

Code No: R22D2104

**MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY**

(Autonomous Institution – UGC, Govt. of India)

**M.Tech I Year I Semester Supplementary Examinations, August 2023****Solar Energy Technology**

(TE)

<b>Roll No</b>										
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**Time: 3 hours****Max. Marks: 60****Note:** This question paper contains two parts A and B

Part A is compulsory which carries 10 marks and Answer all questions.

Part B Consists of 5 SECTIONS (One SECTION for each UNIT). Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 10 marks.

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**PART-A( 10 MARKS)****(Write all answers of this PART at one place)**

- |   |   |   |      |
|---|---|---|------|
| 1 | A | How is the energy being continuously being produce in the sun?                    | [1M] |
|   | B | How does sun tracking helps in energy collection by a flat plate solar collector? | [1M] |
|   | C | Draw the line diagram of Heat transport system                                    | [1M] |
|   | D | Draw the line diagram of solar distributed receiver system                        | [1M] |
|   | E | Define sensible heat  | [1M] |
|   | F | Write a short note on active heating systems                                      | [1M] |
|   | G | Write the advantages of Direct Energy Conversion                                  | [1M] |
|   | H | Write a short note on solar cell performance                                      | [1M] |
|   | I | Write a short note on cost benefit analysis                                       | [1M] |
|   | J | Discuss photo voltaic applications  | [1M] |

**PART-B( 50 MARKS)****SECTION-I**

- |   |   |   |      |
|---|---|---|------|
| 2 | A | Define beam, diffuse and global radiation             | [5M] |
|   | B | Explain detail about different types of solar angles. | [5M] |

OR

- |   |  |  |       |
|---|--|--|-------|
| 3 |  | Estimate the average daily global radiation on a horizontal surface at Baroda (22°N, 73° 10' E) during the month of march, if the average sunshine is 9.5 hours per day Assume a=0.28 and b=0.48 for Baroda city | [10M] |
|---|--|--|-------|

**SECTION-II**

- |   |  |  |       |
|---|--|--|-------|
| 4 |  | Explain solar heliostats and receiver system with line diagram   | [10M] |
|   |  | OR   |       |
| 5 |  | Explain solar central receiver system with line diagram and also write the advantages over other systems | [10M] |

**SECTION-III**

- |   |  |   |       |
|---|--|---|-------|
| 6 |  | Explain in detail various methods of sensible heat storage using solids and liquids | [10M] |
|---|--|---|-------|

OR

- |   |  |   |       |
|---|--|---|-------|
| 7 |  | With the help of neat sketch explain the working of Solar Ponds | [10M] |
|---|--|---|-------|

**SECTION-IV**

8 Explain about any two types of solar cells with neat diagrams. [10M]

OR

9 Describe process of silicon cell construction. Draw the representative power voltage curve for photovoltaic cells and Write the equation of pv module current [10M]

**SECTION-V**

10 Consider a solar plant, installed with initial investment of Rs.  $5 \times 10^6$  . Out of which 44% was used in PV array, 10% was used in battery systems, 8% were used in installation cost and 38% was used in system balance. The individual components of PV system have different life span as shown below in table [10M]

Calculate:

Component	Life span
PV modules	20 years
Batteries	7 years
Solar inverter	15 years
System balance	15 years

Calculate:

- i. annualized total cost of solar PV system
- ii. calculate the unit cost of electricity generated by PV system  
consider average energy output of 75 KWh/day from PV array for one year

OR

11 Write a short note of the following [2M]

- i. Payback period [2M]
- ii. Simple payback period [3M]
- iii. Discounted payback period [2M]
- iv. Net present value [3M]

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Code No: R22D2106

**MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY**

(Autonomous Institution – UGC, Govt. of India)

**M.Tech I Year I Semester Supplementary Examinations, August 2023****Advanced I.C. Engines**

(TE)

<b>Roll No</b>										
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**Time: 3 hours****Max. Marks: 60****Note:** This question paper contains two parts A and B

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Part B Consists of 5 SECTIONS (One SECTION for each UNIT). Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 10 marks.

