SCAN ME

VIT

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

Continuous Assessment Test –II

Programme Name & Branch: B. Tech. **Exam Duration: 90 mins** **Slot: C2+TC2+TCC2**

Semester: Winter 2019-20 **Maximum Marks: 50**

Course Code & Title: MAT3004 Applied Linear Algebra

Exam Mode: Closed book

Answer any *five* questions 5 x 10 = 50 Marks

1. Find a basis for the subspaces $V+W$ and $V\cap W$ of $\mathbb{R}^4$ where the subspaces V and W are spanned by the set of vectors $\{v_1=(1,1,0,0), v_2=(1,0,1,0)\}$ and $\{w_1=(0,1,0,1), w_2=(0,0,1,1)\}$ respectively. Is $V+W=V\oplus W$? (10)

2. a) Check the identity: rank (A) + nullity of A = total number of columns of A for the matrix $A=\begin{bmatrix}1 & -2 & -1\\ 2 & -1 & 3\\ 7 & -8 & 3\\ 5 & -7 & 0\end{bmatrix}$. (5)

   b) Can the matrix $B=\begin{bmatrix}1 & 2\\ 3 & 1\\ 7 & 8\end{bmatrix}$ have a left or right inverse? If so, find it. (5)

3. a) Find the equation of a circle that passes through the points (0, 0), (-1, -3) and (-3, -3). (5)

   b) Is the mapping $T: P_1(\mathbb{R}) \to P_2(\mathbb{R})$ defined by $T(at+b)=at^2+(a-b)t$ linear? (5)

4. a) Find the matrix of reflection about the line $y=\sqrt{3}\,x$. (5)

   b) Find the basis change matrix $[id]_\alpha^\beta$ if $\alpha=\{(1,0),(0,1)\}$ and $\beta=\{(5,1),(1,2)\}$. (5)

5. Let S and T be linear transformations from $\mathbb{R}^3$ to $\mathbb{R}^3$ defined as follows: $S(x,y,z)=(3x+5y+z,-2x+y-z,x-z)$ and $T(x,y,z)=(x-y,y-z,z-x)$. Find the associated matrices $[S]_\alpha, [T]_\alpha, [S+T]_\alpha, [S\circ T]_\alpha$ and $[T^{-1}]_\alpha$ if T^{-1} exists where α is the standard basis of $\mathbb{R}^3$. (10)

6. Let $T:\mathbb{R}^3\to\mathbb{R}^2$ be the linear transformation $T(x,y,z)=(2x-y+z,x+y-2z)$. Let $\alpha=\{v_1=(1,1,1), v_2=(1,2,1), v_3=(0,1,-1)\}$ and $\beta=\{w_1=(1,2), w_2=(2,1)\}$ be ordered bases of $\mathbb{R}^3$ and $\mathbb{R}^2$ respectively. Find the associated matrix $[T]_\alpha^\beta$. (10)

1+1-2

1+2-2

0+1+2