In Pursuit of
Excellence

Course and Faculty Details

SESSION-2019-2020

SEM-3rd

Faculty Details

Name of the Faculty: Rakesh Kumar Gangwar

Designation: Assistant Profes

500kJ of work , The second and third engines deliver 1200kJ and 500 kJ of work respectively. Make calculations for the exhaust temperature of the second and third Carnot engine. **(Ans=250K,500K)**

7. A reversible heat engine absorbs 2500 kJ/cycle of heat from a constant temperature heat source at 2000K and reject some energy as waste heat to a reservoir The work output from the engine is used to drive a reversible refrigerator its source temperature being 300K.The heat outflow from the refrigerator is also taken to the reservoir X.if the total heat flow into the reservoir is 3000 kJ/cycle, make calculations for the temperature of reservoir X. **(Ans 1028.5 K)**
8. A heat engine working on Carnot cycle absorbs heat from three thermal reservoirs at 1000K,800 K and 600K.The engine does 10 kW of net work and reject 400kJ/min of heat to a heat sink at 300 K . If the heat supplied by the reservoir at 1000K is 60% of the heat supplied by the reservoir at 600 Make calculations for the quantity of heat absorbed by each reservoir.**(Ans: 312.5kJ/min , 500 kJ/min, 187.5 kJ/min)**

In Pursuit of Excellence	**Vision & Mission of Institute**	SESSION-2019-2020
		SEM-3rd

Vision of Institute

To develop industry ready professionals with values and ethics for global needs

Mission of Institute

M1: To impart education through outcome based pedagogic principles.

M2: To provide conducive environment for personality development, training and entrepreneurial skills.

M3: To induct high professional ethics and accountability towards society in students.

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Deptt. of Mechanical Engg.
Moradabad Institute of Technology
Moradabad - 244001

Vision &Mission Of Department

Vision of Department

To develop competent and skilled Mechanical Engineers having moral values and ethics for the fulfilment of fast changing global needs.

Mission of the Department

- To nurture continuous enhancement in teaching learning process for imparting strong fundamental knowledge of core, engineering science, and interdisciplinary subjects to students.
- To provide state-of-the-art laboratories for providing hand-on experience of technology, and to provide platforms for leadership and overall personality development.
- To develop strong mentor-mentee relationship for the professional and personal growth of students and also to inculcate moral values and ethics for serving the society.

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Program Education Objectives

The objectives of the Department of Mechanical Engineering are to produce graduates who will have the:

- Employability skills for making career in industries, academia, government services and as an entrepreneur.
- Potential to apply fundamental concepts of mechanical engineering, engineering science and practical training in solving mechanical engineering problems and to contribute in development of technologies.
- Skills to apply leadership, managerial and administrative qualities to lead the projects professionally and ethically.

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Program Outcomes

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling to complex engineering activities, with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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Mechanical Engineering graduates will be able to:

- Identify and solve problems of thermal engineering, strength of materials, fluid mechanics, refrigeration & air conditioning, design, dynamics of machines, mathematics and engineering science.
- Get fundamental knowledge and hand-on experience of different manufacturing processes, material testing techniques and CAD/CAM tooling to apply in various industries.
- Learn quality and industrial management concepts, communication and soft skills along with other interdisciplinary subjects such as programming language, electrical engineering and basic electronics to enhance their employability

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In Pursuit of Excellence
Academic Calendar
SESSION-2019-2020
SEM-3rd

Moradabad Institute of Technology

Ramganga Vihar Phase – II, Moradabad

ACADEMIC CALENDAR

ODD Semester

Session: 2019 – 2020

S. No.	Particulars	Date	Responsibility
1.	**Time Table** (a) Display on Notice Boards (b) Distribution to concerned Teachers	29 July 2019 29 July 2019	O.C. Time – Table
2.	Distribution of class lists to teachers	29 July 2019	O.C. Class / DR
3.	**Registrations** (a) 3rd / 5th /7th Semester (b)List of unregistered students to various department (c) Notifying unregistered students for getting registered at the earliest (through class O.Cs, / Faculty)	1,2,3 Aug.2019 20 Aug 2019 22 Aug 2019	Concerned Teachers OS Academic Concerned HODs
4.	**Commencement of Classes** 3rd / 5th / 7th Semester	2,3,4 Aug.2019	Concerned Teachers
5.	Blow up submission to HODs	30 July 2019	Concerned Teachers
6.	Announcement of Test series dates	16Aug 2019	Dean Academics
7.	(a) Collection of Examination forms from University and announcement of date for availability of forms (b) Last date for submission of forms to office (c) Submission of forms to University	30 Aug 2019**	OS Academic to take timely action as per University directions.
8.	Procurement of stationary & materials for Test Series for full semester (a) Requirement (b) Actual Procurement	31 Aug 2019 5 Sept 2019	Convener Test Series Committee O.S. Academics
9.	(a)Short attendance compilation and information to parents and undertaking format handed over to students (b)Collection of Short attendance undertaking	09 Sept 2019 11 Sept 2019	O.C. Class
10.	**1st Test Series** **Thu, Fri, Sat**	**12, 13,14, Sept 2019**	
	(a) Announcement of Test Series schedule, Invigilation Programme, Seating arrangement etc.	11 Sept 2019	Class Test Committee
	(b) After completion of Test Series- Evaluation of test copies & showing of copies to students (c) Submission of test copies in Nodal Centre (d) Report of poor performance of students to class OCs	21 Sept 2019 25 Sept 2019 26 Sept 2019	Concerned Teachers Concerned Teachers Concerned Teachers
	(e)Short attendance compilation, display on notice board and information to parents	19 Oct 2019	O.C. Class
11.	**2nd Test Series** **Wed, Thus, Fri**	**23,24, 25 Oct 2019**	
	(a) Announcement of Test Series schedule, Invigilation Programme, seating arrangement etc	22 Oct 2019	Class Test Committee

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	(b) After completion of Test Series - Evaluation of test copies & showing of copies to students (c) Submission of test copies in Nodal Centre (d) Report of poor performance of students to class OCs	02 Nov 2019 04 Nov 2019 05 Nov 2019	Concerned Teachers Concerned Teachers Concerned Teachers
12.	Filling of student feedback forms for current semester	27 Nov 2019	Concerned HODs
13.	Requirement of additional Faculty (to be conveyed to Director) (for even semester)	30 Nov 2019	Concerned HODs
14.	(a) Floating the electives for even semester (b) Last date for students choice	26 Nov 2019 30 Nov 2019	Concerned HODs
15.	Announcement of dues list and its last date for clearing dues (Current semester)	**22 Oct 2019**	Accounts/ OS Academic
16.	Date up to which final attendance is to be counted	29 Nov 2019	Concerned teachers
17.	Submission of consolidated list of shortage of attendance to Director and information to Parents	30 Nov 2019	Class O.Cs
18.	**3rd Test Series Thu, Fri, Sat**	**28,29,30 Nov 2019**	
	(a) Announcement of Test Series schedule, Invigilation Programme, Seating arrangement etc.	27 Nov 2019	Class Test Committee
	(b) After completion of Test Series- Evaluation of test copies & showing of copies to students (c) Submission of test copies in Nodal Centre (d) Report of poor performance of students to class OCs	03 Dec2019 04 Dec 2019 04 Dec 2019	Concerned Teacher Concerned Teachers Concerned Teachers
19.	**Submission of sessional marks:** (a) Meeting of Dean Academics, , all HODs and Director regarding attendance and performance of students.	04 Dec 2019	Dean Academics
	(b) Checking of Teachers' Records by HODs	05 Dec 2019	Concerned HODs
	(c) Finalization of sessional marks	05 Dec 2019	Concerned Teachers
	(d) Submission of Award list after final checking and uploading to OS Academics for further necessary action	As per date announced by AKTU	HODs Concerned Teachers
20.	**Theory Examinations:** (a) Collection of Admit Cards / Roll Nos. from University (b) Preparation of Roll lists (c) Collection of stationery such as copies, practical copies drawing sheets, graph paper etc. from University. (c) Procurement of stationery and other materials locally as necessary.	As per AKTU schedule	OS Academics to take appropriate actions as per University directions.
21.	**Practical Examinations:**	As per AKTU schedule	Concerned HODs
	(a) Appointment of Internal Examiners	3 days before the practical exam schedule	Concerned HODs
	(b) Obtaining list of panel of External Examiners from AKTU & preparation of schedule of practical examination.	As per AKTU schedule	OS Academics
	(d) Dispatch of letters/contacting the external examiners	Within 2 days of list obtained from AKTU	HODs and concerned teachers

(2/3)

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22.	**Preparation for Even Semester** (a) Load Distribution by Department (b) Submission to O.C. Time-Table (c) Display of Time Table on Notice Board	 10 Dec 2019 12 Dec 2019 18 Jan 2020	 Concerned Coordinators O.C. Time Table
23.	Registration for Even semester [2019 – 20]	To be announced**	OS Academic
24.	Announcement of Academic calendar for Even semester [2019 – 20]	5 Days before the start of Even sem.	Dean Academics

****May be revised as per AKTU Schedule.**

Nitin 27.7.2019

Dean Academics

Director

Copy to:

1. Chairman	2. Secretary	3. P.A. to Director for Director's folder
4. All HODs	5. DOSW for- 29/7	6. Controller Examination for
7. Associate Dean Academics	8. Registrar for 29/7/19	9. All Faculty Members through HODs
10. O.S. Academics	11. A.S. Examinations	12. Accounts Section
13. T & P Cell 29-7-19	14. Librarian	15. Convener Test Series/ ~~O.C.~~ Time Table

for 29/07/19

for C 27/07/19

for A 29/7/19

for 29/7/19

for 29/07/19

for- ASH 29/7

ME 29.07.19

③/3

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B.Tech. (Mechanical Engineering)

SEMESTER- III

Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	KOE031-38/ KAS302	Engg. Science Course/Maths IV	3	1	0	30	20	50		100		150	4
2	KAS301/ KVE301	Technical Communication/Universal Human Values	2 3	1 0	0 0	30	20	50		100		150	3
3	KME301	Thermodynamics	3	1	0	30	20	50		100		150	4
4	KME302	Fluid Mechanics & Fluid Machines	3	1	0	30	20	50		100		150	4
5	KME303	Materials Engineering	3	0	0	30	20	50		100		150	3
6	KME351	Fluid Mechanics Lab	0	0	2				25		25	50	1
7	KME352	Material Testing Lab	0	0	2				25		25	50	1
8	KME353	Computer Aided Machine Drawing-I Lab	0	0	2				25		25	50	1
9	KME354	Mini Project or Internship Assessment*	0	0	2			50				50	1
10	KNC301/ KNC302	Computer System Security/Python Programming	2	0	0	15	10	25		50			0
11		MOOCs (Essential for Hons. Degree)											
		Total										**950**	**22**

*The Mini Project or internship (3-4 weeks) conducted during summer break after II semester and will be assessed during III semester.

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SEMESTER-III

THERMODYNAMICS

L-T-P
3-1-0

Objectives:

- To learn about work and heat interactions, and balance of energy between system andits surroundings.
- To learn about application of I law to various energy conversion devices.
- To evaluate the changes in properties of substances in various processes.
- To understand the difference between high grade and low-grade energies and II lawlimitations on energy conversion.

UNIT I

Review of Fundamental Concepts and Definitions:
Introduction- Basic Concepts: System, ControlVolume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopicviewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & Inexact Differentials, Cycle Reversibility Quasi – static Process, Irreversible Process, Causes of Irreversibility Energy and its forms, Work and heat (sign convention), Gas laws, Ideal gas, Real gas, Law of corresponding states, Property of mixture of gases, electrical, magnetic,gravitational, spring and shaft work.
Zeroth law of thermodynamics: Concept of Temperature and its' measurement, Temperature scales.
First law of thermodynamics:
First Law for Flow Processes - Derivation of general energy equation for a control volume;Steady state steady flow processes including throttling; Examples of steady flow devices;Unsteady processes; examples of steady and unsteady I law applications for system andcontrol volume. Limitations of first law of thermodynamics, PMM-I. Steady flow systems and their analysis, Steady flow energy equation, Boilers, Condensers, Turbine, Throttling process, Pumps etc.

UNIT II

Second law of thermodynamics:
Thermal reservoirs, Energy conversion, Heat engines, Efficiency, Reversed heat engine, Heat pump, Refrigerator, Coefficient of Performance, Kelvin Planck and Clausius statement of second law of thermodynamics, Equivalence of the two statements. Reversible and irreversible processes, Carnot cycle and Carnot engine, Carnot theorem and it's corollaries, Thermodynamic Temperature Scale, PMM-II.
Entropy: Clausius inequality, Concept of Entropy, Entropy change of pure substance in different thermodynamic processes, Tds equation, Principle of entropy increase, T-S diagram, Statement of the third law of thermodynamics.

UNIT III

Availability and Irreversibility:
Available and unavailable energy, Availability and Irreversibility, Second law efficiency, Helmholtz & Gibb's function.
Thermodynamic relations:
Conditions for exact differentials. Maxwell relations, Clapeyron equation, Joule-Thompson coefficient and Inversion curve. Coefficient of volume expansion, Adiabatic and Isothermal compressibility.

UNIT IV

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Properties of steam and Rankine cycle:
Pure substance, Property of Pure Substance (steam), Triple point, Critical point, Saturation states, Sub-cooled liquid state, Superheated vapour state, Phase transformation process of water, Graphical representation of pressure, volume and temperature, P-T, P-V and P-h diagrams, T-S and H-S diagrams, use of property diagram, Steam-Tables &Moller chart, Dryness factor and it's measurement, processes involving steam in closed and open systems. Simple Rankine cycle.

Air-water vapour mixture and Psychrometry: Psychometric terms and their definitions, Psychometric chart, Different Psychometric processes and their representation on Psychometric chart.

UNIT V

Refrigeration Cycles:
Reversed Carnot Cycle for gas and vapour. Refrigeration capacity, unit of refrigeration.Air Refrigeration cycles; Reversed Brayton Cycle and Bell Coleman Cycle. Vapour compression refrigeration cycle; simple saturated cycle and actual vapour compression refrigeration cycle. Analysis of cycles, effect of superheating, sub-cooling and change in evaporator and condenser pressure on performance of vapour compression refrigeration cycle. Refrigerants; their classification and desirable properties. Vapour absorption refrigeration system.

Course Outcomes:

- After completing this course, the students will be able to apply energy balance to systems and control volumes, in situations involving heat and work interactions.
- Students can evaluate changes in thermodynamic properties of substances.
- The students will be able to evaluate the performance of energy conversion devices.
- The students will be able to differentiate between high grade and low-grade energies.

Books and References:
1. Basic and Applied Thermodynamics by PK Nag, MCGRAW HILL INDIA.
2. Thermodynamics for Engineers by Kroos& Potter, Cengage Learning.
3. Thermodynamics by Shavit and Gutfinger, CRC Press.
4. Thermodynamics- An Engineering Approach by Cengel, MCGRAW HILL INDIA.
5. Basic Engineering Thermodynamics, Joel, Pearson.
6. Fundamentals of Engineering Thermodynamics by Rathakrishnan, PHI.
7. Engineering Thermodynamics by Dhar, Elsevier.
8. Engineering Thermodynamics by Onkar Singh, New Age International.
9. Engineering Thermodynamics by CP Arora.
10. Engineering Thermodynamics by Rogers, Pearson.
11. Fundamentals of Engineering Thermodynamics by Moran, Shapiro, Boettner, & Bailey, John Wiley.
12. Engineering Thermodynamics by Mishra, Cengage Learning.
13. Refrigeration and Air Conditioning by C P Arora, MCGRAW HILL INDIA.

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Syllabus

UNIT-I:

Introduction: Introduction- Basic Concepts: System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & Inexact Differentials, Cycle Reversibility Quasi–static Process, Irreversible Process, Causes of Irreversibility Energy and its forms, Work and heat(sign convention), Gas laws, Ideal gas, Real gas, Law of corresponding states, Property of mixture of gases, electrical, magnetic, gravitational, spring and shaft work

Zeroth law of thermodynamics: Concept of Temperature and its' measurement, Temperature scales.

Beyond: Pressure, pdv-work

First law of thermodynamics: First Law for Flow Processes - Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling; Examples of steady flow devices; Unsteady processes; examples of steady and unsteady I law applications for system and control volume. Limitations of first law of thermodynamics, PMM-I. Steady flow systems and their analysis, Steady flow energy equation, Boilers, Condensers, Turbine, Throttling process, Pumps etc

Beyond: First Law for Non flow processes.

UNIT-II:

Second law of thermodynamics: Thermal reservoirs, Energy conversion, Heat engines, Efficiency, Reversed heat engine, Heat pump, Refrigerator, Coefficient of Performance, Kelvin Planck and Clausius statement of second law of thermodynamics, Equivalence of the two statements. Reversible and irreversible processes, Carnot cycle and Carnot engine, Carnot theorem and it's corollaries, Thermodynamic Temperature Scale,PMM-II.**Entropy:** Clausius inequality, Concept of Entropy, Entropy change of pure substance in different thermodynamic processes, Tds equation, Principle of entropy increase, T-S diagram, Statement of the third law of thermodynamics..

UNIT-III:

Availability and Irreversibility: Available and unavailable energy, Availability and Irreversibility, Secondlawefficiency, Helmholtz&Gibb'sfunction.

Thermodynamicrelations: Conditions for exact differentials. Maxwell relations, Clapeyron equation, Joule-Thompson coefficient and Inversion curve. Coefficient of volume expansion, Adiabatic and Isothermal compressibility.

UNIT-IV:

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Properties of steam and Rankinecycle: Pure substance, Property of Pure Substance (steam), Triple point, Critical point, Saturation states, Subcooled liquid state, Superheated vapour state, Phase transformation process of water,Graphical representation of pressure, volume and temperature, P-T,P-V and P-hdiagrams,T-S and H-S diagrams, use of property diagram, Steam-Tables &Moller chart, Dryness factor and it'smeasurement,processes involving steam in closed and open systems. Simple Rankine cycle.

Air-water vapour mixture and Psychrometry: Psychometric terms and their definitions,Psychometric chart, Different Psychometric processes and their representation on Psychometric chart

UNIT-V:

RefrigerationCycles: Reversed Carnot Cycle for gas and vapour. Refrigeration capacity, unit of refrigeration.Air Refrigeration cycles; Reversed Brayton Cycle and Bell Coleman Cycle. Vapour compression refrigeration cycle; simple saturated cycle and actual vapour compression refrigeration cycle. Analysis of cycles, effect of superheating, sub-cooling and change in evaporator and condenser pressure on performance of vapour compression refrigeration cycle. Refrigerants; their classification and desirable properties. Vapour absorption refrigeration system.

References:

1. Basic and Applied Thermodynamics by P K Nag, MC GRAW HILL INDIA.
2. Thermodynamics for Engineers by Kroos& Potter, Cengage Learning.
3. Thermodynamics by Shavit and Gutfinger, CRC Press.
4. Thermodynamics- An Engineering Approach by Cengel, MCGRAW HILL INDIA.
5. Basic Engineering Thermodynamics, Joel, Pearson.
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7. Engineering Thermodynamics by Dhar, Elsevier.
8. Engineering Thermodynamics by Onkar Singh, New Age International.
9. Engineering Thermodynamics by CP Arora.
10. Engineering Thermodynamics by Rogers, Pearson.
11. Fundamentals of Engineering Thermodynamics by Moran, Shapiro, Boettner, & Bailey, John Wiley.
12. Engineering Thermodynamics by Mishra, Cengage Learning.
13. Refrigeration and Air Conditioning by C P Arora, MCGRAW HILL INDIA

Additional References:

1. Applied thermodynamics by Onkar Singh, New Age International(P),Limited , Publishers
2. Thermal Engineering by R.K.Rajput,Laxmi Publications(P) Limited

Text Books:

1. Thermal Engineering by Mahesh M Rathore, McGra Hill Education (India) Private Limited.

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2. Basic and Applied Thermodynamics by P K Nag, MC GRAW HILL INDIA

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COURSE OUTCOMES (May be 3 -5)

Once the student has successfully completed this course, he/she will be able:

KME-301.1	To explain fundamental concepts of thermodynamics and apply the concept of first law of thermodynamics to open and closed systems.
KME-301.2	To apply the concept of second law of thermodynamics and entropy.
KME-301.3	To apply the concept of availability and irreversibility and thermodynamic relations.
KME-301.4	To apply the properties of pure substance and air-water vapour mixture.
KME-301.5	To Analyze air, vapour compression and absorption refrigeration systems.

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In Pursuit of Excellence	**Course Delivery Method**	SESSION-2019-2020
		SEM-3^{RD}

Name of Subject: Thermodynamics

Subject Code: KME-301

Branch: Mechanical Engineering

Course Plan

Delivery Methods: Chalk & Talk, Power Point Presentation, Tutorials, Video Lectures, Analogy, solving Numerical exercises, assignments, Brainstorming, Group Discussion/Interactive session.

Coverage of

Unit 1 by: - Chalk & Talk, Tutorials, Solving numerical problems, assignments.

Unit 2 by: - Chalk & Talk,, Tutorials, , Solving numerical problems, assignments .

Unit 3 by: - Chalk & Talk, Tutorials, Solving numerical exercises, assignments.

Unit 4 by: - Chalk & Talk, Tutorials, Solving numerical exercises, assignments,

Unit 5 by: - Chalk & Talk, Tutorials, Solving numerical exercises, assignments.

