Assignment Booklet

MSCRWEE Programme
M.Sc (Renewable Energy and Environment)

First Semester	
MRW-001	Energy Conversion
MRW-002	Heat Transfer
MST-001	Foundation of Mathematics and Statistics
MED-003	Energy and Environment

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THE PEOPLE'S
UNIVERSITY

SCHOOL OF ENGINEERING & TECHNOLOGY
INDIRA 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 MSCRWEE (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 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 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. **For any question worth 5 marks the word limit is 200 words, for a 10 mark question it is 350 words.**

2. **All questions are compulsory. All questions carry equal marks.**

Q.1   a)   A six-pole induction motor is running at a speed of 980 rpm when it is fed from 50 Hz source. Find the slip with which the motor is running and the frequency of the rotor current.   5

      b)   Discuss the integrated power generating system for rural areas.   5

Q.2   a)   Enlist the various applications of a solar PV system   5

      b)   What is Vacuum Efficiency? What are the factors on which vacuum efficiency depends?   5

Q.3   a)   Discuss the characteristics of bagasse. How is it possible to convert bagasse into liquid fuel?   5

      b)   Describe the various zones of gas production reactions.   5

Q.4   a)   Determine the theoretical amount of air required for the complete combustion of coal with the following composition: 5 C = 60%, H = 5%, O = 4.8%, S = 0.2%, Nitrogen = 2%, Moisture = 10% and Ash = 18%.   5

      b)   A hydroelectric station is to be designed for a catchment area of 102 sq. km, runoff of 70% and the average rainfall of 127 cm. The head available is 381 m. What power can be developed if the overall efficiency of the plant is 80%?   5

Q.5   Explain the working and construction of a simple gas turbine power plant.   10

Q.6   a)   Discuss the various stages of energy conversion in railway transportation system.   5

      b)   What is combustion efficiency? What are the various factors on which it depends?   5

Q.7   a)   Classify the petroleum. Discuss the characteristics of ideal gasoline.   5

      b)   What is catalytic cracking? Discuss its advantages over thermal cracking.   5

Q.8   a)   Describe the working principle of electrostatic precipitator.   5

b) What is the effect of fly ash on environment? What is the function of spray tower in removing fly ash?   5

Q.9   Write short notes on the following:
a) Hydraulic Sluicing Element   5
b) Magneto hydrodynamic Power Generation   5
c) Bioenergy   5
d) Surge Tanks   5

Note:

1.   **For any question worth 5 marks the word limit is 200 words, for a 10 mark question it is 350 words.**

2.   **All questions are compulsory. Marks for the questions are shown within brackets on the right-hand side.**

Q.1   Discuss the various modes of heat transfer in detail.   10

Q.2   Derive the expression for heat conduction through a cylinder. Assume suitable   10
dimension of the cylinder and the temperature difference across the cylinder.

Q.3   Derive the expression for thermal resistance for the composite plane wall shown in   10
Figures given below. Assume area of cross-section to be 'A' for the Fig. a.

Fig. a   Fig. b
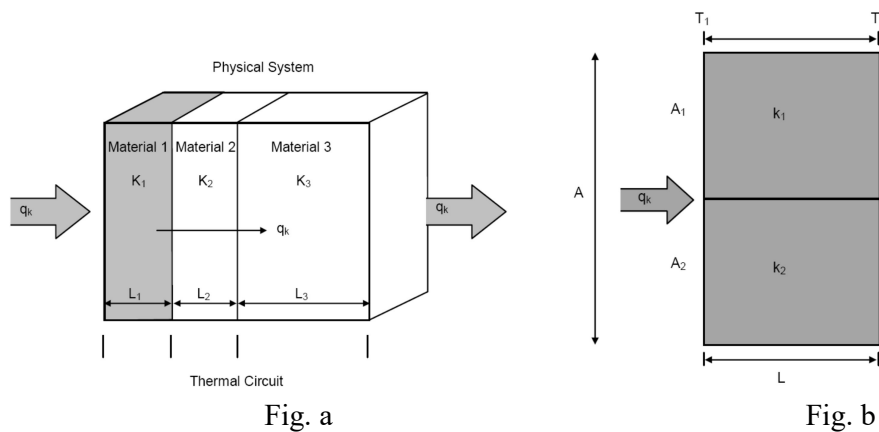
Q.4   Explain thermal insulation and why is it needed? Also, discuss the various types of   10
insulating materials.

Q.5   Derive the expression for the time required for a solid to reach a certain temperature in   10
case of transient conduction using lumped capacitance method.

