Roll No. $\square$ Total No. of Pages : 02

## Total No. of Questions: 18

## B.Tech. (Automobile Engineering) (Sem.-5) <br> NUMERICAL METHODS <br> Subject Code : BTAE-502-18 <br> M.Code : 78226

Time: 3 Hrs.
Max. Marks : 60

## INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

## SECTION-A

## Write briefly :

1. State Simpson's three-Eighth rule
2. In four tosses of a coin, let $x$ be the number of heads. Calculate the expected value of $x$.
3. A sample of 20 items has a mean 42 units and S.D 5 units. Test the hypothesis that it is a random sample from a normal population with mean 45 units.
4. Find a real root of the equation $x=e^{-x}$ using Newton Raphson method.
5. Evaluate $\Delta \tan ^{-1} x$
6. Find positive real root of $x^{3}-x=1$ by bisection method, correct upto 2 decimal places between and 2 .
7. State Merit's of Lagrange's formula
8. Define Spline function.
9. Define types of numerical instability.
10. Prove that the absolute error in the common logarithm of a number is less than half the relative error of the given number.

## SECTION-B

11. Solve the problem $y^{\prime \prime}-x y^{\prime 2}+y^{2}=0 . y(0)=1, y^{\prime}(0)=0$ to evaluate $y(0.1)$ using Taylor's series methods.
12. Use Gauss elimination method to solve the following system of equations:
$2 x+y+z=10,3 x+2 y+3 z=18, x+4 y+9 z=16$
13. Fit a poisson distribution to the following data and test the goodness of fit:

| $x$ | 0 | 1 | 2 | 3 | 4 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $f$ | 109 | 65 | 22 | 3 | 1 |

14. Use Adam's Moulton-Bashforth method to find $y$ (1.4) given $\frac{d y}{d x}=x^{2}(1+y), y(1)=1$, $y(1.1)=1.233, y(1.2)=1.548$ and $y(1.3)=1.979$.
15. a) Compute $f^{\prime}(3)$ from the following table:

| $\boldsymbol{x}$ | 1 | 2 | 4 | 8 | 10 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathbf{F}(\boldsymbol{x})$ | 0 | 1 | 5 | 21 | 27 |

b) Given the initial value problem : $y^{\prime}=1+y^{2}, y(0)=0$, Find $y(0.6)$ by Runge Kutta fourth order method taking $h=0.2$

## SECTION-C

16. A river is 80 m wide. The depth ' $y$ ' of the river at a distance ' $x$ ' from one bank is given by following table:

| $\boldsymbol{x}$ | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\boldsymbol{y}$ | 0 | 4 | 7 | 9 | 12 | 15 | 14 | 8 | 3 |

Find the approximate area of cross-section of the river using Simpson's one - third rule.
17. a) A tank is discharging water through an orifice at a depth of $x$ metre below the surface of the whose area is $\mathrm{A} m^{2}$. Following are the yalues of $x$ for the corresponding values of $A$.

| $\mathbf{A}$ | 1.257 | 1.39 | 1.52 | 1.65 | 1.809 | 1.962 | 2.123 | 2.295 | 2.462 | 2.650 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\boldsymbol{x}$ | 1.5 | 1.65 | 1.8 | 1.95 | 2.1 | 2.25 | 2.4 | 2.55 | 2.7 | 2.85 |

Using the formula (0.018) $\mathrm{T}=\int_{1.5}^{3.0} \frac{A}{\sqrt{x}} d x$, calculate T , the time (in seconds) for the level of the water to drop from 3.0 m to 1.5 m above the orifice.
b) Using Newton's divided difference formula, calculate the value of $f(6)$ from the following data:

| $x$ | 4 | 5 | 7 | 10 | 11 | 13 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{~F}(x)$ | 48 | 100 | 294 | 900 | 1210 | 2028 |

18. Find a positive value of (17) $)^{\frac{1}{3}}$ correct to four decimal places by Newton's Raphson's method.

## NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.

