

2025/FYUG/EVEN/SEM/  
PHYDSM-252/046

FYUG Even Semester Exam., 2025

PHYSICS

( 4th Semester )

Course No. : PHYDSM-252

( Electricity, Magnetism and Electronics )

*Full Marks : 70*

*Pass Marks : 28*

*Time : 3 hours*

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

UNIT—I

1. Answer any *two* of the following questions :

2×2=4

- (a) State and explain Gauss's law of electrostatics.
- (b) Define electric field and electric flux.
- (c) Write down the properties of electric lines of force.

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2. Answer any *one* of the following questions : 10

(a) Define electric charge and write down its SI unit. Derive the expression of electric field due to uniformly charged spherical shell at point inside and outside the shell. 2+8=10

(b) Define capacitance and write down its SI unit. Derive the expression of a parallel plate capacitor with air as dielectric medium. If charge on both the plates of parallel plate capacitor is increased, how the capacitance of the capacitor will change? 2+1+5+2=10

UNIT—II

3. Answer any *two* of the following questions : 2×2=4

- (a) State and explain Biot-Savart law.  
(b) State and explain Ampere's circuital law.  
(c) Define magnetic susceptibility and magnetic induction.

4. Answer any *one* of the following questions : 10

(a) What are diamagnetic, paramagnetic and ferromagnetic materials? Give one example of each. Why is the divergence of magnetic field zero? What is magnetic vector potential? 6+2+2=10

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(b) Write two applications of Ampere's circuital law. Derive the expression of the intensity of magnetic field at a distance  $x$  from centre of a current-carrying circular loop of radius  $r$ . Hence obtain the value of magnetic field intensity at the centre of the circular loop. 2+6+2=10

UNIT—III

5. Answer any *two* of the following questions : 2×2=4

- (a) What is self-inductance and mutual inductance?  
(b) Explain Faraday's laws of electromagnetic induction.  
(c) What do you mean by step-up and step-down transformers?

6. Answer any *one* of the following questions : 10

(a) Obtain the expression of mutual inductance  $M$  of two co-axial coils. Show that magnetic energy stored in an inductor carrying current  $I$  is

$$U_m = \frac{1}{2} L I^2$$

where  $L$  is the self-inductance. What are the different types of losses of transformer? 4+3+3=10

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- (b) Write down the Maxwell's equation of electromagnetism. What is displacement current? Obtain the expression of equation of continuity of current.

4+2+4=10

UNIT—IV

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

2×2=4

- (a) What are conductivity and mobility?  
(b) Draw the forward and reverse bias characteristics of an ordinary *p-n* junction diode.  
(c) What is Zener diode? Draw the symbolic representation of Zener diode.

8. Answer any *one* of the following questions : 10

- (a) Explain the working of a full-wave rectifier with proper circuit diagram. Explain, how Zener diode is used as a voltage regulator. 6+4=10  
(b) Explain the characteristics of CE, CB and CC configuration of a transistor. Write the relation between current gains  $\alpha$  and  $\beta$ . 9+1=10

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UNIT—V

9. Answer any *two* of the following questions :

2×2=4

- (a) What is the difference between analog and digital circuit?  
(b) Draw the truth table of OR gate and AND gate.  
(c) Draw the circuit diagram of a NOT gate using transistor.

10. Answer any *one* of the following questions : 10

- (a) Explain NAND and NOR gates with proper logic gates and truth tables. Why are they called universal gates? What is a XOR gate? 6+2+2=10  
(b) Explain the working of a half and a full adder. Convert  $(37)_{10}$  into its equivalent binary number. Subtract  $(1101)_2$  from  $(1010)_2$  using 1's complement method. 3+3+2+2=10

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