A.G& S.G.SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE

VUYYURU-521165, KRISHNA Dt., A.P.(Autonomous)

Accredited by NAAC with "A" Grade

2022-2023

DEPARTMENT OF MATHEMATICS

MINUTES OF BOARD OF STUDIES

EVEN SEMESTER

19-04-2023

Minutes of the meeting of BOS in Mathematics for B. Sc Degree Courses of AG & SG Siddhartha Degree College of Arts & Science, Vuyyuru, held at 2.30 PM on 19 – 04 – 2023 through online mode.

N.V. Srinivasa Rao   *Presiding*

Members Present:

1) *(signature)* (N.V. Srinivasa Rao)	Chairman		Head, Department of Mathematics, AG & SG S Degree College.
2) (Dr. K. Jaya Lakshmi)	University Nominee		Department of Mathematics, Krishna University, Machilipatnam.
3) (M. Venkateswara Rao)	Subject Expert		Department of Mathematics, Govt. Degree College, Avanigadda.
4) (I. V. Venkateswara Rao)	Subject Expert		Department of Mathematics, P. B. Siddhartha College, Vijayawada
5) *(signature)* (D. Sunitha)	Member		Lecturer in Mathematics AG & SG S Degree College.
6) *(signature)* (A. Bhargavi)	Member		Lecturer in Mathematics AG & SG S Degree College.
7) *(signature)* (Noor Mohammad)	Member		Lecturer in Mathematics AG & SG S Degree College.
8) *(signature)* (K. Rajya Lakshmi)	Member		Lecturer in Mathematics AG & SG S Degree College.
9) *(signature)* (G . Jahanvi)	Student Member		III B.Sc M.P.Cs AG & SG S Degree College.
10) *(signature)* (N. Pavan Sai Kumar)	Student Member		III B.Sc M.P.C (E) AG & SG S Degree College.

Agenda of B.O.S Meeting:

1. To discuss and recommend the Syllabi, Model Question Papers and Guidelines to be followed by question paper setters in Mathematics for 2nd Semester as per the guidelines and instructions prescribed APSCHE and Krishna University from the Academic Year 2022-23.

2. To discuss and recommend the Syllabi, Model Question Papers and Guidelines to be followed by question paper setters in Mathematics for 4th Semester as per the guidelines and instructions prescribed APSCHE and Krishna University from the Academic Year 2022-23.

3. To discuss and recommend the Syllabi, Model Question Papers and Guidelines to be followed by question paper setters in Mathematics for 5th/ 6th Semester as per the guidelines and instructions prescribed APSCHE and Krishna University from the Academic Year 2022-23.

4. Any other matter.

Resolutions.

1. Discussed and recommended that no changes are required in Syllabi. Changes are required in Model Question Papers and Guidelines to be followed by the question paper setters in Mathematics for 2nd Semesters from the Academic year 2022-23. The maximum marks for IA is 30 and SE is 70. Each IA written examination is of 1 Hr. 30 min duration for 20 marks. The tests will be conducted centrally. The average of two such IA is calculated for 20 marks. 5 marks will be allotted for attendance and 5 marks are allotted for Assignment/ Activity. There is no minimum passing for IA and there is no provision for improvement in IA. Even though the candidate is absent for two IA exams/obtain zero marks the external marks are considered (if he/ she gets 40 out of 70) and the result shall be declared as 'PASS' from the Academic year 2022-23.

2. Discussed and recommended that changes are required in Syllabi, Model Question Papers and Guidelines to be followed by the question paper setters in Mathematics for 4th Semesters from the Academic year 2022-23. The maximum marks for IA is 25 and SE is 75. Each IA written examination is of 1 Hr. duration for 15 marks. The tests will be conducted centrally. The average of two such IA is calculated for 15 marks. 5 marks will be allotted basing on Assignment and 5 marks are allotted for activity. There is no minimum passing for IA and there is no provision for improvement in IA. Even though the candidate is absent for two IA exams/obtain zero marks the external marks are considered (if he/ she gets 40 out of 75) and the result shall be declared as 'PASS' from the Academic year 2022-23.

3. Discussed and recommended that changes are required in syllabi, Model Question Papers and Guidelines for question paper setters in Mathematics for the 5th/ 6th Semester for the Academic year 2022-23.

