Assignment Booklet

BSCAEY Programme

B.Sc (Applied Sciences - Energy)

Second Semester	
BEY-002	Energy Resources
BEY-003	Fluid Mechanics
BEY-005	Energy Efficiency and Management
BEY-018	Linear Algebra and Calculus
BEY-020	Computer Basics and PC Software (4)

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SCHOOL OF ENGINEERING & TECHNOLOGY
INDIRA GANDHI NATIONAL OPEN UNIVERSITY
Maidan Garhi, New Delhi – 110 068

JANUARY 2026

Dear Student,

Please read the information on assignments in the Programme Guide that we have sent you after your enrolment. A weightage of 30%, as you are aware, has been earmarked for continuous evaluation, **which wouldconsist of one tutor-marked assignment** for this Programme. The assignment for BSCAEY (first semester) has been given in this booklet.

Instructions for Formatting Your Assignments

Before attempting the assignment, please read the following instructions carefully:

1) On top of the first page of your answer sheet, please write the details exactly in the following format:

ENROLLMENT NO :……………………………………………

NAME :……………………………………………

ADDRESS :……………………………………………

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……………………………………………

PROGRAMME CODE: ………………………..

COURSE CODE: ……………………………….

COURSE TITLE: ………………………………

STUDY CENTRE: ……………………..…….   DATE: ……………….………………...

PLEASE FOLLOW THE ABOVE FORMAT STRICTLY TO FACILITATE EVALUATION ANDTO AVOID DELAY.

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

3) Leave 4 cm margin on the left, top and bottom of your answer sheet.

4) Your answers should be precise.

5) These assignments submitted should be hand written in your own hand writing.

We strongly suggest that you should retain a copy of your answer sheets.

6) You cannot fill the Exam Form without submission of the assignments. So solve it and **submit it at the earliest.** If you wish to appear in the **TEE, June 2026,** you should submit your TMAs by **April 30, 2026.** Similarly, if you wish to appear in the **TEE, December 2026,** you should submit your TMAs by **September 30, 2026.**

7) Assignments will be submitted at **your respective regional centre.**

We wish you good luck!

Assignment -4

(To be done **after** studying the course material)

Course Code: BEY-018
Course Title: Linear Algebra and Calculus
Assignment Code: BEY-018/TMA/2026
Maximum Marks: 100

Last Date of Submission: May 31, 2026 (For June TEE), September 30, 2026 (For December TEE)

Note:

1. **All questions are compulsory. Marks for the questions are shown within the brackets on the right side.**

Q.1	a)	If A, B are symmetric matrices of the same order, then what will be the type of matrix (AB – BA)? Give reasons in support of your answer.	02
	b)	If the matrix A is both symmetric and skew-symmetric, then determine A.	02
	c)	If A is a square matrix, such that $A^2 = A$, then find $(I + A)^3 - 7A$.	02
	d)	If $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & -2 & 4 \end{bmatrix}; I = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}, A^{-1} = \frac{1}{6}(A^2 + aA + bI)$ Find a & b.	04
Q.2	a)	If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = \hat{j} - \hat{k}$, find vector $\vec{c}$ such that $\vec{a} \times \vec{c} = \vec{b}$ and $\vec{a} . \vec{c} = 3$.	05
	b)	Show that area of a parallelogram whose diagonals are given by $\vec{a}$ and $\vec{b}$ is $\frac{\lvert \vec{a} \times \vec{b} \rvert}{2}$. Also find the area of the parallelogram whose diagonals are $2\hat{i} - \hat{j} + \hat{k}$ and $\hat{i} + 3\hat{j} - \hat{k}$.	05
Q.3	a)	Find a vector of magnitude 6, which is perpendicular to both the vectors $2\hat{i} - \hat{j} + 2\hat{k}$ and $4\hat{i} - \hat{j} + 3\hat{k}$.	02
	b)	Find the angle between the vectors $2\hat{i} - \hat{j} + \hat{k}$ and $3\hat{i} + 4\hat{j} - \hat{k}$.	02
	c)	If $\vec{a} + \vec{b} + \vec{c} = 0$, show that $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a}$.	02
	d)	If A,B,C,D are the points with position vectors $\hat{i} + \hat{j} - \hat{k}$, $2\hat{i} - \hat{j} + 3\hat{k}$, $3\hat{i} - 2\hat{j} + \hat{k}$, respectively. Find the projection of $\overrightarrow{AB}$ along $\overrightarrow{CD}$.	02
	e)	Using vectors, find the area of the triangle ABC with vertices A(1,2,3), B(2, -1, 4) and C(4,5,-1).	02
Q.4	a)	Prove that $\begin{vmatrix} b+c & a & a \\ c & c+a & a \\ b & a & a+b \end{vmatrix} = 4abc$	05
	b)	Prove that $\begin{vmatrix} 1 & bc & bc(b+c) \\ 1 & ca & ca(c+a) \\ 1 & ab & ab(a+b) \end{vmatrix}$ is independent of a, b, c.	05
Q.5	a)	Show that the conical tent of given capacity will require the least amount of canvas if its height is $\sqrt{2}$ times its base radius.	02
	b)	An open storage bin with square base and vertical sides is to be constructed from a given amount of material. Determine its dimensions if its volume is to be maximum neglecting the thickness of material and waste in constructing it.	02

