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Paper Id:

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Sub Code: RAG201

Roll No.

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B TECH
(SEM II) THEORY EXAMINATION 2017-18
ENGINEERING MATHEMATICS II

Time: 3 Hours

Total Marks: 70

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt all questions in brief. 2 x 7 = 14

- a. Find inverse of $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$.
- b. Reduce into echelon form $A = \begin{bmatrix} 1 & 1 & 1 \\ 3 & 1 & 1 \end{bmatrix}$.
- c. Determine whether $\frac{1}{z}$ is analytic or not?
- d. Write one dimensional Heat equation.
- e. Discuss the analyticity of $f(z) = \bar{z}$
- f. Show the function $\bar{F}(x^2 - y^2 + x)\hat{i} - (2xy + y)\hat{j}$ is irrotational.
- g. Find the half range sine series for the function $f(x) = x$ is the interval $0 < x < 1$.

SECTION B

2. Attempt any three of the following: 7 x 3 = 21

- a. Find the eigen values and eigen vectors of $A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & -2 & 6 \\ 0 & 0 & -3 \end{bmatrix}$.
- b. Prove that $u = x^2 - y^2 - 2xy - 2x + 3y$ is harmonic. Find a function v such that $f(z) = u + iv$ is analytic. Also, express $f(z)$ in terms of z .
- c. A vector field is given by $F = (x^2 - y^2 + x)\hat{i} - (2xy + y)\hat{j}$. Is this field irrotational? If so find scalar potential.
- d. Obtain the Fourier series for the function $f(x) = x^2$ in $0 < x < 2$.
- e. Solve by Method of separation of variable
- $$3\frac{\partial u}{\partial x} + 2\frac{\partial u}{\partial y} = 0 \quad u(x, 0) = 4e^{-x}$$

SECTION C

3. Attempt any one part of the following: 7 x 1 = 7

(a) Reduce the following matrix to normal form and find rank of $A = \begin{bmatrix} -2 & -1 & 3 & -1 \\ 1 & 2 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & -1 \end{bmatrix}$

(b) Verify Cayley Hamilton theorem for $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$

4. Attempt any one part of the following: 7 x 1 = 7

(a) If $f(z) = \begin{cases} \frac{x^3y(y-ix)}{x^6+y^2}, & z \neq 0 \\ 0, & z = 0 \end{cases}$

Then discuss $\frac{df}{dz}$ at $z = 0$.

(b) Discuss analyticity of $f(z) = |z|^2$

5. Attempt any one part of the following: 7 x 1 = 7

(a) Using Green's Theorem evaluate: $\int_C (x^2 + xy)dx + (x^2 + y^2)dy$, where C is the square formed by the lines $x = \pm 1, y = \pm 1$.

(b) Prove that $(y^2 - z^2 + 3yz - 2x)i + (3xz + 2xy)j + (3xy - 2xz + 2z)k$ is both solenoidal and irrotational

6. Attempt any one part of the following: 7 x 1 = 7

(a) Find the half range Fourier cosine series of $f(x) = x^2$ in $0 < x < 3$.

(b) Obtain the Fourier series for the function

$$f(x) = \begin{cases} x, & -\pi < x < 0 \\ -x, & 0 < x < \pi \end{cases}$$

Hence show that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots = \frac{\pi^2}{8}$

7. Attempt any one part of the following: 7 x 1 = 7

(a) Find the temperature distribution in a rod of length of 2m whose ends are fixed at temperature zero and initial temperature distribution is $f(x) = 100x$.

(b) Solve by method of variation of parameters:

$$\frac{d^2y}{dt^2} - 3\frac{dy}{dt} + 2y = \frac{e^t}{1+e^t}$$