4. Discussed and recommended for organizing seminars, Guest lecturers, Online Examinations and Workshops to upgrade the knowledge of students for Competitive Examinations for the approval of the Academic Council.

N.V.
Chairman

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Title of the Paper: REAL ANALYSIS   **Semester: II**

Course Code	**MAT T21B**	Course Delivery Method	Class Room / Blended Mode - Both
Credits	5	CIA Marks	25
No. of Lecture Hours / Week	6	Semester End Exam Marks	75
Total Number of Lecture Hours	75	Total Marks	100
Year of Introduction :2021-22	Year of Offering: 2021 - 22	Year of Revision: ----	Percentage of Revision: 0%

Course Outcomes:

After successful completion of this course, the student will be able to

1. Get clear idea about the real numbers and real valued functions.
2. Obtain the skills of analyzing the concepts and applying appropriate methods
   fortesting convergence of a sequence/ series.
3. Test the continuity and differentiability and Riemann integration of a function.
4. Know the geometrical interpretation of mean value theorems.

Course Syllabus:

UNIT – I (12 Hours) REAL NUMBERS:

The algebraic and order properties of R, Absolute value and Real line, Completeness property of R, Applications of supremum property; intervals. (No question is to be set from this portion).

Real Sequences:

Sequences and their limits, Range and Boundedness of Sequences, Limit of a sequence and Convergent sequence. The Cauchy's criterion, properly divergent sequences, Monotone sequences, Necessary and Sufficient condition for Convergence of Monotone Sequence, Limit Point of Sequence, Subsequences and the Bolzano-weierstrass theorem – Cauchy Sequences – Cauchy's general principle of convergence theorem.

UNIT –II (12 Hours) INFINITIE SERIES:

Series: Introduction to series, convergence of series. Cauchy's general principle of convergence for series tests for convergence of series, Series of Non-Negative Terms.

1. P-test
2. Cauchy's n^{th} root test or Root Test.
3. D'-Alembert's Test or Ratio Test.
4. Alternating Series – Leibnitz Test.

Absolute convergence and conditional convergence.

UNIT – III (12 Hours) CONTINUITY :

     Limits : Real valued Functions, Bounded ness of a function, Limits of functions. Some extensions of the limit concept, Infinite Limits. Limits at infinity. (No question is to be set from this portion).

Continuous functions: Continuous functions, Combinations of continuous functions, Continuous Functions on intervals, uniform continuity.

UNIT – IV (12 Hours) DIFFERENTIATION AND MEAN VALUE THEORMS:

     The derivability of a function, on an interval, at a point, Derivability and continuity of a function, Graphical meaning of the Derivative, Mean value Theorems; Rolle's Theorem, Lagrange's Theorem, Cauchy's Mean value Theorem

UNIT – V (12 Hours) RIEMANN INTEGRATION :

Riemann Integral, Riemann integral functions, Darboux theorem. Necessary and sufficient condition for R – integrability, Properties of integrable functions, Fundamental theorem of integral calculus, integral as the limit of a sum, Mean value Theorems.

Co-Curricular Activities(15 Hours)

Seminar/ Quiz/ Assignments/ Real Analysis and its applications / Problem Solving.

Text Book:

Introduction to Real Analysis by Robert G.Bartle and Donlad R. Sherbert, published by John Wiley.
Reference 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.

2. Elements of Real Analysis as per UGC Syllabus by Shanthi Narayan and Dr. M.D. Raisinghania, published by S. Chand & Company Pvt. Ltd., New Delhi.

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SEMESTER – II , REAL ANALYSIS

B.Sc MATHEMATICS MODEL PAPER

Time: 3Hrs   **Max.Marks:75M**

SECTION - A

Answer any <u>FIVE</u> questions. Each question carries <u>FIVE</u> marks.   5x5 = 25M

1.
2.
3.
4.
5.
6.
7.
8.