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**PART-A( 10MARKS)****(Write all answers of this PART at one place)**

- |   |   |  |      |
|---|---|--|------|
| 1 | A | Explain thermodynamic cycle.   | [1M] |
|   | B | What do you understand by 'fuel-air cycle approximation'?            | [1M] |
|   | C | What is swirl Ratio?   | [1M] |
|   | D | Describe the Buchi system of turbocharging.                          | [1M] |
|   | E | Is ignition lag is a chemical process?                               | [1M] |
|   | F | What are the fuel factors affected the engine performance.           | [1M] |
|   | G | What are the main sources of pollutants from gasoline/petrol engine? | [1M] |
|   | H | How are hydrocarbons (HC) formed ?                                   | [1M] |
|   | I | Why is cooling necessary for I.C. engines                            | [1M] |
|   | J | Wankel rotary engine could not become successful, why ?              | [1M] |

**PART-B( 50 MARKS)****SECTION-I**

- |   |   |   |      |
|---|---|---|------|
| 2 | A | Explain in detail of the Treatment of exhaust products of combustion.   | [5M] |
|   | B | What is dissociation? How does it affect power developed by the engine? | [5M] |

OR

- |   |   |  |      |
|---|---|--|------|
| 3 | A | Find the percentage change in efficiency of an Otto cycle for a compression ratio of 7 to 1 if the specific heat at constant volume increases by 3%. | [5M] |
|   | B | Explain clearly the effect of compression ratio and mixture strength on thermal efficiency.  | [5M] |

**SECTION-II**

- |   |   |  |      |
|---|---|--|------|
| 4 | A | How do you define volumetric efficiency of an I.C. engine? How is it related to the power output of the engine? How is the volumetric efficiency affected by speed and altitude? | [5M] |
|   | B | What do you mean by supercharging of I.C. engines? Explain, why super charging is essential for the aircraft engine.   | [5M] |

OR

- 5 A A 6-cylinder, 4-stroke direct injection oil engine has bore 140 mm and stroke 210 mm and it runs at 1600 rpm. It consumes 31 kg of fuel per hour. The calorific value of fuel is 42500 kJ/kg and its percentage composition by mass is carbon 86.2, hydrogen 13.5 and non-combustible 0.3. The percentage volumetric composition of dry exhaust gases is  $\text{CO}_2 = 7.0$ ,  $\text{CO} = 0.1$ ,  $\text{O}_2 = 11.2$  and  $\text{N}_2 = 81.8$ . Barometric pressure is 755 mm Hg, room temperature  $30^\circ\text{C}$  and moisture in air is 0.02 kg/kg of air. If the indicated thermal efficiency and mechanical efficiency of the engine are 38% and 80% respectively, determine the volumetric efficiency of the engine under rated condition. [5M]
- B Describe any three factors of affect the volumetric efficiency. [5M]

**SECTION-III**

- 6 A Discuss the effect of engine variables on ignition lag [5M]
- B With the help of a neat sketch explain the working principle of combustion phenomena in CI Engines. [5M]

OR

- 7 A Explain briefly diesel engine injected spray combustion process. [5M]
- B Explain briefly 'continued' and 'timed' injection systems [5M]

**SECTION-IV**

- 8 A Explain briefly the mechanism of formation of nitric oxide (NO). [5M]
- B What are the sources of HC formation in petrol engine? Explain various factors which affect the HC formation [5M]

OR

- 9 A Describe with neat sketches any two types of total emission control packages. [5M]
- B Give the comparison between 'electronic catalytic converter' and 'conventional exhaust catalytic converter'. [5M]

**SECTION-V**

- 10 A Describe briefly 'cooling air' and 'cooling water' requirements for I.C. engines. [5M]
- B A single-stage reciprocating compressor takes  $1 \text{ m}^3$  of air per minute at 1.013 bar and  $15^\circ\text{C}$  and delivers it at 7 bar. Assuming that the law of compression is  $p_v^{1.35} = \text{constant}$ , and the clearance is negligible, calculate the indicated power. [5M]

OR

- 11 A What are the various type of radiators? Explain any one in detail. [5M]
- B A 4-cylinder petrol engine has an output of 52 kW at 2000 r.p.m. A Morse test is carried out and the brake torque readings are 177, 170, 168 and 174 N-m respectively. For normal running at this speed the specific fuel consumption is 0.364 kg/kWh. The calorific value of fuel is 44200 kJ/kg. Calculate: (i) Mechanical efficiency (ii) Brake thermal efficiency of the engine. [5M]

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Code No: R22D2101

**MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY**

(Autonomous Institution – UGC, Govt. of India)

**M.Tech I Year I Semester Supplementary Examinations, August 2023****Advanced Thermodynamics**

(TE)

<b>Roll No</b>										
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**Time: 3 hours****Max. Marks: 60****Note:** This question paper contains two parts A and B

Part A is compulsory which carries 10 marks and Answer all questions.

Part B Consists of 5 SECTIONS (One SECTION for each UNIT). Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 10 marks.

