# B.A./B.Sc. THIRD YEAR MATHEMATICS SYLLABUS
## SEMESTER – V, PAPER -5
## RING THEORY & VECTOR CALCULUS

**60 Hrs**

***UNIT – 1 (12 hrs) RINGS-I : -***

Definition of Ring and basic properties, Boolean Rings, divisors of zero and cancellation laws Rings, Integral Domains, Division Ring and Fields, The characteristic of a ring - The characteristic of an Integral Domain, The characteristic of a Field.

***UNIT – 2 (12 hrs) RINGS-II : -***

Ideals, Definition of Homomorphism – Homorphic Image – Elementary Properties of Homomorphism –Kernel of a Homomorphism – Fundamental theorem of Homomorhphism.

***UNIT –3 (12 hrs) VECTOR DIFFERENTIATION : -***

Vector Differentiation, Ordinary derivatives of vectors, Differentiability, Gradient, Divergence, Curl operators, Formulae Involving these operators.

***UNIT – 4 (12 hrs) VECTOR INTEGRATION : -***

Line Integral, Surface Integral, Volume integral with examples.

***UNIT – 5 (12 hrs) VECTOR INTEGRATION APPLICATIONS : -***

Theorems of Gauss and Stokes, Green's theorem in plane and applications of these theorems.

***Prescribed Book :-***

1.A text Book of B.Sc., Mathematics by B.V.S.S.Sarma and others, published by S. Chand & Company Pvt. Ltd., New Delhi.

***Reference Books :-***


1. Abstract Algebra by J. Fralieh, Published by Narosa Publishing house.
2. Vector Calculus by Santhi Narayana, Published by S. Chand & Company Pvt. Ltd., New Delhi.
3. A Text book of Mathematics,Vol-III, Deepthi Publications.
4. Vector Calculus by R. Gupta, Published by Laxmi Publications.
5. Vector Calculus by P.C. Matthews, Published by Springer Verlag publicattions.
6. Rings and Linear Algebra by Pundir & Pundir, Published by Pragathi Prakashan.


***Suggested Activities***:

Seminar/ Quiz/ Assignments/ Project on Ring theory and its applications

# B.A./B.Sc. THIRD YEAR MATHEMATICS SYLLABUS
## SEMESTER – V, PAPER -6
## LINEAR ALGEBRA

**60 Hrs**

***UNIT – I (12 hrs) : Vector Spaces-I :***

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 combination of Vectors, Linear span Linear independence and Linear dependence of Vectors.

***UNIT –II (12 hrs) : Vector Spaces-II :***

Basis of Vector space, Finite dimensional Vector spaces, basis extension, co-ordinates, Dimension of a Vector space, Dimension of a subspace.

***UNIT –III (12 hrs) : Linear Transformations :***

Linear transformations, linear operators, Properties of L.T, sum and product of LTs, Algebra of Linear Operators, Range and null space of linear transformation, Rank and Nullity of linear transformations – Rank – Nullity Theorem.

***UNIT –IV (12 hrs) : Matrix :***

Matrices, Elementary Properties of Matrices, Inverse Matrices, Rank of Matrix, Linear Equations, Characteristic Roots, Characteristic Values & Vectors of square Matrix, Cayley – Hamilton Theorem.

***UNIT –V (12 hrs) : Inner product space :***

Inner product spaces, Euclidean and unitary spaces, Norm or length of a Vector, Schwartz inequality, Triangle in Inequality, Parallelogram law, Orthogonality, Orthonormal set, complete orthonormal set.

***Prescribed Books :***

1.A text Book of B.Sc., Mathematics by B.V.S.S.Sarma and others, published by S. Chand & Company Pvt. Ltd., New Delhi.

***Reference Books :***

1. Linear Algebra by J.N. Sharma and A.R. Vasista, published by Krishna Prakashan Mandir, Meerut- 250002.
2. Matrices by Shanti Narayana, published by S.Chand Publications.
3. Linear Algebra by Kenneth Hoffman and Ray Kunze, published by Pearson Education (low priced edition), New Delhi.
4. Linear Algebra by Stephen H. Friedberg et al published by Prentice Hall of India Pvt. Ltd. 4th Edition 2007.

***Suggested Activities***:

Seminar/ Quiz/ Assignments/ Project on "Applications of Linear algebra Through Computer Sciences"

**S.V.UNIVERSITY MODEL PAPER**

**III B.Sc , V Semester Examinations**

**PART – II, MATHEMATICS Paper – V**

**(Ring Theory and Vector Calculus)**

**me : 3 hrs** **Max marks : 75**

## SECTION I

**Answer any FIVE questions. Each question carries 5 marks.** **5 X 5= 25**

1. **Define zero divisors in a ring and give an example.**

2. **Prove that every field is an integral domain.**

3. **If f: R→ R' is a homomorphism of a ring R into the ring R' and, 0 and 0' are the zero elements in R and R' respectively then prove that f(0)=0'.**

4. **If f is a homomorphism ring R into a ring R' then prove that Ker *f* is an ideal of R.**

5. **If $\vec{A} = 5t^2\,\bar{\imath} + t\bar{\jmath} - t^3\bar{k}$ and $\vec{B} = \sin t\,\bar{\imath} - \cos t\,\bar{\jmath}$ then find $\frac{d}{dt}\,\vec{A}\,X\,\vec{B}$**