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Mapping of Course Outcomes with POs & PSOs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
KME-301.1	3	3	2	2			2					1
KME-301.2	3	3	2	2			2					1
KME-301.3	3	3	2	2			2					1
KME-301.4	3	3	2	2		2	2					1
KME-301.5	3	3	2	2		2	2					1
KME-301	3	3	2	2		2	2					1

CO	PSO1	PSO2	PSO3
KME-301.1	3	--	--
KME-301.2	3	--	--
KME-301.3	3	--	---
KME-301.4	3	--	--
KME-301.5	3	--	---
KME-301	3	--	--

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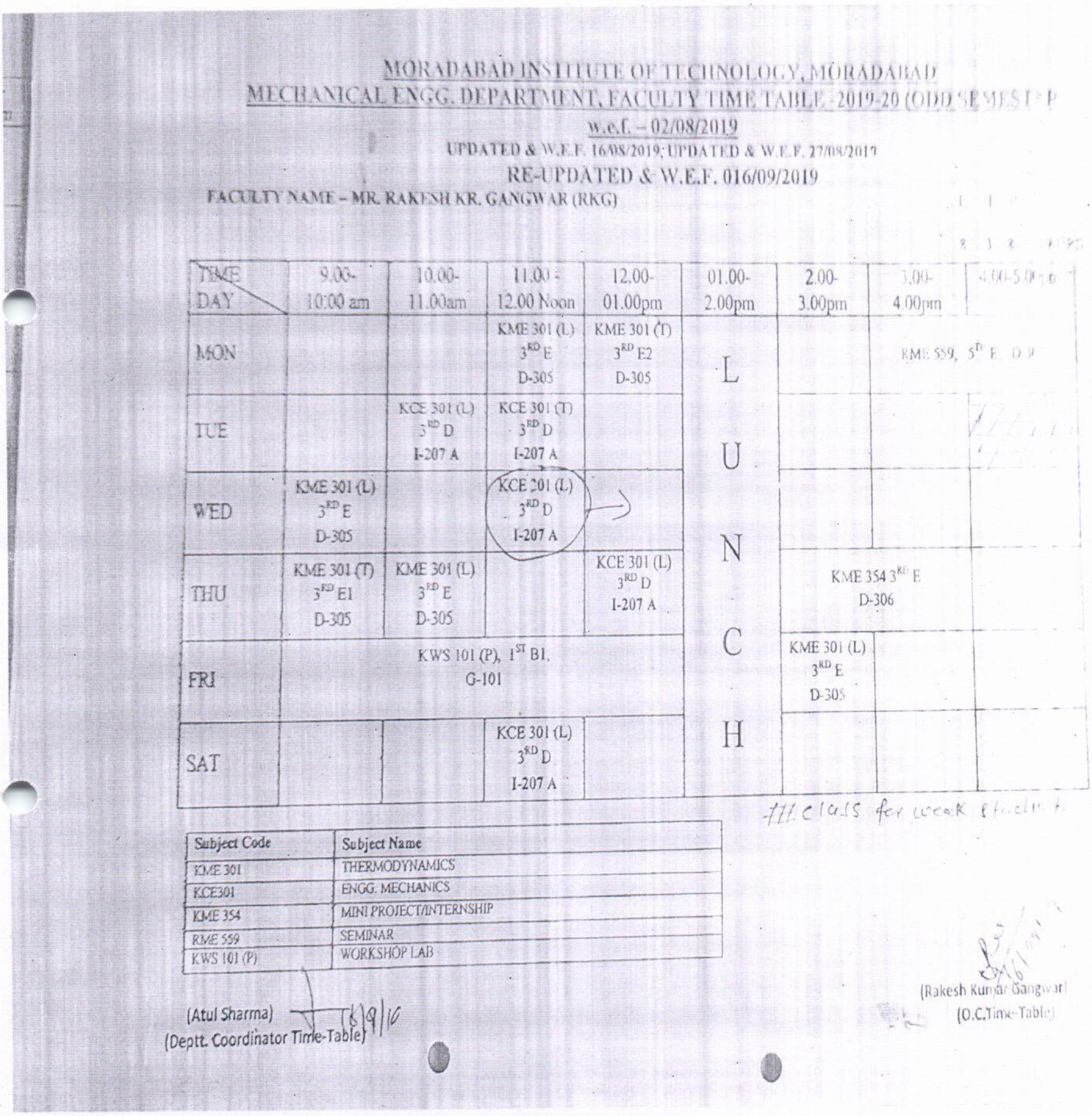
In Pursuit of Excellence	Time Table	SESSION-2019-2020 SEM-3rd



MORADABAD INSTITUTE OF TECHNOLOGY, MORADABAD
MECHANICAL ENGG. DEPARTMENT, FACULTY TIME TABLE -2019-20 (ODD SEMESTER)
w.e.f. – 02/08/2019
UPDATED & W.E.F. 16/08/2019; UPDATED & W.E.F. 27/08/2019
RE-UPDATED & W.E.F. 016/09/2019

FACULTY NAME – MR. RAKESH KR. GANGWAR (RKG)

TIME / DAY	9.00-10:00 am	10.00-11.00am	11.00 - 12.00 Noon	12.00-01.00pm	01.00-2.00pm	2.00-3.00pm	3.00-4.00pm	4.00-5.00
MON			KME 301 (L) 3RD E D-305	KME 301 (T) 3RD E2 D-305	L U N C H		RME 559, 5TH E, D-3	
TUE		KCE 301 (L) 3RD D I-207 A	KCE 301 (T) 3RD D I-207 A					
WED	KME 301 (L) 3RD E D-305		KCE 201 (L) 3RD D I-207 A					
THU	KME 301 (T) 3RD E1 D-305	KME 301 (L) 3RD E D-305		KCE 301 (L) 3RD D I-207 A		KME 354 3RD E D-306		
FRI	KWS 101 (P), 1ST B1, G-101					KME 301 (L) 3RD E D-305		
SAT			KCE 301 (L) 3RD D I-207 A					

III class for weak student

Subject Code	Subject Name
KME 301	THERMODYNAMICS
KCE301	ENGG. MECHANICS
KME 354	MINI PROJECT/INTERNSHIP
RME 559	SEMINAR
KWS 101 (P)	WORKSHOP LAB

(Atul Sharma) 16/9/19
(Deptt. Coordinator Time-Table)

(Rakesh Kumar Gangwar)
(O.C.Time-Table)

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In Pursuit of Excellence	**Lecture Plan** & **Course Coverage**	SESSION-2019-2020 SEM- 3rd

Total Period: 44

Sr. No.	No. of Periods	Topics/Sub Topics	Text Books	CO Covered	Planned Date	Coverage Date	Sign
1.	1	Introduction to CO.PO,PSO,PEO,Evaluation Scheme,Syllabus,Mission,Vission of Institute and Department			**03/08/19**	**03/08/19**	
2.	1	Introduction- Basic Concepts: System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints	[1,2]	CO1	**07/08/19**	**07/08/19** **&** **08/08/19**	
3.	1	Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & Inexact Differentials, Cycle Reversibility Quasi-static Process, Irreversible Process, Causes of Irreversibility Energy and its forms	[1,2]	CO1	**08/08/19**	**14 /08/19** **&** **21/08/19**	
4.	1	Work and heat (sign convention), Gas laws, Ideal gas, Real gas, Law of corresponding states, Property of mixture of gases,	[1,2]	CO1	**14 /08/19**	**22/08/19**	
5.	1	electrical, magnetic, gravitational, spring and shaft work	[1,2]	CO1	**19/08/19**	**26/08/19**	
6.	1	***Pressure its' measurement,**	[1,2]	CO1	**21/08/19**	**28/08/19**	
7.	2	***p.dv -work**	[1,2]	CO1	**22/08/19** **26/08/19**	**29/08/19**	
8.	1	**Zeroth law of thermodynamics:**Concept of Temperature and its' measurement, Temperature scales	[1,2]	CO1	**28/08/19**	**02/09/19**	
9.	3	*** First Law for Non flow processes**	[1,2]	CO1	**29//08/19** **30/08/19** **02/09/19**	**04,05,09 /09/19**	
10.	1	First Law for Flow Processes - Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling	[1,2]	CO1	**04/09/19**	**09,11,16 /09/19**	
11.	1	Examples of steady flow devices;Unsteady processes; examples of steady and unsteady	[1,2]	CO1	**05/09/19**	**17/09/19**	

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12.	1	First law applications for system and control volume. Limitations of first law of thermodynamics, PMM-I	[1,2]	CO1	**09/09/19**	**18,19/09/19**	
13.	1	Steady flow systems and their analysis, Steady flow energy equation, Boilers, Condensers, Turbine, Throttling process, Pumps etc	[1,2]	CO1	**11/09/19**	**20,23/09/19**	
14.	2	Thermal reservoirs, Energy conversion, Heat engines, Efficiency, Reversed heat engine, Heat pump, Refrigerator, Coefficient of Performance,	[1,2]	CO2	**16/09/19** **17/09/19**	**25,26,27/09/19**	
15.	1	Kelvin Planck and Clausius statement of second law of thermodynamics, Equivalence of the two statements	[1,2]	CO2	**18/09/19**	**30/09/19**	
16.	1	Reversible and irreversible processes, Carnot cycle and Carnot engine	[1,2]	CO2	**19//09/19**	**03/10/19**	
17.	1	Carnot theorem and it's corollaries, Thermodynamic Temperature Scale, PMM-II.	[1,2]	CO2	**20/09/19**	**04/10/19**	
18.	1	**Entropy:** Clausius inequality, Concept of Entropy, Entropy change of pure substance in different thermodynamic processes	[1,2]	CO2	**23/09/19**	**10/10/19**	
19.	2	Tds equation, Principle of entropy increase, T-S diagram, Statement of the third law of thermodynamics.	[1,2]	CO2	**25/09/19** **26/09/19**	**11, 14/10/19**	
20.	1	**Availability and Irreversibility**: Available and unavailable energy, Availability and Irreversibility	[1,2]	CO3	**27/09/19**	**16/10/19**	
21.	1	Second law efficiency, Helmholtz & Gibb's function.	[1,2]	CO3	**03/10/19/**	**17/10/19**	
22.	1	**Thermodynamic relations:**Conditions for exact differentials. Maxwell relations,	[1,2]	CO3	**4/10/19/**	**18/10/19**	
23.	1	Clapeyron equation, Joule-Thompson coefficient and Inversion curve	[1,2]	CO3	**10/10/19/**	**19/10/19**	

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24.	1	Coefficient of volume expansion, Adiabatic and Isothermal compressibility	[1,2]	CO3	**11/10/19**	**21/10/19**	
25.	1	Pure substance, Property of Pure Substance (steam), Triple point, Critical point, saturation states, Subcooled liquid state, Superheated vapour state,	[1,2]	CO4	**14/10/19**	**01/11/19**	
26.	1	Phase transformation process of water, Graphical representation of pressure, volume and temperature, P-T, P-V and P-h diagrams, T-S and H-S diagrams,	[1,2]	CO4	**17/10/19**	**04/11/19**	
27.	1	use of property diagram, Steam-Tables &Moller chart, Dryness factor and it's measurement, processes involving steam in closed and open systems	[1,2]	CO4	**18/10/19**	**05/11/19**	
28.	2	Simple Rankine cycle.	[1,2]	CO4	**19/10/19** **21/10/19**	**06/11/19** **08/11/19**	
29.	1	Psychometric terms and their definitions, Psychometric chart,	[1,2]	CO5	**01/11/19**	**13/11/19**	
30.	1	Different Psychometric processes and their representation on Psychometric chart	[1,2]	CO5	**4/11/19**	**14/11/19**	
31.	1	Reversed Carnot Cycle for gas and vapour. Refrigeration capacity, unit of refrigeration.	[1,2]	CO5	**6/11/19**	**15/11/19/**	
32.	2	Air Refrigeration cycles; Reversed Brayton Cycle and Bell Coleman Cycle	[1,2]	CO5	**7/11/19** **08/11/19**	**18/11/19**	
33.	2	Vapour compression refrigeration cycle; simple saturated cycle and actual vapour compression refrigeration cycle	[1,2]	CO5	**13/11/19** **14/11/19**	**20/11/19**	
34.	1	Analysis of cycles, effect of superheating, sub-cooling and change in evaporator and condenser pressure on performance of vapour compression refrigeration cycle	[1,2]	CO5	**15/11/19**	**21/11/19**	
35.	1	Refrigerants; their classification and desirable properties.	[1,2]	CO5	**18/11/19**	**22/11/19**	

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36.	2	Vapour absorption refrigeration system.	[1,2]	CO5	**20/11/9** **21/11/19**	**25/11/19** **26/11/19**	
		Assignment Test 1				**05/08/19**	
		Analysis of Assignment Test 1				**22/08/19**	
		Assignment Test 2				**09/09/19**	
		Analysis of Assignment Test 2				**25/09/19**	
		Assignment Test 3				**30/09/19**	
		Analysis of Assignment Test 3				**10/09/19**	
		Assignment Test 4				**10/09/19**	
		Analysis of Assignment Test 4				**16/10/19**	
		Assignment Test 5				**18/10/19**	
		Analysis of Assignment Test 5				**01/11/19**	
		Assignment Test 6				**01/11/19**	
		Analysis of Assignment Test 6				**06/11/19**	
		Assignment Test 7				**06/11/19**	
		Analysis of Assignment Test 7				**13/11/19**	
		Assignment Test 8				**18/11/19**	
		Analysis of Assignment Test 8				**22/11/19**	
		Assignment Test 9				**22/11/19**	
		Analysis of Assignment Test 9				**27/11/19**	

***Beyond the Syllabus**

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In Pursuit of Excellence	**Tutorial-1**	SESSION-2019-2020
		SEM-3^{rd}

Tutorial 1 [CO - 1]

Sr. No.	**No. of Periods**	**Topics/Sub Topics**	**Coverage Date**		**Sign**
			Batch A	**Batch B**	
1.	1	**Pressure and its measurement,Zeroth law of thermodynamics**	22/08/19	19/08/19	

Q1. Find out the pressure difference shown by the manometer deflection of 30 cm of Mercury. Take local acceleration of gravity as 9.78 m/s2 and density of mercury at room temperature as 13,550 kg/m3. **(Ans. 39755.70 Pa)**

Q2. An evacuated cylindrical vessel of 30 cm diameter is closed with a circular lid. Estimate the effort required for lifting the lid, if the atmospheric pressure is 76 cm of mercury column (Take g = 9.78 m/s2) **(Ans. 7115.48 N).**

Q3. Calculate the actual pressure of air in the tank if the pressure of compressed air measured by manometer is 30 cm of mercury and atmospheric pressure is 101 kPa. (Take g = 9.78 m/s2) **(Ans: 140.76 kPa).**

Q4. Convert the following readings of pressure to kPa, assuming that the barometer reads 760mm Hg.

(a) 90 cm Hg gauge (b) 40 cm Hg vacuum (c) 1.2 m H_2O gauge (d) 3.1 bar

Q5. The temperature scale of a certain thermometer is given by the relation t= Aln (p) +B,where A and B are constants and p is the thermometric property of the fluid in thermometer . At ice point and steam point,if the thermometric property is found to be 1.5 and 7.5 respectively. What will be the temperature corresponding to thermometric property of 3.5 on Celsius scale? **(Ans: 54.64^{o}C)**

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In Pursuit of Excellence	**Tutorial-2**	SESSION-2019-2020
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Tutorial 2 [CO - 1]

Sr. No.	No. of Periods	Topics/Sub Topics	Coverage Date		Sign
			Batch A	Batch B	
1.	1	1st law o f thermodynamics for non flow process	29/08/19	26/08/19	

Q1. A piston-cylinder device with air at an initial temperature of 30^{0}C undergoes an expansion process for which pressure and volume are related as given below:

P (kPa)	100	37.9	14.4
V (m^3)	0.1	0.2	0.4

Calculate the work done by the system. **(Ans: 10.6 kJ)**

Q2. A piston-cylinder device operates 1 kg of fluid at 20 atm. pressure. The initial volume is 0.04 m^3. The fluid is allowed to expand reversibly following a process $pV^{1.45}$= constant so that the volume becomes double. The fluid is then cooled at constant pressure until the piston comes back to the original position. Keeping the piston unaltered, heat is added reversibly to restore it to the initial pressure. Calculate the work done in the cycle. **(Ans: 18.17 kJ)**

Q3. The properties of a certain fluid are related as follows

$u = 196 + 0.718\ t$

$pv = 0.287\ (t + 273)$

Where u is the specific internal energy (kJ/kg), t is in ^{0}C, p is pressure (kN/m^2) and v is specific volume (m^3/kg). For this fluid find c_v and c_p. (Ans: 0.718 kJ/kg and 1.005 kJ/kg)

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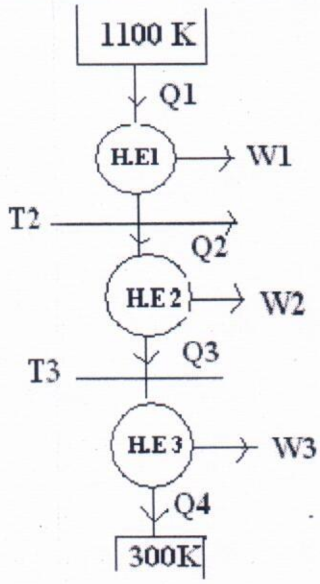
In Pursuit of Excellence	**Tutorial-3**	SESSION-2019-2020
		SEM-3rd

Tutorial 3 [CO - 2]

Sr. No.	No. of Periods	Topics/Sub Topics	Coverage Date		Sign
			Batch A	Batch B	
1.	1	2ND law o f thermodynamics	26/09/19	30/09/19	

1. A heat pump working on a reversed Carnot cycle takes in energy from a reservoir maintained at 3°C and delivers it to another reservoir where temperature is 77°C. The heat pump drives power for its operation from a reversible engine operating within the higher and lower temperature limits of 1077°C and 77°C. For 100 kJ/s of energy supplied to the reservoir at 77°C, estimate the energy taken from the reservoir at 1077°C.**(Ans: 26.71 kJ)**
2. A reversible engine is used for only driving a reversible refrigerator. Engine is supplied 2000 kJ/s heat from a source at 1500 K and rejects some energy to a low temperature sink. Refrigerator is desired to maintain the temperature of 15°C while rejecting heat to the same low temperature sink. Determine the temperature of sink if total 3000 kJ/s heat is received by the sink. **(Ans: Temperature of sink = 351.28°C)**
3. Three reversible engines of Carnot type are operating in series as shown in fig1 between the limiting temperatures of 1100 K and 300 K. Determine the intermediate temperatures if the work output from engines is in proportion of 3 : 2 : 1. (Intermediate temperatures: **700 K** and **433.33 K)**



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In Pursuit of Excellence	**Tutorial-4**	SESSION-2019-2020 SEM- 3rd

Tutorial 4 [CO - 2]

Sr. No.	No. of Periods	Topics/Sub Topics	Coverage Date		Sign
			Batch A	Batch B	
1.	1	Entropy	03/10/19	23/09/19	

1. Determine the change in entropy of universe if a copper block of 1 kg at 150°C is placed in a sea water at 25°C. Take heat capacity of copper as 0.393 kJ/kg K. (Ans: 27.4 J/K)
2. A heat engine is working between the starting temperature limits of T1 and T2 of two bodies. Working fluid flows at rate 'm' kg/s and has specific heat at constant pressure as Cp. Determine the maximum obtainable work from engine.
3. A heat engine operates between source at 600 K and sink at 300 K. Heat supplied by source is 500 kcal/s. Evaluate feasibility of engine and nature of cycle for the following conditions. (i) Heat rejected being 200 kcal/s, (ii) Heat rejected being 400 kcal/s (iii) Heat rejected being 250 kcal/s**(Ans: engine is feasible and cycle is reversible)**
4. A rigid insulated tank is divided into two chambers of equal volume of 0.04 m3 by a frictionless, massless thin piston, initially held at position with a locking pin. One chamber is filled with air at 10 bar & 25°C and other chamber is completely evacuated, Subsequently pin is removed and air comes into equilibrium. Determine whether the process is reversible or irreversible. Consider, R = 0.287 kJ/ kg.K and cv = 0.71 kJ/kg.K**(Ans: irreversebile)**

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In Pursuit of Excellence	**Tutorial-5**	SESSION-2019-2020
		SEM- 3^{rd}

Tutorial 5 [CO - 3]

Sr. No.	No. of Periods	Topics/Sub Topics	Coverage Date		Sign
			Batch A	Batch B	
1.	1	**Availability and Irreversibility**	17/10/19	17/10/19	

1. Heat is supplied reversibly for a heat source to a reversible engine and during this process, the temperature of the working fluid increases from 525K to 875K.Take water equivalent as 100kJ/K and presuming that heat rejection during the cycle takes place at ambient temperature of 290K.Determine the total heat abstracted, available and the loss of available work.**(Ans:35000kJ,51.1kJ)**
2. A heat engine receives heat from a source at 1200K at a rate of 500kW and rejects the waste heat to a medium at 300K.The power output of the heat engine is 180kW.Determine the reversible power and the irreversibility rate from this process.**(Ans:375kW,195kW)**
3. Air at 1bar and 27°C is heated in a non flow system at constant pressure to 177°C.Heat is supplied from a constant temperature reservoir at 577°C.The atmospheric temperature is 20°C.What percentage of heat added per kg of air is the available energy? **(Ans: 65.53%)**

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In Pursuit of Excellence	**Tutorial-6**	SESSION-2019-2020
		SEM- 3^{rd}

