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Odd Semester Examination-2022

Paper Name: Mathematics-I

Paper Code: BTCSE-102/BTCSEAI-102/BTECE-102

Time: 3 Hours

Maximum Marks: 60

Write Your Roll Number On the top of the Question Paper

Section –A

(All questions are compulsory)

(4 X 5 = 20)

S. No	Questions	Marks	Course Outcomes	Blooms Taxonomy Level
Q.1	Find the rank of the matrix $A = \begin{bmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{bmatrix}$ by reducing into the row-echelon form	5	CO5	L4
Q.2	Find the directional derivative of the function $f(x, y, z) = x^2yz + xyz^2$ at the point $(1, -2, 1)$ in the direction of $2\hat{i} - \hat{j} - 2\hat{k}$.	5	CO4	L4
Q.3	Define Beta function and hence Prove that $\int_0^1 \frac{dx}{\sqrt{1-x^5}} = \frac{1}{5} \beta\left(\frac{1}{5}, \frac{1}{2}\right)$.	5	CO1	L5
Q.4	Test the convergence of the following infinite series (i) $\sum_1^\infty \tan\left(\frac{1}{n}\right)$ (ii) $\sum_{n=1}^\infty \left(\frac{n}{n+1}\right)^{n^2}$	5	CO3	L2

Section – B

(Attempt any Four Questions out of Six)

(4 X 10 = 40)

S. No	Questions	Marks	Course Outcomes	Blooms Taxonomy Level
Q.1	Find the eigenvalues and the eigenvectors of the matrix $A = \begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$. Is A diagonalizable?	10	CO5	L4
Q.2 (a)	Find the minimum value of $f(x, y, z) = xy + 2yz + 2zx$ subject to $xyz = 32$	5	CO4	L6
(b)	If $u = (x^2 + y^2 + z^2)^{-\frac{1}{2}}$ then prove that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} + z \frac{\partial u}{\partial z} = -u$	5	CO4	L2
Q.3 (a)	Find the volume of solid generated by revolving the area bounded by parabola $y^2 = 4ax$ and its latus rectum about the x axis.	5	CO1	L4
(b)	Verify the mean value theorem for the function $f(x) = \log x$ on $[1, e]$.	5	CO2	L5
Q.4	Verify Cayley's Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 2 & 1 \\ 0 & 0 & 3 \end{bmatrix}$. Hence compute A^{-1}	10	CO5	L3
Q.5	Define Fourier Series and hence find the Fourier series for the function $f(x) = x$ where $-\pi \leq x \leq \pi$.	10	CO3	L5
Q.6 (a)	Using Maclaurin's series expansion prove that $\log(1+x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \dots$	5	CO2	L3
(b)	Evaluate $\lim_{x \rightarrow 1} (2-x)^{\tan(\frac{\pi x}{2})}$	5	CO2	L5

BL – Bloom's Taxonomy Levels (1- Remembering, 2- Understanding, 3- Applying, 4- Analyzing, 5- Evaluating, 6- Creating CO-Course Outcomes

*****End of Paper*****