Enrolment No.									

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B.E. 2nd Mid Sem Exam

Linear Algebra and Vector Calculus

Date/Day : *03/03/2014*, Thursday **Branch: All Branches**
Time : *12.00 pm to 01:30 pm* **Max. Marks : *30***

Instructions: 1) Figures to the **right** indicate full marks.
2) Use of scientific calculator is permitted.
3) Indicate **clearly**, the options you attempt along with its respective question number.
4) Use the last page of main supplementary for **rough work**.

Attempt any three questions out of five questions.

Q.1 **(a)** Define singular matrix. Find the inverse of the using Gauss-Jordan method of the following matrix $\begin{bmatrix} 2 & 3 & 4 \\ 4 & 3 & 1 \\ 1 & 2 & 4 \end{bmatrix}$. **[5]**

(b) Define Hermition matrix. Express the matrix $A = \begin{bmatrix} 2+3i & 0 & 4i \\ 5 & i & 8 \\ 1-i & -3+i & 6 \end{bmatrix}$ as the sum of a Hermition and a skew Hermition matrix. **[5]**

Q.2 **(a)** Investigate for what values of λ and μ the equations **[5]**
$x + 2y + z = 8$, 2x+2y+2z=13, 3x+4y+$\lambda z = \mu$
have (i) no solution (ii) unique solution (iii) many solution.

(b) Find the directional derivative of $\phi = 4xz^3 - 3x^2y^2z$ at the point $(2,-1,2)$, **[5]**
(i) along the tangent to the curve $x = e^t cost, y = e^t sint,\ z = e^t$ at $t = 0$.
(ii) along the direction normal to the surface $x^2 + y^2 + z^2 = 9$ at (1,2,2).

Q.3 **(a)** Show that $F = (y^2 - z^2 + 3yz - 2x)\hat{\imath} + (3xz + 2xy)\hat{\jmath} + (3xy - 2xz + 2z)\hat{k}$ is conservative, Find (a) Scalar potential (b)The work done by F in moving a particle from A(1,0,1) to B(2,1,3). **[5]**

(b) State Phythagorean Theorem in $\mathbb{R}^n$.Verify Cauchy-Schwarz inequality for the vectors $u = (-3,1,0), v = (2,-1,3)$. **[5]**

Q.4 **(a)** Determine $f(r)$ so that the vector $f(r)\bar{r}$ is both solenoidal and irrotational. **[5]**

(b) Prove that $\nabla^2(r^2 \log r) = 5 + 6 \log r$. **[5]**

Q.5 **(a)** Find the rank of the following matrix **[5]**

$$\begin{bmatrix} 1 & 2 & -1 & 3 \\ 3 & 4 & 0 & -1 \\ -1 & 0 & -2 & 7 \end{bmatrix}$$

(b) Find l, m, n and A^{-1} if $A = \begin{bmatrix} 0 & 2m & n \\ l & m & -n \\ l & -m & n \end{bmatrix}$ is orthogonal. **[5]**