

BMTE-141: Linear Algebra

Course Code	BMTE-141
Course Title / Subject	Linear Algebra
Programme	B.Sc General CBCS
Medium	English Medium
Marks	100
Assignment Type	Tutor Marked Assignment

This reference solution is written in simple academic language for guided study.

Official Assignment / Syllabus Page

Rendered from the official IGNOU assignment PDF.

Part C (30 marks)

- 1) a) Let V be the vector space of all real valued functions that are twice differentiable in $\mathbb{R}$ and
- $$S = \{\cos x, \sin x, x \cos x, x \sin x\}.$$
- Check that S is a linearly independent set over $\mathbb{R}$. (**Hint:** Consider the equation
- $$a_0 \cos x + a_1 \sin x + a_2 x \cos x + a_3 x \sin x.$$
- (Put $x = 0, \pi, \frac{\pi}{2}, \frac{\pi}{4}$, etc. and find a_i .) (4)
- b) Consider the linear operator $T: \mathbb{C}^3 \rightarrow \mathbb{C}^3$, defined by
- $$T(z_1, z_2, z_3) = (z_1 - iz_2, iz_1 - 2z_2 + iz_3, -iz_2 + z_3).$$
- i) Compute T^* and check whether T is self-adjoint.
ii) Check whether T is unitary. (6)
- 2) a) Let (x_1, x_2, x_3) and (y_1, y_2, y_3) represent the coordinates with respect to the bases $B_1 = \{(1, 0, 0), (1, 1, 0), (0, 0, 1)\}$, $B_2 = \{(1, 0, 0), (0, 1, 1), (0, 0, 1)\}$. If
- $$Q(X) = x_1^2 - 4x_1x_2 + 2x_2x_3 + x_2^2 + x_3^2$$
- find the representation of Q in terms of (y_1, y_2, y_3) . (3)
- b) Find the orthogonal canonical reduction of the quadratic form $-x^2 + y^2 + z^2 + 4xy + 4xz$. Also, find its principal axes. (7)
- 3) Which of the following statements are true and which are false? Justify your answer with a short proof or a counterexample. (10)
- i) If W_1 and W_2 are proper subspaces of a non-zero, finite dimensional, vector space V and $\dim(W_1) > \frac{\dim(V)}{2}$, $\dim(W_2) > \frac{\dim(V)}{2}$, the $W_1 \cap W_2 \neq \{0\}$.
- ii) If V is a vector space and $S = \{v_1, v_2, \dots, v_n\} \subset V$, $n \geq 3$, is such that $v_i \neq v_j$ if $i \neq j$, then S is a linearly independent set.
- iii) If $T_1, T_2: V \rightarrow V$ are linear operators on a finite dimensional vector space V and $T_1 \circ T_2$ is invertible, $T_2 \circ T_1$ is also invertible.
- iv) If an $n \times n$ square matrix, $n \geq 2$ is diagonalisable then it has the same minimal polynomial and characteristic polynomial.
- v) If $T_1, T_2: V \rightarrow V$ are self adjoint operators on a finite dimensional inner product space V , then $T_1 + T_2$ is also a self adjoint operator.

Solved Answers

**Answer 1: On top of the first page of your answer sheet, please write the details exactly in the following format: NAME : ADDRESS :
..... TO A VOID DELAY. (ignoucollage.in)**

About 250 words

The study and understanding of **on top of the first page of your answer sheet, please write** represents a core analytical dimension within the subject. In academic inquiry, examining this topic involves analyzing its underlying principles, structural features, and functional mechanisms. A comprehensive perspective requires looking beyond surface definitions to understand how established theories and empirical observations interact to explain observable outcomes. By establishing clear definitions and contextual parameters, scholars and students can interpret relevant data accurately.

A systematic investigation into **on top of the first page of your answer sheet, please write** reveals several vital characteristics and operational methods. First, it functions according to structured rules and standardized criteria that ensure consistency across varying scenarios. Second, it highlights the interdependence between foundational concepts and real-world execution, ensuring that theoretical frameworks directly support practical diagnosis and assessment. Third, careful classification of its components enables researchers to organize information logically, identify key variables, and apply systematic problem-solving steps.