Tutorial 6 [CO - 3]

Sr. No.	No. of Periods	Topics/Sub Topics	Coverage Date		Sign
			Batch A	Batch B	
1.	1	**Availability and Irreversibility**	18/10/19	18/10/19	

1. Find the T.dS equation in the following form

T.dS = C_p dT – β v T dP

Where β is the coefficient of volume expansion.The other symbols have their usual meaning

2. What is clapeyron equation?
3. What are Maxwell equatins and why they are important in thermodynamics?

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In Pursuit of Excellence	**Tutorial-7**	SESSION-2019-2020 SEM- 3rd

Tutorial 7 [CO - 4]

Sr. No.	No. of Periods	Topics/Sub Topics	Coverage Date		Sign
			Batch A	Batch B	
1.	1	**Property of Steam and Rankine Cyle**	07/11/19	04/11/19	

1. In a vertical vessel of circular cross section having diameter of 20 cm water is filled upto a depth of 2 cm at a temperature of 150°C. A tight fitting frictionless piston is kept over the water surface and a force of 10 kN is externally applied upon the piston. If 600 kJ of heat is supplied to water determine the dryness fraction of resulting steam and change in internal energy. Also find the work done.(Ans: 0.456, 547.21 kJ, 53.03 kJ)

2. A Carnot cycle works on steam between the pressure limits of 7 MPa and 7 kPa. Determine thermal efficiency, turbine work and compression work per kg of steam(Ans:**44.21%,969.57 kJ/kg (+ve), 304.19 kJ/kg (–ve)**

3. A steam power plant uses steam as working fluid and operates at a boiler pressure of 5 MPa, dry saturated and a condenser pressure of 5 kPa. Determine the cycle efficiency for (a) Carnot cycle (b) Rankine cycle. Also show the T-s representation for both the cycles. (Ans: **42.95%,36.56%)**

4. A regenerative Rankine cycle has steam entering turbine at 200 bar, 650ºC and leaving at 0.05bar.Considering feed water heaters to be of open type determine thermal efficiency for the following conditions; (a) there is no feed water heater

(b) There is only one feed water heater working at 8 bar

(c) there are two feed water heaters working at 40 bar and 4 bar respectively. Also give layout and T-s representation for each of the case described above(Ans46.18%,49.76%, **46.18%,49.76%, 51.37%**

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In Pursuit of Excellence	**Tutorial-8**	SESSION-2019-2020 SEM- 3rd

Tutorial 8 [CO - 4]

Sr. No.	No. of Periods	Topics/Sub Topics	Coverage Date		Sign
			Batch A	Batch B	
1.	1	**Psychrometry**	14/11/19	18/11/19	

1. Explain the following processes and represent these on a psychrometric chart.
(a) Heating and humidification (b) cooling and dehumidification

2. Determine partial pressure of vapour and relative humidity in the atmospheric air having specific humidity of 16 gm/kg of air and 25°C DBT. **(Ans: 0.0254 bar, 81.98%)**

3.. For the atmospheric air at room temperature of 30°C and relative humidity of 60% determine partial pressure of air, humidity ratio, dew point temperature, density and enthalpy of air.**(Ans:0.9875 bar, 0.01606 kg/kg of dry air, 21.4°C, 1.1835 kg/m3, 71.2 kJ/kg** of dry air)

4. The air enters a duct at 10^0C and 80% RH at the rate of 150 m^3/min and is heated to 30^0c without adding or removing any moisture. The Pressure remains constant at 1 atm.Determine the relative humidity of air at exit from the duct and the rate of heat transfer. **(Ans: 23.5 % ,185.2 m^3 / min, 3704 kJ/min.)**

5. The atmospheric air at 30^0C dry bulb temperature and 75 % RH enters a cooling coil at the rate of 200 m^3/min. The coil dew point temperature is 14 °C and bypass factor of cooling coil is 0.1.Determine 1. The temperature of air leaving the cooling coil 2. The capacity of cooling coil in TR.The amount of water vapour removed/min 9 (Ans: 15.6 ^{0}C , 41.5 TR,2.08 kg/min)

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In Pursuit of Excellence	**Tutorial-9**	SESSION-2019-2020
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Tutorial 9 [CO - 5]

Sr. No.	No. of Periods	Topics/Sub Topics	Coverage Date		Sign
			Batch A	Batch B	
1.	1	**Refrigeration cycle**	21/11/19	21/11/19	

1. A Carnot refrigerator requires 1.2 kW per ton of refrigeration to maintain a temperature of -35°C. Determine
   - **i)** COP of the refrigerator
   - **ii)** The temperature at which the heat is rejected
   - **iii)** COP, if the cycle is used as a heat pump

2. In a Bell Colemn cycle, air is drawn into a cylinder of a compressor at a pressure of 1bar and -5°C.It is compressed isentropically to 5 bar and then cooled to 15 °C. It is then expanded in expansion cylinder to 1 bar and discharged into the refrigerator chamber. The expansion takes palace according to law $PV^{1.22}$= C. Find the work done on the air and the COP of the plant. Also find the plant capacity in TR for a mass flow rate of 20 kg/min.
3. In an open cycle air refrigeration machine air is drawn from a cold chamber at -2 ^{0}C and 1 bar and compressed to 11 bar. It is then cooled at this pressure to the cooler temperature of 20^{0}C and then expanded in expansion cylinder and returned to the cold room.The compression and expansion are isentropic and follows the law $pv^{1.4}$ = C .Sketch the p-v and T-s diagrams of the cycle and for refrigeration of 11 tonnes find

Theoretical C.O.P(b) rate of circulation of air(c) Piston Displacement / min in compressor and expander (Ans: COP= 1.015, 25.5 kg/min, 19.8 M^3/min ,108m^3

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In Pursuit of Excellence	**Tutorial-10**	SESSION-2019-2020 SEM- 3rd

Tutorial 10 [CO - 5]

Sr. No.	No. of Periods	Topics/Sub Topics	Coverage Date		Sign
			Batch A	Batch B	
1.	1	**Refrigeration cycle**	22/11/19	22/11/19	

1. Discuss the effect of following on the performance of a vapor compression system:
   a) Effect of super heating b) Effect of sub-cooling of liquid

2. A refrigerator works between -7°C and 27°C. The vapor is dry at the end of adiabatic compression. There is no under-cooling and evaporation is by throttle valve. Determine the COP and Power of the compressor to remove 180 kJ/min.
   The properties of refrigerant are as

Temp (°C)	Enthalpy (kj/kg)		Entropy (kJ/kg K)	
	Liquid	Latent	Liquid	Vapour
-7	-30	1298	-0.108	4.75
27	115	1173	4.27	4.33

3. A food storage chamber requires a refrigeration system of 12 TR capacity with an evaporator temperature of -8°C and condenser temperature of 30°C.The refrigerant R-12 is subcooled by 5°C before entering the throttle valve and the vapour is superheated by 6°C before entering the compressor.If the liquid and vapour specific heats are 1.235 and 0.733 kJ/kgK respectively find 1. Refrigerating effect /kg 2. Mass of refrigerant circulated /min and 3. COP. **(Ans:130.05 kJ/kg,19.4 kg,6.2)**
   Relevant properties of R-12 are given Below

Saturation Temp.	Enthalpy,kJ/kg		Entropy (kJ/kgK)	
	Liquid	Vapour	Liquid	Vapour
-8	28.0	184.06	0.1148	0.7007
30	64.59	199.62	0.2400	0.6853

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In Pursuit of Excellence	**ASSIGNMENT - 1**	SESSION-2019-2020 SEM-3rd

Home Assignments

Unit 1[CO-1]

Q.1 Define thermodynamics and conservation of energy principle.

Q2. Write down the application areas of the thermodynamics.

Q3. Define thermodynamic system. Discuss about the open and closed systems.

Q4. What is the property of the system? Define intensive and extensive properties of system with example.

Q5. Discuss the continuum principle.

Q6. What is Zeroth Law of thermodynamics?

Q7. What is thermometer?

Q8. Define state, process and cycle with respect to a thermodynamic system.

Q9. Discuss the thermodynamic equilibrium of the system.

Q10. Discuss the various types of energies of the system and define heat and work associated with the system.

Q11. What do you understand by path function and point functions?

Q12. Show that work is a path function, and not a property of the system

A 30 cm high vertical column of a fluid of density 1878 kg/m^3 exist in a pipe where g= 9.65 m/s^2 . What is the pressure at the base of the column?

Q13. A thermocouple with a test junction at t^oC on a gas thermometer scale gives the emf as $e= 0.22t-5.5x10^{-4}t^2$ mV the milivoltmeter is calibrated at ice point and steam points.What will be the reading on this thermometer, when the gas thermometer reads 60^0C

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In Pursuit of Excellence	ASSIGNMENT - 2	SESSION-2019-2020 SEM-3rd

Unit -1[CO- 1]

Define the first law of thermodynamics.

Q2. Explain the PMM1

Q3. A perfect gas at pressure of 750 kPa and 600 K is expanded to 2 bar pressure. Determine final Temperature of gas if initial and final volume of gas is 0.2 m3 and 0.5 m3 respectively

(Ans: 400 K)

Q4. How many gram of CO_2 should place in a 250 mL container at -24°C to produce a pressure of 95 kPa?

(Ans: 0.505g)

Q5. Gas from a bottle of compressed helium is used to inflate an inelastic flexible balloon, originally folded completely flat to a volume of 0.5 m^3. if the barometer reads 760 mm Hg. What is the amount of work done upon the atmosphere by balloon? Sketch the system before and after the process. **(Ans: work done on atmosphere = -50.66 kJ)**

Q6. During one cycle the working fluid in an engine engages in two work interactions: 15 kJ to the fluid and 44 kJ from the fluid, and three heat interactions, two of which are known: 75 kJ to the fluid and 40 kJ from the fluid. Evaluate the magnitude and direction of the third heat transfer. **(Ans: 6 kJ from the system)**

Q7. A gas contained in a cylinder is compressed from 1 MPa and 0.05 m3 to 2 MPa. Compression is governed by pV1.4 = constant. Internal energy of gas is given by U = 7.5 pV – 425, kJ. Where p is pressure in kPa and V is volume in m3.Determine heat, work and change in internal energy assuming compression process to be quasi static. Also find out work interaction, if the 180 kJ of heat is transferred to system between same states. Also explain why it is different from above.

(Ans: Heat = **50 kJ** Work = **25 kJ** (–ve) Internal energy change = **75 kJ**)

Q8. In a steady flow apparatus 135 kJ work done by each kg of fluid. The specific volume of the fluid, pressure and velocity at the inlet are 0.37 m^3/kg, 600kPa and 16 m/s respectively. The inlet is 32m above floor level. The discharge is at floor level. The discharge conditions are 0.62m^3/kg, 100 kPa and 270 m/s.The total heat loss between inlet and outlet is 9 kJ/kg of the fluid. In flowing apparatus, does the specific internal energy increase and by how much? **(Ans: -20 kJ/kg,Decrease)**

Q9. At the inlet to a convergent-divergent nozzle the enthalpy of the fluid passing is 3000 kJ/kg and the velocity is 60 m/s. At the discharge end, the enthalpy is 2757 kJ/kg.The nozzle is horizontal and the heat loss during the flow is negligible.Find(a)Velocity of the fluid at the exit of the nozzle ,(b)if the inlet area is 0.1 m^2 and the specific volume at the inlet is 0.187 m^3/kg find the mass flow rate of the fluid (c) if the specific volume at the oulet is 0.498 m^3/kg,find the

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area at the exit of the nozzle.**(Ans:Velocity = 699.71 m/s,Mass –Flow rate =32.08 kg/s,area= 0.0228 m^3)**

Q.10 The internal energy of air is given by $u = u_o + 0.718t$,where u is in kJ/kg,u_o is any arbitrary value of u at 0°C,kJ/kg ant t is the temperature in 0°C.Also for air $pv = 0.287(t+273)$,where p is in kPa and v is in m^3/kg.A mass of air is stirred by a paddle wheel in an insulated constant volume tank.The velocities due to stirring make a negligible contribution to the internal energy of the air.Air flows out through a small valve in the tank constant. At a certain instant the conditions are as follows: tank volume 0.12m^3, pressure 1MPa, temperature 150^0C, and power to paddle wheel 0.1kW.Find the rate of flow of air out of the tank at this instant.**(Ans:0.845 kg/h)**

In Pursuit of Excellence	**ASSIGNMENT - 3**	SESSION-2019-2020 SEM-3rd

UNIT-2 (CO-2)

1. A refrigerator operates on reversed Carnot cycle. Determine the power required to drive refrigerator between temperatures of 42°C and 4°C if heat at the rate of 2 kJ/s is extracted from the low temperature region. **(Ans: 0.274 kW)**
2. A reversible heat engine operates between two reservoirs at 827°C and 27°C. Engine drives a Carnot refrigerator maintaining –13°C and rejecting heat to reservoir at 27°C. Heat input to the engine is 2000 kJ and the net work available is 300 kJ. How much heat is transferred to refrigerant and total heat rejected to reservoir at 27°C? **(7504.58 kJ , 9204.68 kJ)**

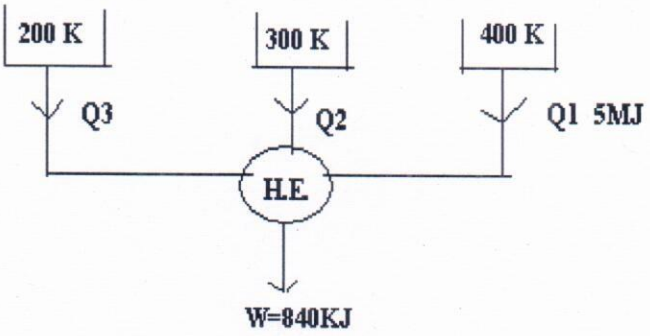

Fig.1

Fig 2

3. 0.5 kg of air executes a Carnot power cycle having a thermal efficiency of 50%. The heat transfer to the air during isothermal expansion is 40 kJ. At the beginning of the isothermal expansion the pressure is 7 bar and the volume is 0.12 m3. Determine the maximum and minimum temperatures for the cycle in Kelvin, the volume at the end of isothermal expansion in m3, and the work and heat transfer for each of the four processes in kJ. For air cP = 1.008 kJ/kg . K, cv= 0.721 kJ/kg. K. **(Ans: 585.36 kJ, 292.68 kJ, 292.68 kJ)**
4. A reversible engine as shown in figure 2 during a cycle of operation draws 5 mJ from the 400 K reservoir and does 840 kJ of work. Find the amount and direction of heat interaction with other reservoirs.**(Ans: 4980 kJ, – 820 kJ)**
5. A reversible heat engine runs between 500°C and 200°C temperature reservoirs. This heat engine is used to drive an auxiliary and a reversible heat pump which runs between reservoir at 200°C and the body at 450°C. The auxiliary consumes one third of the engine output and remaining is consumed for driving heat pump. Determine the heat rejected to the body at 450°C as fraction of heat supplied by reservoir at 500°C. **(Ans. 0.7482)**

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6. Three Carnot engine are arrange in series. The first engine take 4000kJ of heat from a source at 2000K and delivers 1

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dents Absent: 00 Students Present: 12

Sign:

Sign:

r. Munish Chhabra
Professor & Head
. Deptt. of Mechanical Engg.
radabad Institute of Technology

Total No. of Students allotted in Room: 12 **Stu**

Invigilators: 1) Name Dr L.M. Trived

2) Name Atul Sharma

In Pursuit of Excellence	**ASSIGNMENT - 4**	SESSION-2019-2020 SEM-3^{rd}

UNIT-2 (CO-2)

1. Find the change in entropy of steam generated at 400°C from 5 kg of water at 27°C and atmospheric pressure. Take specific heat of water to be 4.2 kJ/kg.K, heat of vaporization at 100°C as 2260 kJ/kg and specific heat for steam given by; cp = R (3.5 + 1.2T + 0.14T2), J/kg.K(Ans: 87.23 kJ/K)
2. Oxygen is compressed reversibly and isothermally from 125 kPa and 27°C to a final pressure of 375 kPa. Determine change in entropy of gas. (Ans: – 0.285 kJ/kg. K)
3. Determine the rate of power loss due to irreversibility in a heat engine operating between temperatures of 1800 K and 300 K. Engine delivers 2 MW of power when heat is added at the rate of 5 MW. **(Ans:2.16 MW)**
4. A reversible heat engine has heat interaction from three reservoirs at 600 K, 700 K and 800 K. The engine rejects 10 kJ/s to the sink at 320 K after doing 20 kW of work. The heat supplied by reservoir at 800 K is 70% of the heat supplied by reservoir at 700 K then determine the exact amount of heat interaction with each high temperature reservoir.**(Ans: Heat supplied by reservoir at 800 K = 61.94 kJ/s Heat supplied by reservoir at 700 K = 88.48 kJ/s Heat supplied to reservoir at 600 K = 120.42 kJ/s)**
5. Two tanks A and B are connected through a pipe with valve in between. Initially valve is closed and tanks A and B contain 0.6 kg of air at 90°C, 1 bar and 1 kg of air at 45°C, 2 bar respectively. Subsequently valve is opened and air is allowed to mix until equilibrium. Considering the complete system to be insulated determine the final temperature, final pressure and entropy change.(Ans: 142.25 kPa, 0.04047 kJ/K)
6. A system at 500 K and a heat reservoir at 300 K are available for designing a work producing device. Estimate the maximum work that can be produced by the device if heat capacity of system is given as; C = 0.05 T 2 + 0.10T + 0.085, J/K
7. Determine entropy change of universe, if two copper blocks of 1 kg & 0.5 kg at 150°C and 0°C are joined together. Specific heats for copper at 150°C and 0°C are 0.393 kJ/kg K and 0.381 kJ/kg K respectively. **(Ans : 0.0116 kJ/K)**
8. Along a horizontal and insulated duct the pressure and temperatures measured at two points are 0.5 MPa, 400 K and 0.3 MPa, 350 K. For air flowing through duct determine the direction of flow

(Ans: from **0.5 MPa, 400 K** to **0.3 MPa & 350 K)**

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		SEM-3^{rd}

UNIT-3 (CO-3)

1. 1000kJ of heat is supplied by hot gases at 1400°C from a fire box. This heat is used to generate the steam at 250°C.The atmospheric temperature is 20°C.Calculate the energy as available and unavailable portion (a) as it leave the hot gases.(b)as it enter the system.**(Ans:824kJ,175.214kJ,439.78kJ,560kJ)**
2. Steam at 1.6 MPa, 300°C enters a flow device with negligible velocity and leaves at 0.1 MPa,150°Cwith a velocity of 150 m/s. During the flow heat interaction occurs only with the surroundings at15°C and steam mass flow rate is 2.5 kg/s. Estimate the maximum possible output from the device.***(Ans:*** **Maximum possible work = 1142.75 kW)**
3. 15 kg/s steam enters a perfectly insulated steam turbine at 10 bar, 300°C and leaves at 0.05bar,0.95dry with velocity of 160 m/s. Considering atmospheric pressure to be 1 bar, 15°C.Determine (a)power output, (b) the maximum power for given end states, (c) the maximum power exhaust steam. Turbine rejects heat to a pond having water at 15°C.***(Ans:*** **Power output = 8970.9 kW, Maximum power output = 12755.7 kw, Maximum power from exhaust steam = 2266.5 kW)**
4. Air in a piston-cylinder arrangement is heated at constant pressure by addition of 100kJ/kg of air.The air is initially at 28°C while the surroundings is at 21°C.calculate the change in availability per kg of air.
   (Ans: 15.66)
5. A rigid cylinder with a volume of 2.5 m^3 contains air at 150kPa and 27°C.The heat is transferred to air from a constant temperature heat source at 1500K and air in the cylinder is heated to 700K.The atmosphere is at 1 bar and $17^{O}C$.Calculate the initial and final availability of air,maximum useful work and irreversibility.(Ans:22.83kJ,504.68kJ,524.53kJ,524.53kJ)
6. If a gas obeys the following equation of stae

$$p= RT/v-a/v^2$$

Calculate the change in enthalpy at constant temperature

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ASSIGNMENT - 6

SESSION-2019-2020

SEM-3^{rd}

UNIT-4 (CO-4)

1. Determine enthalpy, specific volume, entropy for mixture of 10% quality at 0.15 MPa.

(Ans:h = **689.759 kJ/kg** v = **0.116877 m3/kg** s = **2.01257 kJ/kg.K)**

2. A rigid vessel contains liquid-vapour mixture in the ratio of 3:2 by volume. Determine quality of water vapour mixture and total mass of fluid in vessel if the volume of vessel is 2 m3 and initial temperature is 150°C.(Ans: Mass = **1103.99 kg,** Quality = **0.001848)**

3. Steam turbine expands steam reversibly and adiabatically from 4 MPa, 300°C to 50°C at turbine exit. Determine the work output per kg of steam (Ans: **891.27 kJ/kg)**

4. A reheat cycle has steam generated at 50 bar, 500°C for being sent to high pressure turbine and

expanded upto 5 bar before supplied to low pressure turbine. Steam enters at 5 bar, 400°C into low pressure turbine after being reheated in boiler. Steam finally enters condenser at 0.05 bar and subsequently feed water is sent to boiler. Determine cycle efficiency, specific steam consumption and work ratio

5. In a steam power plant the high pressure turbine is fed with steam at 60 bar, 450°C and enters low pressure turbine at 3 bar with a portion of steam bled out for feed heating at this intermediate pressure.Steam finally leaves low pressure turbine at 0.05 bar for inlet to condenser. Closed feed heater raises the condensate temperature to 115°C. Bled steam leaving closed feed heater is passed through trap to mixwith condensate leaving condenser. Consider actual alternator output to be 30MW, boiler efficiency as 90% and alternator efficiency of 98%. Determine

(a) The mass of steam bled for feed heating,

(b) The capacity of boiler in kg/hr

(c) The overall thermal efficiency of plant

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Also give layout and T-s diagram (Ans: Steam bled for feed heating = **0.144 kg/kg steam generated,** Capacity of boiler required = **94428 kg/hr, 37.24%)**

6. Explain the Rankine Cycle with the help of p-v and T-s dia

7. Define the dryness fraction

In Pursuit of Excellence	**ASSIGNMENT - 7**	SESSION-2019-2020 SEM-3rd

UNIT-4 (CO-4)

1. Define and explain the followingterms in relation to psychrometry

(a) Dry bulb temperature (b) Wet bulb temperature (c) Dew point temperature temperature

2. Determine the mass of water added and heat transferred for conditioning atmospheric air at 15°Cand 80% relative humidity to temperature of 25°C and relative humidity of 50%. Final volume of conditioned air is 0.8 m3/s(Ans: Mass of water added = **0.001312 kg/s,** Heat transferred = **12.18 kW)**

3. The following data refers to summer air conditioning of a small office hall with capacity for 30 persons:Outside conditions= 34^0Cdbt and 28^0C wbt

Inside design conditions= 24^0C dbt and 50% RH

Sensible and latent heat= 2100 kJ/min per person

Make calculations for sensible heat factor for the air-conditioning plant**.(Ans: 0.668)**

4. Atmospheric air at 35^0C dbt and 55% relative humidity has been cooled to a state corresponding to 25 ^{0}C dbt and 50% relative humidity.Determine the capacity of the refrigerating machine if it is to handle 125 m^3 of air per min. at initial state**.(Ans:23.72 ton)**

5. A quantity of air having a volume of $300m^3$ at 30^0C wbt is heating to 40^0C dbt.Calculate the amount of heat added and relative humidity at both the states.(Ans:3356)

6. Air at 40 ^{0}C DBT and 60% RH is cooled to 25^0C dbt.It is achieved by cooling and dehumidification.Air flow rate is 40 m^3/min.Using psychrometric chart calculate.

