CBCS Scheme

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15MATDIP31

Third Semester B.E. Degree Examination, June/July 2017
Additional Mathematics - I

Time: 3 hrs. Max. Marks: 80

Note: *Answer FIVE full questions, choosing one full question from each module.*

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Express $\frac{3+4i}{3-4i}$ in the form x + iy. **(06 Marks)**

b. Express $\sqrt{3}+i$ in the polar form and hence find their modulus and amplitudes. **(05 Marks)**

c. Find the sine of the angle between $\vec{a} = 2i - 2j + k$ and $\vec{b} = i - 2j + 2k$. **(05 Marks)**

OR

2 a. Simplify **(06 Marks)**

$$\frac{(\cos 3\theta + i\sin 3\theta)^4(\cos 4\theta + i\sin 4\theta)^5}{(\cos 4\theta + i\sin 4\theta)^3 + (\cos 5\theta + i\sin 5\theta)^{-4}}$$

b. If $\vec{a} = i + 2j - 3k$ and $\vec{b} = 3i - j + 2k$, then show that $(\vec{a} + \vec{b})$ and $(\vec{a} - \vec{b})$ are orthogonal. **(05 Marks)**

c. Find the value of λ, so that the vectors $\vec{a} = 2i - 3j + k$, $\vec{b} = i + 2j - 3k$ and $\vec{c} = j + \lambda k$ are co-planar. **(05 Marks)**

Module-2

3 a. If y = cos (m log x) then prove that $x^2 y_{n+2} + (2n+1)xy_{n+1} + (m^2 + n^2)\, y_n = 0$. **(06 Marks)**

b. With usual notation prove that

$\tan\phi = \frac{rd\theta}{dr}$. **(05 Marks)**

c. If $u = \log_e\left(\frac{x^4 + y^4}{x + y}\right)$, show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 3$. **(05 Marks)**

OR

4 a. Find the Pedal equation of $r = a[1 - \cos\theta]$. **(06 Marks)**

b. Expand $\log_e(1+x)$ in ascending powers of x as far as the term containing x^4. **(05 Marks)**

c. Find the total derivative of $Z = xy^2 + x^2y$, where $x = at^2$ $y = 2at$. **(05 Marks)**

Module-3

5 a. Evaluate $\int_0^{\pi/6} \sin^6 3x\, dx$ using Reduction formula. **(06 Marks)**

b. Evaluate $\int_0^1 x^6\sqrt{1-x^2}\, dx$ – using Reduction formula. **(05 Marks)**

c. Evaluate $\int_1^2\int_0^{2-y} xy\,dx\,dy$. **(05 Marks)**

OR

6 a. Evaluate $\int_0^{\pi/2} \sin^3 x \cos^7 x \, dx$. **(06 Marks)**

b. Evaluate $\int_0^{\pi} x \cos^6 x \, dx$. **(05 Marks)**

c. Evaluate $\int_0^3 \int_0^2 \int_0^1 (x + y + z) \, dz \, dx \, dy$. **(05 Marks)**

Module-4

7 a. A particle moves along the curve $\vec{r} = (1-t^3)\hat{i} + (1+t^2)\hat{j} + (2t - 5)\hat{k}$. Determine the velocity and acceleration. **(06 Marks)**

b. Find the directional derivative of $\phi = xy^2 + yz^3$ at the point (2,-1, 1) in the direction of the vector i + 2j + 2k. **(05 Marks)**

c. Find the constant a, b, c. Such that the vector
$\vec{F} = (x + y + az)\ \hat{i} + (x + cy + 2z)\ \hat{k} + (bx + 2y - z)\hat{j}$ is irrotational. **(05 Marks)**

OR

8 a. Find the angle between the tangents to the curve $\vec{r} = t^2\ \hat{i} + 2t\hat{j} - t^3\hat{k}$ at the points $t = \pm 1$. **(06 Marks)**

b. Find the divergence and curl of the vector
$\vec{F} = (xyz + y^2z)\ \hat{i} + (3x^2 + y^2z)\ \hat{j} + (xz^2 - y^2z)\ \hat{k}$. **(05 Marks)**

c. If $\vec{F} = (ax + 3y + 4z)\ \hat{i} + (x - 2y + 3z)\hat{j} + (3x + 2y - z)\ \hat{k}$ is solenoidal, find a. **(05 Marks)**

Module-5

9 a. Solve $\frac{dy}{dx} = \frac{y}{x - \sqrt{xy}}$. **(06 Marks)**

b. Solve $\frac{dy}{dx} + y \cot x = \sin x$. **(05 Marks)**

c. Solve $\frac{dy}{dx} = \frac{x + 2y - 1}{x + 2y + 1}$. **(05 Marks)**

OR

10 a. Solve $(x^2 - y^2)\, dx = 2xy\, dy$. **(06 Marks)**

b. Solve $x\frac{dy}{dx} + y = x^3 y^6$. **(05 Marks)**

c. $(1 + xy)\, ydx + (1 - xy)\, xdy = 0$. **(05 Marks)**

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