SECTION - B

Answer <u>ALL</u> the questions. Each question carries <u>TEN</u> marks.   5 X 10 M = 50 M

9. a)   OR   b)
10. a)   OR   b)
11. a)   OR   b)
12. a)   OR   b)
13. a)   OR   b)

BLUE PRINT FOR QUESTION PAPER PATTERN COURSE-IV, REAL ANALYSIS

Unit	TOPIC	S.A.Q	E.Q	Total Marks
I	Real Number System and Real Sequence	1	2	25
II	Infinite Series	1	2	25
III	Limits and Continuity	2	2	30
IV	Differentiation and Mean Value Theorem	2	2	30
V	Riemann Integration	2	2	30
	TOTAL	8	10	140

S.A.Q.   = Short answer questions   (5 marks)

E.Q.   = Essay questions   (10 marks)

Short answer questions : 5 X 5 M   = 25 M

Essay questions : 5 X 10 M = 50 M

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Total Marks = 75 .

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Department of Mathematics
COURSE STRUCTURE

Sem	Course Code	Paper	Title of the Paper	Total Marks	Internal Exam	Sem.End Exam	Teaching Hours	Credits
IV	MATT 01A	CORE	SOLID GEOMETRY	100	25	75	6	5

Programme Outcomes

S. No	P.O
	At the end of the Programme the student will be able to:
1	Demonstrate the ability to use mathematical skills such as formulating and tackling mathematics related problems and identifying and applying approximate physical principles and methodologies to solve a wide range of problems associated with mathematics.
2	Apply the underlying unifying structures of mathematics and the relationships among them.
3	Investigate and apply mathematical problems and solutions in variety of contexts related to science and technology, business and industry.

Course Outcomes of MATT01A

S. No	C.O Upon successful completion of this course, students should have the knowledge and skills to:	Mapping
1	Understand the basic concepts of plane to find the length of perpendicular from a given point to given plane, bisectors of angles between two planes, angle between the pair of planes.	L2, PO-1
2	Determine the equation of a line in various forms & image of a given point w.r.t. a line and plane.	L3, PO - 1
3	Compute the equations of the hallow spheres through the given points, plane section of a sphere.	L3, PO - 1
4	Determine orthogonal spheres, coaxial system of spheres. The equation of cone, vertex of a cone ,General equation of second degree should represent a cone.	L3, PO-1
5	Calculate the equation of enveloping cone, reciprocal cone, right circular cone and intersection of two cones with a common vertex.	L3, PO-1

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MATHEMATICS	MATT01A	2022-23 onwards	B.Sc (MPC,MPCS, MSCs, MCCS)

SOLID GEOMETRY

SEMESTER-IV   No of Credits: 5

OBJECTIVE: TO ENHANCE DATA ANALYTICAL SKILLS AND LOGICAL THINKING SKILLS TO THE STUDENTS.

UNIT-I: The Plane   (18Hrs)

1.1   Equation of plane in terms of its interception the axis, Equations of the plane through the given points

1.2   Length of the perpendicular from a given point to a given plane, Bisectors of angles between two planes

1.3   Plane passing through the intersection of two given planes, Orthogonal projection on a plane

1.4   Joint equation of a pair of planes, Angle between the pair of planes, Angle between the pair of parallel planes.

UNIT-I: The Line   (18Hrs)

2.1   Equation of a line in symmetric form and parametric form; Angle between a line and a plane

2.2   The condition that a given line may lie in a given plane, The condition that two given lines are coplanar

2.3   Number of arbitrary constants or parameters in the equations of straight line

2.4   Length of the perpendicular from a given point to a given line.

2.5   The shortest distance between two lines, The length and equations of the line of shortest distance between two straight lines.

UNIT-III: Sphere: (18Hrs)

3.1   Definition and equation of the sphere; Equation of the sphere through given points

3.2   Plane sections of a sphere, Great Circle, Small Circle

3.3   Intersection of sphere and a line.

3.4   Conditions for a plane to intersect a sphere

3.5   Equation of a Sphere through a given circle

3.6   Intersection of a sphere and a line; tangent plane touching spheres, Power of a point;

3.7   Plane of contact; Polar plane; Pole of a Plane; Conjugate points; Conjugate planes; Conjugate lines or polar lines, Angle of intersection of two spheres; Conditions for two Spheres to be orthogonal;

3.8   Radical plane; Radical line, Radical Centre, Coaxial system of spheres; Limiting points.

UNIT-IV: Cones   **(18Hrs)**

4.1   Definition of a cone, Vertex, guiding curve, generators, Equation of the cone with a given Vertex and guiding curve

