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(Pre-CBCS)

(3rd Semester)

ELECTRONICS

THIRD PAPER

(Electronic Devices and Amplifiers)*Full Marks : 55**Time : 2½ hours***(PART : A—OBJECTIVE)***(Marks : 20)**The figures in the margin indicate full marks for the questions*

SECTION—A

(Marks : 5)

Tick (✓) the correct answer in the brackets provided :

1×5=5

1. The drain-source voltage above which drain current becomes constant is known as _____ voltage.

- (a) saturation () (b) pinch-off ()
(c) active () (d) cut-off ()

2. The control element in an SCR is

- (a) cathode () (b) anode ()
(c) drain () (d) gate ()

3. A *p-n* junction that radiates energy as light instead of heat is called a/an

- (a) LED () (b) photo-diode ()
(c) pin diode () (d) Zener diode ()

4. The maximum overall efficiency of a class-B push-pull amplifier is
 (a) 50% () (b) 25% ()
 (c) 78.5% () (d) 85% ()
5. The common-mode gain is
 (a) very high () (b) very low ()
 (c) always unity () (d) unpredictable ()

SECTION—B

(Marks : 15)

Answer any *five* questions of the following :

3×5=15

- For an *n*-channel JFET, $I_{DSS} = 8.7$ mA, $V_p = 3$ V and $V_{GS} = 1$ V.
Find I_D and g_m .
- Explain 90° phase control of an SCR.
- Discuss the construction of solar cell with a neat diagram.
- Write the relation between quality factor and bandwidth of a tuned amplifier. The *Q*-value of a tuned amplifier is 60. If the resonant frequency for the amplifier is 1200 kHz, find (a) bandwidth and (b) cut-off frequency.
- Explain the working of an operational amplifier in inverting configuration.
- What are the advantages of inserting an intrinsic layer in a *p-n* junction diode to form a PIN diode?
- 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.

- Write a short note on UJT relaxation oscillator.

(PART : B—DESCRIPTIVE)

(Marks : 35)

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, $I_{DSS} = 10 \text{ mA}$ and $V_{GS(off)} = 8 \text{ V}$.
- (i) Is this an n -channel or a p -channel?
- (ii) Calculate I_D at $V_{GS} = 3 \text{ V}$.
- (iii) Calculate I_D at $V_{GS} = 3 \text{ V}$. 3

OR

2. (a) Describe the construction and working principle of enhancement mode MOSFET and give some applications of MOSFET. 2+2+1=5
- (b) Define the conventional drain current in FET. On what factor does it depend? 1+1=2
3. (a) Describe the operation of Silicon Controlled Rectifier (SCR). How will you explain this operation using two-transistor analogy? 3+2=5
- (b) What is dynamic resistance of junction diode? Give the condition for linearity of the junction diode. 1+1=2

OR

4. (a) Write the construction and operation of UJT for the cases (i) when emitter is open and (ii) when positive voltage applied to the emitter. 2+2=4
- (b) Explain with diagram, the V - I characteristics of p - n junction diode in forward bias and reverse bias. 3
5. (a) Write down the theory and construction of Light Emitting Diode (LED). 3+2=5
- (b) How is population inversion created in semiconductor laser? 2

OR

6. (a) With a neat diagram, explain the construction and working of a $p-n$ junction photodiode. 2+2=4
- (b) Explain how Zener diode can be used as voltage regulator. 3
7. (a) With a neat diagram, explain the working of single-tuned amplifier. Discuss its frequency response. 3+2=5
- (b) Define the crossover distortion in class-B push-pull amplifier. 2

OR

8. (a) What are power amplifiers? Show that the efficiency of transformer coupled class-A amplifier is 50% in an ideal case. 1+4=5
- (b) Mention some special characteristics that distinguish a tuned amplifier from other amplifiers. 2
9. (a) Derive an expression for the overall gain in an OP-AMP in the case of non-inverting configuration. The non-inverting OP-AMP has $R_f = 5\text{ k}$ and $R_i = 1\text{ k}$. Calculate the voltage gain. 4+1=5
- (b) A differential amplifier has an open-circuit voltage gain of 100. The input signals are 3.25 V and 3.15 V. Determine the output voltage. 2

OR

10. (a) With the help of a circuit diagram, explain the operation of a balanced differential amplifier. 1+4=5
- (b) Why is the 'summing point' of the operational amplifier (OP-AMP) called 'virtual ground'? 2

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