Subject Code: KAG201T

PAPER ID-421670

Roll No:

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

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 following question in brief**	**Marks (10×2=20)**	**CO**
Q.1(a)	Find the inverse of the matrix $A = \begin{bmatrix} 4 & 3 \\ 5 & 7 \end{bmatrix}$.		1
Q.1(b)	For what value of 'b' the rank of the matrix $A = \begin{bmatrix} 1 & 5 & 4 \\ 0 & 3 & 2 \\ b & 13 & 10 \end{bmatrix}$ is 2.		1
Q.1(c)	Show that $f(z) = z + 2\bar{z}$ is not analytic anywhere in the complex plane.		2
Q.1(d)	Define a harmonic function and conjugate harmonic function.		2
Q.1(e)	Find the unit normal vector to the surface $z = x^2 + y^2$ at the point $(1, 1, 2)$.		3
Q.1(f)	Find the value of 'a'for which the vector field $\vec{v} = a(x + y)\hat{\imath} + 4y\hat{\jmath} + 3\hat{k}$, is solenoidal.		3
Q.1(g)	Find the constant term when $f(x) = 1 + \|x\|$ is expanded in Fourier series in the interval (-3, 3).		4
Q.1(h)	State Dirichlet's condition for the expansion of f(x) in Fourier series.		4
Q.1(i)	Classify: $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$.		5
Q.1(j)	Find the general solution of $\frac{\partial u}{\partial x} = \frac{\partial u}{\partial y}$ using method of separation of variables.		5

SECTION -B	**Attempt any three of the following questions**	**Marks (3×10=30)**	**CO**
Q.2(a)	Find the value of k, such that the system of equations $4x + 9y + z = 0,\ kx + 3y + kz = 0$ and $x + 4y + 2z = 0$ Has non-trivial solution. Hence find the solution of the system.		1
Q.2(b)	If $f(z) = u + iv$ is an analytic function, find $f(z)$ in term of z if $\boldsymbol{u} - \boldsymbol{v} = \frac{e^y - \cos x + \sin x}{\cosh y - \cos x}$ When $f\left(\frac{\pi}{2}\right) = \frac{3-i}{2}$.		2
Q.2(c)	Use Divergence Theorem to evaluate $\iint_S \vec{F}\, d\vec{S}$ where $\vec{F} = 4x\hat{\imath} - 2y^2\hat{\jmath} + z^2\hat{k}$ and S is the surface bounding the region $x^2 + y^2 = 4,\ z = 0\ and\ z = 3$.		3
Q.2(d)	For the Fourier series for the function given by $f(x) = \begin{cases} 2t & ,0 < t < 1 \\ 2(2-t), & 1 < t < 2 \end{cases}$.		4
Q.2(e)	A tightly stretched string with fixed end points $x = 0$ and $x = l$ is initially in a position given by $y = y_0 sin^3 \frac{\pi x}{l}$. If it is released from rest from this position, find the displacement$y(x, t)$.		5

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SECTION -C	Attempt any one of the following questions	Marks (1×10=10)	CO
Q.3(a)	Verify Cayley-Hamilton Theorem for the matrix $A = \begin{bmatrix} 1 & 1 & 2 \\ 3 & 1 & 1 \\ 2 & 3 & 1 \end{bmatrix}$. Hence evaluate A^{-1} .		1
Q.3(b)	Find the Eigen values and Eigen vectors of the matrix $A = \begin{bmatrix} 2 & -2 & 3 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{bmatrix}$.		1

SECTION -C	Attempt any one of the following questions	Marks (1×10=10)	CO
Q.4(a)	If f (z) is a regular function of z, prove that $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right) \lvert f(z)\rvert^2 = 4\lvert f'(z)\rvert^2$.		2
Q.4(b)	An electrostatic field in the $xy - plane$ is given by the potential function $\varphi = 3x^2y - y^3$, find the stream function and hence find complex potential.		2

SECTION -C	Attempt any one of the following questions	Marks (1×10=10)	CO
Q.5(a)	State and verify Green's theorem in the plane for $\oint(3x^2 - 8y^2)dx + (4y - 6xy)dy$ where C is the boundary of the region bounded by $x \geq 0,\ y \leq 0\ and\ 2x - 3y = 6$.		3
Q.5(b)	If the directional derivative of $\varphi = ax^2y + by^2z + cz^2x$ at the point (1, 1, 1) has maximum magnitude 15 in the direction parallel to the line $\frac{x-1}{2} = \frac{y-3}{-2} = \frac{z}{1}$, find the values of a, b and c.		3

SECTION -C	Attempt any one of the following questions	Marks (1×10=10)	CO
Q.6(a)	Obtain Fourier series for the function $f(x) = \begin{cases} 1 + \frac{2x}{\pi}, & -\pi < x < 0 \\ 1 - \frac{2x}{\pi}, & 0 < x < \pi \end{cases}$. Hence deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} \cdots\cdots\cdots = \frac{\pi^2}{8}$.		4
Q.6(b)	Solve $(D^2 - DD' - 2D'^2 + 2D' + 2D)z = e^{2x+3y} + \sin(2x + y) + xy$.		4

SECTION -C	Attempt any one of the following questions	Marks (1×10=10)	CO
Q.7(a)	Use the method of separation of variables to solve the equation $\frac{\partial^2 u}{\partial x \partial t} = e^{-t}cosx$ given that $u = 0\ when\ t = 0\ and\ \frac{\partial u}{\partial t} = 0\ when\ x = 0.$		5
Q.7(b)	Find the temperature distribution in a rod of length 2m whose end points are fixed at temperature zero and initial temperature distribution is $f(x) = 100x$.		5

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