Vidya Jyothi Institute of Technology
(An Autonomous Institution)
(Accredited by NAAC & NBA, Approved by AICTE New Delhi & Permanently Affiliated to JNTUH)
Aziznagar Gate, C.B. Post, Hyderabad-500 075

DEPARTMENT OF MECHANICAL ENGINEERING

REGULATION: R15

BATCH: 2017-2021

ACADEMIC YEAR: 2018 - 2019

PROGRAM: B.TECH (MECHANICAL ENGINEERING)

YEAR/SEM: II / I

COURSE NAME: Thermodynamics

COURSE CODE: A13309

NAME OF THE FACULTY: J Emeema

DESIGNATION: Associate Professor

COURSE FILE INDEX

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1. SYLLABUS

II Year B.Tech Mech-I Sem R-15

THERMODYNAMICS

L T P/D C

4 1 0 4

Course Objective:

To understand the treatment of classical Thermodynamics and to apply the First and Second laws of Thermodynamics to engineering applications

Course Outcomes:

At the end of the course, the student should be able to Understand and differentiate between different thermodynamic systems and processes. Understand and apply the laws of Thermodynamics to different types of systems undergoing various processes and to perform thermodynamic analysis. Understand and analyze the Thermodynamic cycles and evaluate performance parameters.

UNIT – I

Introduction : Basic concepts: System, Control volume, Surrounding boundaries, Universe, Types of systems, Macroscopic and Microscopic view points, Concept of Continuum, Thermodynamics Equilibrium, state, Property, Process, Cycle – Reversibility – Quasi – static Process irreversible process, Causes of irreversibility – Energy in state and Transition, Types , Work and heat, Point and path function. Zeroth Law of Thermodynamics – Concept of quality of temperature – Principles of Thermometry – Reference points – Const. Volume gas thermometer – Scales of temperature, Ideal gas scale

UNIT – II

PMM I – Joule's experiments – First law of thermodynamics – Corollaries – First law applied to a process – applied to a flow system – Steady flow energy equation. Limitations of the first law – Thermal Reservoir, Heat pump, Parameters of performance, Second law of thermodynamics, Kelvin planck and Clausius Statements and their Equivalence/ Corollaries, PMM of second kind, Carnot's principle, Carnot cycle and its specialities, Thermodynamic scale of temperature, Clausius inequality, Entropy, Principle of Entropy increase – Energy equation, Availability and irreversibility – Thermodynamic Potentials, Gibbs and Helmhoultz functions, Maxwell Relations – Elementary Treatment of the third law of thermodynamics.

UNIT – III

Pure Substances, p-V-T- surfaces, T-S and h-s diagrams, Mollier Charts Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation, Property tables, Mollier charts – Various thermodynamic processes and energy transfer – Steam calorimetry.

UNIT –IV

Perfect Gas Laws – Equation of State, specific and universal Gas constants – various Non-flow processes, properties, end states, Heat and work Transfer, changes in internal energy – Throttling and free Expansion Processes – Flow processes – Deviations from perfect Gas Model – Vander walls Equation of State – Compressibility charts – variable specific Heats – Gas tables.

Mixtures of perfect Gases – Mole Fraction, Mass friction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction, Volume fraction and partial pressure, Equivalent Gas const. And Molecular internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases

UNIT – V

Power Cycles : Otto Diesel, Dual combustion cycles, Sterling Cycle, Atkinson Cycle, Ericsson Cycle, **Lenoir Cycle** – Description and representation on P-V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles.

TEXT BOOKS

1. Engineering Thermodynamics / PK Nag/TMH, III Edition
2. Thermodynamics – An Engineering Approach – Yunus Cengel & Boles /TMH
3. Engineering thermodynamics –P.Chattopadhyay/Oxford University press

REFERENCES:

1. An introduction to Thermodynamics – YVS Rao / University press
2. Solution Manual to introduction to Thermodynamics, YVC Rao/ University press
3. Engineering Thermodynamics – Jones & Dugan
4. Thermodynamics – Robert Balmer /Jaico pub.
5. Thermodynamics – J.P Holman/ McGrawHill
6. Engineering Thermodynamics – K.Ramakrishna/Anuradha publishers.
7. Fundamentals of thermodynamics – Sonntag, Borgnakke and van wylen,/John wiley & sons (ASIA) Pte Ltd

2. TEXT BOOKS & OTHER REFERENCES

S. NO.	TITLES R15
1	Engineering Thermodynamics / PK Nag/TMH, III Edition
2	Thermodynamics – An Engineering Approach – Yunus Cengel & Boles /TMH
3	Engineering thermodynamics –P.Chattopadhyay/Oxford University press
	Web References: • https://en.wikipedia.org/wiki/Thermodynamics • https://en.wikipedia.org/wiki/Entropy • https://www.nature.com › subjects

S. NO.	REFERENCES R15
1	An introduction to Thermodynamics – YVS Rao / University press
2	Solution Manual to introduction to Thermodynamics, YVC Rao/ University press
3	Engineering Thermodynamics – Jones & Dugan
4	Thermodynamics – Robert Balmer /Jaico pub.
5	Thermodynamics – J.P Holman/ McGrawHill
6	Engineering Thermodynamics – K.Ramakrishna/Anuradha publishers.
7	Fundamentals of thermodynamics – Sonntag, Borgnakke and van wylen,/John wiley & sons (ASIA) Pte Ltd

3. TIME TABLE

VIDYA JYOTHI INSTITUTE OF TECHNOLOGY
MECHANICAL ENGINEERING DEPARTMENT

TIMETABLE 2018-19 w.e.f. 02-07-2018

II B.Tech I Sem **SECTION-A** **ROOM NO:**

TIME/ DAY	9.00-10.00	10.00-11.00	11.00-12.00	12.00-01.00	01.00-01.45	01.45-02.45	02.45-03.45
MON	MOS	MMS	NM	PC	LUNCH	MOS/MMS LAB	
TUE	MMS	ES	MOS	EE		NM	TD
WED	EE	ES	PC	TD		EE-LAB	
THU	TD	MMS	MOS	EE		NM	TD/MOS
FRI	MOS	NM	MMS	EE		TD	ES

