

DEC 2024 EXAMINATION  
B.TECH EXAM  
MA 10011:-MATHEMATICS-I

Code: 1204

Time: 3 Hrs.]

[Max. Marks: 70

TOTAL NO. OF QUESTIONS IN THIS PAPER:5

Note: Attempt all questions. All questions carry equal marks. Each question carries five subparts a, b, c, d and e. Parts a, b and c are compulsory and attempt any one from d and e.

S. No.	Questions	Marks	CO	BL	PI
Q.1	(a) Write down the statement of Taylor's theorem for two variables in powers of (x-a) and (y-b).	(02)	CO1	1	1.1.1
	(b) If $x = r \cos \theta, y = r \sin \theta$ , then evaluate $\frac{\partial(x,y)}{\partial(r,\theta)}$	(02)	CO1	2	1.1.1
	(c) If $u = x^2 + y^2$ where $x = at^2, y = 2at$ , find $\frac{du}{dt}$ .	(03)	CO1	2	1.1.1
	(d) Using Maclaurin series show that $e^{x \cos x} = 1 + x + \frac{x^2}{2} - \frac{x^3}{3} + \dots$	(07)	CO1	3	1.1.2
	OR				
	(e) If $u = \sin^{-1} \left( \frac{x+y}{\sqrt{x}+\sqrt{y}} \right)$ Prove that (i) $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \frac{1}{2} \tan u$ . (ii) $x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = -\frac{\sin u \cdot \cos 2u}{4 \cos^3 u}$ .	(07)	CO1	3	1.1.2
Q.2	(a) Find the radius of curvature at any point (s, φ) of the curve $s = c \tan \phi$	(02)	CO2	2	1.1.1
	(b) Find the radius of curvature at (0,0) for the curve $y = x^3 + 5x^2 + 6x$ .	(02)	CO2	2	1.1.1
	(c) Explain the Lagrange method of undetermined multipliers to find maximum or minimum value of function of three or more variables.	(03)	CO2	1	1.1.2
	(d) A rectangular box open at the top is to have a given capacity. Find the dimensions of the box requiring least material for its construction.	(07)	CO2	4	1.1.2
	OR				
	(e) Find the asymptotes of the curve $y^3 - x^2y - 2xy^2 + 2x^3 - 7xy + 3y^2 + 2x^2 + 2x + 2y + 1 = 0$	(07)	CO2	2	1.1.1
Q.3	(a) Evaluate $\Gamma \left( -\frac{3}{2} \right)$	(02)	CO3	2	1.1.1

	(b)	Evaluate $\int_0^{\infty} e^{-2x} x^3 dx$	(02)	CO3	2	1.1.1																											
	(c)	Show that $\beta(m,n) = \beta(m+1,n) + \beta(m,n+1)$ .	(03)	CO3	2	1.1.1																											
	(d)	Change the order of integration and evaluate $\int_0^1 \int_x^{\sqrt{2-x^2}} \frac{xdydx}{\sqrt{x^2+y^2}}$	(07)	CO3	3	1.1.2																											
		OR																															
	(e)	Evaluate $\iint r^2 dr d\theta$ , over the area between the circles $r = a \sin \theta$ and $r = 2a \sin \theta$	(07)	CO3	3	1.1.1																											
Q.4	(a)	Find the symmetricity of the curve $ay^2 = x^2(a-x)$	(02)	CO4	2	1.1.1																											
	(b)	Find point of intersection with coordinate-axis for the curve $a^2y^2 = x^2(2a-x)(x-a)$	(02)	CO4	2	1.1.1																											
	(c)	Find the area between the cubic $y = x^3$ & the parabola $y = 4x^2$ .	(03)	CO4	3	1.1.1																											
	(d)	Find the surface area of the solid formed by the revolution arc of the parabola $y^2 = 4ax$ bounded by its latus rectum about the x-axis.	(07)	CO4	3	1.1.2																											
		OR																															
	(e)	Trace the curve $r = a \cos 2\theta$	(07)	CO4	2	1.1.1																											
Q.5	(a)	Write a short note on correlation.	(02)	CO5	1	1.1.1																											
	(b)	Find the harmonic mean of 4, 8, 16, 32.	(02)	CO5	2	1.1.1																											
	(c)	Find the mode of the following:	(03)	CO5	2	1.1.2																											
		<table border="1"> <tr> <td>Marks</td> <td>1-5</td> <td>6-10</td> <td>11-15</td> <td>16-20</td> <td>21-25</td> <td>26-30</td> <td>31-35</td> <td>36-40</td> <td>41-45</td> </tr> <tr> <td>Student</td> <td>7</td> <td>10</td> <td>16</td> <td>32</td> <td>24</td> <td>18</td> <td>10</td> <td>5</td> <td>1</td> </tr> </table>	Marks	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	Student	7	10	16	32	24	18	10	5	1											
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	(d)	Find least squares polynomial approximation of degree two to the data	(07)	CO5	3	1.1.2																											
		<table border="1"> <tr> <td>x</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> <tr> <td>y</td> <td>-4</td> <td>-1</td> <td>4</td> <td>11</td> <td>20</td> </tr> </table>	x	0	1	2	3	4	y	-4	-1	4	11	20																			
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		OR																															
	(e)	Calculate the coefficient of correlation between the marks obtained by 8 students in mathematics and statistics	(07)	CO5	4	1.1.2																											
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