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MATDIP401

Fourth Semester B.E. Degree Examination, June/July 2017
Advanced Mathematics – II

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions.

- 1**
- Find the angle between any two diagonals of a cube. (06 Marks)
 - Find the angle between two lines whose direction cosines are given by $l + 3m + 5n = 0$ and $2mn - 6nl - 5lm = 0$. (07 Marks)
 - Find the coordinates of the foot of the perpendicular from A(1, 1, 1) to the line joining the points B(1, 4, 6) and C(5, 4, 4). (07 Marks)
- 2**
- Find the equation of the plane through (2, -1, 6) and (1, -2, 4) and perpendicular to the plane $x - 2y - 2z + 9 = 0$. (06 Marks)
 - Find the equation of a straight line through (7, 2, -3) and perpendicular to each of the lines $\frac{x-1}{3} = \frac{y-3}{4} = \frac{z-4}{5}$ and $\frac{x+2}{4} = \frac{y-3}{5} = \frac{z-4}{6}$. (07 Marks)
 - Find the angle between the planes $x - y + z - 6 = 0$ and $2x + 3y + z + 5 = 0$. (07 Marks)
- 3**
- If \vec{a} , \vec{b} and \vec{c} are any three vectors then prove that

$$\vec{a} \times (\vec{b} \times \vec{c}) = (\vec{a} \cdot \vec{c})\vec{b} - (\vec{a} \cdot \vec{b})\vec{c}$$
 (06 Marks)
 - If $\vec{A} = 4\vec{i} + 3\vec{j} + \vec{k}$, $\vec{B} = 2\vec{i} - \vec{j} + 2\vec{k}$ find a unit vector N perpendicular to the vectors \vec{A} and \vec{B} also show that \vec{A} is not perpendicular to \vec{B} . (07 Marks)
 - Find the value of λ so that the points A(-1, 4, -3), B(3, 2, -5), C(-3, 8, -5) and D(-3, λ , 1) lie on the same plane. (07 Marks)
- 4**
- A particle moves along the curve $x = 2t^2$, $y = t^2 - 4t$, $z = 3t - 5$ where t is time. Find the components of its velocity and acceleration in the direction of the vector $\vec{i} - 3\vec{j} + 2\vec{k}$ at $t = 1$. (06 Marks)
 - Find the angle between tangents to the curve $x = t^2 + 1$, $y = 4t - 3$, $z = 2t^2 - 6t$ at $t = 1$ and $t = 2$. (07 Marks)
 - Find the directional derivative of $x^2yz + 4xz^2$ at (1, -2, -1) in the direction of $2\vec{i} - \vec{j} - 2\vec{k}$. (07 Marks)
- 5**
- Prove that $\text{div}(\text{curl } \vec{A}) = 0$. (06 Marks)
 - Find the divergence and curl of the vector

$$\vec{F} = (xyz + y^2z)\vec{i} + (3x^2y + y^2z)\vec{j} + (xz^2 - y^2z)\vec{k}$$
 (07 Marks)
 - Find the constants a, b, c so that the vector,

$$\vec{F} = (x + 2y + az)\vec{i} + (bx - 3y - z)\vec{j} + (4x + cy + 2z)\vec{k}$$
 is irrotational. (07 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.

- 6 Find :
- a. $L[\sin 5t \sin 3t]$ (05 Marks)
- b. $L[te^{8t} \cos 2t]$ (05 Marks)
- c. $L\left[\frac{1 - e^{at}}{t}\right]$ (05 Marks)
- d. $L\left[\int_0^t e^{2t} \frac{\sin at}{t} dt\right]$ (05 Marks)
- 7 a. Find $L^{-1}\left[\frac{2s-1}{s^2+2s+17}\right]$. (05 Marks)
- b. Find $L^{-1}\left[\frac{s+1}{(s-1)^2(s+2)}\right]$. (05 Marks)
- c. Find $L^{-1}\left[\cot^{-1}\left(\frac{s}{a}\right)\right]$. (05 Marks)
- d. Using convolution theorem evaluate $L^{-1}\left[\frac{s}{(s+2)(s^2+9)}\right]$. (05 Marks)
- 8 a. Using Laplace transforms, solve $\frac{d^2y}{dt^2} + 2\frac{dy}{dt} - 3y = \sin t$ given $y(0) = y'(0) = 0$. (10 Marks)
- b. Using Laplace transforms, solve $\frac{dx}{dt} + y = \sin t$, $\frac{dy}{dt} + x = \cos t$, given $x = 2$, $y = 0$ when $t = 0$. (10 Marks)

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