

# AE-751

M.Sc. (Final)

Term End Examination, 2016-17

# PHYSICS

## Optional

Paper - II (B)

# Numerical Methods and Physics of Laser 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. Derive Newton-Raphson formula and show that the Newton-Raphson process has a second order or quadratic convergence.

( 2 )

2. Explain in brief Gauss elimination method and find out the solution of the following equations :

$$2x + 4y - 6z = -4$$

$$x + 5y + 3z = 10$$

$$x + 3y + 2z = 5$$

3. Compute the values of  $f'(3.1)$  and  $f'(3.2)$  using the following table :

$x$	1	2	3	4	5
$f(x)$	0	1.4	3.3	5.6	8.1

4. Derive Simpson's 1/3-rule using the method of undetermined coefficients.
5. Find the best values of  $a_0$  and  $a_1$  if the straight line  $y = a_0 + a_1x$  is fitted to the data  $(x_i, y_i)$ ; (1, 0.6), (2, 2.4), (4, 4.8) and (5, 5.7). Also find the correlation coefficient.

### Section-B

6. What is Laser ? Explain in brief the structure, working and applications of semiconductor laser diode.
7. Explain in brief the principle of light propagation in a medium with variable refractive index and write its merits and demerits.

( 3 )

8. Write short notes on the following :
  - (a) Nd-YAG laser
  - (b) Laser cavity
9. Explain in brief the effect of non-linear interaction of light with matter and give the necessary theory.
10. What do you mean by Mode Locking Technique in Laser ? Describe its types and give the energy band diagram, equations for three-level and four-level laser system.

\_\_\_\_\_