Subject Code: KAS103T

PAPER ID-411939

Roll No:

BTECH
(SEM I) THEORY EXAMINATION 2021-22
ENGINEERING MATHEMATICS-I

Time: 3 Hours ***Total Marks: 100***

Notes:

- *Attempt all Sections and Assume any missing data.*
- *Appropriate marks are allotted to each question, answer accordingly.*

SECTION-A	Attempt **All** of the following Questions in brief	Marks**(10X2=20)**	**CO**
Q1(a)	If the matrix A=$\begin{bmatrix}-1 & 2 & 3\\ 0 & 3 & 5\\ 0 & 0 & -2\end{bmatrix}$, then find the eigen value of $A^3+5A+8I$.		1
Q1(b)	Reduce the matrix $\begin{bmatrix}1 & 1 & 1\\ 3 & 1 & 1\end{bmatrix}$ into normal form and find its rank.		1
Q1(c)	Find the envelope of the family of straight line $y=mx+\frac{a}{m}$, where m is a parameter.		2
Q1(d)	Can mean value theorem be applied to $f(x)=\tan x$ in $[0,\pi]$.		2
Q1(e)	State Euler's Theorem on homogeneous function.		3
Q1(f)	Find the critical points of the function $f(x,y)=x^3+y^3-3axy$.		3
Q1(g)	Find the area bounded by curve $y^2=x\ and\ \ x^2=y$.		4
Q1(h)	Find the value of $\int_0^1\int_0^x\int_0^{x+y} dx\,dy\,dz$.		4
Q1(i)	Find a unit normal vector to the surface $z^2=x^2+y^2$ at the point $(1,0,-1)$.		5
Q1(j)	State Stoke's Theorem.		5

SECTION-B	Attempt **ANY THREE**of the following Questions	Marks**(3X10=30)**	**CO**
Q2(a)	Find the characteristic equation of the matrix A=$\begin{bmatrix}2 & 1 & 1\\ 0 & 1 & 0\\ 1 & 1 & 2\end{bmatrix}$, compute A^{-1} and prove that $A^8-5A^7+7A^6-3A^5+A^4-5A^3+8A^2-2A+I=\begin{bmatrix}8 & 5 & 5\\ 0 & 3 & 0\\ 5 & 5 & 8\end{bmatrix}$.		1
Q2(b)	State Rolle's theorem and verify Rolle's theorem for the function $f(x)=\frac{sinx}{e^x}\ \ in\ [0,\pi]$.		2
Q2(c)	If u, v and w are the roots of $(\lambda-x)^3+(\lambda-y)^3+(\lambda-z)^3=0$, cubic in λ, find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$.		3
Q2(d)	Find the volume bounded by the cylinder $x^2+y^2=4$ and the plane $y+z=4$ and z = 0.		4
Q2(e)	Apply Green's theorem to evaluate $\int_C\ [(2x^2-y^2)dx+(x^2+y^2)dy]$,where C is the boundary of the area enclosed by the x-axis and the upper half of the circle $x^2+y^2=a^2$.		5

SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X10=10)**	**CO**
Q3(a)	Find the value of k for which the system of eqations $(3k-8)x+3y+3z=0$, $3x+(3k-8)y+3z=0,\ \ 3x+3y+(3k-8)z=0$ has a non-trivial solution.		1
Q3(b)	Find the eigen values and eigen vectors of matrix A=$\begin{bmatrix}2 & 1 & 1\\ 2 & 3 & 2\\ 3 & 3 & 4\end{bmatrix}$.		1

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SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X10=10)**	**CO**
Q4(a)	If $f(x) = \frac{x}{1+e^{\frac{1}{x}}}$; $x \neq 0$ and $f(0) = 0$, then show that the function is continuous but not differentiable at $x = 0$.		2
Q4(b)	If $y = \left(x + \sqrt{1 + x^2}\right)^m$, find $y_n(0)$.		2

SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X10=10)**	**CO**
Q5(a)	Expand x^y in powers of $(x-1)$ and $(y-1)$ up to the third-degree terms and hence evaluate $(1.1)^{1.02}$.		3
Q5(b)	A rectangular box which is open at the top having capacity 32c.c. Find the dimension of the box such that the least material is required for its constructions.		3

SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X10=10)**	**CO**
Q6(a)	Change the order of integration in $I = \int_0^1 \int_{x^2}^{2-x} xy dy dx$ and hence evaluate the same.		4
Q6(b)	Find the position of the C.G. of a semicircular lamina of radius, a if its density varies as the square of the distance from the diameter.		4

SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X10=10)**	**CO**
Q7(a)	Find the directional derivative of $\nabla(\nabla f)$ at the point $(1, -2, 1)$ in the direction of the normal to the surface $xy^2z = 3x + z^2$ where $f = 2x^3y^2z^4$.		5
Q7(b)	Find the constants a, b, c so that $\vec{F} = (x + 2y + az)\hat{\imath} + (bx - 3y - z)\hat{\jmath} + (4x + cy + 2z)\hat{k}$ is irrotational and hence find function $\emptyset$ such that $\vec{F} = \nabla\emptyset$.		5