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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UNIVERSITY

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

JANUARY 2025

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 would consist 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 :…………………………………………

…………………………………………

…………………………………………

PROGRAMME CODE: ………………………..

COURSE CODE: ……………………………….

COURSE TITLE: ………………………………

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

PLEASE FOLLOW THE ABOVE FORMAT STRICTLY TO FACILITATE EVALUATION AND TO 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 2025,** you should submit your TMAs by **April 30, 2025.** Similarly, if you wish to appear in the **TEE, December 2025,** you should submit your TMAs by **September 30, 2025.**

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

We wish you good luck!

Note:

1. **All questions are compulsory.**

Q.1   What are natural gas reserves? Give a brief description about India's natural gas   10
reserves.

Q.2   Describe the classification of energy resources as per its nature, availability and   10
storing capacity.

Q.3   Explain the proximate analysis of coal in detail.   10

Q.4   Describe some of the properties of gasoline in detail.   10

Q.5   Enlist the various steps involved in the front end of nuclear fuel cycle and explain   10
them in detail.

Q.6   Describe in detail any two solar radiation measuring instruments.   10

Q.7   Explain in detail the first generation of solar cells.   10

Q.8   What is solar drying and its types? Explain with neat sketches wherever possible.   10

Q.9   Discuss, in detail the horizontal type of wind turbine along with its advantages   10
and disadvantages.

Q.10   Explain, in detail the process of anaerobic digestion with a neat sketch.   10

1.   **All questions are compulsory.**

Q.1   a)   A certain mass of a liquid has a volume of 5 m 3 and a weight of 39240. Find   05
             the specific weight, specific mass and specific gravity of the liquid.

       b)   The dynamic viscosity of an oil, used for lubrication between a shaft and   05
             sleeve is 6 poise. The shaft is of diameter 0.5m and rotates at 210 rpm.
             Calculate the power lost in the bearing for a sleeve length of 90 mm. The
             thickness of the oil film is 1.4 mm.

Q.2   a)   State the Newton's law of viscosity. Explain the importance of viscosity in   06
             fluid motion. What is the effect of temperature on viscosity of water and that
             of air.

       b)   Distinguish between: 04

             i) Steady flow and unsteady flow

             ii) Uniform and non-uniform flow

             iii) Rotational and irrotational flow and

             iv) Laminar and turbulent flow.

Q.3   Find the depth of oil of specific gravity of 0.82 which produces an intensity   10
             of pressure equal to 2.5 kN/m^2 . Also find the pressure head in terms of water
             and mercury.

Q.4   Explain atmospheric pressure. What is the value of atmospheric pressure   10
             head in terms of mercury column and in terms of water column?

Q.5   What are the different types of mechanical pressure gauges? With the help of   10
             a neat sketch explain the working of a Bourdon's gauge.

Q.6   A rectangular plane surface is 1.5 m wide and 4 m deep. It lies vertically in   10
             water. Determine the total pressure and position of the centre of pressure on
             the plane surface when upper edge is horizontal and (a) coincides with free
             water surface (b) 3 m below the free water surface.

Q.7   Prove that the vertical component of the resultant force on submerged curved   10
             surface is equal to the weight of the liquid supported by the curved surface.

Q.8   Find the volume of the water displaced and position of centre of buoyancy   10
             for a wooden block of width 3 m and depth 2 m, when it floats horizontally
             in water. The density of wooden block is 700 kg/ms^3 and its length 7 m.

Q.9   a)   Explain in brief the following types of equilibrium of floating bodies: 05
             i) Stable equilibrium
             ii) Unstable equilibrium and
             iii) Neutral equilibrium

       b)   Derive an expression for velocity distribution for laminar flow through a   05
             circular pipe. Show that the friction coefficient is equal to 16/Re where Re is
             the Reynolds number.

Q.10   In two dimension flow ψ = 3xy. Prove that the flow is irrotational. Also   10
             determine the corresponding velocity potential.

