuit imbalances ( )

(b) unwanted noise ( )

(c) even-order harmonic distortion ( )

(d) d.c. magnetic saturation effects ( )

7. The parameter h_{fe} is called _____ in CE arrangement with output shorted.

(a) voltage gain ( )

(b) current gain ( )

(c) input impedance ( )

(d) output impedance ( )

8. The frequency response of transformer coupling is

(a) good ( )

(b) very good ( )

(c) excellent ( )

(d) poor ( )

9. For an op-amp with negative feedback, the output is

(a) equal to the input ( )

(b) increased ( )

(c) fed back to the inverting input ( )

(d) fed back to the non-inverting input ( )

10. A common-mode signal is applied to the

(*a*) non-inverting input ( )

(*b*) inverting input ( )

(*c*) both inputs ( )

(*d*) top of the tail resistor ( )

SECTION—B

(*Marks* : 15)

Answer the following questions : 3×5=15

1. For an *n*-channel JFET, I_{DSS} 8 7 mA, V_{p} 3 V, V_{GS} 1 V. Find I_{D} and g_{m}.

OR

Explain the construction and working of depletion type MOSFET.

2. With suitable diagram, explain the *V-I* characteristics of SCR.

OR

Give the energy band description of *p*-type semiconductor with necessary diagram.

3. What are the advantages of tuned amplifier?

OR

Define the cross-over distortion in Class-B push-pull amplifier.

4. What are the advantages and disadvantages of *R-C* coupled transistor amplifier?

OR

What do you understand by hybrid parameters? What are their dimensions?

5. Explain the working of an operational amplifier in inverting configuration.

OR

Define input offset voltage in an op-amp and also mention the effect of temperature change in op-amp.

(PART : B—DESCRIPTIVE)

(*Marks* : 50)

The figures in the margin indicate full marks for the questions

1. *(a)* Why is JFET called a unipolar transistor? Explain the main parameters of a JFET. 1+3=4

(b) For a certain D-MOSFET, I_{DSS} 10 mA and $V_{GS(off)}$ 8 V.

(i) Is this an *n*-channel or a *p*-channel?

(ii) Calculate I_D at V_{GS} 3 V.

(iii) Calculate I_D at V_{GS} 3 V. 3

(c) Write a short note on the differences between MOSFET and JFET. 3

OR

2. *(a)* Write short notes on the following : 2+2+2=6

(i) Shorted-gate drain current (I_{DSS})

(ii) Pinch-off voltage (V_p)

(iii) Gate-source cut-off voltage ($V_{GS(off)}$)

(b) Describe in brief how JFET can be used as an amplifier. 4

3. *(a)* Explain the construction and operation of SCR. 4

(b) The intrinsic stand-off ratio for a UJT is determined to be 0·6. If the inter-base resistance is 10 k , what are the values of R_{B1} and R_{B2}? 3

(c) Explain with diagram, *V-I* characteristics of *p-n* junction diode in forward bias and reverse bias. 3

OR

4. *(a)* Explain firing and triggering of an SCR. Define 90° phase control in SCR. 3+2=5

(b) What is dynamic resistance of junction diode? Give the condition for linearity of the junction diode. 1+1=2

(c) Explain the UJT used as relaxation oscillator. 3

5. *(a)* Draw a neat circuit diagram of class-B push-pull amplifier and explain its working. 5

(b) With a neat diagram, explain the working of double-tuned amplifier. Discuss its frequency response. 3+2=5

OR

6. *(a)* Show that in a class-B push-pull amplifier, the power efficiency is 78·5%. 5

(b) Find out the expressions for impedance and frequency in the parallel resonant circuit used in a tuned amplifier. 2+3=5

7. *(a)* Draw the *h*-parameter equivalent circuit of transistor in CE configuration. Express the input impedance, current gain and voltage gain of the CE configuration in terms of *h*-parameters and load. 2+3=5

(b) A transistor uses transformer coupling for amplification. The output impedance of transistor is 10 k while the input impedance of next stage is 2·5 k . Determine the inductance of primary and secondary of the transformer for perfect impedance matching at a frequency of 200 Hz. 5

OR

8. *(a)* A transistor used in CE arrangement has the following set of *h*-parameters when the d.c. operating point is V_{CE} 10 volts and I_C 1 mA :

$$h_{ie} \quad 2000$$

$$h_{oe} \quad 10^{\ 4} \text{ mho}, \ h_{re} \quad 10^{\ 3}$$

$$h_{fe} \quad 50$$

Determine, *(i)* input impedance, *(ii)* current gain, *(iii)* voltage gain, *(iv)* power gain and *(v)* output impedance. The a.c. load seen by the transistor is r_L 600 and a source resistance of R_S 2 k . 5

(b) With a suitable diagram, explain the frequency response of an *R-C* coupled transistor amplifier. 5

9. *(a)* With a circuit diagram, explain the circuit analysis of op-amp as differentiator. 5

(b) With the help of a circuit diagram, explain the operation of a balanced differential amplifier. 1+4=5

OR

10. *(a)* With a circuit diagram, explain the circuit analysis of op-amp as an integrator. 5

(b) Derive an expression for the overall gain in an op-amp in the case of non-inverting configuration. The non-inverting op-amp has R_f 5 k and R_l 1 k . Calculate the voltage gain. 4+1=5

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