Name:

Enrolment No:

Course: MATH 7002 – Advanced Mathematics
Programme: M. Tech Rotating Equipment
Semester: I (ODD-2018-19)
Time: 03 hrs.
Max. Marks:100

Instructions:

Attempt all questions from **Section A** (each carrying 4 marks); attempt all questions from **Section B** (each carrying 8 marks); attempt all questions from **Section C** (each carrying 20 marks).

Section A
(Attempt all questions)

1\. Find the smallest positive point x such that $f(x)=g(x)$ where $f(x)=\cos x$ and $g(x)=x$ using Bisection method correct to 1 decimal place. **[4]** **CO2**

2\. Write down four limitations of Statistics. **[4]** **CO5**

3\. Solve the following equation by Newton Raphson method correct up to first place of decimal.. $x e^x - 1 = 0$ **[4]** **CO2**

4\. Find out the missing term: **[4]** **CO1**

Alitude (mtr)	*200*	*300*	*400*	*500*	*600*
Air Pressure (Pascal)	*150*	*200*	*230*	---	*540*

5\. Calculate the Geometric Mean of the following data: **[4]** **CO5**

5439 687 92 8 0.7 0.06 0.004 0.0003

SECTION B
(Q6-Q9 are compulsory and Q10 has internal choice)

6\. Find $\frac{dy}{dx}$ at $x=1.05$ using the following data: **[8]** **CO1**

x	*1.0*	*1.1*	*1.2*	*1.3*	*1.4*
y	*7.989*	*8.403*	*8.781*	*9.129*	*9.451*

7\. (i) Find the binomial distribution whose mean is 5 and variance is 10/3. **[8]** **CO5**

(ii) Ten percent of screws produced in a certain factory turn out to be defective. Find the probability that in a sample of 10 screws chosen at random, exactly two will be defective.

8.

Kirchhoff's voltage law says that the sum of the voltage drops around any closed path in the network in a given direction is zero. When this principle is applied to a circuit, we obtain the following linear system of equations:

$$(R_1+R_3+R_4)I_1+R_3I_2+R_4I_3=E_1$$

$$R_3I_1+(R_2+R_3+R_5)I_2-R_5I_3=E_2$$

$$R_4I_1-R_5I_2+(R_4+R_5+R_6)I_3=0$$

Solve for the currents I_1, I_2 and I_3 if $R_1=1, R_2=1, R_3=2, R_4=1, R_5=2, R_6=4$ and $E_1=23, E_2=29$, using Cholesky factorization method.

[8] **CO2**

9.

Ten competitors in a musical test were ranked by the three judges A, Band C in the following order:

Ranks by A	*1*	*6*	*5*	*10*	*3*	*2*	*4*	*9*	*7*	*8*
Ranks by B	*3*	*5*	*8*	*4*	*7*	*10*	*2*	*1*	*6*	*9*
Ranks by C	*6*	*4*	*9*	*8*	*1*	*2*	*3*	*10*	*5*	*7*

Using rank correlation method discuss which pair of judges has the nearest approach to common likings in music.

[8] **CO5**

10.

[8] **CO3**

Solve by Picard's method: $\frac{dy}{dx}=x, \frac{dz}{dx}=x^3(y+z)$, where $y=1 \wedge z=\frac{1}{2}$ at $x=0$. Obtain the values of $y \wedge z\, when\, x=0.2$ correct up to two places of decimal.

OR

Solve the equation $\frac{dy}{dx}=x+y$ with initial condition $y(0)=1$ by Runge-Kutta method of 4th order from $x=0$ to $x=0.2$ with $h=0.1$.

SECTION C **(Q11 is compulsory and Q12 has internal choice)**			
11.A	The average height of 500 students is 151 cm and the standard deviation is 15 cm. Assuming that the heights are normally distributed, find out that how many students have heights between 120 and 155 cm. Given that the area under the standard normal curve between z = 0 and z = 0.27 is 0.4808 and between z = 0 and z =0.27 is 0.1084.	**[10]**	**CO5**
11.B	Show that the third divided difference with arguments $x_0, x_1, x_2$and x_3 of the function $\frac{1}{x}$ is$(-1)^3 \frac{1}{x_0 x_1 x_2 x_3}$.	**[10]**	**CO1**
12.	Solve steady state 2-D heat flow problem $u_{xx} + u_{yy} = 0$ with following conditions using Liebmann's iteration process: $0 \le x \le 4, 0 \le y \le 4, u(0,y) = 0, u(4,y) = 8 + 2y,$ $u(x,0) = \frac{x^2}{2}, u(x,4) = x^2$ where $u(x,y)$ is temperature at the point (x,y). Perform two iterations only. **OR** Solve $u_t = 5u_{xx}$ with $u(0,t) = 0; u(5,t) = 60$ and $u(x,0) = \begin{cases} 20x \; for \; 0 < x \le 3 \\ 60 \; for \; 3 < x \le 5 \end{cases}$; for five time steps taking $h = 1$ by using Bender-Schmidt method.	**[20]**	**CO4**