

Printed Pages : 5



NAG201

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 180219

Roll No.

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B. Tech.

(SEM. II) THEORY EXAMINATION, 2014-15
ENGINEERING MATHEMATICS - II

Time : 3 Hours]

[Total Marks : 100

Note : Attempt all questions.

SECTION A

1 Attempt all parts of this question : **10×2=20**

- Find Curl of $\vec{f} = x^2y\hat{i} - 2xz\hat{j} + 2yz\hat{k}$ at the point $(1, 0, 2)$.
- State Green's theorem.
- Define harmonic function.
- Find the period of $\sin nx$.
- Find a_0 if $f(x) = x$ is expanded in half range Fourier cosine series.
- Form the partial differential equation from $z = ax + by + a^2 + b^2$.

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[Contd...

- (g) Write the one dimensional heat equation and its solution.
- (h) Solve $\frac{\partial u}{\partial x} = \frac{\partial u}{\partial y}$ by method of separation of variables.
- (i) Define skewness.
- (j) Find the median of the following item :
3, 2, 5, 9, 7, 4, 3, 8.

SECTION B

2 Attempt any three parts of the following : **3×10=30**

- (a) Using Green's theorem evaluate :

$$\int_C \left[(x^3 - xy^3) dx + (y^2 - 2xy) dy \right] \text{ where } C \text{ is}$$

the square having vertices at the points (0, 0), (2, 0), (2, 2) and (0, 2).

- (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) Find the Fourier series to represent the function

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

hence show that $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots$

- (d) Find the temperature distribution in a rod of length a which is totally insulated including the ends if the initial temperature is $x(a-x)$.
- (e) Using the method of least squares, fit a straight line to the following data :

x	0	1	2	3	4
y	1.0	2.9	4.8	6.7	8.6

SECTION C

Note : Attempt any two parts from each questions. $(2 \times 5) \times 5 = 50$
All questions are compulsory.

- 3 (a) Find grad ϕ when ϕ is given by $\phi = 3x^2y - y^3z^2$ at the point $(1, -2, -1)$.
- (b) Prove that $\vec{W} = \frac{1}{2} \text{curl } \vec{V}$, where \vec{W} is angular velocity and \vec{V} is linear velocity.
- (c) Find $\iint_S \vec{F} \cdot \hat{n} dS$, where
- $$\vec{F} = (2x + 3z)\hat{i} - (xz + y)\hat{j} + (y^2 + 2z)\hat{k} \quad \text{and}$$
- S is the surface of the sphere having centre at $(3, -1, 2)$ and radius 3.

- 4 (a) Evaluate $\lim_{z \rightarrow 2e^{i\pi/3}} \left[\frac{z^3 + 8}{z^4 + 4z^2 + 16} \right]$
- (b) Discuss the analyticity of $f(z) = z \bar{z}$
- (c) Find the analytic function $f(z)$ in terms of z whose imaginary part is $\cos x \cosh y$.
- 5 (a) Find the half range cosine series for $f(x) = x$ in $0 < x < c$.
- (b) Solve : $(D^2 + 3DD' + 2D')z = \cos(x + 3y)$
- (c) Solve : $(D^2 + 2D' - 3)z = e^{2x-3y}$
- 6 (a) Solve by the method of separation of variables

$$y \frac{\partial u}{\partial x} + x \frac{\partial u}{\partial y} = 0$$
- (b) Solve : $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$, in a rectangle with
 $u(0, y) = 0$, $u(a, y) = 0$, $u(x, b) = 0$ and
 $u(x, 0) = f(x)$.
- (c) Find the temperature distribution in a rod of length ℓ whose ends are kept at zero temperature and the initial temperature is u_0 .

- 7 (a) Calculate the mean deviation from the following data :

Class interval :	0-10	10-20	20-30	30-40	40-50	50-60
Frequency :	3	5	11	5	4	9

- (b) Calculate the coefficient of skewness from the following data :

$x:$	1	2	3	4	5
$f:$	8	28	56	70	56

- (c) From the following data calculate median :

$x:$	15	25	35	45	55	65
$f:$	18	29	46	62	96	56

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