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MATDIP401

Fourth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Advanced Mathematics – II

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions.

1.
 - a. Find the angle between any two diagonals of a cube. (06 Marks)
 - b. The direction cosines of three mutually perpendicular lines are l_1, m_1, n_1 , l_2, m_2, n_2 and l_3, m_3, n_3 . Show that the line with direction cosines $l_1 + l_2 + l_3$, $m_1 + m_2 + m_3$, $n_1 + n_2 + n_3$ is equally inclined to the above lines. (07 Marks)
 - c. Find the equations of the plane passing through the points (1, 2, 3) (0, 1, 4) and (0, 0, 1). (07 Marks)
2.
 - a. Derive the equation to the plane in the intercept form $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$. (06 Marks)
 - b. Find the angle between the lines $\frac{x-1}{1} = \frac{y-5}{0} = \frac{z+1}{2}$ and $\frac{x+3}{3} = \frac{y}{5} = \frac{z-5}{2}$. (07 Marks)
 - c. Find the image of the point (1, 2, 3) in the line $\frac{x+1}{2} = \frac{y-3}{3} = -z$. (07 Marks)
3.
 - a. Show that the position vectors of the vertices of a triangle $2\mathbf{i} - \mathbf{j} + \mathbf{k}$, $\mathbf{i} - 3\mathbf{j} - 5\mathbf{k}$, $3\mathbf{i} - 4\mathbf{j} - 4\mathbf{k}$ form a right angled triangle. (06 Marks)
 - b. Find a vector of magnitude 12 units which is perpendicular to the vectors $\vec{a} = 4\mathbf{i} - \mathbf{j} + 3\mathbf{k}$ and $\vec{b} = -2\mathbf{i} + \mathbf{j} - 2\mathbf{k}$. (07 Marks)
 - c. Find λ so that the points A(-1, 4, -3), B(3, 2, -5), C(-3, 8, -5) and D(-3, λ , 1) are coplanar. (07 Marks)
4.
 - a. Find the unit tangent vector of the space curve $x = 1 + t^3$, $y = 2t^3$, $z = 2 - t^3$ at $t = 1$. (06 Marks)
 - b. Find the angle between the tangents to the curve $\vec{r} = \left(t - \frac{t^2}{2}\right)\mathbf{i} + t^2\mathbf{j} + \left(t + \frac{t^2}{2}\right)\mathbf{k}$ at $t = \pm 1$ (07 Marks)
 - c. A particle moves along the curve whose parametric equations are $x = t - \frac{t^3}{3}$, $y = t^2$ and $z = t + \frac{t^3}{3}$, where 't' is the time. Find the velocity and acceleration at any time 't'. Also find their magnitudes at $t = 3$. (07 Marks)
5.
 - a. Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $x = z^2 + y^2 - 3$ at (2, -1, 2). (06 Marks)
 - b. Find the constants a, b, c such that the vector, $\vec{F} = (x + y + az)\mathbf{i} + (bx + 2y - z)\mathbf{j} + (x + cy + 2z)\mathbf{k}$ is irrotational. (07 Marks)
 - c. If $\vec{A} = \text{grad}(x^3 + y^3 + z^3 - 3xyz)$ then find $\text{div } \vec{A}$ and $\text{curl } \vec{A}$. (07 Marks)