(a) The DPT

(b)Mass of water drained out per hour.

©Capacity of cooling coil

If the apparatus dew-point temperature is 20^0C,find the bypass factor of coil.(Ans: 43.24 kg/min,23.36 kg/hr,8.03 ton,0.25)

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ASSIGNMENT - 8

SESSION-2019-2020

SEM-3rd

UNIT-5 (CO-5)

4. Define "Refrigeration".

5. Define the tonne of refrigeration

6. Define the actual and theoretical C.O.P

7. A Carnot refrigerator requires 1.2 kW per ton of refrigeration to maintain a temperature of -35°C. Determine
i)COP of the refrigerator **ii)** COP, if the cycle is used as a heat pump

8. What are the limitations of Reversed Carnot Cycle?

9. With block diagram explain the difference between Refrigerator and Heat Pump. What is the thermodynamic advantage of using Heat Pump than that of electric heater?

10. A Carnot refrigerator requires 1.2 kW per ton of refrigeration to maintain a temperature of -35°C. Determine
- **iv)** COP of the refrigerator
- **v)** The temperature at which the heat is rejected
- **vi)** COP, if the cycle is used as a heat pump

11. A refrigerator using Reversed Carnot cycle requires 1.25 kW per TR to maintain a temperature of -30°C. Find
- **i)** COP of refrigeration system
- **ii)** Temperature at which heat is rejected
- **iii)** Heat rejected in kW,
- **iv)** COP if the system is acting as a Heat pump

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ASSIGNMENT - 9

SESSION-2019-2020

SEM-3^{rd}

UNIT-5 (CO-5)

1. Explain the bell-colemon cycle with the help of T-S and P-V diagram.

2. Explain the vapour compression cycle with help of T-S and P-V diagram.

3. A refrigeration system has air leaving refrigerated space at 7°C and 1 bar and subsequently air is compressed isentropically to 5 bar. After being compressed air is cooled up to 27°C at this pressure and then expanded isentropically up to 1 bar and discharged into refrigerated space. Determine COPofsystem. (Ans: 1.71)

4. In a refrigerator working on Bell Coleman cycle the air enters compressor at 1 bar and –10°C andgetscompressed up to 5.5 bar. Compressed air is cooled to 27°C at same pressure before being sent to expander for expansion up to 1 bar and then passes through refrigerated space. Determine refrigerationcapacity, hp required to run compressor and COP of system if air flow rate is 0.8 kg/s(**Ans:** Refrigeration capacity = **18.07 ton,** HP required to run compressor = **177.86 hp,** COP = **1.59)**

5. A refrigerator working on simple vapour compression cycle operates between the temperature of 25°C and – 15°C withNH3, refrigerant. Ammonia is found to be dry after compression and no under cooling of liquid refrigerant occurs in cycle. Using following data obtain COP of system.

Temp.	**Enthalpy(kJ/kg)**		**Entropy(kJ/kg K)**	
	h_f	h_g	S_f	S_g
-15^0C	**-54.51**	**1303.74**	**-0.2132**	**5.0536**
25^0C	**99.94**	**1317.95**	**0.3386**	**4.4809**

6. A vapour compression cycle works on Freon-12 refrigerant with condensation temperature of 40°Cand evaporator temperature of – 20°C. Refrigeration effect of 2.86 ton is desired from the cycle.The compressor runs with 1200 rpm and has clearance volume of 2%. Considering compression index of 1.13 and following data determine. (a) theCOP(b) the piston displacement in the reciprocating compressor used for compression.Properties of Freon – 12.

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Temp(^{0}C)	Sat.Pressure (Bar)	Specific Volume $V_g(m^3/kg)$	Enthalpy kJ/kg		Entropy kJ/kg K		Specific heat (kJ/kg/K)	
			h_f	h_f	S_f	S_g	C_{pf}	C_{pg}
-20	**1.51**	**0.1088**	**17.8**	**178.61**	**0.0730**	**0.7082**	**-**	**0.605**
40	**9.61**	**-**	**74.53**	**203.05**	**0.2716**	**0.682**	**0.976**	**0.747**

(Ans: COP = **3.175** Piston displacement = **569.45 cm3)**

7. A vapour compression refrigeration cycle operates between the condensation temperature of 20°Cand evaporator temperature of –10°C with carbon dioxide as refrigerant. Temperature after isentropiccompression is 40°C and condensate leaves at 10°C before being passed through expansion valve. Determine COP of system and mass flow rate of CO_2 required to get refrigeration effect of 2kW.Propertiesof CO_2 are given as under: Properties of CO_2

Temp(^{0}C)	Sat.Pressure (Bar)	Specific Volume $V_g(m^3/kg)$	Enthalpy kJ/kg		Entropy kJ/kg K		Specific heat (kJ/kg/K)	
			h_g	h_f	S_f	S_g	C_{pf}	C_{pg}
20	**57.27**	**-**	**144.11**	**299.62**	**0.523**	**1.0527**	**2.889**	**2.135**
-10	**26.49**	**0.014**	**60.78**	**322.28**	**0.2381**	**1.2324**	**-**	**-**

(Ans: COP = **6.51**, Mass flow rate = **0.1016 kg/s)**

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In Pursuit of Excellence	**List of Students**	SESSION-2019-2020 SEM-3rd

MORADABAD INSTITUTE OF TECHNOLOGY

Ram Ganga Vihar – Phase – II, Moradabad

2nd Year 3rd Sem Batch 2018-19

Branch – Mechanical Engineering

SECTION-E

S.No	Student No	Roll No	Name of Students	Father's Name	Remark
1.	1840259	1808240001	AARAV SANKET	VIJAY KUMAR	
2.	1840003	1808240003	ABHINEET BHARDWAJ	KRISHAN KUMAR	
3.	1840058	1808240004	ABHISHEK BHATNAGAR	J.K. BHATNAGAR	
4.	1840047	1808240005	ABHISHEK SINGH	KASHI NATH SINGH	
5.	1840237	1808240006	AJAY KUMAR	INDRAPAL SINGH	
6.	1840258	1808240007	AMAN GAHLAUT	SATYAPAL SINGH	
7.	1840152	1808240008	ANMOL SAGAR	SURENDRA SAGAR	
8.	1840175	1808240009	APURV CHANDEL	ASHISH CHANDEL	
9.	1840157	1808240010	ARPIT TYAGI	AVNISH KUMAR TYAGI	FW
10.	1840104	1808240011	ATIGYA GARG	SHARAD KUMAR GARG	
11.	1840092	1808240012	DEEPAK PAL	SHIVNANDAN SINGH	
12.	1840008	1808240013	DEEPRANSH SINGH	DEEPENDRA SINGH	
13.	1840239	1808240014	DEVISH KUMAR	CHHATTARPAL SINGH	
14.	1840121	1808240015	DHARMESH DHAWAN	SUNIL KUMAR DHAWAN	FW
15.	1840260	1808240018	IBRAHIM KHAN	QAMAR HASEEN	
16.	1840127	1808240019	KARTIK CHAUDHARY	RAJVEER SINGH	
17.	1840163	1808240020	KRISHNA OMPRAKASH KASHYAP	OMPRAKASH BABURAM KASHYAP	
18.	1840122	1808240021	LAKSHAY KAUSHIK	PRAVEEN KAUSHIK	
19.	1840267	1808240022	LOKENDRA	RAM PAL SINGH	
20.	1840128	1808240023	MANJUL KUMAR	RAVI PRAKASH	
21.	1840090	1808240024	MANOJ KUMAR	SURESH KUMAR	
22.	1840246	1808240025	MAYANK ANAND	BRIJ BHUSHAN RAVI	
23.	1840137	1808240027	MOHD. RAHIL	MOHD. HANEEF	FW
24.	1840007	1808240028	MUSKAN BHATNAGAR	KULDEEP BHATNAGAR	

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25.	1840264	1808240029	NIPUN VASHISHTHA	DAKSH KUMAR SHARMA	
26.	1840206	1808240030	PRANJAL CHAUDHARY	VIKAS KUMAR	
27.	1840266	1808240031	RAHUL ANAND	MUKESH ANAND	
28.	1840129	1808240032	ROMESHWAR SARAN	OMKAR SARAN	
29.	1840233	1808240033	SAMAN ALI	MOHD. ALI	
30.	1840016	1808240034	SAMYAK JAIN	NEERAJ JAIN	
31.	1840012	1808240035	SHANTANU TIWARI	ANADI TIWARI	
32.	1840173	1808240036	SUDHEER KUMAR GAUTAM	JAVAR SINGH	
33.	1840126	1808240037	UDAY VARSHNEY	SANDEEP KUMAR	
34.	1840084	1808240038	YASIR MUMTAZ	MUMTAZ HUSAIN	

Diploma

35.	2194003		AMAN KUMAR	ABHILASH CHANDRA	
36.					
37.					

Batch E1	1-17
Batch E2	18 - Rest

Dr Nitin Agarwal
Dean – Academics

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MORADABAD INSTITUTE OF TECHNOLOGY
Department of Mechanical Engineering
2nd year E Section Sem- 3rd

Attendance upto 06/09/2019

S No.	Roll No.	Name of Student	KME-301	
			A	H
1	1808240001	AARAV SANKET	18	18
2	1808240003	ABHINEET BHARDWAJ	13	18
3	1808240004	ABHISHEK BHATNAGAR	12	18
4	1808240005	ABHISHEK SINGH	14	18
5	1808240006	AJAY KUMAR	10	18
6	1808240007	AMAN GAHLAUT	13	18
7	1808240008	ANMOL SAGAR	18	18
8	1808240009	APURV CHANDEL	12	18
9	1808240010	ARPIT TYAGI	15	18
10	1808240011	ATIGYA GARG	16	18
11	1808240012	DEEPAK PAL	14	18
12	1808240013	DEEPRANSH SINGH	14	18
13	1808240014	DEVISH KUMAR	18	18
14	1808240015	DHARMESH DHAWAN	15	18
15	1808240018	IBRAHIM KHAN	14	18
16	1808240019	KARTIK CHAUDHARY	11	18
17	1808240020	KRISHNA OMPRAKASH KASHYAP	14	18
18	1808240021	LAKSHAY KAUSHIK	16	18
19	1808240022	LOKENDRA	9	18
20	1808240023	MANJUL KUMAR	15	18
21	1808240024	MANOJ KUMAR	2	18

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22	1808240025	MAYANK ANAND	12	18
23	1808240027	MOHD. RAHIL	18	18
24	1808240028	MUSKAN BHATNAGAR	16	18
25	1808240029	NIPUN VASHISHTHA	18	18
26	1808240030	PRANJAL CHAUDHARY	12	18
27	1808240031	RAHUL ANAND	12	18
28	1808240032	ROMESHWAR SARAN	11	18
29	1808240033	SAMAN ALI	15	18
30	1808240034	SAMYAK JAIN	15	18
31	1808240035	SHANTANU TIWARI	16	18
32	1808240036	SUDHEER KUMAR GAUTAM	17	18
33	1808240037	UDAY VARSHNEY	17	18
34	1808240038	YASIR MUMTAZ	16	18
35		AMAN KUMAR	15	18
36		ANKIT PAL	0	10
37		MUNISH HUSSAIN	8	11
38		ANNANT BANSAL	12	13

Moradabad Institute of Technology

Ram Ganga Vihar, Phase-II, Moradabad
2ND Year 3RD Semester ODD 2019-20

Mechanical Engineering
Section-E

ATTENDAVE
UPTO 30/09/19

SUBJECT :THERMODYNAMICS (KME -301)

S.NO.	Roll No	Name of Students	ATTEND	HELD
1.	1808240001	AARAV SANKET	34	36
2	1808240003	ABHINEET BHARDWAJ	25	36
3	1808240004	ABHISHEK BHATNAGAR	29	36
4	1808240005	ABHISHEK SINGH	20	36
5	1808240006	AJAY KUMAR	21	36
6	1808240007	AMAN GAHLAUT	25	36
7	1808240008	ANMOL SAGAR	34	36
8	1808240009	APURV CHANDEL	13	36
9	1808240010	ARPIT TYAGI	30	36
10	1808240011	ATIGYA GARG	30	36
11	1808240012	DEEPAK PAL	29	36
12	1808240013	DEEPRANSH SINGH	27	36
13	1808240014	DEVISH KUMAR	30	36
14	1808240015	DHARMESH DHAWAN	29	36
15	1808240018	IBRAHIM KHAN	26	36
16	1808240019	KARTIK CHAUDHARY	16	36

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17	1808240020	KRISHNA OMPRAKASH KASHYAP	24	36
18	1808240021	LAKSHAY KAUSHIK	27	36
19	1808240022	LOKENDRA	18	36
20	1808240023	MANJUL KUMAR	32	36
21	1808240024	MANOJ KUMAR	8	36
22	1808240025	MAYANK ANAND	24	36
23	1808240027	MOHD. RAHIL	32	36
24	1808240028	MUSKAN BHATNAGAR	34	36
25	1808240029	NIPUN VASHISHTHA	35	36
26	1808240030	PRANJAL CHAUDHARY	20	36
27	1808240031	RAHUL ANAND	24	36
28	1808240032	ROMESHWAR SARAN	25	36
29	1808240033	SAMAN ALI	30	36
30	1808240034	SAMYAK JAIN	29	36
31	1808240035	SHANTANU TIWARI	31	36
32	1808240036	SUDHEER KUMAR GAUTAM	34	36
33	1808240037	UDAY VARSHNEY	30	36
34	1808240038	YASIR MUMTAZ	33	36
35		AMAN KUMAR	29	36
36		ANANT BANSAL	30	32
37		MUNISH HUSSAIN	18	32
38		ANKIT PAL	9	32

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MORADABAD INSTITUTE O

Department of Mechanica

2nd year E Section S

Attendance upto 16/

S No	Roll No.	Name of Student	KME-301(thermo		KME-302		KME-303		KME-351		KMI
			A	H	A	H					
1	1808240001	AARAV SANKET	41	42							
2	1808240003	ABHINEET BHARDWAJ	28	42							
3	1808240004	ABHISHEK BHATNAGAR	34	42							
4	1808240005	ABHISHEK SINGH	22	42							
5	1808240006	AJAY KUMAR	26	42							
6	1808240007	AMAN GAHLAUT	31	42							
7	1808240008	ANMOL SAGAR	40	42							
8	1808240009	APURV CHANDEL	19	42							
9	1808240010	ARPIT TYAGI	35	42							
10	1808240011	ATIGYA GARG	35	42							
11	1808240012	DEEPAK PAL	35	42							
12	1808240013	DEEPRANSH SINGH	30	42							
13	1808240014	DEVISH KUMAR	36	42							
14	1808240015	DHARMESH DHAWAN	33	42							
15	1808240018	IBRAHIM KHAN	32	42							
16	1808240019	KARTIK CHAUDHARY	19	42							
17	1808240020	KRISHNA OMPRAKASH	30	42							
18	1808240021	LAKSHAY KAUSHIK	33	43							
19	1808240022	LOKENDRA	20	43							
20	1808240023	MANJUL KUMAR	39	43							
21	1808240024	MANOJ KUMAR	14	43							
22	1808240025	MAYANK ANAND	23	43							
23	1808240027	MOHD. RAHIL	38	43							
24	1808240028	MUSKAN BHATNAGAR	40	43							
25	1808240029	NIPUN VASHISHTHA	40	43							
26	1808240030	PRANJAL CHAUDHARY	22	43							
27	1808240031	RAHUL ANAND	28	43							
28	1808240032	ROMESHWAR SARAN	31	43							
29	1808240033	SAMAN ALI	36	43							
30	1808240034	SAMYAK JAIN	32	43							
31	1808240035	SHANTANU TIWARI	34	43							
32	1808240036	SUDHEER KUMAR GAUTAM	39	43							
33	1808240037	UDAY VARSHNEY	33	43							
34	1808240038	YASIR MUMTAZ	39	43							
35		AMAN KUMAR	32	43							
36		ANKIT PAL	13	43							
37		MUNISH HUSSAIN	18	43							
38		ANNANT BANSAL	39	43							

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MORADABAD INSTITUTE OF TECHNOLOGY

Department of Mechanical Engineering

2nd year E Section Sem- 3rd

Attendance upto 15/11/2019

S No	Roll No.	Name of Student	KME-303								
			H	A			A	H			
1	1808240001	AARAV SANKET	59	57							
2	1808240003	ABHINEET BHARDWAJ	59	42							
3	1808240004	ABHISHEK BHATNAGAR	59	49							
4	1808240005	ABHISHEK SINGH	59	36							
5	1808240006	AJAY KUMAR	59	39							
6	1808240007	AMAN GAHLAUT	59	45							
7	1808240008	ANMOL SAGAR	59	55							
8	1808240009	APURV CHANDEL	59	33							
9	1808240010	ARPIT TYAGI	59	50							
10	1808240011	ATIGYA GARG	59	50							
11	1808240012	DEEPAK PAL	59	50							
12	1808240013	DEEPRANSH SINGH	59	46							
13	1808240014	DEVISH KUMAR	59	52							
14	1808240015	DHARMESH DHAWAN	59	49							
15	1808240018	IBRAHIM KHAN	59	47							
16	1808240019	KARTIK CHAUDHARY	59	31							
17	1808240020	KRISHNA OMPRAKASH	59	43							
18	1808240021	LAKSHAY KAUSHIK	61	46							
19	1808240022	LOKENDRA	61	34							
20	1808240023	MANJUL KUMAR	61	53							
21	1808240024	MANOJ KUMAR	61	19							
22	1808240025	MAYANK ANAND	61	37							
23	1808240027	MOHD. RAHIL	61	54							
24	1808240028	MUSKAN BHATNAGAR	61	56							
25	1808240029	NIPUN VASHISHTHA	61	56							
26	1808240030	PRANJAL CHAUDHARY	61	32							
27	1808240031	RAHUL ANAND	61	42							
28	1808240032	ROMESHWAR SARAN	61	46							
29	1808240033	SAMAN ALI	61	51							
30	1808240034	SAMYAK JAIN	61	47							
31	1808240035	SHANTANU TIWARI	61	49							
32	1808240036	SUDHEER KUMAR GAUTAM	61	54							
33	1808240037	UDAY VARSHNEY	61	48							
34	1808240038	YASIR MUMTAZ	61	54							
35		AMAN KUMAR	61	45							
36		ANKIT PAL	61	23							
37		MUNISH HUSSAIN	61	28							
38		ANNANT BANSAL	61	55							

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Set-1

Moradabad Institute of Technology

(Class Test –I)

SUBJECT- THERMODYNAMICS (KME-301)

Session – 2019-20 Semester – 3rd (odd sem.)

