2024/FYUG/ODD/SEM/
PHYDSM-201T/059

FYUG Odd Semester Exam., 2024

PHYSICS

(3rd Semester)

Course No. : PHYDSM-201T

(Electricity, Magnetism and Electronics)

Full Marks : 70
Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks for the questions

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UNIT—I

1. Answer any *two* from the following : 2×2=4

(a) Define electric field and electric field lines.

(b) Define elecrostatic potential. What do you mean by electric dipole?

(c) On what factors does the capacitance of a parallel plate capacitor depend?

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2. *(a)* State and prove Gauss' law in electrostatics. 1+3=4

(b) Using Gauss' law, find the electric field intensity due to an infinite plane sheet of charge. 3

(c) Show that the potential difference between any two points in an electric field is given by the line integral of the electric field taken over any path joining them. 3

OR

3. *(a)* Derive an expression for the capacitance of an isolated spherical conductor. 4

(b) Prove that the total electrostatic energy stored in a parallel plate capacitor is $\frac{1}{2}CV^2$. 4

(c) A spherical conductor of radius 10 cm is charged to a potential of 1500 volt. Calculate its surface charge density. 2

UNIT—II

4. Answer any *two* from the following : 2×2=4

(a) State Biot-Savart law.

(b) Define magnetic induction and magnetic intensity.

(c) Write down the physical significance of magnetic vector potential.

5. *(a)* Deduce an expression for magnetic flux density at any point on the axis of a circular coil carrying current. 5

(b) Find the expressions for divergence and curl of magnetic field. 2+3=5

OR

6. *(a)* State Ampere's circuital law. Obtain an expression for magnetic field due to a solenoid using Ampere's circuital law. 1+3=4

(b) Define magnetic susceptibility and permeability. Derive the relation connecting magnetic susceptibility and magnetic permeability. 2+2=4

(c) Mention the distinguishing features of dia-, para- and ferro-magnetic materials. 2

UNIT—III

7. Answer any *two* from the following : 2×2=4

(a) State Faraday's laws of electromagnetic induction.

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(b) Explain how Lenz's law is in accordance with the law of conservation of energy.

(c) Which of the Maxwell's equations indicates the absence of magnetic monopoles? Explain.

8. (a) What is mutual inductance? Find an expression for mutual inductance between two coils. 1+3=4

(b) Explain the working principle of a transformer with necessary diagram. What are the different losses of transformer? 4+2=6

OR

9. (a) State and prove the equation of continuity. 5

(b) Obtain the wave equation of electro-magnetic wave in free space. Show that the speed of waves is equal to the speed of light. 3+2=5

UNIT—IV

10. Answer any *two* from the following : 2×2=4

(a) What do you mean by P-type and N-type semiconductors?

(b) Define conductivity and mobility.

(c) What is a transistor? Draw the symbols of NPN and PNP transistors.

11. (a) What is rectifier? Describe the working of full-wave rectifier with circuit diagram. 1+4=5

(b) What is Zener diode? With proper circuit diagram, explain how a Zener diode can be used for the purpose of voltage regulation. 1+4=5

OR

12. (a) What do you mean by α and β? Derive a relation between α and β. 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+2+3=7

(b) Draw the circuit diagram for determining static characteristics of a PNP transistor in CE mode. 3

UNIT—V

13. Answer any *two* from the following : 2×2=4

(a) Explain the difference between analog and digital circuits.

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(b) Write down the logical symbol and truth table of XOR gate for two variables.

(c) What do you mean by half-adder circuit? Write its truth table.

14. (a) What do you mean by binary number system, octal number system and hexadecimal number system? 3

(b) Convert the binary number 1101 to its decimal equivalent. 2

(c) Define NAND and NOR gates. Construct truth table for them. Why are NAND and NOR gates called universal gates? 5

OR

15. (a) Realize a two-input AND gate using diodes and explain its working with the help of its truth table. 5

(b) What are half adder and full adder? Draw the block diagram of a full adder and describe its working. 5

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