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TDC (CBCS) Even Semester Exam., 2023

PHYSICS

(Honours)

(4th Semester)

Course No. : PHSHCC-403T

(Analog System and Applications)

Full Marks : 50
Pass Marks : 20

Time : 3 hours

The figures in the margin indicate full marks for the questions

SECTION—A

Answer any *ten* questions from the following : 2×10=20

1. What are meant by conductivity and mobility?

2. Explain what are meant by static and dynamic resistances in case of a semiconductor diode.

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3. What is ripple factor? Write the value of ripple factor in case of *(a)* half-wave rectifier and *(b)* full wave rectifier.

4. Discuss the principle of operation of the Light Emitting Diodes (LED).

5. Describe in brief the working of a solar cell.

6. What is load line analysis of a transistor? Explain in brief.

7. Draw the circuit diagram of voltage divider bias. Explain why it is used widely.

8. What do you mean by transistor pairing and stabilization?

9. What are *h* parameters for a two-port network?

10. Mention the Barkhausen's criterion for self-sustained oscillations.

11. What is distortion in an amplifier? What are the causes?

12. Write some advantages of *R-C* coupled amplifier.

13. Give the characteristics of an ideal OP-AMP.

14. What is virtual ground? What is the purpose of using it?

15. What are open loop and closed loop gain of an OP-AMP?

SECTION—B

Answer any *five* questions from the following : 6×5=30

16. What is a *P-N* junction? Also explain the current flow mechanism in forward and reverse biased diode. 1+5=6

17. *(a)* Describe the principle of a full-wave rectifier. 3

(b) In a full-wave rectifier without filter the load resistance is 1000 Ω. If the diode has forward bias dynamic resistance of 10 Ω, the voltage across half the secondary winding is of amplitude 44 volts and frequency is 50 Hz. Calculate—

(i) peak and average value of current;

(ii) d.c. power output and total power input;

(iii) rectifier efficiency. 3

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18. *(a)* Define the *(i)* static current amplification factor (α) in common base mode and *(ii)* static forward current transfer ratio (β) in common emitter mode. Derive a relation between α and β. 2+2=4

(b) The current gain (β) in common emitter circuit is 49. Calculate the common base current gain (α). Find the base current when the emitter current is 3 mA. 2

19. What is a Zener diode? Draw the *V-I* characteristic curve for a Zener diode. With proper circuit diagram, explain how a Zener diode can be used for the purpose of voltage regulation. 1+1+4=6

20. Obtain the expressions of voltage gain, current gain, input impedance and output impedance of a single-stage CE amplifier using *h* parameter. 1½×4=6

21. What is meant by amplification? How are the amplifiers classified? Mention the fundamental difference among Class A, Class B, Class AB and Class C amplifiers. 1+2+3=6

22. Describe the working of an *R-C* phase shift oscillator. Derive an expression for its frequency of oscillation.

23. Write the principle of Hartley oscillator. Mention one use of Hartley oscillator. Write the differences between Hartley and Colpitts oscillator. 2+1+3=6

24. Mention the characteristics of practical OP-AMP IC-741. Give the concept of slew rate and explain why IC-741 is not used for high frequency applications. 2+(2+2)=6

25. Explain in brief the use of op-amp as *(a)* subtractor and *(b)* differentiator. 3+3=6

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