SL.NO	SUBJECT	FACULTY
1	MECHANICS OF SOLIDS	K.Rajesh Kumar
2	MATERIAL SCIENCE AND METALLURGY	K.Narender reddy
3	THERMODYNAMICS	K.Ashok chary
4	ELECTRICAL AND ELECTRONICS	Swapna
5	NUMERICAL METHODS	Sridevi
6	ENVIRONMENTAL SCIENCE	S.Sunita
7	PROFESSIONAL COMUNICATION	A.Surender
8	MOS/MMS - LAB	K.Rajesh Kumar & G Sravya/ K.Narender reddy/K.Ashok chary
9	EE-LAB	Swapna

H.O.D

VIDYA JYOTHI INSTITUTE OF TECHNOLOGY
MECHANICAL ENGINEERING DEPARTMENT

TIMETABLE 2018-19 w.e.f. 02-07-2018

SECTION-B ROOM NO:

II B.Tech ISem

TIME/ DAY	9.00-10.00	10.00-11.00	11.00-12.00	12.00-01.00	01.00-01.45	01.45-02.45	02.45-03.45
MON	TD	ES	EE	NM	LUNCH	EE-LAB	
TUE	MOS	EE	MMS	NM		PC	ES
WED	MMS	NM	MOS	TD		MOS/MMS-LAB	
THU	EE	TD	PC	MMS		MOS	TD/MOS
FRI	ES	EE	MOS	TD		MMS	NM

SL.NO	SUBJECT	FACULTY
1	MECHANICS OF SOLIDS	G.Sravya
2	MATERIAL SCIENCE AND METALLURGY	Sudha bindhu
3	THERMODYNAMICS	Dr.B.Ravinder reddy
4	ELECTRICAL AND ELECTRONICS	Swapna
5	NUMERICAL METHODS	Udaya sree
6	ENVIRONMENTAL SCIENCE	S.Sunitha
7	PROFESSIONAL COMUNICATION	A.Surender
8	MOS/MMS-LAB	G.sravya & Saniya/ Sudha bindhu & K.Narendra reddy
9	EE-LAB	Vikram

H.O.D

VIDYA JYOTHI INSTITUTE OF TECHNOLOGY
MECHANICAL ENGINEERING DEPARTMENT
TIMETABLE 2018-19 w.e.f. 02-07-2018

II B.Tech I Sem **SECTION-C** **ROOM NO:**

TIME/ DAY	9.00-10.00	10.00-11.00	11.00-12.00	12.00-01.00	01.00-01.45	01.45-02.45	02.45-03.45
MON	EE	TD	ES	MOS	LUNCH	NM	MMS
TUE	TD	EE	PC	MMS		MOS/MMS - LAB	
WED	MMS	TD	NM	EE		ES	MOS
THU	MOS	NM	EE	MMS		EE-LAB	
FRI	PC	TD	MOS	ES		NM	TD/MOS

SL.NO	SUBJECT	FACULTY
1	MECHANICS OF SOLIDS	K.Rajesh Kumar
2	MATERIAL SCIENCE AND METALLURGY	K.Narender reddy
3	THERMODYNAMICS	K.Srinivasa Rao
4	ELECTRICAL AND ELECTRONICS	Bhavana Reddy
5	NUMERICAL METHODS	Sridevi
6	ENVIRONMENTAL SCIENCE	Mounika
7	PROFESSIONAL COMUNICATION	A.SURENDER
8	MOS/MMS-LAB	G.Sowmya &Saniya/srinivasa rao & narender reddy
9	EE-LAB	Sowjanya

H.O.D

VIDYA JYOTHI INSTITUTE OF TECHNOLOGY
MECHANICAL ENGINEERING DEPARTMENT
TIMETABLE 2018-19 w.e.f. 02-07-2018

II B.Tech I Sem SECTION-D ROOM NO:

TIME/ DAY	9.00- 10.00	10.00- 11.00	11.00- 12.00	12.00- 01.00	01.00- 01.45	01.45- 02.45	02.45- 03.45
MON	NM	MMS	PC	TD	LUNCH	EE	ES
TUE	NM	ES	EE	MOS		EE-LAB	
WED	TD	PC	MOS	EE		MMS	NM
THU	MOS	EE	MMS	TD		MOS/MMS-LAB	
FRI	ES	TD	MOS	NM		MMS	TD/MOS

SL.NO	SUBJECT	FACULTY
1	MECHANICS OF SOLIDS	Abul Hasan
2	MATERIAL SCIENCE AND METALLURGY	Dr.N.Ravinder Reddy
3	THERMODYNAMICS	Dr.B.Ravinder Reddy
4	ELECTRICAL AND ELECTRONICS	Vijay Kumar
5	NUMERICAL METHODS	Udaya Sree
6	ENVIRONMENTAL SCIENCE	Mounika
7	PROFESSIONAL COMUNICATION	A.SURENDER
8	MOS/MMS- LAB	Hasan& chandra/saniya & Dr.N.Ravinder Reddy
9	EE-LAB	Vijay Kumar

H.O.D

4. PROGRAM OUTCOMES(PO'S) & PROGRAM SPECIFIC OUTCOMES(PSO'S)

PROGRAM OUTCOMES

Engineering Graduates will be able to:

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. 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 the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. 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.

PO6. 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.

PO7. 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.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with 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.

PO11. 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.

PO12. 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.

PROGRAM SPECIFIC OUTCOMES

After completion of the Program (B.Tech), graduates will be able to:

PSO1. Analyze and solve problems of thermal and manufacturing in the comprehensive design of mechanical engineering components.

