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17MATDIP31

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Additional Mathematics - I

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Find the modulus and amplitude of

$$\frac{3+i}{2+i}$$

(07 Marks)

If $x = \cos \theta + i \sin \theta$, then show that $x^n = \cos n\theta + i \sin n\theta$.

(07 Marks)

- c. Simplify $\frac{(\cos 30^\circ + i \sin 30^\circ)^4 (\cos 40^\circ + i \sin 40^\circ)^5}{(\cos 40^\circ + i \sin 40^\circ)^3 (\cos 50^\circ + i \sin 50^\circ)^4}$

(06 Marks)

OR

- 2 a. Find the sine of the angle between $A = 2i + 3j - k$ and $B = 6i - 3j + 2k$. (07 Marks)

- b. Find the value of λ , so that the vectors $a = 2i - 3j + k$, $b = i + 2j - 3k$ and $c = i + \lambda j + k$ are coplanar. (07 Marks)

- c. Prove that $a \times (b \times c) + b \times (c \times a) + c \times (a \times b) = 0$. (06 Marks)

Module-2

- 3 a. Find the n^{th} derivative of $e^x \cos(bx + c)$. (07 Marks)

- b. If $y = a \cos(\log x) + b \sin(\log x)$ prove that $x^2 y_{n+2} + (2n+1)xy_{n+1} + (n^2+1)y_n = 0$. (07 Marks)

- c. If $u = \sin^{-1} \frac{x-y}{x+y}$, prove that $x \frac{du}{dx} + y \frac{du}{dy} = \tan u$. (06 Marks)

OR

- 4 a. Find the pedal equation of $r = \cos n\theta$. (07 Marks)

- b. Expand $\log_e(1+x)$ in ascending powers of x as far as the term containing x^4 . (07 Marks)

- c. If $x = r \cos \theta$, $y = r \sin \theta$, find $\frac{\partial^2(x,y)}{\partial(r,\theta)^2}$ (06 Marks)

Module-3

- 5 a. Evaluate $\int_0^1 \int_0^1 (1+xy^2) dx dy$ (07 Marks)

- b. Evaluate $\int \sin^4 x \cos^3 x dx$ (07 Marks)

- c. Evaluate $\int_{-\pi/4}^{\pi/4} \frac{1}{1+\tan^2 x} dx$ (06 Marks)

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OR

- 6 a. Evaluate $\int_3^4 \int_1^2 (x^2 y + e^y) dy dx$ (07 Marks)
- b. Evaluate $\int_0^{\pi} x \sin^5 x dx$ (07 Marks)
- c. Evaluate $\int_0^2 \int_0^1 \int_0^1 (x^2 + y^2 + z^2) dx dy dz$ (06 Marks)

Module-4

- 7 a. If particle moves on the curve $x = 2t$, $y = t^2 - 4t$, $z = 3t - 5$ where t is the time. Find the velocity and acceleration at $t = 1$. (07 Marks)
- b. Find the angle between the tangents to the curve $\mathbf{r} = t^2 \mathbf{i} - 2t \mathbf{j} - t^3 \mathbf{k}$ at the point $t = \pm 1$. (07 Marks)
- c. If $\mathbf{F} = (3x^2y - z)\mathbf{i} + (xz^3 + y^4)\mathbf{j} - 2x^3z^2\mathbf{k}$ find $\text{grad}(\text{div } \mathbf{F})$ at $(2, -1, 0)$. (06 Marks)

OR

- 8 a. Find the directional derivative of $(I) = 4xz^3 - 3x^2y^2z$ at $(2, -1, 2)$ along $2\mathbf{i} - 3\mathbf{j} + 6\mathbf{k}$ (07 Marks)
- b. Find the unit normal to the surface $x^2y + 2xz = 4$ at $(2, -2, 3)$. (07 Marks)
- c. Show that $\mathbf{F} = (2xy^2 + yz)\mathbf{i} + (2x^2y + xz + 2yz^2)\mathbf{j} + (2y^2z + xy)\mathbf{k}$ is irrotational. (06 Marks)

Module-5

- 9 a. Solve $\frac{dy}{dx} = \sin(x + y)$ (07 Marks)
- b. Solve $\frac{dy}{dx} + y \cot x = \cos x$ (07 Marks)
- c. Solve $(x - y + 1)dy - (x + y - 1)dx = 0$ (06 Marks)

OR

- 10 a. Solve $(e^{4x} + e^{2x})dx + e^{2x} \left(\frac{x}{y} - 1 \right) dy = 0$. (07 Marks)
- b. Solve $(x^3 \cos^2 y - x \sin 2y) dx = dy$. (07 Marks)
- c. Solve $(3x^2y^4 + 2xy)dx + (2x^3y^3 - x^2)dy = 0$ (06 Marks)