

Roll No. 15127813

Total Pages : 02

BT-3/D-23

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MATHEMATICS-III

BS-205A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Section. All questions carry equal marks.

Section A

1. Examine the convergence of the series :

(i) $\frac{1}{2\sqrt{1}} + \frac{x^2}{3\sqrt{2}} + \frac{x^4}{4\sqrt{3}} + \frac{x^6}{5\sqrt{4}} + \dots \infty$

(ii) $\frac{1}{2} + \frac{2}{3}x + \left(\frac{3}{4}\right)^2 x^2 + \left(\frac{4}{5}\right)^3 x^3 + \dots \infty$

2. Prove that $x^2 = \frac{\pi^2}{3} + 4 \sum_{n=1}^{\infty} (-1)^n \frac{\cos nx}{n^2}$, $-\pi < x < \pi$.

Hence show that :

$$\sum \frac{1}{n^2} = \frac{\pi^2}{6}$$

Section B

3, Solve :

$$\frac{2x}{y^3} dx + \frac{(y^2 - 3x^2)}{y^4} dy = 0.$$

4, Solve $x^2 \frac{d^2 y}{dx^2} - x \frac{dy}{dx} + y = \log x$ using the method variation of parameter for finding the particular integral.

Section C

5. Change the order of integration in $I = \int_0^{4a} \int_{x^2/4a}^{2\sqrt{ax}} dy dx$.

6, Evaluate $\iint_D (x+2y) dx dy$, where D is the region bounded by the parabolas $y = 2x^2$ and $y = 1 + x^2$.

Section D

7. For the function $\phi(x, y) = \frac{x}{x^2 + y^2}$, find the magnitude of the directional derivative along a line making an angle 30 with the positive x-axis at (0, 2).

8, State Green's Theorem for a plane and verify the same for $\int_C (3x^2 - 8y^2) dx + (4y - 6xy) dy$, where C is the boundary of the region bounded by $x \geq 0$, $y \leq 0$ and $2x - 3y = 6$.