6. **If a = x+y+z, b= $x^2+y^2+z^2$ and c = xy + yz+ zx prove that [grad a, grad b, grad c] = 0**

7. **Evaluate $\int_c \bar{F}.d\bar{r}$ where $\bar{F} = xy\,\bar{\imath} + yz\,\bar{\jmath} + zx\,\bar{k}$ and curve c is $\bar{r} = t\,\bar{\imath} + t^2\,\bar{\jmath} + t^3\bar{k}$ , t varying from -1 to 1.**

8. **State Gauss divergence theorem .**

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## SECTION II

**Answer any FIVE questions. Each question carries 10 marks.** **5 X 10 = 50**

**9a. Prove that every finite integral domain is field.**

**OR**

**b. Prove that characteristic of a Boolean ring is 2.**

**10a. Prove that intersection of two ideals in a ring is an ideal.**

**OR**

**b. State and prove Fundamental theorem of homomorphism on rings.**

**11a. If** $\bar{r} = a\cos t\,\bar{\imath} + a\sin t\,j + at\tan\theta\ \bar{k}$, **find** $\left|\frac{d}{dt}\bar{r}\ X\frac{d^2}{dt^2}\bar{r}\right|$ **and** $\left[\frac{d}{dt}\bar{r}\ \ \frac{d^2}{dt^2}\bar{r}\ \ \frac{d^3}{dt^3}\bar{r}\right]$.

**OR**

**b. Find the directional derivative of the function** $f=x^2-y^2+2z^2$ **at the point P(1,2,3) in the direction of the line PQ where Q=(5,0,4).**

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**12a.** If $\bar{F} = x^2y^2\,\bar{\imath} + y\bar{\jmath}$ then evaluate $\int_C \bar{F}\,.\,d\bar{r}$ where C is the curve $y^2 = 4x$ in XY-plane from(0,0)to (4,4).

**OR**

**b.** If $\bar{F} = 2y\,\bar{\imath} - 3\bar{\jmath} - x^2\bar{k}$ and S is the surface $y^2 = 8x$ in the first octant bounded by the planes $y = 4$ and $z = 6$, evaluate $\int_S \bar{F}\,.\bar{N}\,dS$.

**13a.** State and prove Stokes theorem.

**OR**

**b.** Verify Green's theorem in the plane for $\int_c (3x^2-8y^2)\,dx+(4y-6xy)\,dy$ where C is the closed curve bounded by $y=\sqrt{x}$ and $y= x^2$.

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**S.V.UNIVERSITY MODEL PAPER**

**III B.Sc , V Semester Examinations**

**PART – II, MATHEMATICS Paper – VI**

**(Linear Algebra)**

**me : 3 hrs** **Max marks : 75**

## SECTION I

**Answer any FIVE questions. Each question carries 5 marks.** **5 X 5= 25**

1. **Let R be a field of real numbers and W = {(x,y,z) / x,y,z ϵR} .Is W a sub-space of $V_3(R)$.**

2. **$W_1$ and $W_2$ are two sub spaces of finite dimensional vector space V(F) then prove that $W_1 \cap W_2$ is a vector space .**

3. **Define basis and dimension of a vector space.**

4. **Prove that every non empty subset of a linearly independent set of vectors is a linearly independent.**

5. **Find the rank of the matrix $\begin{bmatrix} 1 & 2 & 3 & 0 \\ 2 & 4 & 3 & 2 \\ 3 & 2 & 1 & 3 \\ 6 & 8 & 7 & 5 \end{bmatrix}$ by reducing into echelon form.**

6. **Define characteristic vector and characteristic value of a matrix.**

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7. **Define inner product space and give an example.**

8. **In the inner product space $R^3$ find the $\|\alpha\|$ and unit vector of $\alpha$ where $\alpha = (1,2,3)$.**

## SECTION II

**Answer any FIVE questions. Each question carries 10 marks.** **5 X 10 = 50**

**9a. Prove the necessary and sufficient condition for the sub-set W of V to be a sub-space of V is $\forall a, b \in F, \alpha, \beta \epsilon V \implies a\alpha + b\beta \epsilon W$.**

**OR**

**b. Verify whether the vectors (1,3,2), (1,-7,-8),(2,1,-1) of $V_3(R)$ are linearly independent or dependent.**

**10a. Prove that in a finite dimensional vector space any two bases will have same number of elements.**

**OR**

**b. Verify whether the set S = {(1,0,0),(1,1,0),(1,1,1)} is a basis of $R^3(R)$ or not.**

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**11a. State and prove Rank –Nullity theorem .**

**OR**

**b. Let T: $V_2 \rightarrow V_3$ be defined by T(x,y) = (x+y,2x-y,7y). Find $[T:B_1,B_2]$ where $B_1$, $B_2$ are standard basis of $V_2$ and $V_3$.**

**12a. Find the Eigen Values and Eigen vectors of the matrix** $A = \begin{bmatrix} 3 & 1 & 1 \\ 2 & 4 & 2 \\ 1 & 1 & 3 \end{bmatrix}$

**OR**

**b. State and prove Cayley- Hamilton theorem.**

**13a. State and prove Cauchy Schwarz inequality.**

**OR**

**b. In an inner product space , any orthogonal set of non zero vectors is linearly independent**

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