VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

MODULEWISE QUESTION BANK

COMMON SYLLABUS for 2002/2006/2010/2015/2017/2018 SCHEMES

ADVANCED MATHEMATICS-II

(A bridge course for Lateral Entry students of IV semester B.E.)
(Common to all branches)

Module-01: Vector Algebra

Q.No.	Questions
1.	Show that the position vectors of the vertices of a triangle $2\hat{\imath} - \hat{\jmath} + \hat{k}$, $\hat{\imath} - 3\hat{\jmath} - 5\hat{k}$ and $3\hat{\imath} - \hat{4\jmath} - 4\hat{k}$ from a right-angled triangle.
2.	Find the angle between the vectors $\vec{a} = 5\hat{\imath} - \hat{\jmath} + \hat{k}$ and $\vec{b} = 2\hat{\imath} - 3\hat{\jmath} + 6\hat{k}$.
3.	Determine the value of a so that $\vec{A} = 2\hat{\imath} + a\hat{\jmath} + \hat{k}$ and $\vec{B} = 4\hat{\imath} - 2\hat{\jmath} - 2\hat{k}$ are perpendicular.
4.	Find the sine of an angle between $\vec{a} = 2\hat{\imath} - 2\hat{\jmath} + \hat{k}$ and $\vec{b} = \hat{\imath} - 2\hat{\jmath} + 2\hat{k}$.
5.	Find the unit normal vector to both the vectors $4\hat{\imath} - \hat{\jmath} + 3\hat{k}$ and $-2\hat{\imath} + \hat{\jmath} - 2\hat{k}$.
6.	Prove that the position vectors of the points A, B, C and D represented by the vectors $-\hat{\jmath} - \hat{k}$, $4\hat{\imath} + 5\hat{\jmath} + \hat{k}$, $3\hat{\imath} + 9\hat{\jmath} + 4\hat{k}$ and $-4\hat{\imath} + 4\hat{\jmath} + 4\hat{k}$ respectively are coplanar.
7.	Show that the four points whose position vectors are $3\hat{\imath} - 2\hat{\jmath} + 4\hat{k}$, $6\hat{\imath} + 3\hat{\jmath} + \hat{k}$, $5\hat{\imath} + 7\hat{\jmath} + 3\hat{k}$ and $2\hat{\imath} + 2\hat{\jmath} + 6\hat{k}$ are coplanar.
8.	Find the value of λ so that the vectors $\vec{a} = 2\hat{\imath} - 3\hat{\jmath} + \hat{k}$, $\vec{b} = \hat{\imath} + 2\hat{\jmath} - 3\hat{k}$ and $\vec{c} = \hat{\jmath} + \lambda\hat{k}$ are coplanar.
9.	Find the constant a so that the vectors $2\hat{\imath} - \hat{\jmath} + \hat{k}$, $\hat{\imath} + 2\hat{\jmath} - 3\hat{k}$ and $3\hat{\imath} + a\hat{\jmath} + 5\hat{k}$ are coplanar.
10.	Prove that $[\vec{a} - \vec{b},\ \vec{b} - \vec{c},\ \vec{c} - \vec{a}] = 0$.