4.2   Condition that the general equation of the second degree should represent a cone

4.3   Enveloping cone of a surface, Equations of cones with vertex at origin

4.4   Condition that a cone may have three mutually perpendicular generators, Intersection of a line with a cone

4.5   Tangent lines and tangent plane at a point, Condition that a plane may touch a cone

4.6   Reciprocal cones, Intersection of two cones with a common vertex

4.7   Right circular cone, Equation of the right circular cone with a given vertex, Axis and semi-vertical angle.

UNIT-V: Cylinders: **(18Hrs)**

5.1   Definition of a cylinder, Equation to the cylinder whose generators intersect a given Conic and are parallel to a given line

5.2   Enveloping cylinder of a sphere

5.3   The right circular cylinder

5.4   Condition for tangents, Director Sphere.

Student Activities:

4) **Class-room activities:** Power point presentations, Assignments

5) **Library activities:** Visit to library and preparation of notes for Assignment problems.

6) **Activities in the Seminars, workshops and conferences:** Participation/presentation in seminar/workshop/conference.

CO-CURRICULAR ACTIVITES:

•   Quiz Competitions, Seminars
•   Group Discussions

WEB LINKS:

https://www.whitman.edu/mathematics/calculus online/sectionl 2.05.html
https://en.wikipedia.org/wiki/Sphere

Prescribed Text book:

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHER	YEAROF PUBLICATION
1	V. Krishna Murthy	A text book of mathematics for B.A/B.ScVol-1	S-Chand	2015

Reference books:

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Dr. A. Anjaneyulu	A text book of mathematics for B.A/B.ScVol-1	Deepthi Publications	2015
2	Shanti Narayan and P.K. Mittal	Analytical Solid Geometry	S.Chand& Company Ltd.	2010
3	Dr.C Govardhan	A text book of mathematics for B.A/B.ScVol-1	Telugu Academy	2009

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SEMESTER – IV

Model Paper

COURSE CODE : **MAT T01A**

TITLE OF THE PAPER : **SOLID GEOMETRY**

Time: 3hrs. **Max. Marks: 75**

Section-A

Answer any FIVE questions **(5x5=25 Marks)**

1. Find the equation of the plane through (4, 4, 0) and perpendicular to the planes x+2y+2z and 3x+3y+2z-8=0. (CO l, L2)

2. Find the angle between the planes 2x-3y-6z =6 and 6x+3y-2z=18. (CO l, L2)

3. Find the image of the point (2,-1,3) in the plane 3x-2y+z=9 (CO2, L3)

4. Find the equation to the sphere through 0=(0,0,0) and making intercepts a, b, c on the axes. (CO3, L3)

5. Find the equations of the spheres passing through the circle $x^2 + y^2 = 4$, z=0 and is intersected by the plane x+2y+2z=0 in a circle of radius 3. (CO3, L3)

6. Find the equation of the cone whose vertex is (1, 1, 0) and whose guiding curve is y=0, $x^2 + z^2 = 4$ (CO4, L3)

7. Find the equation to the cone which passes through the three coordinate axes and the lines (CO4, L3) $-\ \overline{\ \ }\ -$ and $-\ -\ -$

8. Find the equation of the cylinder whose generators are parallel to and which $-$

Passes through the curve $x^2 + y^2$=16, z=0 (COS, L3)

Section-B

Answer ALL questions. **(5 x 10 = 50 Marks)**

9(a). Prove that the equation $2x^2 - 6y^2 - 12z^2 + 18yz + 2zx + xy = 0$ represents a pair of planes, and find the angle between them. (COl, L2)

(OR)

9(b). Find the bisecting plane of the acute angle between the planes 3x-2y+6z+2 =0, 2x-y+2z+2=0 (COl, L2)

I0(a). Find the image of the line $\underline{\quad}\quad \overline{\quad}\quad \underline{\quad}$ in the plane x+y+z=l (CO2, L3)

OR)

I0(b). Find the length and equations to the line of S.D between the lines **(CO2, L3)**

$\overline{\quad}\quad \overline{\quad}\quad \overline{\quad}$ and $\overline{\quad}\quad \overline{\quad}\quad \overline{\quad}$

11(a). Show that the plane 2x-2y+z+12=0 touches the sphere $x^2 + y^2 + z^2 - 2x - 4y + 2z - 3 = 0$ and find the point of contact. (CO3, L3)

(OR)

