



M.Sc. (Final)

Term End Examination, 2017-18

PHYSICS

Paper - II(B)

Numerical Methods and Physics of Lasers and Laser Applications

Time : Three Hours] [Maximum Marks : 100
[Minimum Pass Marks : 36

Note : Answer **five** questions in all, selecting at least **two** questions from each Section. All questions carry equal marks.

Section - A

1. (a) Prove the Newton-Raphson method converges to the solution quadratically.
(b) Compute the positive root of the equation $x^4 - x - 10 = 0$ by Newton-Raphson method.

(2)

2. Find the approximate value of $\int_0^{\pi/3} \sqrt{\cos \theta} d\theta$ by dividing the interval into 6 equal parts using Simpson's 1/3 rule.
3. Illustrate Trapezoidal Rule and obtain its general form.
4. (a) Find the real root of equation $x^2 - y^2 = 3$ and $x^2 + y^2 = 13$.
(b) Explain the Newton-Cotes integration formula.
5. (a) Determine the largest eigenvalue and the corresponding eigenvector of the matrix :

$$A = \begin{bmatrix} 4 & 1 & 0 \\ 1 & 20 & 1 \\ 0 & 1 & 4 \end{bmatrix}$$

to three correct decimal places using the power method.

- (b) Show that the matrix

$$\begin{bmatrix} 12 & 4 & -1 \\ 4 & 7 & 1 \\ -1 & 1 & 6 \end{bmatrix}$$

is positive definite.

(3)

Section - B

6. Explain longitudinal and transverse models of Laser cavity.
7. Explain the construction and working of Ruby Laser and its properties.
8. (a) Explain Laser induced multi-photon process.
(b) Write medical and engineering applications of Lasers.
9. (a) What is Raman Scattering. Explain its uses in pollution studies.
(b) Explain Gaussian Beam and its properties.
10. Write short notes on any **three** the following :
 - (a) Semiconductor laser
 - (b) Mode locking
 - (c) Light wave communication
 - (d) Stable two-mirror optical resonator