Q.6   Define the following dimensionless numbers   10

     a) Nusselt number

     b) Biot number

     c) Prandtl number

     d) Grashoff Number

     e) Reynolds number

Q.7   Define the following: 10
       a) Specific Heat Capacity
       b) Thermal diffusivity
       c) Thermal Equilibrium
       d) Transmissivity
       e) Spectral Intensity

Q.8   Two very large parallel plates with emissivity 0.3 and 0.8 exchange radiative energy.   10
       Determine the percentage reduction in radiative energy transfer when a polished
       aluminium radiation shield ($\varepsilon = 0.04$) is placed between them.

Q.9   How are the heat exchangers classified? Describe the plate type heat exchanger in   10
       detail.

Q.10   Compare a straight tube and bent tube boiler with neat sketches while enlisting the   10
       advantages and disadvantages.

Note:

1.   For any question worth 5 marks the word limit is 200 words, for a 10 mark question it is 350 words and for a 20 mark question it is above 500 words.

2.   All questions are compulsory. Marks for the questions are shown within brackets on the right-hand side.

Q.1   State whether the following statements are True or False and also give the reason in support of your answer.

     a) Collection of rich persons in India forms a set.   2

     b) Following rule is a function from A to B.   2
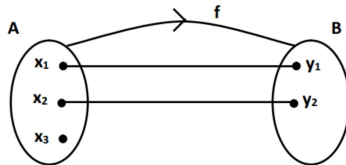
     c) $\dfrac{d}{dx}(9-7x)^5 = 45(9-7x)^4$ 2

     d) In exclusive method, upper limit of a class is included in the same class.   2

     e) The order of the matrix $\begin{bmatrix} 2 & 5 & 6 \\ 4 & 3 & 1 \end{bmatrix}$ is 3 × 2.   2

Q.2   a)   If four cards are chosen from a pack of 52 playing cards then find the number of ways that all four cards are:

     a) of same suit   2
     b) red   2
     c) face cards   2
     d) king   2
     e) of different suit   2

Q.3   Arrange the numbers 49, 36, 42, 19, 22, 27, 14, 13, 24, 48, 23, 28, 17, 42,   10
39, 45, 22, 24, 17, 41, 18, 42, 38, 43, 11, 27, 36, 13, 40, 30, 24, 10, 18, 47,
18, 19, 23, 12, 27 in stretched stem-and-leaf display that has single-digit
starting parts and leaves, but has stem width of 5.

Q.4   If the universal set is U={1, 2, 3, 4, 5, 6, 7, 8} and A = {2, 3, 6, 7}, B = {4, 6, 8}, C = {6, 7, 8} are the subsets of U, then verify
     a) De-Morgan's laws   5
     b) left distributive law   5

Q.5   Evaluate the following:

     a) $\int x^2\, e^{2x}\, dx$ 5

b) $\frac{dy}{dx}$, where $y = (4x + 5)^4 (9x + 4)^5$ 5

Q.6   a) Prove that $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = (a + b + c)(ab + bc + ca - a^2 - b^2 - c^2)$ 5

     b) What do you mean by primary data and secondary data? Also give an example in each case.   5

Q.7   Draw a box plot with whisker, +ve sign and outliers for the following data: 20
42, 37, 28, 23, 32, 25, 26, 39, 38, 41, 22, 38, 21, 31, 26, 36, 42, 52, 50, 47, 24, 53, 28

Q.8   a) Find the values of **a** and **b**, if the function **f** given below is continuous at x=2   8

$$f(x)=\begin{cases} a+b & x < 2 \\ a+bx+4, & x = 2 \\ 5, & x > 2 \end{cases}$$

     b) Draw a histogram for the following data: 12

Wages	40-49	50-69	70-99	100-109	110-119
No of workers	2	20	60	35	4

Also draw frequency polygon in the same graph

Note:

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2.   All questions are compulsory. Marks for the questions are shown within brackets on the right-hand side.

Q.1   What is solar photovoltaic technology? Discuss its underlying principle and applications.   15

Q.2   Explain how the carrying capacity of the Earth can be estimated using various parameters.   10

Q.3   Give a brief description of the future projection of world energy demand as per EIA International Energy Outlook2004.   10

Q.4   Discuss the advantages and limitations of Clean Development Mechanism to help meet the challenge of combating climate change.   10

Q.5   Discuss the factors that need to be kept in view while formulating the energy policy.   10

Q.6   What is energy economics? Explain the factors that need to be considered in energy economics.   10

Q.7   Describe the positive and negative impacts of the solar energy technology on the environment.   5

Q.8   Discuss the working of a wind energy system with the help of a suitable diagram.   5

Q.9   Discuss the advantages and limitations of small hydropower plant   5

Q.10   Write short notes on the following: (4x5=20)
   a) Functions of the components of a thermal power plant
   b) Benefits of carbon taxation
   c) Working of a biogas plant
   d) Fuel switching