11(b). Find the limiting points of the co-axial system of spheres of which two members are
$x^2 + y^2 + z^2 + 3x - 3y + 6 = 0$, $x^2 + y^2 + z^2 - 6y - 6z + 6 = 0$ (CO3, L3)

12(a). Find the vertex of the cone
$7x^2 + 2y^2 + 2z^2 - 10zx + 10xy + 26x - 2y + 2z - 17 = 0$ (CO4, L3)

(OR)

12(b). Find the equation to the right circular cone whose vertex is (1,-2,-1), axes the line
—— —— —— and semi vertical angle 60° (CO4, L3)

13(a). Find the equation to the right circular cylinder whose guiding circle is
$x^2 + y^2 + z^2 = 9$, x- y + z =3 (CO5, L3)

(OR)

13(b). Find the equation of the enveloping cylinder of the sphere $x^2 + y^2 + z^2 - 2x + 4y - 1 = 0$, having its generators parallel to the line x=y=z. (CO5, L3)

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DEPARTMENT OF MATHEMATICS

COURSE STRUCTURE

Semester	Course Code	Paper	Title of the paper	Total marks	Internal exam	Sem end exam	Teaching hours	credits
IV	MAT T41A	CORE	Linear Algebra	100	25	75	5	5

Programme Outcomes:

S.No	P. O
	At the end of the program the student will able to
1	Demonstrate the ability to use mathematical skills such as formulating and tackling mathematics related problems and identifying and applying approximate physical principles and methodologies to solve a wide range of problems associated with mathematics.
2	Apply the underlying unifying structures of mathematics and the relationships among them.
3	Investigate and apply mathematics problem and solutions in variety of contexts related to science and technology, business and industry.

Course Outcomes of MAT T41A

S. No	C.O	
	Upon successful completion of their course, students should have the knowledge and skills to	
1.	Knowledge in fundamental concepts of vector spaces.	L2, PO-1
2.	Ability to understand the basic concepts of Basis and Dimensions.	L2, PO-1
3.	Discuss the linear transformations, rank and nullity.	L2, PO-1
4.	Appreciation in the concept of matrices as a tool in solving system of linear equations and determining eigen values and eigen vectors.	L2, PO-1
5	Ability to understand the basis concepts of inner product spaces and to develop hypothetical ideas and laws to solve the related problems in the context.	L4, PO-1

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MATHEMATICS	MAT T41A	2022 – 23 Onwards	B.Sc.(MPC,MPCS,MCCs,MSCS)

LINEAR ALGEBRA

SEMESTER-IV **No of Credits: 5**

OBJECTIVE: TO ENHANCE THE ANALYTICAL SKILLS AND APPLICATION SKILLS.

UNIT I: Vector spaces (18hrs)

1.1 Vector space definition – general properties of Vector space.

1.2 subspace definition – theorems & related problems.

1.3 Linear sum of two subspaces, linear combination of vectors and linear span of a set –
theorems &related problems.

1.4 Linear dependence of vectors - theorems & related problems.

1.5 Linear independence of vectors - theorems & related problems.

UNIT II: Basis and Dimension (18hrs)

2.1 Basis of a vector space – definition, Basis existence, Basis extension, Basis Invariance,
theorems.

2.2 Coordinates – definition & related problems.

2.3 Dimension of a vector space, dimension of a subspace - theorems & related problems.

2.4 Quotient space, dimension of Quotient space - theorems.

UNIT III: Linear Transformation (18hrs)

3.1 Vector space homomorphism – definitions

3.2 Linear transformation, Properties of L.T., Determination of L.T. - theorems & related
problems.

3.3 Sum of linear transformations, scalar multiplication of L.T., product of linear
transformations, Algebra of linear operators - theorems & related problems.

3.4 Range & Null space of a L.T. – Definitions, theorems & related problems.

3.5 Rank nullity theorem - related problems.

UNIT IV: Matrices   (18hrs)

4.1 Fundamentals of Matrices.

4.2 Elementary matrix operations & elementary matrices.

4.3 Rank of a matrix – definition, related problems.

4.4 Echelon form of a matrix, reduction to normal form, PAQ form, Inverse of a matrix –
   related problems only.

4.5 System of linear equations – homogeneous & non homogeneous linear equations - related
   problems.

4.6 Eigen values & Eigen vectors of a matrix – definitions, theorems & related problems.

4.7 Cayley - Hamilton theorem, related problems.

UNIT V: Inner product spaces   (18hrs)

5.1 Inner product spaces – definition, Norm (or) Length of a vector - theorems & related
   problems.

5.2 Schwarz in equality, Triangle inequality, parallelogram law – theorems.

5.3 Orthogonality – orthogonal, orthonormal vectors, orthogonal set, orthonormal sets of
   I.P.S - theorems & related problems.