PSO2. An ability to design, develop and implement mechanical engineering solutions keeping in view the sustainability and environmental issues with social responsibility.

5. COURSE OBJECTIVES & COURSE OUTCOMES (CO'S)

Course Objectives: R15

The objective of the course is to:

1	To understand the treatment of classical Thermodynamics
2	to apply the First and Second laws of Thermodynamics to engineering applications
3	Appreciate the concepts of Pure substance, Perfect Gas Laws, Mixtures of perfect gases and to analyze the performance of Power cycles

Course Outcomes: R 15

At the end of the course, the students should be able to:

CO1	Identify thermodynamic systems, understand concepts of zeroth law, first law, work and heat interactions.
CO2	State and illustrate second law of thermodynamics. Identify and explain concepts of entropy, enthalpy, specific energy, reversibility, availability and irreversibility
CO3	Understand the concepts of phase transformation of pure substance.
CO4	Appreciate the concepts of perfect gas laws. Analyze mixtures of perfect gases
CO5	Understand power cycles and evaluate the performance

6. MAPPING OF CO'S WITH PO'S & PSO'S

R15

CO-PO/PSO MAPPING

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Thermodynamics/ A13309	CO1	3	3		3		3	2	2	1	3		3	3	3
	CO2	3	3		3			2			3		3	3	2
	CO3	3		3	2	3		2		1	3			2	3
	CO4	3	3	3	3	3	3	2	2		3				2
	CO5	2	3	3	2	2	3	2	3	1	3		3		3
AVG		**2.8**	**3**	**3**	**2.6**	**2.67**	**3**	**2**	**2.3**	**1**	**3**		**3**	**2.67**	**2.6**

7. ACADEMIC CALENDAR

Vidya Jyothi Institute of Technology (Autonomo

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(Aziz Nagar, C.B.Post, Hyderabad -500075)

II/III/IV B.Tech I & II Semester Academic Calendar for the Academic Year 2018-2019

II/III/IV YEAR I SEMESTER		Commencement of Class Work 02.07.2018	
	From	**To**	**Duration**
I Spell of Instruction	02-07-2018	28-08-2018	8 Weeks
I Mid Examinations	29-08-2018	01-09-2018	4 Days
II Spell of Instruction	03-09-2018	12-10-2018	6 Weeks
Dussehra Holidays	13-10-2018	21-10-2018	9 Days
II Spell of Instruction Continuation	22-10-2018	03-11-2018	2 Weeks
II Mid Examinations	05-11-2018	10-11-2018	4 Days
Preparation & Practical Examinations	12-11-2018	21-11-2018	1 Week
End Semester Examinations	22-11-2018	10-12-2018	2 Weeks
Supplementary/ Semester Break	11.12.2018	16.12.2018	1 Week
II/III/IV YEAR II SEMESTER		**Commencement of Class Work 17.12.2018**	
I Spell of Instruction	17.12.2018	12.02.2019	8 Weeks
I Mid Examinations	13.02.2019	16.02.2019	4 Days
II Spell of Instruction	18.02.2019	13.04.2019	8 Weeks
II Mid Examinations	15.04.2019	18.04.2019	4 Days
Preparation & Practical Examinations	20.04.2019	27.04.2019	1 Week
End Semester Examinations	29.04.2019	15.05.2019	2 Weeks
Supplementary/ Summer Vacation	16.05.2019	30.06.2019	6 Weeks
Commencement of classes will be from 01.07.2019			

DIRECTOR

8. TEACHING SCHEDULE

Lecture No. as per period	Topic R15
UNIT-I	
LH 1	Introduction, Basic concepts, System, Control Volume, Surroundings, Boundaries, Universe, Types of systems
LH 2	Macroscopic & Microscopic view Points, Concept of Continuum
LH 3	Thermodynamic Equilibrium, State, Property, Process, Cycle
LH 4	Reversibility, quasi-static process, reversible process, causes of irreversibility
LH 5	Energy in state & in transition, types, Displacement & other forms of work
LH 6	Heat, Path & Point functions
LH 7	Problems on work & heat(Tutorial)
LH 8	Zeroth law of Thermodynamics, Concept of Temperature
LH 9	Principles of Thermometry, Reference Points
LH 10	Constant Volume Gas Thermometer, Scales of temperature, Ideal gas scale
	UNIT-II
LH 11	Joule's Experiments-First law of Thermodynamics
LH 12	Corollaries, PMM-1
LH 13	First law applied to a flow system, steady flow energy equation
LH 14	Problems on 1st law of Thermodynamics for closed & steady flow system(Tutorial)
LH 15	Problems on 1st law of Thermodynamics for steady flow system(Tutorial)
LH 16	Limitations of First Law-Thermal Reservoir
LH 17	Heat Engine, Heat Pump, Parameters of Performance
LH 18	Problems on heat engine, heat pump and refrigerator(Tutorial)
LH 19	Second law of Thermodynamics
LH 20	Kelvin-Planck & Clausius statements & their Equivalence/Corollaries
LH 21	PMM of second kind, Carnot's Principle, Carnot cycle & its specialties
LH 22	Thermodynamic scale of Temperature, Clausius Inequality
LH 23	Entropy, Principle of Entropy Increase-Energy Equation
LH 24	Availability & Irreversibility
LH 25	Thermodynamic Potentials, Gibbs & Helmholtz functions
LH 26	Maxwell relations, Elementary treatment of the Third law of Thermodynamics
UNIT-III	
LH 27	Pure substance, Phase transformations,
LH 28	P-V diagrams, P-T,
LH 29	T-S diagrams, P-V-T Surfaces
LH 30	h-s diagrams-Mollier charts,
LH 31	Triple point critical state, properties during change of phase
LH 32	Dryness fraction, property tables, Clausius-Clapeyron equation
LH 33	Steam calorimetry
LH 34	Problems on pure substance(Tutorial)

