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MATDIP401

Fourth Semester B.E. Degree Examination, December 2012

Advanced Mathematics - II

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions.

- 1 a. Prove that the angle between two lines whose direction cosines are (l_1, m_1, n_1) and (l_2, m_2, n_2) is $\cos \theta = l_1 l_2 + m_1 m_2 + n_1 n_2$. (06 Marks)
 - b. Find the projection of the line AB on CD where A = (1, 3, 5), B = (6, 4, 3), C = (2, -1, 4) and D = (0, 1, 5).
 - c. Find the angle between any two diagonals of cube. (07 Marks)
- 2 a. Find the equation of the plane passing through the points (3, 1, 2) and (3, 4, 4) and perpendicular to 5x + y + 4z = 0. (06 Marks)
 - b. Show that the points (0, -1, 0), (2, 1, -1), (1, 1, 1) and (3, 3, 0) are coplanar. (07 Marks)
 - c. Find the equation of the plane through the points (1, 0, -1), (3, 2, 2) and parallel to the line $\frac{x-1}{1} = \frac{1-y}{2} = \frac{z-2}{3}.$ (07 Marks)
- 3 a. Find the value of λ such that the vectors $\lambda i + j + 2k$, 2i 3j + 4k and i + 2j k are coplanar. (06 Marks)
 - b. If $\vec{a} = 4i + 2j k$, $\vec{b} = 2i j$ and $\vec{c} = j 3k$, find (i) $(\vec{a} \times \vec{b}) \cdot (\vec{b} \times \vec{c})$, (ii) $(\vec{a} \times \vec{b}) \times (\vec{b} \times \vec{c})$.
 - c. Find the cosine and sine of the angle between the vectors 2i j + 3k and i 2j + 2k.

 (07 Marks)
- 4 a. Find the components of velocity and acceleration at t = 2 on the curve, $\vec{r} = (t^2 + 1)i + (4t - 3)j + (2t^2 - 6t)k \text{ in the direction of } i + 2j + 2k.$ (06 Marks)
 - $b. \quad \text{Find the angle between the tangents to the curve } \ \vec{r} = \left\{t \frac{t^3}{3}\right\} i + t^2 j + \left\{t + \frac{t^3}{3}\right\} k \ \text{ at } t = \pm 3.$
 - c. Find the directional derivative of $\phi = x^2yz + 4xz^2$ at (1, -2, -1) along 2i j 2k. (07 Marks)
- 5 a. If $\vec{F} = \nabla(xy^3z^3)$, find div \vec{F} and curl \vec{F} at the point (1, -1, 1). (06 Marks)
 - b. Show that $\vec{F} = (y+z)i + (z+x)j + (x+y)k$ is irrotational. Also find a scalar function ϕ such that $\vec{F} = \nabla \phi$. (07 Marks)
 - c. Prove that $\nabla^2(\log r) = \frac{1}{r^2}$ where $\vec{r} = xi + yj + zk$ and $r = |\vec{r}|$. (07 Marks)

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(05 Marks) (05 Marks)

(05 Marks)

(05 Marks)

- - a. Find Laplace transform of (2t + 3)².
 b. Find Laplace transform of e^{2t} cos 3t.
 - c. Find $L\left\{\frac{\cos 2t \cos 3t}{t}\right\}$.
 - d. Using Laplace transform, evaluate $\int e^{-2t} t \cos t dt$.
- a. Find inverse Laplace transform of $\frac{s}{s^2 + 4s + 13}$. (06 Marks)
 - b. Find $L^{-1}\left\{\frac{1}{(s^2+3s+2)(s+3)}\right\}$. (07 Marks)
 - c. Find $L^{-1}\left\{\log\left(\frac{s^2+1}{s^2+s}\right)\right\}$. (07 Marks)
- a. Solve the differential equation $y'' + 4y' + 3y = e^{-t}$ with $y(0) \neq 1$ and y'(0) = 1 by using Laplace transforms. (10 Marks)
 - b. Solve by using Laplace transforms $\frac{dx}{dt} 2y = \cos 2t$, $\frac{dy}{dt} + 2x = \sin 2t$ with x = 1, y = 0 at t = 0. (10 Marks)