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AF-3507

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.

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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.

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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

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