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**Note: Steam Tables are permitted****PART-A (10 MARKS)****(Write all answers of this PART at one place)**

- |          |   |   |             |
|----------|---|---|-------------|
| <b>1</b> | A | Explain at least three different causes of irreversibility associated with a process. | <b>[1M]</b> |
|          | B | What do you understand by macroscopic and microscopic viewpoints?                     | <b>[1M]</b> |
|          | C | Write the equation of state.  | <b>[1M]</b> |
|          | D | Write the non flow energy equation.   | <b>[1M]</b> |
|          | E | Differentiate between heat and work transfer.   | <b>[1M]</b> |
|          | F | Explain with suitable equations of formation of energy                                | <b>[1M]</b> |
|          | G | Differentiate between otto and diesel cycles  | <b>[1M]</b> |
|          | H | Draw the vapour compression cycle   | <b>[1M]</b> |
|          | I | Draw and labelling of pv cell   | <b>[1M]</b> |
|          | J | Draw and labelling of simple hydro thermo electric generation                         | <b>[1M]</b> |

**PART-B****SECTION-I ( 50 MARKS)****SECTION-I**

- |          |   |  |             |
|----------|---|--|-------------|
| <b>2</b> | A | I. Derive the first and second Tds equations.  | <b>[3M]</b> |
|          |   | II. Derive the expression for difference in specific heat capacities $C_p$ and $C_v$ . | <b>[2M]</b> |
|          | B | What are different laws of thermodynamics? Explain them with their corollaries.        | <b>[5M]</b> |

OR

- |          |   |  |             |
|----------|---|--|-------------|
| <b>3</b> | A | Discuss about Entropy, availability and unavailability.  | <b>[5M]</b> |
|          | B | Exhaust gases leave an internal combustion engine at and 1 bar after having done 1050 KJ of work per kg of gas in the engine ( $C_p$ of gas = 1.1 KJ / kg K). Assume the temperature of the surroundings. Find<br>i) How much available energy per kg of gas is lost by throwing away the exhaust gases?<br>ii) What is the ratio of the lost available energy to the engine work? | <b>[5M]</b> |

**SECTION-II**

- |          |   |   |             |
|----------|---|---|-------------|
| <b>4</b> | A | Explain the thermodynamics of cooling tower and how to evaluate the makeup water requirement.   | <b>[5M]</b> |
|          | B | 10 m <sup>3</sup> /min of dry air at 32°C mixed with a stream of hydrogen at 127°C to form a mixed stream at 47°C and 1bar. The mixing occurs adiabatically and | <b>[5M]</b> |

at steady state.

Determine

- (i) The mass flow rates of the dry air and hydrogen, in kg/min
- (ii) Mole fractions of the dry air and hydrogen in existing mixture.

OR

- 5 A Determine the pressure of saturated steam at 40°C if at 35°C the pressure is 5.628 kPa, the enthalpy of vaporization is 2418.6kJ/kg and the specific volume is 25.22m<sup>3</sup>/kg. The enthalpy of vaporization is essentially constant over this temperature range. [5M]
- B 0.5kg of air is compressed reversibly and adiabatically from 80kPa, 60°C to 0.4MPa, and then expanded at constant pressure to the original volume. Sketch these processes on p–v and T–s planes. Compute the heat transfer and work transfer for the whole path. Take characteristics gas constant of dry air R=0.287 kJ/kgK. [5M]

### SECTION-III

- 6 A Define chemical potential of a component in terms of U, H and G. [5M]
- B Calculate the maximum power developed and irreversibility of a chemical reaction process of fuel C<sub>8</sub>H<sub>18</sub> burnt with 200% theoretical air. The products of combustion leave at 100<sup>0</sup>K and the ambient temperature is 288<sup>0</sup>K. [5M]

OR

- 7 A Gaseous butane at 250°C is mixed with air at 400K and burned with 400% theoretical air. Determine the adiabatic flame temperature. [5M]
- B An internal combustion engine burns liquid octane and uses 150% theoretical air. The air and fuel enter at 25°C, and the products leave the engine exhaust ports at 900K. In the engine 80% of the carbon burns to CO<sub>2</sub> and the remainder burns to CO. The heat transfer from this engine is just equal to the work done by the engine. Determine
- i) The power output of the engine if the engine burns 0.006 kg/sec of fuel and
  - ii) The composition and the dew point of the products of combustion.