LH 35	Problems on pure substance(Tutorial)
LH 36	Various Thermodynamic processes and energy transfer
	UNIT- IV
LH 37	Perfect Gas Laws - Equation of State, specific and Universal gas constant
LH 38	Various Non-flow processes, Properties, End states
LH 39	Heat and Work Transfer, Changes in Internal Energy
LH 40	Throttling and Free Expansion Processes - Flow processes
LH 41	Deviations from perfect Gas model - Vander Waals Equation of State
LH 42	Compressibility charts
LH 43	Variable specific Heats — Gas Tables
LH 44	Problems on non-flow processes(Tutorial)
LH 45	Problems on non-flow processes(Tutorial)
LH 46	Mixtures of perfect Gases – Mole Fraction, Mass friction
LH 47	Gravimetric and volumetric Analysis
LH 48	Dalton's Law of partial pressure, Avogadro's Laws of additive volumes
LH 49	Mole fraction, Volume fraction and partial pressure
LH 50	Equivalent Gas const. And Molecular Internal Energy, Enthalpy,
LH 51	Specific Heats and Entropy of Mixture of perfect Gases and Vapour
LH 52	Problems on Mixtures of perfect gases(Tutorial)
	UNIT-V
LH 53	Power cycles – Working of IC Engine
LH 54	Otto Cycle
LH 55	Diesel cycle
LH 56	Dual cycle
LH 57	Comparison of Cycles
LH 58	Mean Effective Pressures on Air standard basis
LH 59	Problems on Otto Cycle(Tutorial)
LH 60	Problems on Diesel Cycle(Tutorial)
LH 61	Problems on Dual Cycle(Tutorial)
LH 62	Sterling Cycle,
LH 63	Ericsson Cycle
LH 64	Atkinson cycle, Lenoir cycle
LH 65	Problems on Sterling Cycle(Tutorial)
LH 66	Problems on Ericsson Cycle(Tutorial)

9. ASSIGNMENT QUESTIONS

ASSIGNMENT-I **R15** **A.Y: 2018-19**

Q.No.	Questions	CO's	BL
1	Write the Steady Flow Energy Equation SFEE. What are the applications of SFEE?	CO 1	L2
2	Explain thermodynamic equilibrium	CO1	L2
3	A piston cylinder device operates one kg of fluid at 20 atm pressure. The initial volume is 0.04 m^3. The fluid is allowed to expand reversibly according to the law $PV^{1.45}$ = Constant so that the volume is doubled. The fluid is then cooled at constant pressure until the piston comes back to its original position. Keeping the piston unaltered, heat is added reversibly to restore it to the initial pressure. Calculate the work done in the cycle.	CO2	L3
4	Define Irreversibility. What are the causes of Irreversibility?	CO2	L1
5	Prove the equivalence of Kelvin-plank and Clausius statements	CO2	L2

ASSIGNMENT II

Q.No.	Questions	CO's	BL
1	Define the following: a) Critical Point b) Triple Point c) Dryness fraction of steam	CO3	L2
2	Explain P-v Diagram for pure water with a neat sketch.	CO3	L3
3	State and Prove Dalton’s law of Partial pressures	CO4	L2
4	Derive air standard Efficiency of Otto Cycle	CO5	L3
5	A Diesel Engine has a Compression Ratio of 14. Cut-Off takes place at 6 % of the stroke. Find the Air Standard Efficiency	CO5	L3

10. MID QUESTION PAPERS I & II

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(Aziz Nagar, C.B.Post, Hyderabad -500075)

2nd Year B.Tech 1st Semester 1st Mid Exam

Branch: Mechanical **Duration: 90 Minutes**
Subject: Thermodynamics **Marks: 20**
Date: 30-08-2018 **Session: AN**

Course Outcomes:

1. Identify thermodynamic systems, understand concepts of zeroth law, first law, work and heat interactions.
2. State and illustrate second law of thermodynamics. Identify and explain concepts of entropy, enthalpy, specific energy, reversibility, availability and irreversibility
3. Understand the concepts of phase transformation of pure substance.
4. Appreciate the concepts of perfect gas laws. Analyze mixtures of perfect gases
5. Understand power cycles and evaluate the performance

Bloom Levels:

Remember	1
Understand	2
Apply	3
Analyze	4
Evaluate	5
Create	6

PART-A (3Q×2M = 6 Marks)		Course Outcomes		Bloom Levels	Marks
ANSWER ALL THE QUESTIONS		CO	PO		
1	Define heat and work	1	1,2,3,9,7,12	1	2
2	Define PMM-II	2	1,2,6,12	1	2
3	Define a pure substance with examples	3	1,3,4,8,12	1	2

PART-B (5+5+4 = 14 Marks)		Course Outcomes		Bloom Levels	Marks
ANSWER ALL THE QUESTIONS		CO	PO		
4.i.a)	Differentiate between microscopic and macroscopic view	1	1,2,3,4,5,6,7, 8,9,12	3	2
4.i.b)	Explain intensive and extensive properties with examples	1	1,2,3,4,6,7,8, 9,12	2	3
[OR]					
4.ii.	0.142 m^3 of certain ideal gas at 21 bar and 337 ^0C is expanded isothermally to 6 times the initial volume. The gas is further cooled to 30 ^oC at constant volume and finally come back to initial conditions Polytropically. Find the work done in each process and net work done and heat transfer during the cycle. Sketch the process on P-v plot.	1	1,2,5,12	4	5
5. i.a)	Prove equivalence of Kelvin-Plank and Clasius statement	2	1,2,3,4,6,7,8, 12	3	5
[OR]					
ii.a)	5kg of a gas heated from a temperature of 373K at constant volume till its pressure becomes three times its original pressure. For this process calculate: (i) heat transfer (ii) change in internal energy (iii) change in enthalpy (iv) change in entropy	2	1,2,3,4,6,7,9, 10,12	3	5
6.i)	Explain with a neat sketch the P-T diagram of a pure substance	3	1,2,3,4,5,12	3	4
[OR]					
ii)	Draw and explain T-v diagram for water.	3	1,2,6,7,8,9,12	3	4