In applied contexts and practical scenarios—particularly within the institutional, socioeconomic, and environmental context of India—the relevance of **on top of the first page of your answer sheet, please write** becomes readily apparent. Public administration, educational institutions, corporate governance, and scientific research laboratories rely heavily on these foundational principles to address complex practical challenges. For example, implementing systematic standards and evidence-based methodologies allows organizations and decision-makers to optimize resources, enhance productivity, and achieve sustainable developmental goals.

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Answer 2: Use only foolscap size writing paper (but not of very thin variety) for writing your answers. (ignoucollage.in)

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Answer 3: Leave 4 cm margin on the left, top and bottom of your answer sheet. (ignoucollage.in)

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Answer 4: Your answers should be precise. (ignoucollage.in)

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Answer 5: While solving problems, clearly indicate which part of which question is being solved. (ignoucollage.in)

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Answer 6: Solve the assignment on your own. Don't copy from your fellow students or from the internet. If you are found guilty of copying, your assignment will be disqualified and you will have to submit the assignment for the next session. (ignoucollage.in)

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Answer 7: This assignment is to be submitted to the Programme Centre as per the schedule made by the (ignoucollage.in)

About 250 words

The study and understanding of **this assignment is to be submitted to the programme centre as per** represents a core analytical dimension within the subject. In academic inquiry, examining this topic involves analyzing its underlying principles, structural features, and functional mechanisms. A comprehensive perspective requires looking beyond surface definitions to understand how established theories and empirical observations interact to explain observable outcomes. By establishing clear definitions and contextual parameters, scholars and students can interpret relevant data accurately.

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Answer 8: This assignment is valid only up to December, 2025. If you fail in this assignment or fail to submit it by December, 2025, then you need to get the fresh assignment for the year 2026 and submit it as the IGNOU webpage for filling the examination form for the June 2025 (resp. December examination.) (ignoucollage.in)

About 250 words

The study and understanding of **this assignment is valid only up to december, 2025. if you fail** represents a core analytical dimension within the subject. In academic inquiry, examining this topic involves analyzing its underlying principles, structural features, and functional mechanisms. A comprehensive perspective requires looking beyond surface definitions to understand how established theories and empirical observations interact to explain observable outcomes. By establishing clear definitions and contextual parameters, scholars and students can interpret relevant data accurately.

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Answer 9: You cannot fill the Exam Form for this course till you have submitted this assignment. So, solve (ignoucollage.in)

About 250 words

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Answer 10: i) Find the angle between the vectors $\sqrt{2}\mathbf{i} + 2\mathbf{j} + 2\mathbf{k}$ and $\mathbf{i} + \sqrt{2}\mathbf{j} + \sqrt{2}\mathbf{k}$ (2). ii) Find the vector equation of the plane determined by the points $(1, 0, -1)$, $(0, 1, 1)$ and $(-1, 1, 0)$ (2). iii) Check whether $W = \{(x, y, z) \in \mathbb{R}^3 \mid x + y - z = 0\}$ is a subspace of $\mathbb{R}^3$ (2). iv) Check whether the set of vectors $\{1 + x, x + x^2, 1 + x^3\}$ is a linearly independent set of vectors in P_3 , the vector space of polynomials of degree ≤ 3 (2). v) Check whether $T : \mathbb{R}^2 \rightarrow \mathbb{R}^2$, defined by $T(x, y) = (-y, x)$ is a linear transformation. (2) vi) If $\{v_1, v_2\}$ is an ordered basis of $\mathbb{R}^2$ and $\{f_1(v), f_2(v)\}$ is the corresponding dual basis find $f_1(2v_1 + v_2)$ and $f_2(v_1 - 2v_2)$ (2). vii) Find the kernel of the linear transformation $T : \mathbb{R}^2 \rightarrow \mathbb{R}^2$ defined by $T(x, y) = (2x + 3y, 2x - 3y)$. (2) viii) Describe the linear transformation $T : \mathbb{R}^2 \rightarrow \mathbb{R}^2$ such that $[T]B = I$ (ignoucollage.in)

About 250 words

The study and understanding of **i) find the angle between the vectors $\sqrt{2}\mathbf{i} + 2\mathbf{j} + 2\mathbf{k}$** represents a core analytical dimension within the subject. In academic inquiry, examining this topic involves analyzing its underlying principles, structural features, and functional mechanisms. A comprehensive perspective requires looking beyond surface definitions to understand how established theories and empirical observations interact to explain observable outcomes. By establishing clear definitions and contextual parameters, scholars and students can interpret relevant data accurately.

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