Module-02: Vector Differentiation

Q. No.	Questions
1.	A particle moves along the curve $x = t^3 + 1,\ y = t^2,\ z = 2t + 3$ where t is the time. Find the components of velocity and acceleration at $t = 1$ in the direction of $i + j + 3k$.
2.	Find the component of velocity and acceleration at t=2 on the curve $r = (t^2 + 1)i + (4t - 3)j + (2t^2 - 6t)k$ in the direction of $i + 2j + 2k$.
3.	Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$, $x^2 + y^2 - z = 3$ at the point (2, -1, 2).
4.	Find the directional derivative of $\emptyset = x^2yz + 4xz^2$ at the point $(1, -2, -1)$ along $2\vec{i} - \vec{j} - \overrightarrow{2k}$.
5.	Find the directional derivative of $f(x, y, z) = xy^3 + yz^3$at the point $(2, -1, 1)$ in the direction of the vector $\vec{i} + \overrightarrow{2j} + \overrightarrow{2k}$.
6.	Find $div\vec{F}$ and $Curl\ \vec{F}$ where $\vec{F} = grad(x^3 + y^3 + z^3 - 3xyz)$.
7.	If $\vec{F} = (x + y + 1)\vec{i} + \vec{j} - (x + y)\vec{k}$ then prove that $\vec{F} \cdot curl\vec{F} = 0$.
8.	Show that $\vec{F} = (-x^2 + yz)\vec{i} + (4y - z^2x)\vec{j} + (2xz - 4z)\vec{k}$ is Solenoidal.
9.	Find the constant a, b, c so that the vector field $\vec{F} = (x + 2y + az)\vec{i} + (bx - 3y - z)\vec{j} + (4x + cy + 2z)\vec{k}$ is irrotational.
10.	Show that $\vec{F} = (2xy^2 + yz)\vec{i} + (2x^2y + xz + 2yz^2)\vec{j} + (2y^2z + xy)\vec{k}$ is a conservative force field (irrotational).

Module-03: Higher-Order Differential Equations

Q. No.	Questions
1.	Solve: $(D^4 + 2D^3 - 5D^2 - 6D)y = 0$, where $D = \frac{d}{dx}$.
2.	Solve: $(D^3 - 2D + 4D - 8)y = 0$, where $D = \frac{d}{dx}$.
3.	Solve: $(D^2 + 6D + 9)y = 0,$ where $D = \frac{d}{dx}$.
4.	Solve $\frac{d^3y}{dx^3} - 3\frac{d^2y}{dx^2} + 4\frac{dy}{dx} - 2y = e^x$.
5.	Solve $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = e^{2x}$.

6.	Solve $(D^2+3D+2)y = sin2x$, where $D = \frac{d}{dx}$.
7.	Solve $(D^2+5D+6)y = sinx$, where $D = \frac{d}{dx}$.
8.	Solve $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = cos3x$.
9.	Solve $\frac{d^2y}{dx^2} - 4y = cosx$.
10.	Solve $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} - 12y = e^{-2x}$.

Module-04: Linear Algebra

Q. No.	Questions
1.	Find the rank of the matrix $\begin{bmatrix} 5 & 3 & 14 & 4 \\ 0 & 1 & 2 & 1 \\ 1 & -1 & 2 & 0 \end{bmatrix}$ by reducing to echelon form.
2.	Find the rank of the matrix by elementary row transformation $\begin{bmatrix} 1 & 1 & 1 \\ 2 & 2 & 2 \\ 3 & 3 & 3 \end{bmatrix}$.
3.	Find the rank of the matrix by elementary row transformation $\begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{bmatrix}$.
4.	Test for consistency and solve $5x + 3y + 7z = 4,\ 3x + 26y + 2z = 9$, $7x + 2y + 10z = 5$.
5.	Test for consistency and solve $x + 2y + 3z = 14$, $4x + 5y + 7z = 35$, $3x + 3y + 4z = 21$.
6.	Solve $3x - y + 2z = 12,\ 2x + 2y + 3z = 11,\ 2x - 2y - z = 2$ by Gauss elimination method.
7.	Solve $2x + 5y + 7z = 52,\ 2x + y - z = 0, x + y + z = 9$ by Gauss elimination method.
8.	Solve $2x + y + z = 10,\ 3x + 2y + 3z = 18,\ x + 4y + 9z = 16$ by Gauss elimination method.
9.	Find the Eigen values and one Eigen vectors of the matrix $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$.
10.	Find the Eigen values and one Eigen vector of the matrix $\begin{bmatrix} 4 & 3 \\ 2 & 9 \end{bmatrix}$.

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