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(Aziz Nagar, C.B.Post, Hyderabad -500075)

2nd Year B.Tech 1st Semester 2nd Mid Exam

Branch: Mechanical **Duration: 90 Minutes**
Subject: Thermodynamics **Marks: 20**
Date: 09-11-2018 **Session: FN**

Course Outcomes:

1. Identify thermodynamic systems, understand concepts of zeroth law, first law, work and heat interactions.
2. State and illustrate second law of thermodynamics. Identify and explain concepts of entropy, enthalpy, specific energy, reversibility, availability and irreversibility
3. Understand the concepts of phase transformation of pure substance.
4. Appreciate the concepts of perfect gas laws. Analyze mixtures of perfect gases
5. Understand power cycles and evaluate the performance

<u>Bloom Levels:</u>

Remember	1
Understand	2
Apply	3
Analyze	4
Evaluate	5
Create	6

PART-A (3Q×2M = 6 Marks)		Course Outcomes		Bloom Levels	Marks
ANSWER ALL THE QUESTIONS		CO	PO		
1.i)	What is the importance of Mollier diagram?	3	1,2,5,12	2	2
[OR]					
ii)	Define degree of superheat and latent heat of fusion.	3	1,3,4,8,12	1	2
2.i)	What is the significance of Vander Waal's equation of state?	2	1,2,7,11	1	2

[OR]					
ii)	Define volumetric and gravimetric analysis	4	1,2,3,4	1	2
3. i)	Draw the P-v and T-s diagram of Atkinson Cycle?	4	1,3,7,11	1	2
[OR]					
ii)	Calculate efficiency of diesel cycle when compression ratio is 15 and cut off ratio is 10%	4	1,3,4,8,12	2	2
	PART-B (5+5+4 = 14 Marks)	**Course Outcomes**		**Bloom Levels**	**Marks**
ANSWER ALL THE QUESTIONS		**CO**	**PO**		
4.i.a)	Derive Clausius Clapeyron equation.	1	1,5,7,9	4	4
[OR]					
4.i.b)	Explain intensive and extensive properties with examples	1	1,2,3,4,6,7,8, 9,12	3	3
[OR]					
4.ii.	Steam initially at 1.5MPa, 300ºC expands reversibly and adiabatically in asteam turbine to 400C. Determine the ideal work output of the Turbine perkg of steam?	4	1,2,5,12	4	5
5. i.a)	Prove equivalence of Kelvin-planks and clasius statement	2	1,3,4,8,12	3	4
[OR]					
ii.a)	A tank having a volume of 0.6m^3 contains oxygen at 25ºC and 480 kPa. Nitrogen is introduced into the tank without producing change in temperature until the pressure becomes 920 kPa. Determine the mass of each gas and its partial volume	4	1,3,4,8,12	3	5
6 i.a)	Derive the expression for air standard efficiency of a constant pressure(diesel) cycle?	2	1,3,7,11	4	5
[OR]					
ii.a)	An engine working on Otto cycle has a volume of 0.45m^3 pressure 1barand temperature 300ºC at the beginning of the compression stroke. At the end of the compression stroke the pressure is 11bar. 210 kJ of heat is added at constant volume. Determine efficiency and mean effective pressure	4	1,3,4,8,12	4	5

11 RUBRICS FOR MID-EVALUATION

VIDYA JYOTHI INSTITUTE OF TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

RUBRICS FOR MID-EVALUATION

Criteria of Evaluation	Poor	Satisfactory	Good	Very Good	Excellent
Interpretation	Answer reflects that the question was not understood at all.	Answer reflects that the question was somewhat understood	Answer reflects that the Question was understood to a reasonable level	Answer reflects that the Question was understood to an appreciable level	Answer reflects that the Question was completely understood
Presentation	No proper presentation	Presentation was marginal with issues in legibility and grammar	Presentation was clear but with grammatical errors	Presentation was explicitly good and clear with minor grammatical errors	Presentation was excellent and clear with no grammatical errors
Solution	Solution has more errors	Solution has moderate amount of errors	Solution was complete but with minor errors	Solution was complete but with no clear mention of entire procedure	Solution was accurate/ complete with clear mention of the entire procedure.

12. LECTURE NOTES

UNIT-I

The study of thermodynamics is important because many machines and modern devices change heat into work, such as an automobile engine or turn work into heat or cooling, such as with a refrigerator. Understanding how thermodynamics works helps to understand how machines that use thermodynamics work.

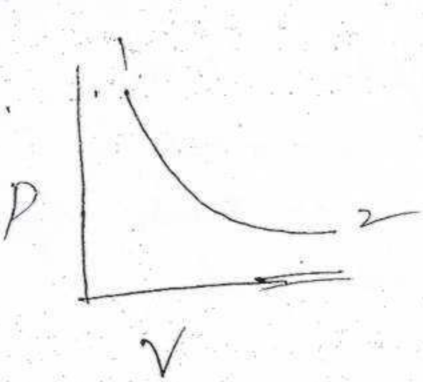
Thermodynamics can be defined as the science that deals with the interaction between energy and material systems. This subject was developed by Carnot, Mayer, Clausius, Joule, Kelvin, Maxwell, planck, Caratheodary and Gibbs.

The Study of thermodynamics is the basis of fields such as steam power plants, Internal combustion engines, Gas dynamics, Aerodynamics, Fluid mechanics, Air conditioning, Refrigeration and Heat Transfer.

