

MASTER OF TECHNOLOGY (NANO TECHNOLOGY) (CBCS- 2015 COURSE)
M. Tech. (Nano Technology) Sem-II :SUMMER- 2022
SUBJECT : NANO COMPUTING

Day : Tuesday
Date : 26-07-2022

S-14246-2022

Time : 10:00 AM-01:00 PM
Max. Marks : 60

N. B. :

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Answers to both the sections should be written in **SEPARATE** answer books.
- 4) Use of non-programmable calculator is **ALLOWED**.
- 5) Assume suitable data if necessary.

SECTION – I

Q.1 Apply Newton – Raphson method to find the positive root of the algebraic equation. **(10)**

$$f(x) = x^4 - 3x^3 + 2x^2 + 2x - 7 = 0.$$

Perform five iteration (Hint take $x_0 = 2.1$)

OR

Wind forces 'f' acting on a racing boat per feet height above the deck is given **(10)** by the equation:

$$f(x) = 100 \left(\frac{x}{1+x} \right) e^{-\frac{x}{15}}$$

Integrate the above equation using Simpson's 1/3rd rule between 0 to 20 feet use a step size of 2 feet to carry out the integration.

Q.2 Find the derivative of the following functions: **(10)**

- i) $f(x) = \cos(2x + 3)$
- ii) $f(x) = \log(7x + 5)$
- iii) $f(x) = 6x^5 - 3x^3 + 3\pi x^2 + 10$
- iv) $f(x) = e^{-(5x+3)}$
- v) $f(x) = \frac{1}{(ax+b)^m}$

OR

For the following function: **(10)**

$$f(x) = -0.5x^4 + 4x^3 - 10x^2 + 8.5x + 1$$

Approximate value of its derivative at $x = 0.1$

- i) Using forward difference formula
- ii) Using backward difference formula
- iii) Using central difference formula
- iv) Which of the above three is a better approximation to the real answer.

P. T. O.

- Q. 3** Determine the response of damped vibrating system corresponding to: (10)
 $y'' + 3y' + 2y = r(t)$, $y(0)=0$, $y'(0)=0$ where $r(t) = e^{-t}$,
if $0 < t < 1$ and 0 otherwise

OR

Find discrete Fourier series expansion of: (10)

$$f(t) = \begin{cases} -1 & -\frac{T}{2} < t < 0 \\ 1 & 0 < t < \frac{T}{2} \end{cases}$$

SECTION – II

- Q. 4** Discuss Fourier Series and Fourier transform of derivatives. What is the importance of Fourier transform in nano technology? (10)

OR

Explain D'Alembert principle with example and discuss its role in nano computing. (10)

- Q. 5** Write a note on Monte Carlo methods using the following points: (10)

- i) The need for Monte Carlo methods
- ii) Monte Carlo methods in mathematics
- iii) Brief discussion on Monte Carlo molecular dynamics

OR

Discuss Galerkin approximation in relation to finite element method. (10)

- Q. 6** Write note on nano optics and nano electronics. (10)

OR

Discuss the role of MATLAB in mathematical modelling in relation to nano-modelling. Write program to find the root of algebraic equation
 $px^2 + qx + r = 0$. (10)

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