P.R. GOVERNMENT COLLEGE (A), KAKINADA
III B.Sc., MATHEMATICS – Semester V (w.e.f. 2018-19)
Paper VI : Linear algebra

Total Hrs. of Teaching Learning & Evaluation: 75 @ 6 h / Week Total Credits: 05

Objective:

- To improve the students ability of understanding the most application oriented topic in Mathematics that is Linear Algebra.
- To equip the skill of understanding the concepts and writing the proofs of the Theorems.

Unit - I: Vector Spaces – I (12 Hrs)

Vector spaces, General properties of vector spaces, n-dimensional vectors, Addition and scalar multiplication of vectors, Internal and external composition, Null Space, Vector Subspaces, Algebra of subspaces, Linear sum of two subspaces, Linear combination of vectors, Linear span, Linear dependence and linear independence of Vectors.

Unit - II: Vector spaces – II (12 Hrs)

Basis of vector space, Finite dimensional vector space, Basis extension, Co-ordinates, Dimension of vector space, Dimension of subspace, Quotient space and Dimension of Quotient space.

Unit - III: Linear transformations (12 Hrs)

Linear transformations, Linear operators, Properties of linear transformation, Sum and product of linear transformations, Algebra of Linear Operators, Range space and Null Space of LT, Rank and Nullity of a LT, Rank & Nullity theorem.

Unit - IV: Matrix (12 Hrs)

Linear Equations, Characteristic Values and Characteristic Vectors of square matrix – Cayley - Hamilton Theorem.

Unit - V: Inner Product Space (12 Hrs)

Inner Product spaces, Euclidean and Unitary spaces, Norm or length of a vector, Schwartz's inequality, Triangle Inequality, Parallelogram law, Orthogonality and orthonormal set, Complete orthonormal set, Gram-Schmidt Orthogonalisation Process, Bessel's inequlity and Parsvel's identity.

Co-Curricular: Assignment, Seminar, Quiz, etc. **(15 Hrs)**

Additional Inputs: Diagonalization of a matrix.

Prescribed Text Books:

J.N. Sharma & A.R.Vasista, Linear Agebra, Krishna Prakasham Mandir, Meerut.

Books for Reference:

9 III year Mathematics Linear Algebra and Vector Calculus, Telugu Academy.

10 A Text Book of B.Sc. Mathematics, Vol-III, S. Chand & Co.

BLUE PRINT FOR QUESTION PAPER PATTERN
SEMESTER-V, PAPER VI

Unit	TOPIC	V.S.A.Q	S.A.Q (including choice)	E.Q (including choice)	Marks Allotted
I	Vector spaces - I	01	01	02	22
II	Vector spaces - II	01	01	02	22
III	Linear Transformation	01	01	01	14
IV	Char. values and char. vectors	01	01	01	14
V	Inner product spaces	01	01	02	22
Total		05	05	08	94

V.S.A.Q. = Very Short answer questions (1 mark)
S.A.Q. = Short answer questions (5 marks)
E.Q . = Essay questions (8 marks)

Very Short answer questions : 5 x 1 M = 05
Short answer questions : 3 x 5 M = 15
Essay questions : 5 x 8 M = 40

Total Marks : = 60

P. R. Government College (A), Kakinada
III year B.Sc. Degree Examinations, – V Semester
Mathematics Course: Linear Algebra
Paper-VI (Model Paper w.e.f. 2019-20)

Time: 2 Hrs 30 Min **Max. Marks: 60 M**

PART – I

Answer ALL the following questions. Each question carries 1 mark. **5 x 1 = 5 M**

1. Define linear combination of vectors.
2. Write the standard basis of $V_2(R)$.
3. Find the null space of the transformation $T: R^2 \to R^3$ defined by $T(x, y) = (x + y, x - y, y)$.
4. Find the Eigen values of the matrix $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$
5. Write Bessel's inequality.

PART –II

Answer any THREE of the following questions. Each question carries 5 marks.

3 x 5 = 15 M

6. Determine whether the set of vector {(1, -2, 1), (2, 1, -1), (7, -4, 1)} is linearly dependent or Linearly independent.
7. If W is a subspace of a finite dimensional vector space $V(F)$ then prove that W is also finite dimensional and $\dim W \leq \dim V$.
8. Find T(x, y, z) where T: $R^3 \to R$ is defined by T(1,1,1)=3, T(0,1,-2)=1, T(0,0,1)= -2.
9. Solve the following system of linear equations
   $2x - 3y + z = 0,\ x + 2y - 3z = 0,\ 4x - y - 2z = 0.$
10. State and prove Parsevel's identity.

PART –III

Answer any FIVE questions from the following by choosing at least TWO from each section. Each question carries 8 marks. **5 X 8 = 40 M**

SECTION – A

11 Prove that a non empty subset W of a vector space $V(F)$ is a subspace of V if and only if $a, b \in F, \alpha, \beta \in W \Rightarrow a\alpha + b\beta \in W$.

12 Let V(F) be a vector space and S = $\{ \alpha_1, \alpha_2, \ldots \alpha_n \}$ is a finite subset of non-zero vectors of V(F). Then S is linearly dependent if and only if some vector $\alpha_k \in$ S, $2 \leq k \leq n$, can be expressed as a linear combination of its preceding vectors.

13 Show that the set of vectors { (2, 1, 4), (1, -1, 2), (3, 1, -2)} form a basis for R^3.

14 Let W be a sub space of a finite dimensional vector space V(F), then prove that dim V/W = dimV – dimW.

SECTION – B

15 State and prove rank and nullity theorem.

16 Discuss for all values of λ, the system of equations $x + y + 4z = 6, x + 2y - 2z = 6, \lambda x + y + z = 6$ as regards existence and nature of solutions.

17. State and prove Cauchy-Schwarz's inequality.

18. Applying Gram-Schmidt process, obtain an orthonormal basis of $R^3(R)$ from the basis {(2, 0, 1), (3, -1, 5), (0, 4, 2) }.

11.

12.