Branch/Section – ME / E Time – 1 hr M.M. - 15

NOTE- Attempt all Questions

1. Explain the concept of macroscopic and microscopic view points applied to study of thermodynamics.

   CO-1 **(2 Marks)**

2. State the Zeroth law of thermodynamics. **CO-1** **(2 Marks)**

3. An inelastic flexible balloon is inflated from initial empty state to a volume of 0.4 m3 with H_2 available from hydrogen cylinder. For atmospheric pressure of 1.0313 bar determine the amount of work done by balloon upon atmosphere and work done by atmosphere. **CO-1** **(2Marks)**

   $W = \int_{cy} p \cdot dV + \int_{balloon} p \cdot dV = 40.52$ kJ upon atm

   -40.52 by atm

4. A non – flow system undergoes a frictionless process according to a low **p = (4.5/v) +2**, where p is in bar and the volume v is in m^3/kg .During the process the volume changes from 0.12 m^3 / kg to 0.04 m^3/kg and the temperature increases by 150°C.The change in internal energy of the fluid is given as **du = C_v dT**, where C_v = 0.71 kJ/kg.K. Find out (a) heat transfer and (b) change in enthalpy. Assume a fluid quantity of 10 kg. CO-1 (3Marks)

   $\Delta u = \int c_v dT = 94.43 \frac{kJ}{kg}$

   $W = \int p \cdot dV = -510.37 \frac{kJ}{kg}$

   $q = w + \Delta u = -415.94 \frac{kJ}{kg}$

   $\Delta h = 78.43 \frac{kJ}{kg}$.

5. A nozzle is a device for increasing the velocity of a steadily flowing stream .At the inlet to a certain nozzle the enthalpy of fluid passing is 3000 kJ/kg and the velocity is 60 m/s. At the discharge end, the enthalpy is 2762 kJ/kg. The nozzle is horizontal and there is negligible heat loss from it **(a)** Find the velocity at exit from nozzle. **(b)** if the inlet area is 0.1 m^2 and the specific volume at inlet is 0.187 m^3/kg, find the mass flow rate **(c)** if the specific volume at the nozzle exit is 0.498 m^3/kg , find the exit area of the nozzle . **CO-1** **(3Marks)**

   692.5 m/s , 32.08 kg/s

   0.023m^2

6. 2 kg of an ideal gas is compressed adiabatically from pressure 100kPa and temperature 220 K to a final pressure of 400 kPa .Make calculations for : **CO-1** **(3Marks)**

   (a) Work performed

   (b) Heat added to or subtracted from the system = zero

   (c) Change in internal energy $\delta Q = dU + \delta W$

   Take C_p = 1 kJ/kg K C_v = 0.707 kJ/kg K

   $= 156.04$ kJ

   $R = c_p - c_v = 0.293 \frac{kJ}{kgK}$

   $V_1 = \frac{mRT_1}{P_1} = 1.29 m3$

   $\gamma = \frac{c_p}{c_v} = 1.414$

   $V_2 = \left(\frac{P_1}{P_2}\right)^{\frac{1}{\gamma}} \times V_1 = 0.484$ m3

   $T_2 = \frac{P_2 V_2}{mR} = 330.4K$

   $W = \frac{P_1 V_1 - P_2 V_2}{\gamma - 1} = -158.04$ kJ

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Moradabad Institute of Technology

Set-1

Department of Mechanical Engineering

(Class Test –2)

Course – B.Tech

Session – 2019-20

Subject- Thermodynamics

Max.Marks. – 15

Semester – 3rd

Section- E

Sub Code: KME-301

Time – 1 hr 15Min.

Q.No.	1	2	3	4	5	6
CO No.	2	3	2	2	1 & 2	1& 3

NOTE- Attempt all Questions

SECTION-A

1. Determine change in entropy of universe if a copper block of 1 kg at 27°C is dropped from a height of 200 m in the sea water at 27°C. (Heat capacity for copper= 0.393 kJ/kg.K) **(2Marks)**

$Q = mgh = 1962 J$

2. (a)Define availability, and Dead state **(2Marks)**

$\Delta S = 6.54 \frac{KJ}{105K}$

(b)Define the term volume expansivity and Joule- Thompson Cofficient .

$\beta = \frac{1}{v}\left(\frac{\partial v}{\partial T}\right)_p$ $\mu = \left(\frac{\partial T}{\partial p}\right)_h$

3. State the Kelvin-Planck and Clausius statement of 2nd law of thermodynamics and prove their equivalence. **(2Marks)**

SECTION-B

4. ✓ A heat pump is run by a reversible heat engine operating between reservoirs at 800°C and 50°C. The heat pump working on Carnot cycle picks up 15 kW heat from reservoir at 10°C and delivers it to a reservoir at 50°C. The reversible engine also runs a machine that needs 25 kW. Determine the heat received from highest temperature reservoir and heat rejected to reservoir at 50°C. **(3Marks)**

$W_{3-1} = 498.86 KJ$ $Q_{3-1} = 498.86$ $S_1 - S_3 = 1.3857$

5. 3 kg of air at 150 kPa pressure and 360 K temperature is compressed polytropically to pressure 750 kPa according to the law $PV^{1.2}$ = constant. Subsequently the air is cooled to intial temperature at constant pressure. This is followed by expansion at constant temperature till the original pressure of 150 kPa is reached. Sketch the cycle on p-v and T-s Plot and determine the work done , heat transfer and entropy change for each process and complete cycle. **(3Marks)**

$S_3 - S_2 = -0.8109$

$W_{2-3} = -95.57 KJ$

$Q_{2-3} = -334.66 KJ$

$W_{1-2} = -477.85 KJ$

$Q_{1-2} = -238.76 KJ$ $S_2 - S_1 = -0.5762$

6. A steam turbine has steam flowing at steady rate of 5 kg/s entering at 5 MPa and 500°C and leaving at 0.2 MPa and 140°C. During flow through turbine a heat loss of 600 kJ/s occurs to the environment at 1 atm and 25°C. Determine **(3 Marks)**

$B_1 = m(h_1 - h_0) - T_0(S_1 - S_0)$

$6792431 4$

(a) the availability of steam at inlet to turbine (b) the turbine output

$Q + mh_1 = mh_2 + W$

$W = 28291 4/s$

(c) the maximum possible turbine output (d) the maximum possible turbine output (e) Irreversibility

Neglect the changes in kinetic energy and potential energy during flow and C_p = 1.005 kJ/kg.Kand R= 0.287 kJ/kg.K

$W_{max} = A_1 - A_2$

$= m[(h_1 - h_2) - T_0(S_1 - S_2)]$

$\boxed{W_{max} = 3053.18 KJ/s}$

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Moradabad Institute of Technology Set-1

Department of Mechanical Engineering

(Sessional Test –3)

Course – B.Tech Semester – 3rd Session – 2019-20 Section- E Subject- Thermodynamics

Sub Code: KME-301 Max.Marks. – 15 Time – 1 hr 15Min.

Q.No.	1	2	3	4	5	6
CO No.	4	4	5	4	4	5

NOTE-1. Attempt all Questions. Use of Steam Table, Refrigeration Table and psychrometry chart is permitted

capacity of cooling coil = ma (h1-h2) = ~~2081kJ~~/m

8709kJ/m

= 41.5TK

$\boxed{ma = \frac{V_1}{v_{s1}} = 226.2\ kg/m}$

SECTION-A

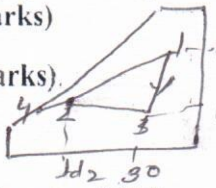
1. Define triple point , sublimation ,critical point and dryness fraction **(2Marks)**
2. Explain (a) Cooling and Dehumidification (b) Heating and Humidification with help of psychrometry chat. **(2Marks)**

$h_1 = 82\ kJ/kg \quad h_3 = 58, \ h_2 = 43.5$

3. Explain the simple vapour absorption system with neat sketch. **(2Marks)**

$BPF = \frac{T_{d2} - ADP}{T_{d1} - ADP}$

$= 15.6°C$



$v_{s1} = 0.884\ m^3/kg$

$w_1 = 0.0202\ kg/kg$ of dry air

$w_2 = 0.011\ kg/kg$ of dry air

SECTION-B

$q_{in} = h_1 - h_2$

4. The atmospheric air at 30°C dry bulb temperature and 75 % RH enters a cooling coil at the rate of 200 m³/min.The coil dew point temperature is 14°C and by-pass factor of the coil is 0.1.Determine:) (a) The temperature of air leaving the cooling coil (b) The capacity of cooling coil in TR. (c) amount of water vapour removed per minute. **(3Marks)**

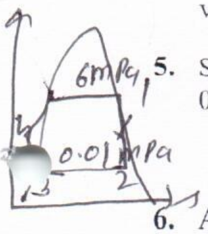
$\boxed{= ma(w_1 - w_2) = 2.08}$

$s_1 = s_2 = (s_f + x s_{fg})$ 10kPa $\boxed{x = 0.698}$

$\eta = 35.47\%$

$m = 57.97$

$P = 53.09\ kW$



5. Steam enters the turbine as 100 % saturated vapour at 6 MPa and saturated liquid enters the pump at a pressure of 0.01 MPa if the heat rate to boiler is 150MW determine **(3Marks)**

$h_1 = 2785.1\ kJ/kg$

$s_1 = 5.8891$

$h_{f2} = 191.81$

$h_{fg2} = 2392.82$

(a) The thermal efficiency (b) The mass flow rate of steam(c) The net work transfer from cycle

$h_3 = h_{f3} = 191.81 \quad v_{f3} = 0.00100$ $s_{f2} = 0.6492$

$s_{fg2} = 7.5010$

6. A vapour compression refrigeration cycle operates between the condensation temperature of 20°C and evaporator temperature of –10°C with carbon dioxide as refrigerant. Temperature after isentropic compression is 40°C and condensate leaves at 10°C before being passed through expansion valve. Determine COP of system and mass flow rate of CO2 required to get refrigeration effect of 2 kW. Properties of CO2 are given as under:Properties of CO₂. **(3 Marks)**

Temp(°C)	Sat pressure(bar)	Specific vol.(m/kg)	Enthalpy(kJ/kg)		Entropy(kJ/kg-K)		Specific Heat((kJ/kg-K)	
		(vapour)	Liquid	vapour	Liquid	vapour	Liquid	vapour
20	57.27	-----	144.11	299.62	0.523	1.0527	2.889	2.135
-10	26.49	0.014	60.78	322.28	0.2381	1.2324	----	---------

2 = m × 196.86

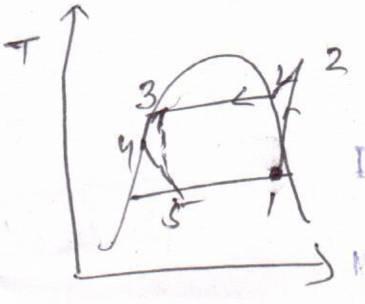
m = 0.1016 kg/s/m $x_1 = 0.961$

COP = 6.51/m

$h_2 = h_g + C_p(40-20)$ at 20°C

$s_2 = s_1$

$s_2 = s_g + c_{pg} \ln\left(\frac{273+40}{273+20}\right)$



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Department of Mechanical Engineering

(Special Sessional Test –2)

SUBJECT- THERMODYNAMICS (RME-301)

Course – B.Tech

Session – 2019-20 Semester – 3rd (odd sem.)

Branch/Section – ME/ E Time – 1 hr 15Min. M.M. – 15

Q.NO.	1	2	3	4	5	6
CO NO.	2	3	2	2	2	3

NOTE- Attempt all Questions

1. Define the entropy and prove that two isentropic lines cannot intersect each other. **(2 Marks)**
2. (a) Define the Helmholtz and Gibbs function. **(2 Marks)**

   (b) Write the Maxwell relations.
3. Define third law of thermodynamics and kelvin plank's statement. **(2Marks)**
4. A closed system executed a reversible cycle 1–2–3–4–5–6–1 consisting of six processes. During processes 1–2 and 3–4 the system receives 1000 kJ and 800 kJ of heat, respectively at constant temperatures of 500 K and 400 K, respectively. Processes 2–3 and 4–5 are adiabatic expansions in which the steam temperature is reduced from 500 K to 400 K and from 400 K to 300 K respectively. During process 5–6 the system rejects heat at a temperature of 300 K. Process 6–1 is an adiabatic compression process. Determine the work done by the system during the cycle and thermal efficiency of the cycle. **(3Marks)**
5. A reversible engine is used for only driving a reversible refrigerator. Engine is supplied 2000 kJ/s heat from a source at 1500 K and rejects some energy to a low temperature sink. Refrigerator is desired to maintain the temperature of 15°C while rejecting heat to the same low temperature sink. Determine the temperature of sink if total 3000 kJ/s heat is received by the sink. **(3Marks)**
6. A feed water heater has 5 kg/s water at 5MPa, 40^{0}C flowing through it .The water is heated from two constant temperature sources. One source adds 900 kW from a 100^{0}C reservoir and other source adds heat from a 200^{0}C reservoir in such a way that water is heated to 180^{0}C.calculate the reversible work. Take atmospheric temperature as 27^{0}C. **(3Marks)**

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Moradabad Institute of Technology

Department of Mechanical Engineering

makeup
(~~Special~~ Sessional Test)

SUBJECT- THERMODYNAMICS (KME-301)

Course – B.Tech

Session – 2019-20

Semester – 3rd (odd sem.)

Branch/Section – ME/ E

Time – 1 hr 15Min.

M.M. – 15

Q.NO.	1	2	3	4	5	6
CO NO.	4	4	5	4	5	4

NOTE- Attempt all Questions

1. Define critical point and Triple Point. **(2 Marks)**
2. Explain Sensible Heating and cooling with the help of psychrometry chart. **(2 Marks)**
3. Explain the simple vapour absorption system with neat sketch. **(2Marks)**
4. A steam power plant uses steam as working fluid and operates at a boiler pressure of 5 MPa, dry saturated and a condenser pressure of 6 kPa. Determine the cycle efficiency for
   (a) Carnot cycle
   (b) Rankine cycle.
   Also show the T-s representation for both the cycles.
5. An ideal vapour compressin system uses R-12 as the refrigerant.The system uses an evaporation temperature of 0°C and condenser temperature of 40°C.The capacity of the system is 7TR.Determine.

(a) The mass flow rate of refrigerant.
(b) Power Required to run the compressor
(c) Heat rejected in the condenser
(d) COP of system

Properties of R-12 are given below . C_p for superheated vapour as 0.6kJ/kg.K **(3Marks)**

Temp. **0°C**	**Pressure** **Bar**	**h_f** kJ/kg	**h_g** kJ/kg	**s_f** kJ/kgK	**S_g** **kJ/kgK**
0	3.087	36.05	187.53	0.142	0.696
40	9.609	74.59	203.2	0.727	0.681

6. Define the following terms in relation to psychrometry. **(3Marks)**

a) Relative humidity
b) Specific humidity
c) Dry bulb temperature

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Subject Teacher: Mr. Rakesh Gangwar

MIT Group of Institutions, Moradabad

ATTENDANCE SHEET

Class Test [✓ I] / II / III

Session: 2019-20

Date: 12/9/19 Shift: 4th Room No: A-316

Year: 2nd Semester: 3rd Section/Branch: E/ME

Subject Name: Thermodynamics Subject Code: KME-301

S. No	Roll No.	Name of Student	Branch	Signature
1.				
2.	1808240027	Mohd Rahil	ME	Rahil
3.	1808240028	Muskan Bhatnagar	ME	
4.	1808240029	Nipun vashishtha	ME	
5.	1808240034.	Samyak Jain	ME	Samyak
6.	1808240033	Saman Ali	ME	Saman Ali
7.	1808240032	Rameshwar Saran	ME	
8.	1808240031	Rahul Anand	ME	Rahul
9.	1808240030	Pranjal chaudhary	ME	
10.	1808240035	Shantanu Tiwari	M.E.	Shant
11.	1808240036	Sudheer Ku. Gautam	ME	
12.	1808240037	Uday Varshney	ME	
13.	1808240038	Yasir Mumtaz	ME	Yasir
14.	1808210024	Anant Bansal	ME	
15.		Munis Hussain	M.E	
16.		Aman Kumar	M.E	
17.				
18.	1808240025 }	← Absent →		
19.				
20.	1808240024 }	← Debarred →		
21.	ANKIT PAL			
22.				
23.				
24.				
25.				
26.				
27.				
28.				
29.				
30.				

Total No. of Students allotted in Room: 18-2=16 Students Absent: 01 Students Present: 15

Invigilators: 1) Name Manoj Kr Singh Sign:

2) Name Puneet Kumar Sign: 12/9/19

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Moradabad Institute of Technology

12/09/19

Subject Teacher. MR. Rakesh K. Gangwar
(ME)

MIT Group of Institutions, Moradabad

ATTENDANCE SHEET

Class Test [✓ I] / II / III

Session: 2019-20

Date: 12/9/19

Shift: 4th

Room No: A-315

Year: 2nd

Semester: 3rd

Section/Branch: E/ME

Subject Name: Thermodynamics

Subject Code: KME-301

S. No	Roll No.	Name of Student	Branch	Signature
1.	1808240001	Aarav Saket	ME	Aarav
2.	1808240004	Abhishek Bhatnagar	ME	Abhish
3.	1808240005	Abhishek Singh	ME	A singh
4.	1808240006	Ajay Kumar	ME	Ajay
5.	1808240007	Aman Gahlaut	ME	AmanGahlaut
6.	1808240008	Anmol Sagar	ME	
7.	1808240009	Apurv Chandel	ME	
8.	1808240010	Arpit Tyagi	ME	ArpitTyagi
9.	1808240011	Atigye Garg	ME	Atigye
10.	1808240018	Ibrahim Khan	ME	Ibrahim
11.	1808240015	Dharmesh Dhawan	ME	Dharmesh
12.	1808240014	Devish Kumar	ME	
13.	1808240013	DEEPANSH SINGH	ME	
14.	1808240012	Deepak Pal	ME	
15.	1808240019	Kartik Chaudhary	ME	
16.	1808240020	Krishna Omprakash Kashyap.	M.E	
17.	1808240021	Lakshay kaushik	ME	Lakshay
18.	1808240022	Lokendra	ME	Lokendra.
19.	1808240023	Manjul	ME	manjul
20.	1808240003	Abhineet bhardwaj	ME	
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Total No. of Students allotted in Room: 20 Students Absent: NIL Students Present: 20

Invigilators: 1) Name Anurag Malik Sign:

2) Name Dr L M Trivedi Sign:

Dr. Munish Chhabra
Professor & Head
Deptt. of Mechanical Engg.
Moradabad Institute of Technology

Subject Teacher: Mr. R. K. Gangwar

MIT Group of Institutions, Moradabad

ATTENDANCE SHEET

Session: 2019-20 **Class Test** I / II / III ✓

Date: 22/10/2019 **Shift:** 2nd **Room No:** A-315

Year: 2nd **Semester:** 3rd **Section/Branch:** E/ M.E.

Subject Name: Thermodynamics **Subject Code:** KME-301

S. No	Roll No.	Name of Student	Branch	Signature
1.	1808240001	Aarav Sanket	ME	Aarav Sanket
2.	1808240006	Ajay Kumar	M.E	Ajay Kumar
3	1808240007	Aman Gahlaut	ME	Aman.
4	1808240012	Deepak Pal	ME	Deepak
5.	1808240011	Atigya Garg	ME	Atigya
6.	1808240010	Arpit Tyagi	ME	Arpit Tyagi
7.	1808240008	Anmol Nagar	ME	
8.	1808240013	Deepransh Singh	ME	
9.	1808240014	Devish Kumar	ME	
10.	1808240015	Dharmesh Dhawan	ME	Dharmesh
11.	1808240018	Ibrahim Khan	ME	Ibrahim
12	1808240027	Mohd Rahil	ME	Rahil
13.	1808240028	Muskan Bhatnagar	ME	
14.	1808240025	Mayank Anand	ME	Mayank Anand
15.	1808240023	Manjul Kumar	ME	
16.	1808240022	Lokendra	ME	Lokendra.
17.	1808240021	Lakshay Kaushik	ME	Lakshay
18.	1808240020	Krishna Kashyap.	ME	
19.	1808240003	Abhineet Bhardwaj	ME	Abhineet
20.	1808240006			
21	007			
22.	009	A B S E N T		
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Total No. of Students allotted in Room: ㉓ Students Absent: 04 Students Present: 19

Invigilators: 1) Name R. K. Gangwar Sign: 22/10/19

2) Name Sachin K. Ag. Sign:

Dr. Munish Chhabra
Professor & Head
Deptt. of Mechanical Engg.
Moradabad Institute of Techn.

Subject Teacher. Mr. Rakesh K. Garg

MIT Group of Institutions, Moradabad

ATTENDANCE SHEET

Session: 2019-20

Class Test I / [✓ II] / III

Date: 22/10/19

Shift: 2nd

Room No: A-313

Year: 2nd

Semester: 3rd

Section/Branch: E/ME

Subject Name: Thermodynamics

Subject Code: KME-301

S. No	Roll No.	Name of Student	Branch	Signature
1.	1808240029	Nipon vashishtha	ME	
2.	1808240030	Pranjal chaudhary	ME	
3.	1808240031	Rahul Anand	ME	Rahul
4.	1808240032	Romeshwar Saran	ME	
5.	1808240033	Saman Ali	ME	Saman Ali
6.	1808240034	Samyak Jain	ME	Samyak
7.	1808240035	Shantanu Tiwari	ME	Shantanu
8.	1808240036	Sudheer Ku Gautam	ME	
9.	1808240038	Yasir Mumtaz	ME	Yasir
10.	1808210024	Anant Bansal	M.E.	
11.	36	Aman Kumar	ME	Aman
12.	38	Munis Hussain	M.E	
13.				
14.	37	Ankit Pal (Debarred)		
15.				
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Designation: Assistant Professor

Department: Mechanical Engineering

Course Details

Name of the Programme: B.Tech.