### SECTION-IV

- 8 A Describe the working of combined cycle power generation with diagrams. [5M]
- B In a Cogeneration plant, the power load is 5.6 MW and the heating load is 1.163MW. Steam is generated at 40bar and 500°C and is expanded isentropically through a turbine to a condenser at 0.06bar. The heating load is supplied by extracting steam from the turbine at 2bar which condensed in the process heater to saturated liquid at 2bar and then pumped back to the boiler. Compute The steam generation capacity of the boiler in tonnes/hr. The heat input to the boiler in MW. [5M]

OR

- 9 A Discuss the significance of onsagar relations in evaluating the irreversibilities for coupled flows. [5M]
- B Explain the procedure for second law analysis of power cycle. Describe the second law analysis of rankine power cycle. [5M]

### SECTION-V

- 10 A Explain the working of Magneto hydrodynamic generator. Discuss its advantages and limitations. [5M]
- B Derive the expression for power and efficiency for a thermionic generator. [5M]

OR

- 11 A Differentiate thermo ionic power generation and photovoltaic cells. [5M]
- B What is thermo electric energy? Explain its working principle. [5M]

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Roll No										
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Time: 3 hours

Max. Marks: 60

Note: This question paper contains two parts A and B

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**PART-A (10 MARKS)****Write all answers of this PART at one place)**

- 1 A Differentiate Lagrangian and Euler approaches towards fluid motion [1M]
- B What are the assumptions made in deriving Bernoulli's equation? [1M]
- C What you mean by compressible flow? [1M]
- D What are the various forces influence Navier-Stokes equation? [1M]
- E Explain creep motion. [1M]
- F Define momentum thickness [1M]
- G Draw a diagram for velocity distribution across a pipe flow [1M]
- H Which forces predominant in turbulent flow? [1M]
- I Define MACH number [1M]
- J Give the relation between area, velocity in sonic, supersonic flows [1M]

**PART-B( 50 MARKS)****SECTION-I**

- 2 A The velocity components for a fluid flow are:  $u = a+by-cz$ ,  $v=d-bx-ez$ ,  $w=f+cx-ey$  [5M]  
where a, b, c, d, e and f are arbitrary constants
    - i) Show that it is a possible case of fluid flow
    - ii) Is the fluid flow irrotational? If not determine the vorticity and rotation
  - B The following data relate to an inclined venturimeter. [5M]  
Diameter of the pipeline = 400 mm  
Inclination of the pipeline with the horizontal =  $30^\circ$   
Throat diameter = 200mm  
The distance between the mouth and throat for the meter = 600 mm  
Sp. Gravity of oil flowing through the pipeline = 0.7  
Sp. Gravity of heavy liquid (U-tube) = 13.6  
Reading of the differential manometer = 50 mm  
The co-efficient of the meter = 0.98  
Determine the rate of flow in the pipeline.
- OR
- 3 A A stream function is given by,  $\psi = 3x^2y + (3+t)y^2$  [5M]  
Find the flow rates across the faces of the triangular prism having a thickness of 2.5m in the Z-direction at the instant  $t=3$  seconds
  - B Derive Euler's Equation of motion [5M]



**SECTION-II**

- 4 Derive Navier-Stokes equation for Viscous compressible flows [10M]  
OR
- 5 A A liquid of viscosity of 0.9 poise is filled between two horizontal plates 10 mm apart. If the upper plate is moving at 1 m/s with respect to the lower plate which is stationary and the pressure difference between two sections 60 m apart is 60 kN/m<sup>2</sup>, determine: [5M]  
(i) The velocity distribution,  
(ii) The discharge per unit width, and  
(iii) The shear stress on the upper plate.
- B Explain the influence of pressure gradient in Couette flow and explain adverse and favourable pressure gradients [5M]

**SECTION-III**

- 6 Derive an expression for displacement, momentum and energy thicknesses of boundary layer. [10M]  
OR
- 7 A The velocity distribution in the boundary layer is given by:  $\frac{u}{U} = \frac{y}{\delta}$ , where u is the velocity at a distance y from the plate and u = U at y =  $\delta$ ,  $\delta$  being boundary layer thickness. Find: (i) The displacement thickness, (ii) The momentum thickness, (iii) The energy thickness, and (iv) The value of  $\frac{\delta^*}{\theta}$ . [5M]
- B For the velocity profile in laminar boundary layer as,  $\frac{u}{U} = \frac{3}{2}\left(\frac{y}{\delta}\right) - \frac{1}{2}\left(\frac{y}{\delta}\right)^3$  [5M]  
Find the thickness of the boundary layer and the shear stress 1.5 m from the leading edge of a plate. The plate is 2 m long and 1.4 m wide and is placed in water which is moving with a velocity of 200 mm per second. Find the total drag force on the plate if  $\mu$  for water = .01 poise.