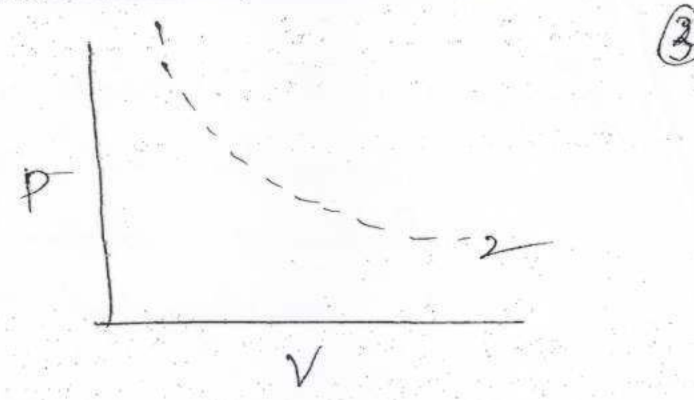
An important application area of thermodynamics is the biological system. Most diets are based on the simple energy balance because, the net energy gained by a person in the form of fat is equal to the difference between the energy intake from food and the energy expended by exercise.

There are four laws in thermodynamics, there is no mathematical proof for these laws and these laws are deduced from experimental Observations.

Zeroth law explains the principle of thermal equilibrium and establishes the concept of temperature. The first law introduces the concept of Internal energy. The second law introduces the concept of entropy and the third law enables the evaluation of absolute entropy.



Reversible process



Irreversible process

Cycle: A cycle is a process whose initial & final states are the same. Thus at the end of a cycle, all the properties of the working fluid have the same values as they had in the initial state.

cycle —[Thermodynamic cycle / Mechanical cycle]

A Thermodynamic cycle is one in which the chemical composition of the working fluid during a process does not change. eg water that circulates through a steam power plant and refrigerant that passes through a refrigeration plant are examples of the thermodynamic cycle. Here there is a change of phase during the process, but the end states do not change.

Mechanical cycle: during the process, the properties of the working fluid change. eg. In an I.C Engine air & fuel are burnt in the engine, converted into the products of combustion and are then exhausted into atmosphere

State :- The State of a system is its Condition or Configuration described in Sufficient detail so that one State may be distinguished from all other states

property A property of a System is any Observable Characteristic of a System

Thus property of a System depends Solely upon the State of the System and not upon how that State may have been reached

State :- The State of a system is its Condition or Configuration described in sufficient detail so that one state may be distinguished from all other states

path is the Complete Series of States through which the System passes during a Change from one given State to another State

process The transformation of a System ~~from one~~ fixed State to another State is called a process

property A property of a System is any Observable Characteristic of a System
eg Speed, pressure, density, volume etc
Thus the property of the system depends Solely upon the state of [illegible] upon how that state may have been

13 PPT MATERIAL

THERMODYNAMICS

J Emeema
Associate Professor
Department of Mechanical Engineering

Basic Concepts of Thermodynamics

Why is the study of Thermodynamics important?

- The study of thermodynamics is important because many machines and modern devices change heat into work, such as an automobile engine or turn work into heat or cooling, such as with a refrigerator.
- Understanding how thermodynamics works helps you understand how machines that use thermodynamics work.

Basic Concepts of Thermodynamics

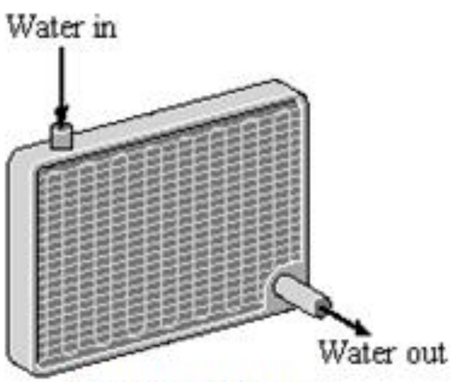
Thermodynamics can be defined as science that deals with the interaction between energy and material systems.

Thermodynamics is the study of the movement of heat from one body to another and the relations between heat and other forms of energy.

This subject was developed mainly by Carnot, Mayer, Clausius, Joule, Kelvin, Maxwell, Planck Caratheodory and Gibbs.