Branch: Mechanical Engineering

Name of Subject: Thermodynamics

Category of Course: Core Branch

Batch: 2018-2022

Section: 2019-20

Subject Code: KME-301

RE - CT.

Subject Teacher....R.K. Gangwar....

MIT Group of Institutions, Moradabad

ATTENDANCE SHEET

Session: 2019-20

Class Test I / [✓ II] / III

Date: ..13-11-19....

Shift: ...2 - 3:15 PM...

Room No: ...D-395...

Year: ...2nd...

Semester: ...3rd...

Section/Branch: ...E / ME...

Subject Name: ...Thermodynamics...

Subject Code: ...KME-301

S. No	Roll No.	Name of Student	Branch	Signature
1.	1808240019	Kartik Chaudhary	ME	
2.	1808240009	Apurv Chandel	ME	Apurv
3.	1808240005	Abhishek Singh	ME	A.Singh
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Total No. of Students allotted in Room: 03 **Students Absent:** NIL **Students Present:** 03

Invigilators: 1) Name R. K. Gangwar **Sign:** 13/11/19

2) Name_____ **Sign:**_____

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Moradabad Institute of Technology

Subject Teacher..R.K. Gangwar........

MIT Group of Institutions, Moradabad

ATTENDANCE SHEET

Session: 2019-20

Re- Class Test I / II / [✓ III]

Date: 02/12/19

Shift: II (3:45-5PM)

Room No: ....

Year: 2nd

Semester: 3rd

Section/Branch: E/M.E

Subject Name: Thermodynamics.

Subject Code: KME-301

S. No	Roll No.	Name of Student	Branch	Signature
1.	1800240007	AmanGahlaut	ME	Aman
2.				
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Total No. of Students allotted in Room: ________

Students Absent: ________

Students Present: ________

Invigilators: 1) Name________________________ Sign:________________________

2) Name________________________ Sign:________________________

Dr. Munish Chhabra
Professor & Head
Deptt. of Mechanical Engg.
Moradabad Institute of Technology
Moradabad-244001

Subject Teacher: Mr. Rakesh Kr. Gangwar

MIT Group of Institutions, Moradabad

ATTENDANCE SHEET

Session: 2019-20 Class Test I / II / [✓ III]

Date: 28/11/2019 **Shift:** 2nd **Room No:** A-315

Year: 2nd **Semester:** 3rd **Section/Branch:** E / M.E.

Subject Name: Thermodynamics **Subject Code:** KME-301

S. No	Roll No.	Name of Student	Branch	Signature
1.	1808240001	Aarav Sanket	ME	Aarav Sanket
2.	1808240004	Abhishek Bhatnagar	ME	
3.	1808240005	Abhishek Singh	ME	
4.	1808240009	Apurv Chandel	ME	
5.	1808240010	Arpit Tyagi	ME	Arpit Tyagi
6.	1808240011	Atigya Garg	ME	Atigya
7.	1808240012	Deepak Pal	ME	
8.	1808240014	Devish Kumar	ME	
9.	1808240015	Dharmesh Dhawan	ME	Dharmesh
10.	1808240018	Ibrahim Khan	ME	Ibrahim
11.	1808240028	Muskan Bhatnagar	ME	Muskan
12.	1808240027	Mohd Rahil	ME	Rahil
13.	1808240021	Lakshay Kaushik	ME	Lakshay
14.	1808240013	Rupansh Singh	ME	
15.	1808240003			
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17.	07			
18.	08			
19.	19	← Absent		→
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Dr. Munish Chhabra
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Deptt. of Mechanical Engg.
Moradabad Institute of Technology
Moradabad - 244001

Total No. of Students allotted in Room: 24-1=23 Students Absent: 9 Students Present: 14

Invigilators: 1) Name Sachin Kr. Agarwal Sign:

2) Name Sandeep Kumar Sign:

Subject Teacher: Mr. Rakesh Gangwar

MIT Group of Institutions, Moradabad

ATTENDANCE SHEET

Session: 2019-20

Class Test I / II / III

Date: 28/11/19

Shift: IInd

Room No: A-313

Year: 2nd

Semester: IIIrd

Section/Branch: F(ME)

Subject Name: Thermodynamics

Subject Code: KME-301

S. No	Roll No.	Name of Student	Branch	Signature
1.	1808240029	Nipun Vashishtha	ME	
2.	1808240030	Pranjal chaudhary	ME	
3.	1808240032	Romeshwar Saran	ME	
4.	1808240034	Samyak Jain	ME	Samyak
5.	1808240038	Yasir - Mumtaz	ME	Yasir
6.	1808210024	Anant Bansal	M.E.	
7.		Munis Hussain	M.E	
8.	1808210031			
9.	'' 33			
10.	35			
11.	'' 36			
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14.	''	Aman kumar		
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⑥

Dr. Munish Chhabra
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Moradabad - 244001

Total No. of Students allotted in Room: 13 Students Absent: 6 Students Present: 7

Invigilator: 1) Name Dr. Modika Gupta Sign: Modika

2) Name Dr. Manuj kumar Agarwal Sign:

Subject Teacher: Mr. Rakesh km. Gangwar

MIT Group of Institutions, Moradabad

ATTENDANCE SHEET

Session: 2019-20

Makeup

Class Test I / II / III

Date: 03/12/19 **Shift:** Ist **Room No:** D306

Year: 2nd **Semester:** 3rd **Section/Branch:** E/ME

Subject Name: Thermodynamics **Subject Code:** KME-301

S. No	Roll No.	Name of Student	Branch	Signature
1.	1808240023	Manjul Kumar	ME	Manjul
2.	1808240031	Rahul Anand	ME	Rahul
3.	1808240036	Sudheer Ku. Gautam	ME	
4.	1808240035	Shantanu Tiwari	M.E.	
5.	1808240030	Pranjal Chaudhary	ME	Pranjal
6.		Aman Kumar	ME	Aman
7.		Ankit Pal	ME	Ankit Pal
8.	1808240022	Lokendra	ME	Lokendra
9.	1808240006	Ajay Kumar	M.E	Ajay
10.	1808240037	Uday Varshney	ME	
11.	1808240025	Mayank Anand	ME	
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Total No. of Students allotted in Room: ________ **Students Absent:** ________ **Students Present:** ________

Invigilators: 1) Name Atul Sharma **Sign:**

2) Name________ **Sign:**________

Dr. Munish Chhabra
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In Pursuit of Excellence	**List of Students having short attendance**	SESSION-2019-2020 SEM-3rd

1808240009	APURV CHANDEL
1808240019	KARTIK CHAUDHARY
1808240022	LOKENDRA
1808240024	MANOJ KUMAR
	ANKIT PAL

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Moradabad - 244001

In Pursuit of Excellence	**Class Test Marks**	SESSION-2019-2020
		SEM-3rd

Moradabad Institute of Technology

Ram Ganga Vihar, Phase-II, Moradabad

2nd Year 3rd Semester

Mechanical Engineering **Section-E**

Sessional Marks KME-301 Thermodynamics

S/N	Roll No.	Name of Students	CT-1	CT-2	CT-3
1	1808240001	AARAV SANKET	2	4	5.5
2	1808240003	ABHINEET BHARDWAJ	6	4.5	A
3	1808240004	ABHISHEK BHATNAGAR	11	A	9.5
4	1808240005	ABHISHEK SINGH	6	5.5	2
5	1808240006	AJAY KUMAR	4.5	1.5	A
6	1808240007	AMAN GAHLAUT	1	4	6.5
7	1808240008	ANMOL SAGAR	10.5	5.5	A
8	1808240009	APURV CHANDEL	8	1	2.5
9	1808240010	ARPIT TYAGI	8.5	5	2
10	1808240011	ATIGYA GARG	7	0.5	5.5
11	1808240012	DEEPAK PAL	7	2	3.5
12	1808240013	DEEPRANSH SINGH	5.5	0.5	5
13	1808240014	DEVISH KUMAR	6.5	1	4.5
14	1808240015	DHARMESH DHAWAN	11	5.5	8.5
15	1808240018	IBRAHIM KHAN	10	5	7.5
16	1808240019	KARTIK CHAUDHARY	5	6.5	A
17	1808240020	KRISHNA OMPRAKASH KASHYAP	6.5	4.5	A
18	1808240021	LAKSHAY KAUSHIK	4.5	5	5.5
19	1808240022	LOKENDRA	4	3	A
20	1808240023	MANJUL KUMAR	2.5	3.5	A
21	1808240024	MANOJ KUMAR	A	A	A
22	1808240025	MAYANK ANAND	A	3	A
23	1808240027	MOHD. RAHIL	10	5.5	8
24	1808240028	MUSKAN BHATNAGAR	10.5	5.5	11
25	1808240029	NIPUN VASHISHTHA	9.5	5	7

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Moradabad Institute of Technology
Moradabad- 244001

In Pursuit of Excellence	**List of Weak Students** (Action taken for Improvement)		SESSION-2019-2020
			SEM-3RD

Moradabad Institute of Technology

Ram Ganga Vihar, Phase-II, Moradabad

2nd Year 3rd Semester

Mechanical Engineering Section-E

S/N	Roll No.	Name of Students	CT-1	CT-2	CT-3
1	1808240001	AARAV SANKET	2	4	5.5
2	1808240006	AJAY KUMAR	4.5	1.5	A
3	1808240007	AMAN GAHLAUT	1	4	6.5
4	1808240021	LAKSHAY KAUSHIK	4.5	5	5.5
5	1808240022	LOKENDRA	4	3	A
6	1808240023	MANJUL KUMAR	2.5	3.5	A
7	1808240024	MANOJ KUMAR	A	A	A
8	1808240025	MAYANK ANAND	A	3	A
9	1808240030	PRANJAL CHAUDHARY	0	0.5	1
10	1808240031	RAHUL ANAND	2	2.5	0
11	1808240036	SUDHEER KUMAR GAUTAM	2	0.5	A
12		AMAN KUMAR	0	3	A
13		ANKIT PAL	A	A	10

Dr. Munish Chhabra
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Moradabad - 244001

In Pursuit of Excellence

List of Bright Students

(Action taken for enhancing performance)

SESSION-2019-2020

SEM-3RD

Moradabad Institute of Technology

Ram Ganga Vihar, Phase-II, Moradabad

2nd Year 3rd Semester

Mechanical Engineering **Section-E**

S/N	Roll No.	Name of Students	CT-1	CT-2	CT-3
1	1808240004	ABHISHEK BHATNAGAR	11	A	9.5
2	1808240008	ANMOL SAGAR	10.5	5.5	A
3	1808240015	DHARMESH DHAWAN	11	5.5	8.5
4	1808240018	IBRAHIM KHAN	10	5	7.5
5	1808240027	MOHD. RAHIL	10	5.5	8
6	1808240028	MUSKAN BHATNAGAR	10.5	5.5	11
7	1808240029	NIPUN VASHISHTHA	9.5	5	7

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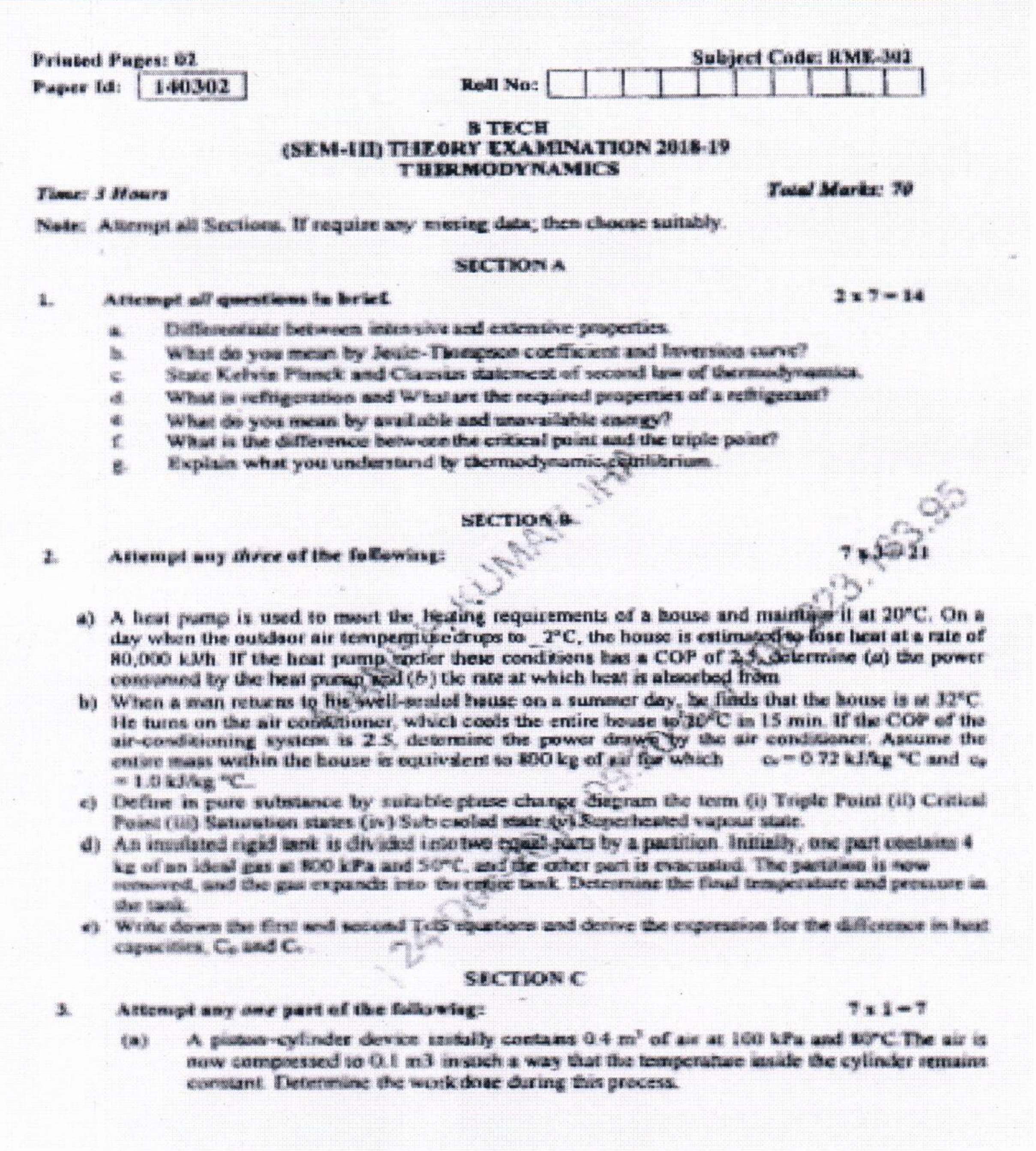
Moradabad - [illegible]

In Pursuit of Excellence	**Previous Year Question Papers**	SESSION-2019-2020
		SEM-



Printed Pages: 02 **Subject Code: RME-302**

Paper Id: 140302 **Roll No:**

B TECH
(SEM-III) THEORY EXAMINATION 2018-19
THERMODYNAMICS

Time: 3 Hours ***Total Marks: 70***

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. **Attempt *all* questions in brief.** **2 x 7 = 14**

   a. Differentiate between intensive and extensive properties.
   b. What do you mean by Joule-Thompson coefficient and Inversion curve?
   c. State Kelvin Planck and Clausius statement of second law of thermodynamics.
   d. What is refrigeration and What are the required properties of a refrigerant?
   e. What do you mean by available and unavailable energy?
   f. What is the difference between the critical point and the triple point?
   g. Explain what you understand by thermodynamic equilibrium.

SECTION B

2. **Attempt any *three* of the following:** **7 x 3 = 21**

a) A heat pump is used to meet the heating requirements of a house and maintain it at 20°C. On a day when the outdoor air temperature drops to _2°C, the house is estimated to lose heat at a rate of 80,000 kJ/h. If the heat pump under these conditions has a COP of 2.5, determine (*a*) the power consumed by the heat pump and (*b*) the rate at which heat is absorbed from

b) When a man returns to his well-sealed house on a summer day, he finds that the house is at 32°C. He turns on the air conditioner, which cools the entire house to 20°C in 15 min. If the COP of the air-conditioning system is 2.5, determine the power drawn by the air conditioner. Assume the entire mass within the house is equivalent to 800 kg of air for which $c_v = 0.72$ kJ/kg °C and $c_p = 1.0$ kJ/kg °C.

c) Define in pure substance by suitable phase change diagram the term (i) Triple Point (ii) Critical Point (iii) Saturation states (iv) Sub cooled state (v) Superheated vapour state.

d) An insulated rigid tank is divided into two equal parts by a partition. Initially, one part contains 4 kg of an ideal gas at 800 kPa and 50°C, and the other part is evacuated. The partition is now removed, and the gas expands into the entire tank. Determine the final temperature and pressure in the tank.

e) Write down the first and second TdS equations and derive the expression for the difference in heat capacities, C_p and C_v.

SECTION C

3. **Attempt any *one* part of the following:** **7 x 1 = 7**

   (a) A piston-cylinder device initially contains 0.4 m^3 of air at 100 kPa and 80°C. The air is now compressed to 0.1 m3 in such a way that the temperature inside the cylinder remains constant. Determine the work done during this process.

Dr. Munish Chhabra
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Moradabad Institute of Technology
Mora...

(b) Air at 100 kPa and 280 K is compressed steadily to 600 kPa and 400 K. The mass flow rate of the air is 0.02 kg/s, and a heat loss of 16 kJ/kg occurs during the process. Assuming the changes in kinetic and potential energies are negligible, determine the necessary power input to the compressor.

4. Attempt any *one* part of the following: 7 x 1 = 7

(a) The Two Carnot engines work in series between the sources and sink temperatures of 550 K 350 K. If both engines develop equal power, determine the intermediate temperature.

(b) Show that the Kelvin–Planck and the Clausius statement of the second law of thermodynamics are equivalent.

5. Attempt any *one* part of the following: 7 x 1 = 7

(a) In a certain process, a vapour while condensing at 420^{0}C, transfers heat to water evaporating at 250^{0}C. The resulting steam is used in power cycle, which rejects heat at 35^{0}C. What is the fraction of the available energy in the heat transferred from the process vapour at 420^{0}C that is lost due to the irreversible heat transfer at 250^{0}C?

(b) State the Clapeyron equation and discuss its importance during phase change of pure substance. Derive the equation for Clausius-Clapeyron equation for evaporation of liquids.

6. Attempt any *one* part of the following: 7 x 1 = 7

(a) Steam at 20 bar and 360^{0}C is expanded in a steam turbine to 0.08 bar. It then enters a condenser, where it is condensed to saturated liquid water. The pump feeds back the water into the boiler. (a) Assuming ideal processes, find per Kg of steam the net work and the cycle efficiency. (b) If the turbine and the pump have each 80 % efficiency, find the percentage reduction in the net work and cycle efficiency.

(b) Explain the following processes and show them on psychometric chart:

i. Sensible heating and cooling
ii. Heating and humidification
iii. Cooling and dehumidification

7. Attempt any *one* part of the following: 7 x 1 = 7

(a) Explain the vapour compression cycle with the help of T-s and p-h diagram.

(b) A refrigerator operates on ideal vapour compression cycle between 0.14 MPa and 0.8 MPa. If the mass flow rate of the refrigerant is 0.06 Kg/s, determine: (a) the rate of heat removal from the refrigerated space, (b) the power input to the compressor, (c) the heat rejection rate in the condenser and (d) the COP

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Printed pages: **Sub Code: RME 302**

PaperID 4 0 0 3 **Roll No.** ☐☐☐☐☐☐☐☐☐☐☐

B.Tech.
(SEM-III) THEORY EXAMINATION 2017-18
THERMODYNAMICS

Time: 3 Hours ***Total Marks: 70***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

2. Use of Steam Tables and Mollier chart is permitted.

SECTION A

1. Attempt *all* questions in brief. **2 x7 = 14**

- **a.** What is quasi static process? Discuss it.
- **b.** Define the Carnot theorem.
- **c.** What is the concept of entropy?
- **d.** What is the second law efficiency? Define it.
- **e.** Define a Joule-Thomson coefficient.
- **f.** Discuss the triple point and critical point.
- **g.** What is the refrigeration effect?

SECTION B

2. Attempt any *three* of the following: **7 x 3 = 21**

a. Derive Steady Flow Energy Equation (S.F.E.E.). Also write the steady flow energy equation for heat exchanger, nozzle, turbine, pump and boiler with suitable assumptions.

b. The following equation gives the internal energy of a certain substance

$u = 3.4\,pv + 85$; where u is kJ/kg, p is in kPa and v is in m^3/kg.

A system composed of 2.5 kg of this substance expands from an initial pressure of 500 kPa and a volume of 0.25 m^3 to a final pressure 100 kPa in a process in which pressure and volume are related by $pv^{1.25}$ **= constant.**

(i) If the expansion is quasi-static, find Q, dU and W for the process (ii) In another process, the same system expands according to the same pressure-volume relationship as in part (i), and from the same initial state to the same final state as in part (i), but the heat transfer in this case is 32 kJ. Find the work transfer for this process. (iii) Explain the difference in work transfer in parts (i) and (ii).