**SECTION-IV**

- 8 A Obtain mean continuity equation and mean momentum equation for time average equations [5M]  
B With a neat sketch explain the phenomenon of flow separation [5M]  
OR
- 9 A Discuss and present Karman-Prandtl's equations for hydrodynamically smooth and rough boundaries in pipe flows [5M]  
B The velocity of flow in a badly corroded 7.5 cm pipe is found to increase 20 percent as a pitot tube is moved from a point 1 cm from the wall to a point 2 cm from the wall. Estimate the height of roughness elements. [5M]

**SECTION-V**

- 10 A Derive Rankine-Hugoniot equations for normal shock wave [5M]  
B How disturbances in compressible fluid propagated? [5M]  
OR
- 11 For a normal shock wave in air Mach number is 2. If the atmospheric pressure and air density are 26.5 kN/m<sup>2</sup> and 0.413 kg/m<sup>3</sup> respectively, determine the flow conditions before and after the shock wave. Take constant value  $\gamma = 1.4$ . [10M]

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Code No: R22DHS53

**MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY**

(Autonomous Institution – UGC, Govt. of India)

**M.Tech I Year I Semester Supplementary Examinations, August 2023****Research Methodology**

(MD, TE, VLSIES &amp; ASP)

<b>Roll No</b>									
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**Time: 3 hours****Max. Marks: 60****Note:** This question paper contains two parts A and B

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**PART-A (10 MARKS)****Write all answers of this PART at one place**

- |          |   |  |             |
|----------|---|--|-------------|
| <b>1</b> | A | What are the objectives of Research?                               | <b>[1M]</b> |
|          | B | Discuss any four problems faced by researchers in India?           | <b>[1M]</b> |
|          | C | What is the difference between systematic and stratified sampling? | <b>[1M]</b> |
|          | D | What are the primary data collection methods?                      | <b>[1M]</b> |
|          | E | What is research design and need for research design?              | <b>[1M]</b> |
|          | F | What is the hypothesis in research?                                | <b>[1M]</b> |
|          | G | What is the difference between ANOVA and Kruskal-Wallis test?      | <b>[1M]</b> |
|          | H | State the methodology of research.                                 | <b>[1M]</b> |
|          | I | List down the steps involved in writing a report?                  | <b>[1M]</b> |
|          | J | What is plagiarism? How plagiarism can be avoided?                 | <b>[1M]</b> |

**PART-B (50 MARKS)****SECTION-I**

- |          |   |  |             |
|----------|---|--|-------------|
| <b>2</b> | A | Explain the terms Fundamental Research, Basic Research, Applied Research and Industrial Research with suitable examples. | <b>[5M]</b> |
|          | B | Literature review helps in identifying a suitable research problem. Comment.   | <b>[5M]</b> |

OR

- |          |   |   |             |
|----------|---|---|-------------|
| <b>3</b> | A | Elaborate on common errors committed by researchers in selecting the research problem.                    | <b>[5M]</b> |
|          | B | What is a literature review?<br>Explain the effective literature studies approach for a research problem. | <b>[5M]</b> |

**SECTION-II**

- |          |   |  |             |
|----------|---|--|-------------|
| <b>4</b> | A | What do you mean by "Sample Design"? Under what circumstances one should use a probability sample? | <b>[5M]</b> |
|          | B | What is statistical data analysis in research methodology?   | <b>[5M]</b> |

OR

- |          |   |  |             |
|----------|---|--|-------------|
| <b>5</b> | A | What is collection of data explain primary and secondary source to collect the data? | <b>[5M]</b> |
|----------|---|--|-------------|

B What is data processing and write about analysis methods? [5M]

**SECTION-III**

6 A How do you formulate a research hypothesis? What is the purpose of the formulation of hypothesis? [5M]

B What is difference between deductive and inductive research? [5M]

OR

7 A Write about various components of research design? [5M]

B Describe some of the important research designs used in experimental hypothesis-testing research study. [5M]

**SECTION-IV**

8 A Describe some of the important research designs used in experimental hypothesis-testing research study. [5M]

B In an experiment on the immunisation of goats from Anthrax, the following results were obtained. Derive your inference on the effectiveness of vaccine. [5M]

	Survived	Died	Total
Inoculated	15	2	17
Non inoculated	4	10	14
Total	19	12	31

OR

9 A What is Hypothesis-testing? [5M]

B Test whether the variances are significantly different in the following sample. [5M]

Sample I (X1)	45	46	49	25	17	18	13	56	58
Sample II (X2)	47	49	43	27	29	38	37		

**SECTION-V**

10 A Explain the factors considered for technical report writing. [5M]

B Write the procedure for plagiarism analysis. [5M]

OR

11 A Identify different formats of Research proposal writing. Outline and explain the format of experimental report writing. [5M]

B What is trademark? Describe role of trademark in business. [5M]

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