5.4 Gram- Schmid orthogonalization process, Bessel's Inequality and Parseval's Identity.

Prescribed Text book:

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	V. Venkateswara Rao, N. Krishna Murthy.	A text book of Mathematics for B.A/B.ScVol – III. (Pg No: 111-192; 232 – 321 & 339 – 389; 395 – 434).	S-Chand & Co.	2006

Reference Text books:

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	J.N. Sharma and A. R. Vasistha	Linear Algebra	Krishna PrakashanMandir Meerut-250002.	
2.	Dr. A. Anjaneyulu	A Text Book of Mathematics B.A/B.Sc – Vol III	Deepthi Publications	3rd Edition 2006 - 2007

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SEMESTER – IV   **Model Paper**

COURSE CODE   **: MAT T41A**   **Time: 3hrs.**
TITLE OF THE PAPER   **: LINEAR ALGEBRA**   **Max. Marks: 75**

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SECTION – A

Answer any FIVE of the following questions   **5X5=25M**

1. The set W of ordered triads (x, y, 0) where x, y ϵ F is a subspace of $V_3(F)$. (CO1, L2)

2. If two vectors are linearly dependent, prove that one of them is a scalar multiple of the

   other.   (CO1, L2)

3. Show that the set { (1,0,0), (1,1,0),(1,1,1) } is a basis of $C^3(C)$. Hence find the coordinates

   of the vector (3+4i, 6i, 3+7i) in $C^3(C)$.   (CO2,L4)

4. Describe explicitly the linear transformation T: $R^2 \rightarrow R^2$ such that T(2, 3) = (4, 5) and

   T(1, 0) = (0,0)   (CO3,L2)

5. Find the rank of the matrix $\begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$.   (CO4,L2)

6. Solve the system $2x_1 - x_2 + x_3 = 0$, $3x_1 + 2x_2 + x_3 = 0$, $x_1 - 3x_2 + 5x_3 = 0$.   (CO4,L2)

7. Show that zero is a characteristic root of a matrix if and only if the matrix is

   singular.   (CO4,L2)

8. State & prove the Triangle Inequality.   (CO5,L2)

SECTION -B

Answer the following questions.   **5X10=50M**

9a) If S, T are the subset of a vector space V (F), then prove that

   i) S $\subseteq$ T $\Rightarrow$ (i) L(S) $\subseteq$ L (T)

   ii) L (S U T) = L(S) + L(T).   (CO1,L2)

(OR)

9b). Let V (F) be a vector space and $S = \{ \alpha_1, \alpha_2, \alpha_3, \ldots \ldots \alpha_n \}$ is a finite subset of non-zero

vectors of V (F).Then S is linear 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.   (CO1, L2)

10a) State and prove Basis extension theorem.   (CO2, L2)

(OR)

10b) Let W be a subspace of a finite dimensional vector space V (F) then

dim V/W = dim V – dim W.   (CO2,L2)

11a) Find T (x, y, z) where $T : R^3 \rightarrow R$ is defined by T (1 , 1, 1) = 3; T(0, 1 ,-2) = 1;

T(0, 0, 1) = -2.   (CO3, L2)

(OR)

11b) State and prove Rank – nullity theorem.   (CO3, L4)

12a) Show that the only number λ for which the system $x + 2y + 3z = \lambda x$, $3x + y + 2z = \lambda y$,

$2x + 3y + z = \lambda z$ has non-zero solutions is 6.   (CO4,L2)

(OR)

12b) State and prove Cayley – Hamilton theorem.   (CO4,L2)

13a) State and prove Cauchy – Schwarz's Inequality.   (CO5,L4)

(OR)

13b) Given $\{(2,1,3), (1, 2, 3), (1, 1, 1)\}$ is a basis of R^3; Construct an orthonormal basis.

(CO5,L4)

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