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Deptt. of Mechanical Engg.
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Moradabad - 244001

c. Two reversible heat engines 'A' and 'B' are arranged in series, engine 'A' rejecting heat directly to engine 'B'. Engine 'A' receives 200 kJ at a temperature of 421°C from a hot source, while engine 'B' is in communication with a cold sink at a temperature of 4.4°C. If the work output of 'A' is twice that of 'B', find

(i) The intermediate temperature between engine 'A' and engine 'B'

(ii) The efficiency of each engine

(iii) The heat rejected to the cold sink.

d. An iron cube at a temperature of 400°C is dropped into an insulated bath containing 10 kg water at 25°C. The water finally reaches a temperature of 50 °C at steady state. Given that the specific heat of water is equal to 4186 J/kg K. Find the entropy changes for the iron cube and the water. Is the process reversible? If so why?

e. Discuss the coefficient of **volume expansion, adiabatic and isothermal compressibility.** Also find the loss in available energy due to given heat transfer. If 3 kg of gas (c_v = 0.81 kJ/kg K) initially at 2.5 bar and 400 K receives 600 kJ of heat from an infinite source at 1200 K and the surrounding temperature is 290 K.

SECTION C

3. Attempt any *one* part of the following: 7x 1 = 7

(a) A nozzle is a device for increasing the velocity of a steadily flowing stream. At the inlet to a certain nozzle, the enthalpy of the fluid passing is 3000 kJ/kg and the velocity is 60 m/s. At the discharge end, the enthalpy is 2762 kJ/kg. The nozzle is horizontal and there is negligible heat loss from it.

(i) Find the velocity at exists from the nozzle.

(ii) If the inlet area is 0.1 m and the specific volume at inlet is 0.187 m^3 /kg, find the mass flow rate.

(iii) If the specific volume at the nozzle exit is 0.498 m^3/kg, find the exit area of the nozzle.

(b) A mass of 8 kg gas expands within a flexible container so that the *p*–*v* relationship is of the from *pv* = constant. The initial pressure is 1000 kPa and the initial volume is 1 m^3. The final pressure is 5 kPa. If specific internal energy of the gas decreases by 40 kJ/kg, find the heat transfer in magnitude and direction.

4. Attempt any *one* part of the following: 7x 1 = 7

(a) Two kg of water at 80°C are mixed adiabatically with 3 kg of water at 30°C in a constant pressure process of 1 atmosphere. Find the increase in the entropy of the total mass of water due to the mixing process (c_p of water = 4.187 kJ/kg K).

(b) What are limitations of the first law of thermodynamics? Discuss the statements of the second law of thermodynamics. Also prove that the violation of the Kelvin–Planck statement leads to the violation of the Clausius statement.

5. Attempt any *one* part of the following: **7x 1 = 7**

(a) What is the maximum useful work which can be obtained when 100 kJ are abstracted from a heat reservoir at 675 K in an environment at 288 K? What is the loss of useful work if a temperature drop of 50°C is introduced between the heat source and the heat engine, on the one hand, and the heat engine and the heat sink.

(b) Discuss the Clapeyron equation and also explain the Joule-Kelvin effect with help of inversion curve and inversion temperature.

6. Attempt any *one* part of the following: **7x 1 = 7**

(a) Explain the Rankine cycle with the help of neat sketch, P-V and T-S diagram. If 5 kg of water at 45°C is heated at a constant pressure of 10 bar until it becomes superheated vapour at 300°C. Find the change in volume, enthalpy, internal energy and entropy.

(b) A turbine operates under steady flow conditions, receiving steam at the following state: Pressure 1.2 MPa, temperature 188°C, enthalpy 2785kJ/kg, velocity 33.3 m/s and elevation 3 m. The steam leaves the turbine at the following state: Pressure 20 kPa, enthalpy 2512 kJ/kg, velocity 100 m/s, and elevation 0 m. Heat is lost to the surroundings at the rate of 0.29kJ/s. If the rate of steam flow through the turbine is 0.42 kg/s, what is the power output of the turbine in kW?

7. Attempt any *one* part of the following: **7x 1 = 7**

(a) Explain the vapour compression refrigeration cycle and its C.O.P. with the help of T-S, P-H and flow diagram. Can this cycle be reversible? If not, why?

(b) A refrigerator working on Bell Coleman cycle operates between pressure limits of 1.05 bar and 8.5 bar. Air is drawn from the cold chamber at 10℃, Air coming out compressor is cooled ta 30℃ before entering the expansion cylinder. Expansion and compression follow the $pv^{1.35}$= constant. Determine C.O.P of the system.

Printed Pages - 7 **NME - 303**

(Following Paper ID and Roll No. to be filled in your Answer Books)

Paper ID : 2012250 **Roll No.** ☐☐☐☐☐☐☐☐☐☐

B.TECH.

Regular Theory Examination (Odd Sem - III), 2016-17

THERMODYNAMICS

Time : 3 Hours ***Max. Marks : 100***

SECTION - A

1. **Attempt all parts. All parts carry equal marks. Write answer of each part in short.** **(10×2=20)**

   a) List any five physical properties of matter which can be used for measurement of temperature.

   b) How does a homogeneous system differ from a heterogeneous system?

   c) Write Boyle's law and Charle's Law.

d) State Carnot theorem.

e) Compare heat pump and refrigerator.

f) State third law of thermodynamics.

g) Is the availability function same for a non-flow and a flow process? Justify.

h) What advantages are obtained if superheated steam is used in steam prime movers.?

i) Define dryness fraction of steam.

j) Define brake power in an IC Engine.

SECTION - B

Attempt any 5 questions from this section.(5×10=50)

2. In a gas turbine unit, the gases flow through the turbine is 15 kg/s and the power developed by the turbine is 12000 kW. The enthalpies of gases at the inlet and outlet are

1260 kJ/kg and 400 kJ/kg respectively, and the velocity of gases at the inlet and outlet are 50 m/s and 110 m/s respectively. Calculate:

i) The rate at which heat is rejected to the turbine, and

ii) The area of the inlet pipe given that the specific volume of the gases at the inlet is 0.45 m^3/kg.

3. 3 kg of air at 1.5 bar pressure and 77°c temperature at state 1 is compressed polytropically to state 2 at pressure 7.5 bar, index of compression being 1.2. It is then cooled at constant temperature to its original state 1 . Find the net work done and heat transferred.

4. Explain the entropy principle and apply it to a closed system.

5. Two kg of air at 500 kPa, 80°C expands adiabatically in a closed system until its volume is doubled and its temperature becomes equal to that of the surroundings which is 100 kPa, 5°C. For this process determine.

a) The maximum work

b) The change in availability

c) The irreversibility

6. Show that violation of Kelvin Planck statement of second law of thermodynamics implies a violation of Clausius statement.

7. Draw the p-T diagram of pure substance and explain its various regions of the diagram in details?

8. Discuss the effect of pressure of steam at inlet to turbine, temperature at inlet to turbine and pressure at exit from turbine upon Rankine cycle performance.

9. Explain the following:

a) Brake specific fuel consumption,

b) Brake mean effective pressure,

c) Mechanical efficiency,

d) Brake thermal efficiency,

e) Indicated thermal efficiency.

SECTION - C

Attempt any 2 questions from this section

(2×15=30)

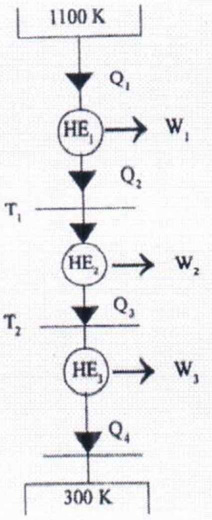
10. a) Compare SI engines with CI engines **(8)**

b) Define a thermodynamic system. Differentiate between open system, closed system and an isolated system. **(7)**

11. a) Derive the steady flow energy equation applied to compressor. **(7)**

b) Throttling calorimeter has steam entering to it at 10MPa and coming out of it at 0.05 MPa and 100°C. Determine dryness fraction of steam. **(8)**

12. Three reversible engines of Carnot type are operating in series as shown between the limiting temperatures of 1100 K and 300 K. Determine the intermediate temperatures if the work output from engines is in proportion of 3 : 2 :1.



Moradabad Institute of Technology, Moradabad

Department of Mechanical engg.

Question Bank (Session – 2019-20)

3rd Semester, Thermodynamics (KME-301)

1. What is quasi static process? Discuss it.
2. Explain the concept of continuum.
3. Define thermodynamic system , Surrounding and boundary
4. Differentiate between closed and open system.
5. Define state function and path function.
6. State the Zeroth law of thermodynamics.
7. State the first law of thermodynamics.
8. Write Boyle's law and Charle's law
9. State the Kelvin Planck and Clausius statements of 2nd law of thermodynamics.
10. Define the Carnot theorem.
11. Explain Heat reservoir, Heat engine, Heat pump and refrigerator
12. What is the concept of entropy?
13. Give the third law of thermodynamics.
14. What is the second law efficiency? Define it.
15. Define 'available energy' and 'unavailable energy'
16. Describe the Helmholtz function.
17. Describe Clapeyron equation.
18. What is meant by a dead state? Discuss its' importance.
19. Define a Joule-Thomson coefficient.
20. Discuss the triple point and critical point.
21. What is the refrigeration effect?
22. Define unit of refrigeration.
23. Explain sensible heating and sensible cooling on psychrometric chart.
24. Explain the Humidification and Dehumidification.

25. An inelastic flexible balloon is inflated from initial empty state to a volume of 0.4 m3 with H2 available from hydrogen cylinder. For atmospheric pressure of 1.0313 bar determine the amount of work done by balloon upon atmosphere and work done by atmosphere.
    (Ans: Work done by system upon atmosphere = 40.52 kJ Work done by atmosphere = – 40.52 kJ)
26. Derive Steady Flow Energy Equation (S.F.E.E.). Also write the steady flow energy equation for heat exchanger, nozzle, turbine, pump and boiler with suitable assumptions.
27. A nozzle is a device for increasing the velocity of a steadily flowing stream. At the inlet to a certain nozzle, the enthalpy of the fluid passing is 3000 kJ/kg and the velocity is 60 m/s. At the discharge end, the enthalpy is 2762 kJ/kg. The nozzle is horizontal and there is negligible heat loss from it. (i) Find the velocity at exists from the nozzle. (ii) If the inlet area is 0.1 m and the specific volume at inlet is 0.187 m3 /kg, find the mass flow rate. (iii) If the specific volume at the nozzle exit is 0.498 m3/kg, find the exit area of the nozzle
28. The following equation gives the internal energy of a certain substance u = 3.4 pv + 85; where u is kJ/kg, p is in kPa and v is in m3/kg. A system composed of 2.5 kg of this substance expands from an initial pressure of 500 kPa and a volume of 0.25 m3 to a final pressure 100 kPa in a process in which pressure and volume are related by pv1.25 = constant. (i) If the expansion is quasi-static, find Q, dU and W for the process (ii) In another process, the same system expands according to the same pressure-volume relationship as in part (i), and from the same initial state to the same final state as in part (i), but

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the heat transfer in this case is 32 kJ. Find the work transfer for this process. (iii) Explain the difference in work transfer in parts (i) and (ii).

29. A mass of 8 kg gas expands within a flexible container so that the p–v relationship is of the from pv = constant. The initial pressure is 1000 kPa and the initial volume is 1 m3. The final pressure is 5 kPa. If specific internal energy of the gas decreases by 40 kJ/kg, find the heat transfer in magnitude and direction
30. Determine the heat transfer and its direction for a system in which a perfect gas having molecular weight of 16 is compressed from 101.3 kPa, 20°C to a pressure of 600 kPa following the law pV1.3 = constant. Take specific heat at constant pressure of gas as 1.7 kJ/kg.K
31. An evacuated bottle of 0.5 m3 volume is slowly filled from atmospheric air at 1.0135 bars until the pressure inside the bottle also becomes 1.0135 bar. Due to heat transfer, the temperature of air inside the bottle after filling is equal to the atmospheric air temperature. Determine the amount of heat transfer.
32. 3 kg of air at 1.5 bar pressure and 77°C temperature at state 1 is compressed polytropically to state 2 at pressure 7.5 bar, index of compression being 1.2. It is then cooled at constant temperature to its original state 1. Find the net work done and heat transferred
33. A reversible heat engine operates between two reservoirs at 827°C and 27°C. Engine drives a Carnot refrigerator maintaining –13°C and rejecting heat to reservoir at 27°C. Heat input to the engine is 2000 kJ and the net work available is 300 kJ. How much heat is transferred to refrigerant and total heat rejected to reservoir at 27°C?
34. Three reversible engines of Carnot type are operating in series as shown between the limiting temperatures of 1100 K and 300 K. Determine the intermediate temperatures if the work output from engines is in proportion of 3 : 2 : 1
35. Two reversible heat engines 'A' and 'B' are arranged in series, engine 'A' rejecting heat directly to engine 'B'. Engine 'A' receives 200 kJ at a temperature of 421°C from a hot source, while engine 'B' is in communication with a cold sink at a temperature of 4.4°C. If the work output of 'A' is twice that of 'B', find (i) The intermediate temperature between engine 'A' and engine 'B' (ii) The efficiency of each engine (iii) The heat rejected to the cold sink.
36. An iron cube at a temperature of 400°C is dropped into an insulated bath containing 10 kg water at 25°C. The water finally reaches a temperature of 50 °C at steady state. Given that the specific heat of water is equal to 4186 J/kg K. Find the entropy changes for the iron cube and the water. Is the process reversible? If so why?
37. What are limitations of the first law of thermodynamics? Discuss the statements of the second law of thermodynamics. Also prove that the violation of the Kelvin–Planck statement leads to the violation of the Clausius statement
38. Discuss the coefficient of volume expansion, adiabatic and isothermal compressibility. Also find the loss in available energy due to given heat transfer. If 3 kg of gas (cv = 0.81 kJ/kg K) initially at 2.5 bar and 400 K receives 600 kJ of heat from an infinite source at 1200 K and the surrounding temperature is 290 K.
39. Two kg of water at 80°C are mixed adiabatically with 3 kg of water at 30°C in a constant pressure process of 1 atmosphere. Find the increase in the entropy of the total mass of water due to the mixing process (cp of water = 4.187 kJ/kg K).
40. Determine entropy change of universe, if two copper blocks of 1 kg & 0.5 kg at 150°C and 0°C are joined together. Specific heats for copper at 150°C and 0°C are 0.393 kJ/kg K and 0.381 kJ/kg K respectively.
41. A heat engine is working between the starting temperature limits of T1 and T2 of two bodies. Working fluid flows at rate 'm' kg/s and has specific heat at constant pressure as Cp. Determine the maximum obtainable work from engine.

42. What is the maximum useful work which can be obtained when 100 kJ are abstracted from a heat reservoir at 675 K in an environment at 288 K? What is the loss of useful work if a temperature drop of 50°C is introduced between the heat source and the heat engine, on the one hand, and the heat engine and the heat sink?

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43. Discuss the Clapeyron equation and also explain the Joule-Kelvin effect with help of inversion curve and inversion temperature.

44. Explain the Rankine cycle with the help of neat sketch, P-V and T-S diagram. If 5 kg of water at 45°C is heated at a constant pressure of 10 bar until it becomes superheated vapour at 300°C. Find the change in volume, enthalpy, internal energy and entropy. (b) A turbine operates under steady flow conditions, receiving steam at the following state: Pressure 1.2 MPa, temperature 188°C, enthalpy 2785kJ/kg, velocity 33.3 m/s and elevation 3 m. The steam leaves the turbine at the following state: Pressure 20 kPa, enthalpy 2512 kJ/kg, velocity 100 m/s, and elevation 0 m. Heat is lost to the surroundings at the rate of 0.29kJ/s. If the rate of steam flow through the turbine is 0.42 kg/s, what is the power output of the turbine in kW?

45. Explain the vapour compression refrigeration cycle and its C.O.P. with the help of T-S, P-H and flow diagram. Can this cycle be reversible? If not, why?

46. A refrigerator working on Bell Coleman cycle operates between pressure limits of 1.05 bar and 8.5 bar. Air is drawn from the cold chamber at 10 ℃, Air coming out compressor is cooled ta 30 ℃ before entering the expansion cylinder. Expansion and compression follow the pv1.35= constant. Determine C.O.P of the system.

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डा0 ए0पी0जे0 अब्दुल कलाम प्राविधिक विश्वविद्यालय, उत्तर प्रदेश, लखनऊ
Dr. A.P.J. Abdul Kalam Technical University, Uttar Pradesh, Lucknow

(Formerly Uttar Pradesh Technical University)

Sessional Marks Examination (सैत्रिक अंक)

Sessional Brief (सैत्रिक संक्षिप्त)

Print (प्रिंट करें)

Institute Code & Name	:	MORADABAD INSTITUTE OF TECHNOLOGY,MORADABAD(082)
Course Code & Name	:	B.Tech
Branch Code & Name	:	Mechanical Engineering
Semester	:	3
FacultyName	:	Rakesh Kumar Gangwar
SubjectCode	:	KME301
Marks Type	:	
Is Finally Submitted to University	:	False (It will be TRUE after submitting to University by your college.)

Sessional Marks (सैत्रिक अंक)

Sr.no. (क्रम संख्या)	Roll No. (अनुक्रमांक)	Name (नाम)	Obt.(CT) प्राप्त (CT)	Max.(CT) अधिकतम (CT)	Obt. TA (Assign./Att.)	Max. TA (Assign./Att.)	Obt. CT+TA	Max. CT+TA	Remark (टिप्पणी)
1	1808210024	ANANT BANSAL	10	30	20	20	30 ✓	50	
2	1808240001	AARAV SANKET	10	30	20	20	30 ✓	50	
3	1808240003	ABHINEET BHARDWAJ	11	30	19	20	30 ✓	50	
4	1808240004	ABHISHEK BHATNAGAR	21	30	19	20	40 ✓	50	
5	1808240005	ABHISHEK SINGH	12	30	18	20	30 ✓	50	
6	1808240006	AJAY KUMAR	12	30	18	20	30 ✓	50	
7	1808240007	AMAN GAHLAUT	11	30	19	20	30 ✓	50	
8	1808240008	ANMOL SAGAR	16	30	20	20	36 ✓	50	
9	1808240009	APURV CHANDEL	11	30	19	20	30 ✓	50	
10	1808240010	ARPIT TYAGI	14	30	20	20	34 ✓	50	
11	1808240011	ATIGYA GARG	13	30	20	20	33 ✓	50	
12	1808240012	DEEPAK PAL	11	30	19	20	30 ✓	50	
13	1808240013	DEEPRANSH SINGH	11	30	19	20	30 ✓	50	
14	1808240014	DEVISH KUMAR	11	30	19	20	30 ✓	50	
15	1808240015	DHARMESH DHAWAN	20	30	19	20	39 ✓	50	
16	1808240018	IBRAHIM KHAN	18	30	19	20	37 ✓	50	
17	1808240019	KARTIK CHAUDHARY	12	30	18	20	30 ✓	50	
18	1808240020	KRISHNA OMPRAKASH KASHYAP	11	30	19	20	30 ✓	50	
19	1808240021	LAKSHAY KAUSHIK	11	30	19	20	30 ✓	50	
20	1808240022	LOKENDRA	13	30	17	20	30 ✓	50	
21	1808240023	MANJUL KUMAR	11	30	19	20	30 ✓	50	
22	1808240025	MAYANK ANAND	12	30	18	20	30 ✓	50	
23	1808240027	MOHD RAHIL	18	30	20	20	38 ✓	50	
24	1808240028	MUSKAN BHATNAGAR	22	30	20	20	42 ✓	50	
25	1808240029	NIPUN VASHISHTHA	17	30	20	20	37 ✓	50	
26	1808240030	PRANJAL CHAUDHARY	12	30	18	20	30 ✓	50	
27	1808240031	RAHUL ANAND	12	30	18	20	30 ✓	50	
28	1808240032	ROMESHWAR SARAN	11	30	19	20	30 ✓	50	
29	1808240033	SAMAN ALI	11	30	20	20	31 ✓	50	
30	1808240034	SAMYAK JAIN	12	30	19	20	31 ✓	50	
31	1808240035	SHANTANU TIWARI	11	30	19	20	30 ✓	50	
32	1808240036	SUDHEER KUMAR GAUTAM	10	30	20	20	30 ✓	50	
33	1808240037	UDAY VARSHNEY	10	30	20	20	30 ✓	50	
34	1808240038	YASIR MUMTAZ	14	30	20	20	34 ✓	50	
35	1900820409001	AMAN KUMAR	11	30	19	20	30 ✓	50	
36	1900820409002	ANKIT PAL	12	30	18	20	30 ✓	50	
37	1900820409003	MUNIS HUSSAIN SIDDIQUI	11	30	19	20	30 ✓	50	

Director's Signature

Faculty Signature

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In Pursuit of Excellence	**Course outcome Attainment**	SESSION-2019-2020
		SEM-3rd

CO Attainment Gap

Course Code	CO	CO Targets	CO Attainment	CO Attainment Gap (Target - Attainment)
KME-301	CO1	45	36.03	8.97
	CO2	45	39.41	5.59
	CO3	45	38.79	6.21
	CO4	45	40.41	4.59
	CO5	45	40.14	4.86

If Gap > 0 : Target not attained
If Gap ≤ 0 : Target attained

Closure of Quality Loop

Course Code	CO	CO Targets	CO Attainment Gap	Action proposed to bridge the gap where targets are not achieved	Modification of targets where Achieved
KME-301	CO1	45	8.97	Contact hours will be increased for problem solving in next offering of course	
	CO2	45	5.59	Contact hours will be increased to cover the content and More practice time will provide to students in next offering of course	
	CO3	45	6.21	Contact hours will be increased for problem solving in next offering of course	
	CO4	45	4.59	Contact hours will be increased to cover the content and More practice time will provide to students in next offering of course	
	CO5	45	4.86	Explain the content in detail with live examples in next offering of course	

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Thermo-ynamics

UNIT-1

Thermodynamics :- "Thermodynamics is the science of energy transfer and its effect on the physica properties of the substance."

