SANKALCHAND PATEL COLLEGE OF ENGINEERING VISNAGAR

Mid Term Examination, March- 2009

B.E SECOND SEMESTER (All Branches)

SUBJECT: Mathematics-II **TIME: 10:30 to 12:15**

DATE: 23/03/2009 **Max. Marks: 40**

Q-1: Answer the following questions(Any three) **[12]**

(1) Which of the following subset S of $\mathcal{C}(0,\infty)$ are linearly independent

(i) $\{\sin(x+1),\ \sin x, \cos x\}$ (ii) $\{x^2, x, 1\}$.

(2) If e_1=(1,1,0) , e_2=(1,0,1) , e_3=(0,1,1) then prove that span of { e_1,e_2,e_3}= $\mathbb{R}^3$.

(3) Show that $B = \left\{\begin{pmatrix}1 & 0\\ 0 & 0\end{pmatrix}, \begin{pmatrix}1 & 1\\ 0 & 0\end{pmatrix}, \begin{pmatrix}1 & 1\\ 1 & 0\end{pmatrix}, \begin{pmatrix}1 & 1\\ 1 & 1\end{pmatrix}\right\}$ is basis of $M_{2\times 2}\ (\mathbb{R})$.

(4) Find a basis and dimensions of the subspace

$\{(a_1, a_2, a_3, a_4) \mid a_1 + a_2 = 0,\ a_2 + a_3 = 0,\ a_3 + a_4 = 0\}$ of $\mathbb{R}^4$.

Q-2: Answer the following questions **[08]**

(1) Show that $W = \{(x, y, z) \mid x + y + z = 0\}$ is a subspace of $\mathbb{R}^3$.

(2) Show that $W = \left\{y = f(x) \in \mathcal{C}(\mathbb{R},\mathbb{R}) \mid \frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 2\right\}$ is not subspace of $\mathcal{C}(\mathbb{R},\mathbb{R})$.

(3) Find $u+v,\ 4u,\ 2u-3v,\ u\bullet v,\ \|u\|,\ \|v\|,\ d(u,v)$ for $u = (3,-2,1,4),\ v = (7,1,-3,6)$

(4) Is $W = \{(x, y) \mid x^2 = y^2\}$ a subspace of $\mathbb{R}^2$.

Q-3: Answer the following questions (Any three) **[12]**

(1) **Solve the following system of linear equations by Gauss-elimination method**

$4x - 8y + 3z = 16,\quad -x + 2y - 5z = -21,\quad 3x - 6y + z = 7$

(2) **Solve the following system of linear equations by Gauss-Jordan elimination method**

$x + y + 3z = 5$, $2x - y + 4z = 11$, $-y + z = 3$

[P.T.O]

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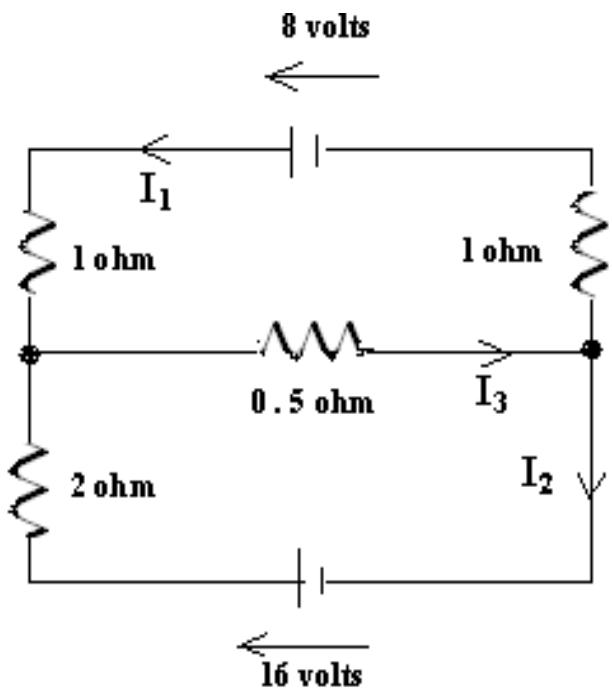
(3) Find the currents in the following networks by using Kirchhoff's laws



(4) Reduce the matrix $\begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$ to the row echelon form.

Q-4: Answer the following questions (Any two) **[08]**

(1) Show that $\langle f, g \rangle$ is an inner product on $C[a,b]$, where $\langle f, g \rangle = \int_a^b f(t)\, g(t)\, dt$.

(2) Verify Schwartz's inequality for vectors $x = (-1,1,-1)$, $y = (2,0,2)$.

(3) Find the angle (θ) between vectors $x = (1,5,0)$ and $y = (-5,1,3)$.

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