11501

Roll No.

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11501

B. Tech. I - Sem. (Main / Back) Exam., March - 2021

1FY2-01 Engineering Mathematics - I

Time: 3 Hours

Maximum Marks: 160

Min. Passing Marks:

Instructions to Candidates:

Part – A: *Short answer questions (up to 25 words) 10 × 3 marks = 30 marks. All **ten** questions are compulsory.*

Part – B: *Analytical/Problem solving questions 5 × 10 marks = 50 marks. Candidates have to answer **five** questions out of **seven**.*

Part – C: *Descriptive/Analytical/Problem Solving questions 4 ×20 marks = 80 marks. Candidates have to answer **four** questions out of **five**.*

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

PART – A

Q.1 Evaluate - $\beta\left(\frac{5}{2},\frac{3}{2}\right)$.

Q.2 Write the formula for volume of solid revolution when the revolution is about y – axis.

Q.3 State p – test for convergence of the series.

Q.4 Find whether the series $\sum \frac{\sqrt{n}}{n^2+1}$ is convergent or not.

Q.5 Find Fourier series coefficients a_0 and a_n for the function $f(x) = x^3$, $-\pi \le x \le \pi$

Q.6 State Parseval's theorem.

Q.7 If $u = x^y + y^x$, then find $\frac{\partial^2 u}{\partial x \partial y}$.

Q.8 Evaluate - $\int_1^2 \int_0^{3y} y \, dy \, dx$.

Q.9 Discuss curl of a Vector point function.

Q.10 State Gauss – divergence theorem.

PART – B

Q.1 Show that - $\int_0^1 \frac{dx}{\sqrt{(1-x^4)}} = \frac{\sqrt{2}}{8\sqrt{\pi}}\left(\sqrt{\frac{1}{4}}\right)^2$.

Q.2 Test the convergence of the following series -

$$\frac{x}{1.2} + \frac{x^2}{3.4} + \frac{x^3}{5.6} + \frac{x^4}{7.8} + \cdots \ldots\ldots.., x > 0.$$

Q.3 Expand $f(x) = e^x$ in a cosine series over (0, 1).

Q.4 Find the directional derivative of the function $f = x^2 - y^2 + 2z^2$ at the point P(1, 2, 3) in the direction of the line PQ where Q is the point (5, 0, 4).

Q.5 Discuss the maximum or minimum values of $u = x^3y^2 (1 - x - y)$.

Q.6 Change the order of the integration in –

$I = \int_0^1 \int_{x^2}^{2-x} xy \, dx \, dy$ and hence evaluate the same.

Q.7 Using Green's theorem to evaluate $\int_C (x^2y \, dx + x^2 \, dy)$, where C is the boundary described counter clockwise of the triangle with vertices (0, 0), (1, 0) and (1, 1).

PART – C

Q.1 (a) Find the surface of the solid generated by the revolution of the ellipse $x^2 + 4y^2 = 16$ about its x – axis.

(b) Find the volume of the solid generated by the revolution of $r = 2a\cos\theta$ about the initial line.

Q.2 Find the Fourier series for the function $f(x) = e^{-ax}$, $-\pi < x < \pi$. Hence, prove that –

$$\frac{\pi}{\sinh \pi} = 2\left[\frac{1}{2^2+1} + \frac{1}{3^2+1} + \frac{1}{4^2+1} + \cdots \ldots \ldots\right].$$

Q.3 (a) If $u = \sin^{-1}\left(\frac{x^2+y^2}{x+y}\right)$, then prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \tan u$.

(b) Evaluate – $\int_1^e \int_1^{\log y} \int_1^{e^x} \log z \, dz \, dx \, dy$.

Q.4 (a) Explain cos x in powers of $\left(x - \frac{\pi}{2}\right)$ by Taylor's series.

(b) Discuss the continuity of the function –

$$f(x, y) = \begin{cases} xy^3, & (x, y) \neq (0, 0) \\ 0, & (x, y) = (0, 0) \end{cases} \text{ at } (0, 0).$$

Q.5 Verify Stoke's theorem for $F = (x + y)\hat{i} + (2x - z)\hat{j} + (y + z)\hat{k}$ for the surface of a triangular lamina with vertices (2, 0, 0), (0, 3, 0) and (0, 0, 6).

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