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PHYSICS

(Major)

Paper : 5.4

(**Electronics**)

Full Marks : 60

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

1. Answer the following questions very briefly :

1×7=7

- (a) What is meant by race-around condition in flip-flop?
- (b) What is surface leakage current in a junction diode?
- (c) The basic principle of a power amplifier does not violate the law of conservation of energy. Explain.
- (d) What is current gain of a transistor?
- (e) In an amplitude modulation, the value of modulation index m_a is equal to 1. What is the physical meaning of it?

- (f) What is the condition that must be satisfied in order to receive the maximum power by a two-terminal network from another network?
- (g) There are two basic conditions for oscillation in a feedback amplifier. What are these basic conditions?

2. Answer the following questions : 2×4=8

- (a) Distinguish between Zener breakdown and Avalanche breakdown in semiconductor diodes.
- (b) Determine the current I_D and the voltage v_0 in the circuit of Fig. 1, if the voltage drop across the diode is 0.7 volt.

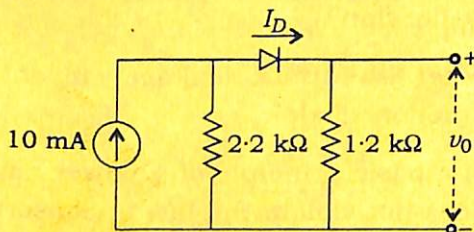


Fig. 1

- (c) What could be the possible reasons for reduction in voltage gain of transistor R-C coupled amplifier at high frequency?

(d) Mention one advantage and one disadvantage of single sideband transmission.

3. What do you mean by a clamping circuit? Draw the circuit diagram of a d.c. restorer. How does the circuit function? $1+2+2=5$

Or

Explain why half-wave rectifier is called a poor device for rectification. Derive an expression for efficiency of such rectifier.

$2+3=5$

4. What is the basic principle of power amplifier? Draw the circuit diagram of a class B push-pull power amplifier using power transistor and derive an expression for the efficiency. What is the percentage of maximum efficiency? $1+3+1=5$

Or

How can a transistor be considered as a two-port or four-terminal device? What are the variables related to input and output ports in case of a transistor? Establish the relations of h parameters with these variables for small input a.c. signal and hence draw the h parameter a.c. equivalent circuit.

$1+2+2=5$

5. Transform the circuit in Fig. 2 into Thevenin's equivalent circuit, where R_L is load resistance. Calculate the Thevenin's equivalent impedance and voltage. Draw the Norton's equivalent circuit. 2+2+1=5

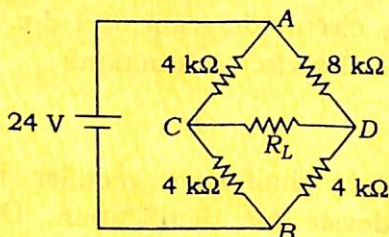


Fig. 2

6. Answer any *two* questions from the following : 5×2=10

(a) Convert the decimal numbers 128.25_{10} and 100.75_{10} to its binary equivalent and find the difference using 2's complement method. Add binary numbers 1100.11_2 and 1011.01_2 . Verify the result by converting them to decimal numbers. 3+1+1=5

(b) Define the critical frequency of an ionospheric layer. Show that the critical frequency f_c is related to the peak electron concentration N_p of the reflecting layer by $f_c = 9\sqrt{N_p}$ (in SI unit). 2+3=5

- (c) Fig. 3 shows an OP-AMP circuit with capacitor C in between inverting input and output. Express v_0 in terms of v_1 and v_2 .

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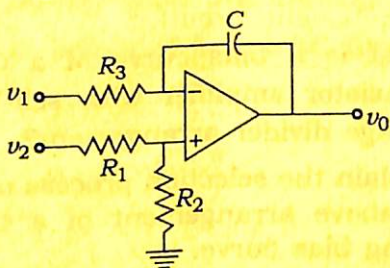


Fig. 3

- (d) If an amplifier is to be unstable and oscillate it must satisfy the Nyquist criterion. What is Nyquist criterion? Explain its significance.

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7. Answer any *two* questions from the following :

5×2=10

- (a) Define ASK, FSK and PSK methods of digital communication. Draw the diagrams of any two of them in response to a modulating signal. 3+2=5
- (b) What are the different types of CRO? Lissajous figures can be employed to measure the phase difference between two signals. Briefly explain how this is measured. 2+3=5

(c) What is amplitude modulation? Show that in amplitude modulation two sidebands are equispaced with respect to carrier frequency. $1+4=5$

(d) What is a bias curve of a CE mode transistor amplifier with self-bias and voltage divider arrangement?

Explain the selection process of Q point in above arrangement of a transistor using bias curve.

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8. Answer any *two* questions from the following :

$5 \times 2 = 10$

(a) What is discriminator? What are the processes for FM wave detection? Give a sketch of frequency response curve of the Foster-Seely detector. $1+3+1=5$

(b) Show that NOR gate is equivalent to bubbled AND gate. IC 7400 is a Quad 2-input NAND gate. It is possible to obtain AND, OR, NOT gates from this IC. How? $2+3=5$

(c) What is an integrated circuit? Describe the photolithographic etching process used in IC fabrication. $1+4=5$

(d) Write short note on any *one* of the following :

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- (i) Microprocessor
- (ii) Master slave *J-K* flip-flop
- (iii) Function of L-type LC filter
