

2M/PHY-150(Th) Syllabus-2023

2026

(May-June)

FYUP : 2nd Semester Examination

PHYSICS

(Major)

(**Electricity and Magnetism, Optics
and Electronics**)

(PHY-150)

(**Theory**)

Marks : 56

Time : 3 hours

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

Answer any **eight** questions.

1. State and prove Gauss's law in electrostatics. Apply this law to obtain the expression for electric field at any position due to a uniformly charged infinite wire.

1+3+3=7

2. (a) Show that the electrostatic field is conservative in nature.

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(Turn Over)

- (b) Define displacement vector $\vec{D}$, polarization vector $\vec{P}$ and permittivity. Obtain the relation $\vec{D} = \epsilon_0 \vec{E} + \vec{P}$.

1+1+1+2=5

3. (a) Using Biot-Savart law calculate the magnetic field due to a straight conductor of finite length. 5

- (b) Calculate the magnetic field due to an infinite straight conductor carrying current of 100 A at a distance of 5 cm from it. 2

4. (a) State Faraday's law of electromagnetic induction. Express the law in its integral and differential form. 1+4=5

- (b) Write down Maxwell's equations in free space. 2

5. (a) Derive the expression for the resonant frequency of a parallel LCR circuit. 5

- (b) What are sharpness of resonance and Q-factor of a series LCR circuit? 2

6. State and explain Fermat's principle. Using this principle obtain the law of reflection at the curved surface. 1+2+4=7

7. (a) Explain cardinal points of an optical system with neat diagram. 5
- (b) Show that the distance between a nodal point and its corresponding principal plane is equal to the sum of the focal lengths. 2
8. (a) Obtain the relation for the equivalent focal length of two thin convex lenses separated by a distance d . 4
- (b) The power of two thin convex lenses in contact is 0.166×10^2 dioptre. If the focal length of one of the lenses is 15 cm find the focal length of the other. 3
9. (a) Convert the decimal numbers $(65.85)_{10}$ and $(25.75)_{10}$ to their binary equivalent. 2
- (b) Convert $(1101)_2$, $(10010)_2$ and $(11111)_2$ to decimal. 3
- (c) Subtract using 2's complement $(1110)_2$ from $(1011)_2$. 2
10. (a) What is a universal gate? Explain how NAND gate can be used as a universal gate. 1+4=5
- (b) Draw the circuit diagram of a (i) diode logic AND gate and (ii) diode logic OR gate. 2

11. (a) State De Morgan's theorem. 2

(b) Apply De Morgan's theorems to show that

$$(i) \overline{AB + \overline{CD}} = \overline{AB} \cdot CD$$

$$(ii) \overline{A + \overline{BC}} = \overline{A}BC \quad 2+3=5$$

12. Draw the circuit diagram of a CE configuration and explain the input and output characteristics. 2+2+3=7
