1(a)	Define equal vector and null vector. Find the scalar product of the vectors (2, 3, 1) and (3, 1, -2). Also find the angle between them.	**4**
(b)	Find a unit vector perpendicular to each of the vectors $r_1 = 3i + 2j - 4k$ and $r_2 = i + j + 2k$	**2**
(c)	Find the angle between the surfaces $x^2 + y^2 + z^2 = 49$ and $x^2 + y^2 - z = 43$ at (6, 3, -2).	**4**
2(a)	Show that the vector $\vec{F} = (6xy + z^3)\underline{i} + (3x^3 - z)\underline{j} + (3xz^2 - y)\underline{k}$ is irrotational.	**4**
(b)	Evaluate $\oint_c (5x^2 + 3y)dx + 11yzdy + 10xz^3dz$ along the following paths c: (i) the straight lines from (0, 0, 0) to (0, 0, 1) then to (0, 1, 1) and then to (1, 1, 1) (ii) the straight line joining from (0, 0, 0) to (3, 9, 27)	**6**
3(a)	Show that the divergence of the curl of a vector field *A* is zero.	**4**
(b)	Let $\vec{A} = xy^2\,\underline{i} - 3x^2y\,\underline{j} + 2yz^2\,\underline{k}$. Now find curlcurl of $\vec{A}$ at (1, 0, - 4).	**6**
4(a)	Write down three vector operators gradient, divergence and curl.	**5**
(b)	Verify the relation $\nabla \times (\nabla \times A) = \nabla(\nabla \cdot A) - \nabla^2 A$ for the vector $A = x^2yi + 2xyzj + 3y^2zk$	**5**
5(a)	State and prove Green's theorem.	**5**
(b)	Apply Green's to find $\oint_c (x^2ydx + x^2dy)$, where c is the boundary of the region enclosed by the line y = x and the curve $y = x^2$	**5**
6(a)	Give the statement of the Divergence theorem.	**2**
(b)	Verify Divergence theorem for the vector field $\vec{F} = (2xy + z)\underline{i} + y^3\,\underline{j} - (x + 3y)\underline{k}$	**8**
7(a)	Find $\iint \vec{F}.\hat{n}\, dA$, where $\vec{F} = x^2\,\underline{i} + 3y^2\,\underline{k}$ and S is the portion of the planes x + y + z = 1 in the first octant.	**6**
(b)	Evaluate $\oint_c y^2dx - x^2dy$, where c is the triangle whose vertices are (1, 0), (0, 1), (-1, 0).	**4**