Indian Institute of Technology Kharagpur
Department of Mathematics
MA41003/MA30003 - Linear Algebra
Test - 3
AUTUMN 2021

Instructions: Answers all the questions. No queries will be entertained during the examination.

i. write the solutions file name in the following format

```
Roll No_Name_LA Test-3
```

And on the first page, your roll number and name should appear.

ii. Question paper is of the type fill in the blanks. Write the main answers on the first page and then write the detailed solutions from the second page onwards.

iii. No marks will be given if there are no detailed solutions from the second page onward.

iv. Please submit a single Pdf file. All the pages in the file should be in vertical

v. In the last two tests few students did not provide a single pdf file and the file is not in pdf format, So I unable to correct that file. For these candidates, I will conduct a reexamination for test-2 and test-1.

Question Paper

1. Let V be an inner product space and let $u, v \in V$ such that $\|u\| = 3,\ \|u+v\| = 4,\ \|u-v\| = 6$. Then $\|v\| = ----------$.

2. Let $P_2(R)$ be an inner product space of all polynomials of degree ≤ 2 with an inner product given by $< p, q >= \int_{-1}^{1} p(t)q(t)dt$. Then the orthonormal basis for $P_2(R)$ corresponding to the linearly independent set $\{1, x, x^2\}$ is $------------$.

3. Let $V_2(C)$ be an inner product space with the standard inner product and $T : V_2(C) \to V_2(C)$ be the linear map given $T(1, 0) = (1 + i, 2),\ T(0, 1) = (i, i)$. Then for all $(x, y) \in V_2(C),\ T^*(x, y) = ---------$ and T is normal(True/ False)$= ---------$

4. Let $R^3(R)$ be an inner product space with the standard inner product and $T : R^3(R) \to R^3(R)$ be the linear map given $T(a, b, c) = (b + c, -a + 2b + c, a - 3b - 2c),\ (a, b, c) \in R^3$. Is T a self-adjoint operator (YES/NO)$= -----$

5. Let $V_3(R)$ be an inner product space with standard inner product, and $W = span\{u = (2, -1, 6)\}$. Then the projections of $v = (4, 1, 2)$ on to the subspaces W and $W^{\perp}$, respectively, are $------$ and $----------$.