Course Code: BEY-005
Course Title: Energy Efficiency and Management
Assignment Code: BEY-005/TMA/2025
Maximum Marks: 100
Last Date of Submission: May 31, 2025 (For June TEE), September 30, 2025 (For December TEE)
Note:

1. **All questions are compulsory.**

Q.1	Describe the energy conservation opportunities for residential and commercial application.	10

Q.2	Explain the methods of Energy Audit with suitable examples.	10

Q.3	Discuss the various Schemes of BEE under the Energy Conservation Act-2001.	10

Q.4	Explain the ESCO contract in brief. Discuss the Drawback and role of ESCO.	10

Q.5	Describe the process of material and energy balance with the help of suitable example.	10

Q.6	What is combustion? Explain various types of combustion. How efficient combustion could improve the efficiency?	10

Q.7	Explain in brief Energy efficiency versus Energy conservation. Write step wise procedure to calculate Boiler efficiency.	10

Q.8	What is power factor? How it could be improved?	10

Q.9	Describe the basic construction of a transformer with a neat sketch.	10

Q.10	Write short notes on any four of the following:	10

a) Sankey Diagram
b) Waste heat recovery
c) Energy efficient lighting
d) Demand side management
e) Project planning technique

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 $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & -2 & 4 \end{bmatrix}; I = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}, A^{-1} = \frac{1}{6}(A^2 + aA + bI)$ 04

      Find a & b.

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 $\vec{a} \cdot \vec{c} = 3$.   05

      b)   Show that area of a parallelogram whose diagonals are given by $\vec{a}$ and $\vec{b}$ is $\dfrac{|\vec{a} \times \vec{b}|}{2}$.   05

      Also find the area of the parallelogram whose diagonals are $2\hat{i} - \hat{j} + \hat{k}$ and $\hat{i} + 3\hat{j} - \hat{k}$.

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   05

      $\begin{vmatrix} b+c & a & a \\ c & c+a & a \\ b & a & a+b \end{vmatrix} = 4abc$

      b)   Prove that   05

      $\begin{vmatrix} 1 & bc & bc(b+c) \\ 1 & ca & ca(c+a) \\ 1 & ab & ab(a+b) \end{vmatrix}$ is independent of a, b, c.

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 $\left[0, \dfrac{\pi}{2}\right]$.

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

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

c) Find $\dfrac{\partial z}{\partial x}$ and $\dfrac{\partial z}{\partial y}$ 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 $\dfrac{dp}{dt}$ is equal to $p - \dfrac{k}{\epsilon} p^2$, where k and ϵ are both positive constants. If p $(0) = 1$, then find the limiting population as $t \to \infty$. **05**

Q.9

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

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

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

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

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**

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

Course Code: BEY-020
Course Title: Computer Basics and PC Software
Assignment Code: BEY-020/TMA/2025
Maximum Marks: 100
Last Date of Submission: May 31, 2025 (For June TEE), September 30, 2025 (For December TEE)
Note:

1. **All questions are compulsory.**

Q.1	Compare the first-generation computer with fifth generation computers. Give one example of each type.	08
Q.2	Analyze the classification of computers with respect to speed and storage. Provide an example each. Explain different types of main memory with a suitable example. Discuss various file access methods.	08

Q.3	Convert the following numbers to relevant number systems
	  i. Convert the binary number $(1101)_2$ to a decimal number
	  ii. Convert the octal number $(22)_8$ to a decimal number
	  iii. Convert the hexadecimal number $(121)_{16}$ to a decimal number
	  iv. Convert the decimal number 456 to binary number.
		08

Q.4	Briefly explain the sub cycles involved in execution of a machine instruction. Write notes on various registers in CPU.	08
Q.5	Explain the working principle of a magnetic disk with a diagram. Define the terms (i) seek time (ii) search time (iii) Access time	08
Q.6	Describe the different types of ports in a basic computer. Explain any 5 types of output devices with its specific function.	08
Q.7	Discuss the types of personal computers and elaborate its features. Explain the classification of software's and provide an example each.	08
Q.8	Write a C program to search an element in an array of integers using sequential search.	04
Q.9	Write a program to apply sorting in a set of integers.	06
Q.10	Write a C Program to Concatenate Two Strings Without Using strcat() function	10
Q.11	What is the function of a Modem in enabling Internet access, and how does it handle the conversion of data between digital and analog formats?	04
Q.12	What are the differences in data transmission speeds and costs between LAN, MAN, and WAN, and how do these differences influence their applications?	04

Q.13	Explain the functions of the following in the context of networking:
	  a) TCP/IP
	  b) IP addresses
	  c) DNS
	  d) OSI model
		04

Q.14	What technologies and equipment are typically required to set up a LAN and MAN for an office, and how do they contribute to network performance?	04
Q.15	What role do collaboration tools in e-learning platforms play in enhancing the learning experience, and how can they be effectively utilized?	04

Q.16   Explain the following in the context of the Internet and its applications: 04
      a) Web Browsing
      b) Search engines