The subject of thermodynamics deals with ener and its transfermation, including heat, work and physical properties of substances. It also deals with thermodynamic equilibrium and feasibility o process. → Greek work Threme (Heat) + Dynamics (Motio or power)

Macroscopic V/s Microscopic Views :- It is well known that every substance is compared of a large number of molecules. The propertys of substance depend on the behavior of these molec There are two points of view from which the behavior of matter can be studied :- the macro scopic & microscopic.

In the marcroscopic approach, a certain quantity of matter is consider without the event occurri at molecular level. The macroscopic approach in the study of thermodynamics is also called class thermodynamics.

①

It provide a direct and easy way to the solvi
engineering problems. In the macroscopic approach

① structure of matter is not consider.

② only a few variables are needed to describ
the state of the system

③ The values of these variables can be measu

The microscopic approach is more elaborate. we know that every system is composed of large number of molecules. If it is a gas e molecule at a given instant has a certain position, velocity and energy and for each molecules these change very frequently as a result of collisions. The behavior of gas is derived by summing up the behavior of each molecule such a study made in micros ~~and~~ or statistical thermodynamics.

In the microscopic approach.

① The knowledge of the structure of matter necessary

② A large number of variables are needed t describe the state of the system

③ The values of the variables can't measured easily.

Thermodynamic System ÷

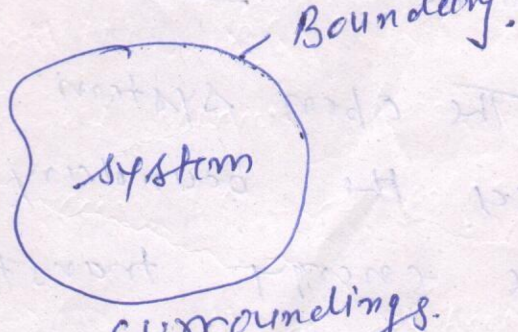
A Thermodynamic system is defined as a certain quantity of matter or a prescribed region in space considered for Thermodynmic

Study.

* The region outside the system is called the surroundings or environment.

* The real or imaginary surface that separt the system from its surroundings is called the boundary. The boundary of the system may be fixed or movable.

* The system and its surroundings constitute the universe

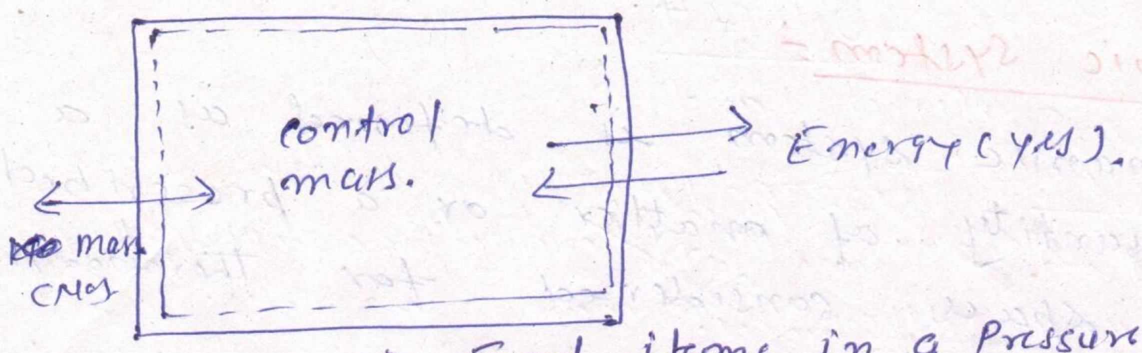


Closed system ÷

* consists of a fixed ~~mass~~ amou of mass and no mass can cross its boundary.

* The volume of a closed system may very an hence its bounday ~~may~~ is movable.

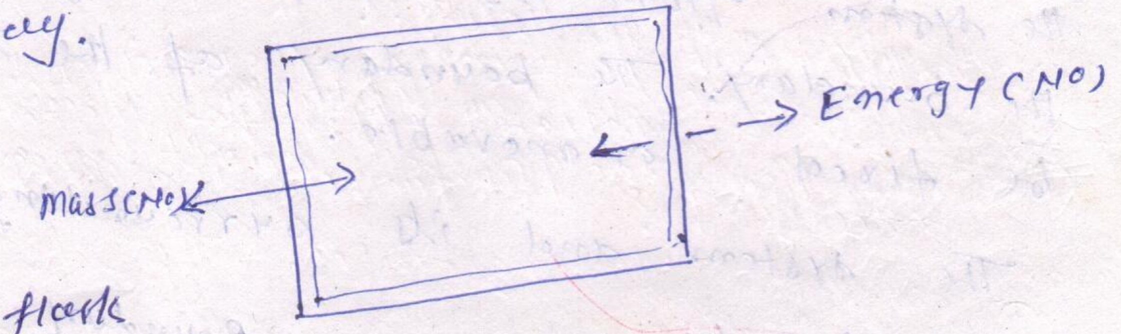
* The energy in the form of heat or work ca cross the boundary.



* Food items in a Pressure cooker

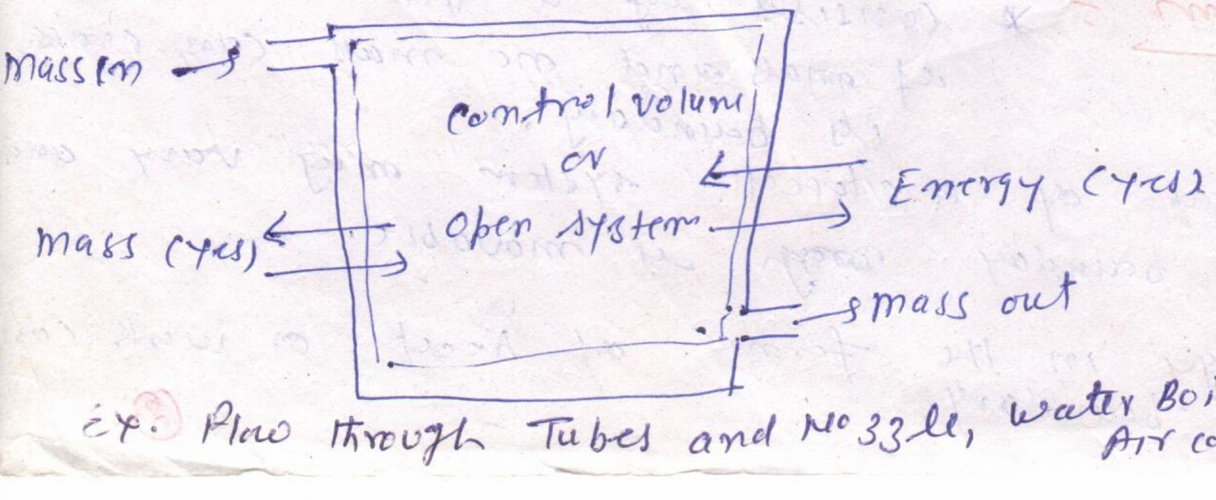
* Refrigerater and Ice - cream Freezer.

Isolated system :- An isolated system is a speci
case of closed system in which energy cann
not cross the boundary of the system. This sy
is not in communication with its surround
in any way.



* Thermes flask

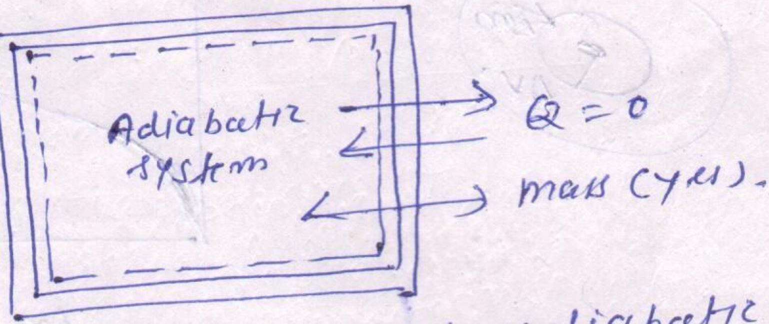
Open system :- The open system is one in which matter crosses the boundary of the system. there may be energy transfer also. such as compressor, turbine, nozzle.



Ex. Flow through Tubes and Nozzle, water Boiler, Reciprocating Air compressor

Adiabatic system ÷ An adiabatic system is a special case of an open system in which m can cross the control surface, but energy in the for of heat is not allowed to cross the control sur of the system. However energy in other form ca enter and leave the system. Insulated turbine, thro valve, water pumps, water turbines, insulated hea exchanger.

Ex. Insulated Turbines, Throttle valves, water Pump, Insulated heat Exchange

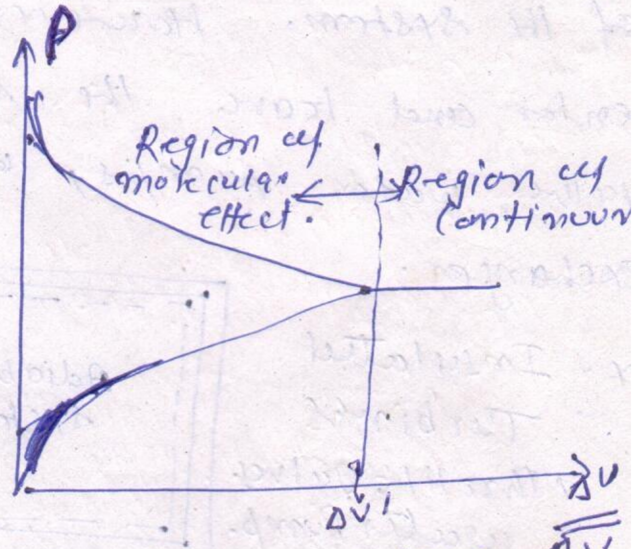


Representation of adiabatic system.

Homogeneous system ÷ A system is called homog means if it consist of a single physical phase.

Heterogenous system ÷ When a system is mixtu of two or more than two phase of matter i called heterogeneous system.

Continuum ÷ matter is made up of discrete parti called atom. These atoms are widely spaced (freepa in a gaseous phase and matter may also have some voids. The macroscopic approach is applica when the smallest unit of matter is larg enough compared to mean free path of the atoms. Under such circumstances, the matter i a system is considered as continuous and homogeneous without any hole. This is ca concept of continuum.



Let us consider the mean Δm in a volume ΔV surrounded the point P as shown in fig. The ratio of Δm/ΔV is the average mass density of the system within volume ΔV. The vol. ΔV' is the smallest volume about the point P for which the mass can be consider continuous.

$$\rho = \lim_{\Delta V \to \Delta V'} \left(\frac{\Delta m}{\Delta V} \right)$$

$\Delta V \to 0$, the density becomes uncertain.

* The continuum is not applicable whe the number of molecules in a system be negligible e.g. a system under high vacuum

$$P = \lim_{\Delta A \to \Delta A'} \left(\frac{\Delta F_n}{\Delta A} \right)$$

* **Homogeneous system** :- A system is called a homogeneous system if it consist of a single physical phase, either solid, liquid or gas only. ice, water, steam, sugar or salt dissolved in water, air, oxygen, nitrog gas.

* **Hetrogeneous system** :- When a system is a mixture of two or more than two phas of matter, it is called a heterogeneous system.

Ex mixture of ice + water, mixture of water and steam, dal, rice + water in a pressu cooker etc.

* **Intrinsic Properties** :- These are the basic properties and cannot defined in terms of other properties. Ex. length, mass, Time, ar Vol., Pressure, temp., electric current etc

* **Extrinsic Properties** :- These are properties whos values can't be assigned independently,

There are characteristic of the motion or Position of a system and are measured in reference to certain datum ex velocity accn, P.E, K.E., enthalpy, entropy etc

Work and Heat Transfer

* A closed system and its surroundings can interect in two ways ⓐ By work Transfer ⓑ By Heat Transfer. These may be called energy interactions.

In thermodynamic analysis, all form of energy can be put into two groups:

① stored energy

② Transit energy

① Stored energy: The stored form of energy co further be classified

a) marcoscopic forms of energy: P.E + K.E (w.r.t. some outside reference)

b) microscopic forms of energy: Internal Energy
(which are related to molecular structure of a system)

② Transit Energy: Energy in transition. It is the energy possessed by a system, which is capable of crossing the boundaries. Heat ener & work Transfer are transit form of energy

Internal Energy :- The sum of all the microscop forms of energy is called internal energy. The internal energy of a system is the energ stored within the body resulting from the Kinetic + Potential energy of its molecules. Thus the internal energy of any system may be viewed as the sum of K.E + P.E. of molecules.

$$U = \underset{\substack{\downarrow \\ \text{Internal} \\ \text{K.E of molecules}}}{K.E} + P.E \rightarrow \text{Internal P.E. of molecules}$$

Work :- work is a form of energy in trans

* Energy can cross the boundary of the system as heat or work.

* If Energy crossing the boundary is not hea then it must be work.

Ex: A moving Piston, a rotating shaft, a rising weight are all associated with work interaction.

" An energy interaction b/w system + surround during a process can be considered as work transfer, if its sole effect on every thing extern to system could have been raise a weight."

* Thermodynamic work refers to transfer of energy due to potential difference other than temperature difference, without transfer of mass across the system boundary.

* ① The Production of work is desirable, Therefore the workdone by a system is considered +ve

② The consumption of work is always undesiral therefore work done on a system is considered -ve

Heat :- It is a transfer form of energy that flows b/w two systems (or a system & surrounding by virtue of temperature difference b/w them

* Unit of heat is Joule in SI units & calories in MKS unit. It is denoted by Q.

* Heat transfer per unit mass is denoted by q.

Sig convention:-

* Heat transferred to a system is considered +ve

Heat transferred from a system is considered -ve

Specific Heat :- It is defined as heat energy required to change the temp. of the unit mass of a substance by ~~1~~ one degree.

It is denoted by c & measured in KJ/kg.K in SI unit & K cal/kg.K in MKS.

$$C = \frac{Q}{m.\Delta t} \quad J/kg.K.$$

* Since heat is not a property, so specific heat is qualified with the process through whi exchange of heat is made.

for gases, It process is contl pressure it is cp and if process is contl volume it is cv.

* The product of mass and specific heat (mc) is called the heat capacity of the substance It is represented by C, cp & cv.

Latent Heat :- is the amount of heat transfer require to cause a phase change in unit mass of a substance at contl pressure & temp

Enthalpy :

The sum of the internal energy U and the product of pressure P and volume V ~~appears frequently in many thermodynamic~~

is call enthalpy.

$$\boxed{H = U + PV}$$

* It is a property

Specific enthalpy $h = u + Pv$

$$\left(h = \frac{KJ}{kg} \right)$$

Difference b/w work & Heat

* Heat is low grade energy, whereas the work is high-grade energy.

* Heat Transfer take place due to temp. difference only while work transfer take pla due to any potential difference in pressure, voltage, height, velocity, temp. etc

* A stationary systems can't do work, while such a restriction is not imposed on heat-transfer.

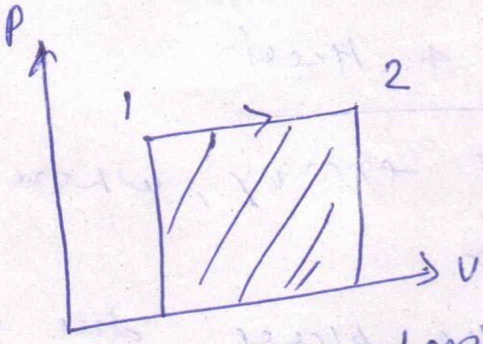
entire quantity of ~~heat~~ work can converted in heat or any other form of energy, while conversion of entire quantity of heat in work is not possible

* conversion of work into heat is possible with a single process, while conversion of heat in work requires a complete cyclic process

* p.dV work in various quasi-static process :-

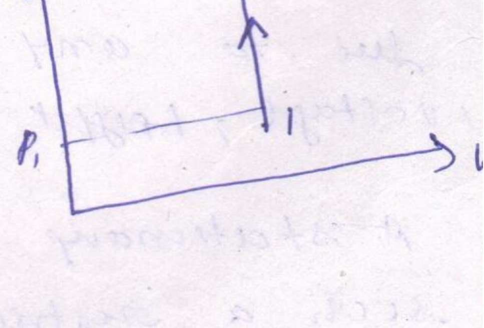
① contt Pressure Process (isobaric or isopiestic Process

$$W_{1-2} = \int_{V_1}^{V_2} PdV = P(V_2 - V_1)$$

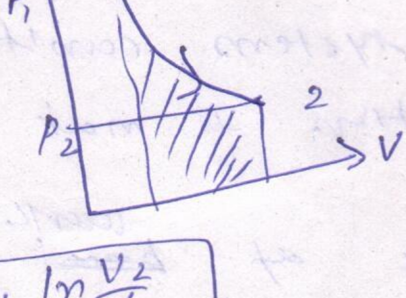


② contt volume (isochoric) Process

$$W_{1-2} = \int PdV = 0$$



③ Process $PV = C$



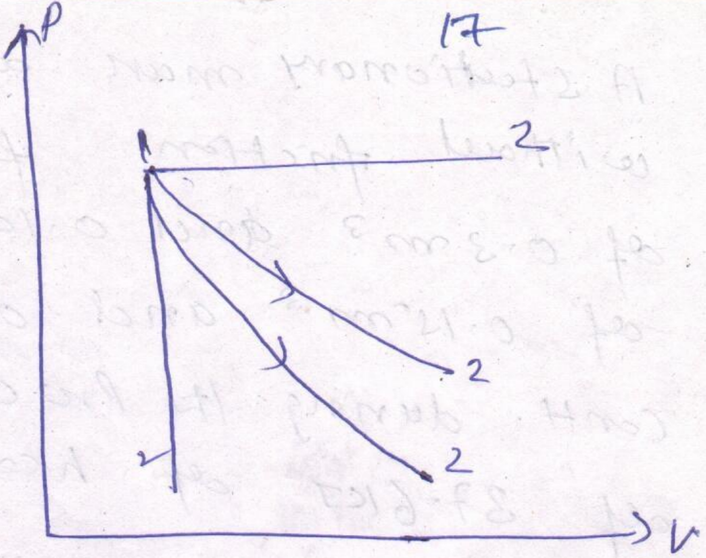
$pV = P_1V_1 = C$

$P = \frac{P_1V_1}{V}$

$$\boxed{W_{1-2} = \int_{V_1}^{V_2} P.dv = P_1V_1 \ln\frac{V_2}{V_1}}$$

$$\boxed{W_{1-2} = P_1V_1 \ln\frac{P_1}{P_2}}$$

④ Process $PV^n = C$



$$PV^n = P_1V_1^n = P_2V_2^n = C$$

$$P = \frac{P_1V_1^n}{V^n}$$

$$W_{1-2} = \int_{V_1}^{V_2} P\,dV$$

$$= \int_{V_1}^{V_2} \frac{P_1V_1^n}{V^n}\,dV$$

$$= P_1V_1^n\left[\frac{V^{-n+1}}{-n+1}\right]_{V_1}^{V_2} = \frac{P_1V_1^n}{1-n}\left[V_2^{1-n} - V_1^{1-n}\right]$$

$$= \frac{P_2V_2^n \times V_2^{1-n} - P_1V_1^nV_1^{1-n}}{1-n} = \frac{P_2V_2 - P_1V_1}{1-n}$$

$$\boxed{W_{1-2} = \frac{P_1V_1 - P_2V_2}{n-1}}$$

$(U_b \cdot U_d) + (U_a - U_d)$

$\underline{52 - 42} = 10$

Sol^n

$Q_{acb} = 84\ kJ$ $\quad W_{acb} = 32\ kJ$

$Q_{acb} = U_b - U_a + W_{acb}$

$84 = U_b - U_a + 32$

$U_b - U_a = 52\ kJ$

$W_{adb} = W_{ad} + W_{db}$

$10.5 = W_{ad} + 0$

$W_{ad} = 105$

$Q_{ad} = U_d - U_a + W_{ad}$

$= 42 + 10.5$

$= 52.5\ kJ$

ⓐ $Q_{adb} = U_b \cdot U_a$
$+ W_{adb}$

$= 52 + 10$

$Q_{adb} = 62.5\ k$

ⓑ $Q_{b-a} = U_a - U_b + W$

$= -52 - 2$

$\boxed{Q_{b-a} = -73}$

liberate

$Q_{db} = U$
$+ W$

$Q_{db} =$

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Q: A stationary mass of gas is compressed without friction from an initial state of 0.3 m³ and 0.105 MPa to a final state of 0.15 m³ and 0.105 MPa, the pressure rema const. during the process. There is a transfe of 37.6 kJ of heat from gas during the process. How much does the internal energy of the gas change.

$W_{1-2} = \int PdV = P(V_2 - V_1)$

$= -15.75 kJ.$

$Q = \Delta U + W$

$Q_{1-2} = -37.6$

$-37.6 = U_2 - U_1 \cancel{+} 15.75$

$\boxed{U_2 - U_1 = -21.85 kJ}$

Q: When a system is taken from state a to b along path acb 84 kJ of heat flow into system and systemed does 32 kJ of wor

a) How much will the heat that flows into the system along path adb be, if the work done is 10.5 kJ ⓑ When the system is returned f b to a along the curved path, the work done on the system is 21 kJ does the system abso or liberates the heat & how much ⓒ If Ua Ud = 0 42 kJ find heat absorbed in proce ad & db.