Reg. No. | | | | | | | | | | | | | | |

B.E / B.TECH. DEGREE EXAMINATIONS, MAY 2023

Fourth Semester

MA18452 – PARTIAL DIFFERENTIAL EQUATIONS AND COMPUTATIONAL METHODS

(Automobile Engineering)

(Regulation 2018 / Regulation 2018A)

TIME: 3 HOURS **MAX. MARKS: 100**

CO 1 Students will be able to identify and solve partial differential equations analytically.
CO 2 Students will be familiar with the application of the Fourier series concept in Boundary value problems.
CO 3 Students will be familiar with the techniques of solving algebraic or transcendental equations and linear system of equations.
CO 4 Students will acquire the knowledge of Interpolation and Approximation and Curve fitting.
CO 5 Students will be aware of solving partial differential equations numerically.

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Form the partial differential equation by eliminating the constants a and b from $z=(x^2+a^2)(y^2+b^2)$.	1	2
2.	Solve $(D^2-2DD'+D'^2)z=0$.	1	3
3.	What is the constant a^2 in the wave equation $u_{tt}=a^2u_{xx}$?	2	2
4.	The ends A and B of a rod l cm long have the temperature 40ºC and 90ºC until steady state prevails. Find the temperature in the rod at that state.	2	2
5.	What is the condition for convergence and order of convergence in Newton Raphson method?	3	1
6.	Using Gauss elimination method, solve $x+y=2,\ 2x+3y=5$.	3	3
7.	State on what basis an interpolation formula is to be chosen.	4	1
8.	Find the third divided differences with arguments 0, 1, 4, 5 of the function $f(x)=x^3-x^2+3x+8$.	4	2
9.	State standard five point formula and diagonal five point formula.	5	1
10.	What is the condition of stability for the Bender-Schmidt method?	5	2

PART- B (5 x 14 = 70 Marks)

				Marks	CO	RBT LEVEL
11.	**(a)**	**(i)**	Form the partial differential equation by eliminating an arbitrary function from $f(x^2+y^2+z^2,\ x+y+z)=0$.	(7)	1	3
		(ii)	Solve $(4D^2-4DD'+D'^2)z=e^{3x-2y}+\sin x$.	(7)	1	3
			(OR)			
	(b)	**(i)**	Find the singular integral of the partial differential equation $z=px+qy+\left(\frac{q}{p}-p\right)$.	(7)	1	3
		(ii)	Solve $(3z-4y)p+(4x-2z)q=2y-3x$.	(7)	1	3
12.	**(a)**		A tightly stretched flexible string has its ends fixed at $x=0$ and $x=l$. At time $t=0$, the string is given a shape defined by $f(x)=\lambda x(l-x)$, where k is a constant, and then released from rest. Find the displacement of any point x of the string at anytime $t>0$.	(14)	2	3
			(OR)			
	(b)		A rectangular plate with insulated surface is 10cm width and so long compared to its width that it may be considered infinite in length without introducing an appreciable error. If the temperature along are short edge $y=0$ is $u(x,0)=8\sin\left(\frac{\pi x}{10}\right)$ for $0<x<10$ while the two long edges $x=0$ and $x=10$ as well as the short edge are kept at $0^\circ C$, find the steady state temperature function $u(x,y)$.	(14)	2	3
13.	**(a)**	**(i)**	Establish the formula to find the square root of $\frac{1}{N}$, using Newton's – Raphson method. Hence evaluate $\frac{1}{23}$ correct to four decimal places.	(7)	3	3
		(ii)	Using Gauss-Jordan method, find the inverse of $\begin{pmatrix} 8 & -4 & 0 \\ -4 & 8 & -4 \\ 0 & -4 & 8 \end{pmatrix}$.	(7)	3	3
			(OR)			
	(b)	**(i)**	Solve $x+y+54z=110,\ 27x+6y-z=-85,\ 6x+15y+2z=72$ by Gauss-Seidel method	(7)	3	3

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(ii) Find the numerically largest eigen value and the corresponding eigen vector of the matrix $\begin{pmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$. **(7)** 3 3

14. (a) (i) The population of a town in the census is as given in the data. Estimate the population in the year 1996. **(7)** 4 3

Year (x)	1961	1971	1981	1991	2001
Population(in 1000's)	46	66	81	93	101

(ii) Using Lagrange's formula, fit a polynomial to the data: **(7)** 4 3

x	0	1	3	4
y	-12	0	6	12

Also find y at $x = 2$.

(OR)

(b) Using Newton's divided difference formula, find the value of $f(2)$, $f(8)$ and $f(15)$ from the data below: **(14)** 4 3

x	4	5	7	10	11	13
$f(x)$	48	100	294	900	1210	2028

15. (a) Solve $\nabla^2 u = 8x^2 y^2$ for the square mesh given $u = 0$ on the 4 boundaries dividing the square into 16 sub-squares of length 1 unit. **(14)** 5 3

(OR)

(b) Given $\frac{\partial^2 f}{\partial x^2} = \frac{\partial f}{\partial t}$, $f(0,t) = f(5,t) = 0$, $f(x,0) = x^2(25 - x^2)$, find f in the range taking $h = 1$ and upto 5 seconds. **(14)** 5 3

PART- C (1 x 10 = 10 Marks)

(Q.No.16 is compulsory)

	Marks	CO	RBT LEVEL
16. Find the cubic polynomial which takes the following values.	(10)	4	3

x	0	1	2	3
$f(x)$	1	2	1	10

Hence or otherwise evaluate $f(4)$.

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