

3015

B.Tech. (ME) 2nd Semester (G-Scheme)

Examination, May-2024

MATH-II

Paper : BSC-MATH-102-G

Multivariable Calculus, Differential Equations &

Complex Analysis

Time allowed : 3 hours]

[Maximum marks : 75

Note: Answer any one from each unit. Question No.-1 is compulsory.

1. Answer all the questions : $6 \times 2.5 = 15$

(a) Solve

$$(12x + 5y - 9)dx + (5x + 2y - 4)dy = 0$$

(b) Find the Integrating factor

$$\cos^2 x \frac{dy}{dx} + y = \tan x$$

(c) State Gauss theorem.

(d) Write the Cauchy-Riemann equation.

(e) Define poles and Singularity of an Analytic function.

$$(f) \int_0^{2a} \int_0^{x^2/4a} xy \, dy \, dx$$

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[P.T.O.]

Unit-I

2. (a) $\iint (x + y)^2 dx dy$ over the area bounded by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ 7.5
- (b) Evaluate by changing the order of Integration $\int_0^1 \int_0^{\sqrt{1-x^2}} y^2 dx dy$. 7.5
3. (a) 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 x -axis and upper half of circle $x^2 + y^2 = a^2$. 7.5
- (b) $\int_0^a \int_0^x \int_0^{x+y} e^{x+y+z}$ 7.5

Unit-II

4. (a) Solve the differential equation $xy(1 + xy^2) \frac{dy}{dx} = 1$ 7.5
- (b) Solve : $y - 2px = \tan^{-1}(xp^2)$ 7.5
5. (a) Solve : $x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + y = \log x$ 7.5
- (b) Solve by method of variation of Parametre $y'' - 6y' + 9y = \frac{e^{3x}}{x^2}$ 7.5

Unit-III

6. Determine the analytic function whose real part is
 $u = e^{2x}(x \cos 2y - y \sin 2y)$ 15
7. (a) Show that the function $f(z) = \sqrt{|xy|}$ is not regular although the Cauchy-Riemann Equation is satisfied. 10
- (b) Find the image in w -plane of the disk $|z - 1| \leq 1$ under the mapping $w = \frac{1}{z}$. 5

Unit-IV

8. (a) Use Cauchy Integral formula to evaluate
 $\oint_C \frac{e^{2z}}{(z+1)^4} dz$ where C is the circle
 $|z| = 2$. 7.5
- (b) Evaluate $\oint_C (\bar{z})^{2+i}$ along
 (i) The line $y = x$
 (ii) The real axis to 2 and then vertically to $2 + i$ 7.5

[P.T.O.]

9. (a) Evaluate $\oint_C \frac{2z-1}{z(z+1)(z-3)} dz$ where C is the

circle $|z| = 2$.

7.5

(b) $\int_0^{2\pi} \frac{\cos 3\theta d\theta}{5-4 \cos \theta}$

7.5