c) Find the height of a right cylinder with greatest lateral surface area that may be inscribed in a given sphere of radius R. 02

d) Given a point on the axis of the parabola $y^2 = 2px$ at a distance a from the vertex, find the abscissa of the point of the curve closest to it. 02

e) Can Rolle's theorem be applied to each of the following functions? Find 'c' in case it can be applied. 02

i. $f(x) = \sin^2 x$ on the interval $[0, \pi]$.

ii. $f(x) = x^2 + 4$ on $[-2, 2]$.

iii. $f(x) = \sin x + \cos x$ on $\left[0, \frac{\pi}{2}\right]$.

iv. $f(x) = x^3 - 2x$ on $[0, 1]$.

Q.6 a) Explain why Lagrange's mean value theorem is not applicable to the following functions in the respective intervals: $f(x) = 13x + 11, x \in [1,3]$. 03

b) Verify means valueS theorem for the function $f(x) = 4x^3 - 4x$ in the interval $[a,b]$, where $a=0$, and $b=3$. 03

c) Find 'c' of Cauchy's mean value theorem for the function $f(x) = 2.ln(x)$ and $g(x) = x^2 - 1$ in the interval $[2,3]$. 04

Q.7 Find the first order partial derivatives

a) $$z = \frac{p^2(r+1)}{t^3} + pre^{2p+3r+4t}$$ 03

b) $g(s,t,v) = t^2 \ln(s+2t) - \ln(3v)(s^3 + t^2 - 4v)$ 03

c) Find $\frac{\partial z}{\partial x}$ *and* $\frac{\partial z}{\partial y}$ for the function $x^2 \sin(y^3) + xe^{3z} - \cos(z^2) = 3y - 6z + 8$ 04

Q.8 a) Find the orthogonal trajectories of the family of circles $x^2 + (y-c)^2 = c^2$, where c is a parameter. 05

b) In a certain isolated population $p(t)$ the rate of population growth $\frac{dp}{dt}$ is equal to $p - \frac{k}{\epsilon}p^2$, where k and ε are both positive constants. If $p(0) = 1$, then find the limiting population as $t \rightarrow \infty$. 05

Q.9 a) Use the method of Laplace transforms to find the solution of the initial value problem $y'' + 9y = 6 \cos 3t, \quad y(0) = 2, \ y'(0) = 0$ 04

b) Determine the solution of the undamped (forced vibrations) system 06

$$m\ddot{u} + Ku = F_0 \cos wt, \qquad u(0) = 0, \dot{u}(0) = 1$$

When, $w \neq \sqrt{\frac{K}{m}}$.

Q.10 a) Reduce the equation 05

$$xy'' + y' + xy = 0, \quad x > 0$$

into Bessel's equation and hence write its general solution in terms of Bessel's functions.

b) Prove that 05

$$4J_n'' + 2J_n(x) = J_{n-2}(x) + J_{n+2}(x)$$