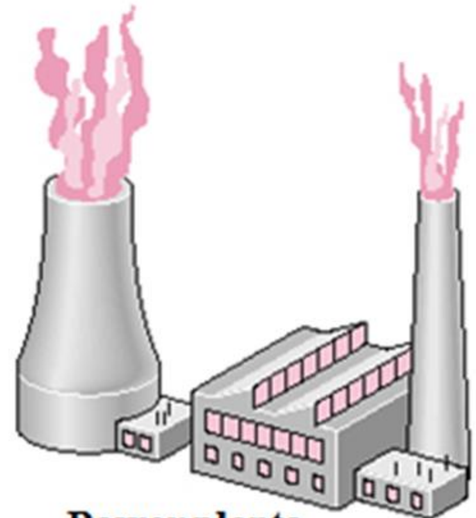
Basic Concepts of Thermodynamics

➢ Applications of Thermodynamics



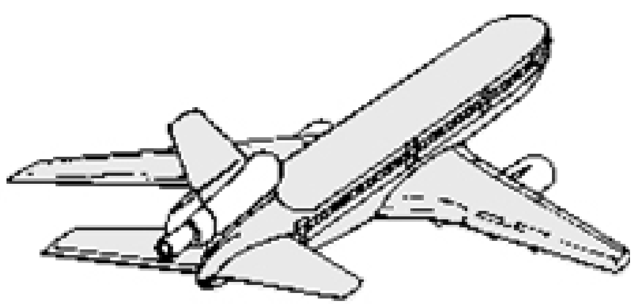
Car radiators

The human body

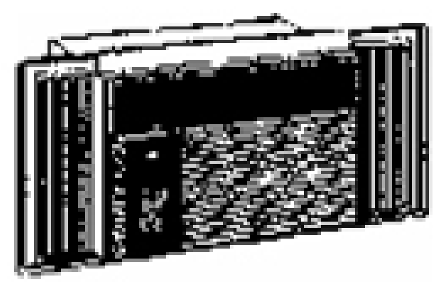


Power plants

Refrigeration systems



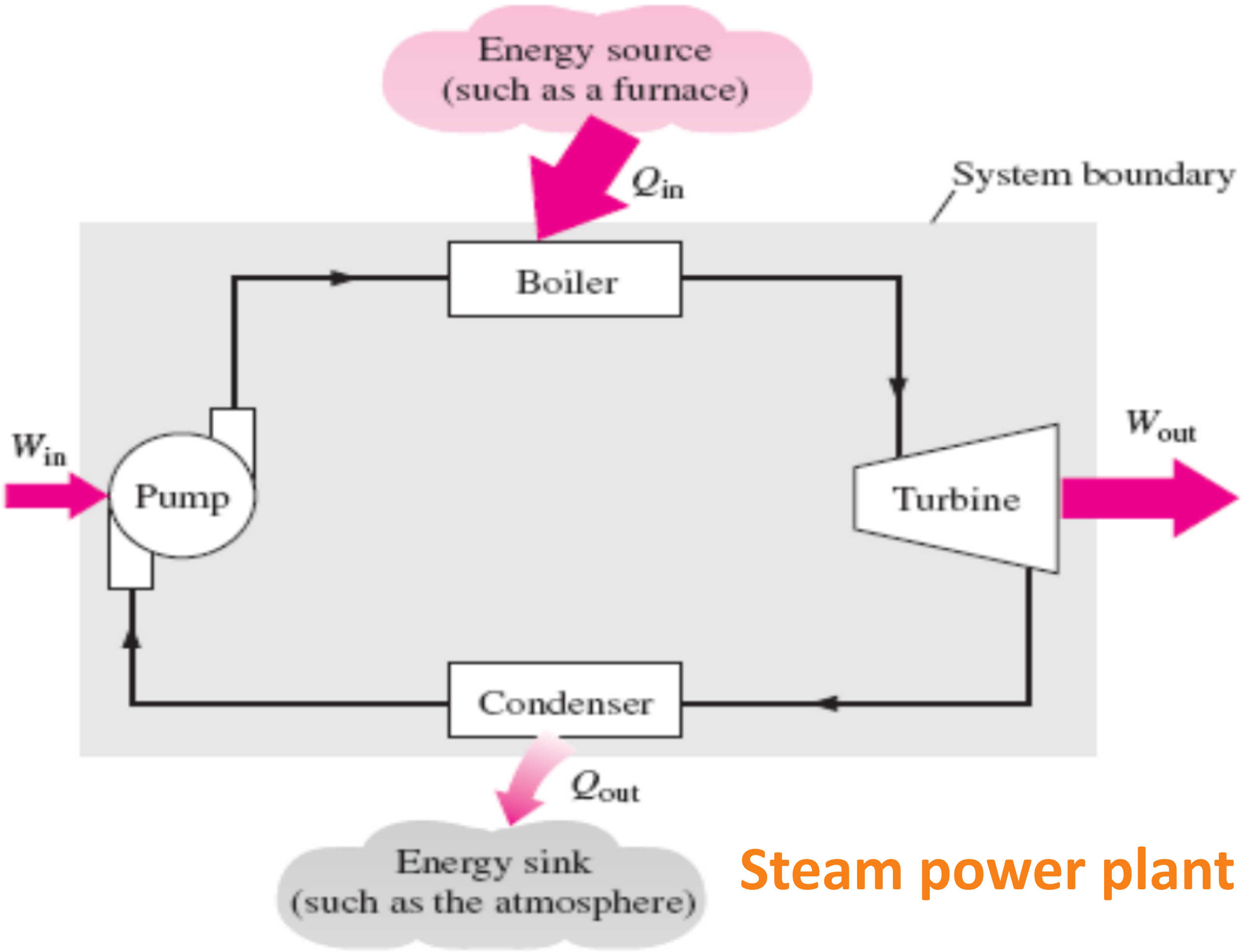
Airplanes



Air-conditioning systems

Basic Concepts of Thermodynamics

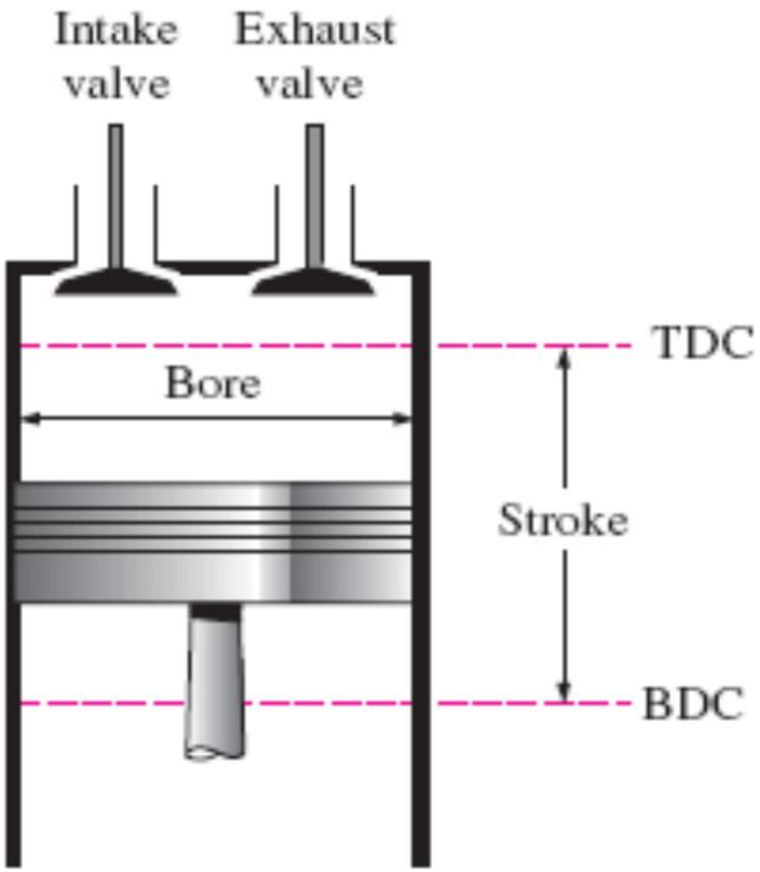
- Some practical applications



Steam power plant

Basic Concepts of Thermodynamics

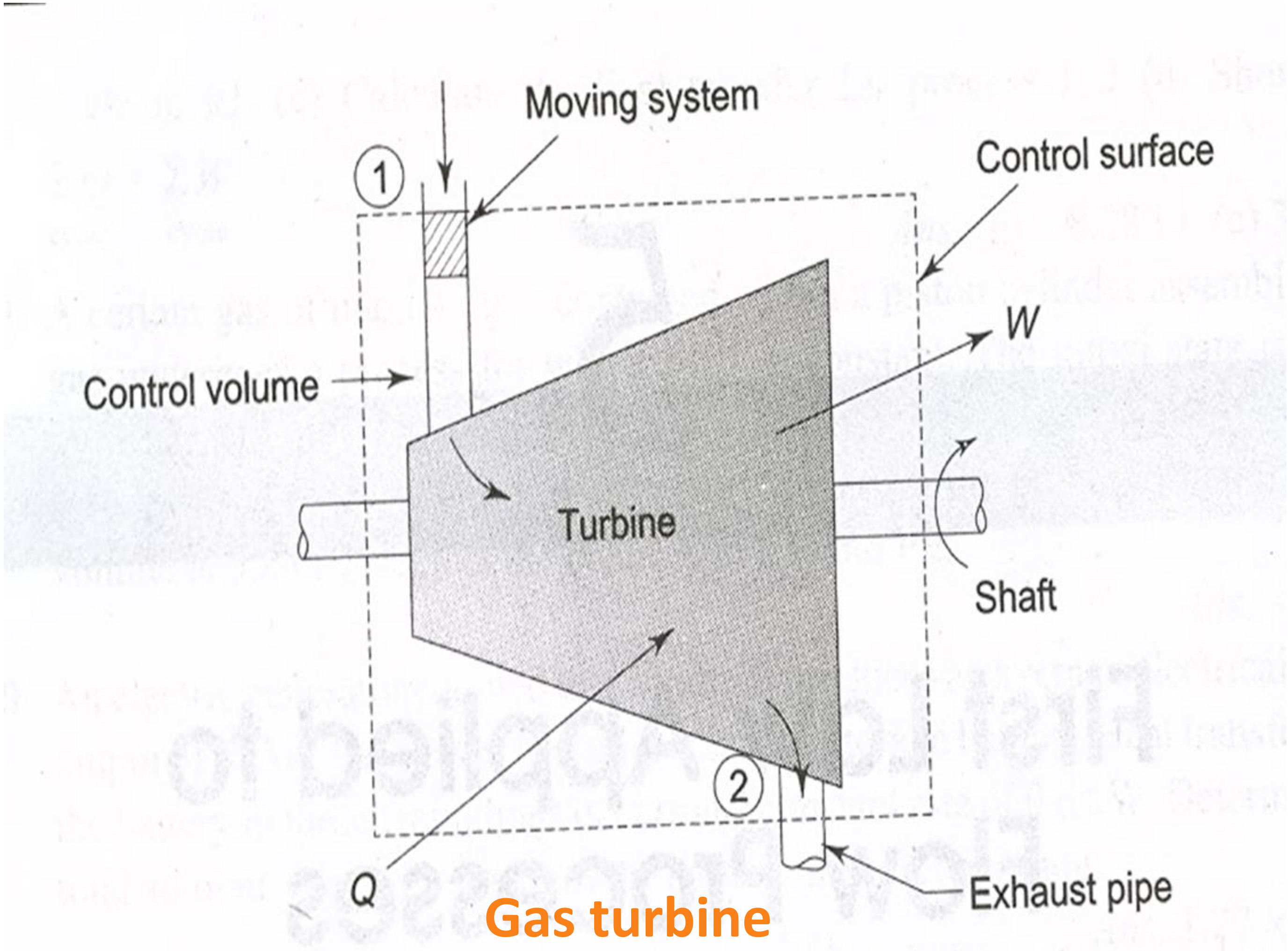
- Some practical applications



I.C Engine

Basic Concepts of Thermodynamics

- Some practical applications



Gas turbine

Basic Concepts of Thermodynamics

Macroscopic and Microscopic aspects:

- There are two approaches in Thermodynamics to understand the system
- Microscopic approach considers the behaviour of every molecule by using statistical methods.
- Macroscopic approach we are concerned with the average effects of molecules.

14 END SEMESTER EXAMINATION QUESTION PAPERS

Vidya Jyothi Institute of Technology (Autonomous)

(Accredited by NAAC & NBA, Approved By A.I.C.T.E., New Delhi, Permanently Affiliated to JNTU, Hyderabad)
(Aziz Nagar, C.B.Post, Hyderabad -500075)

R15

Subject Code:A13309

B.Tech. II Year I Semester Supplementary Examination NOVEMBER-2019

SUBJECT NAME:THERMODYNAMICS **BRANCH : MECH**

Time: 3 Hours **Max. Marks:75**

Note: *This question paper contains two Parts A and B.*
Part A is compulsory which carries 25 Marks. Answer all the questions.
Part B consists of 5 questions. Answer all the questions.

Bloom`s Level:

Remember	L1	Analyze	L4
Understand	L2	Evaluate	L5
Apply	L3	Create	L6

PART - A		Bloom's Level	25Marks
ANSWER ALL THE QUESTIONS			
1	Define terms work and heat.	L2	3M
2	What is Zeroth Law of Thermodynamics?	L4	2M
3	Write short note on steady flow Energy equation for a open system.	L3	3M
4	Define Heat pump and Heat Engine.	L2	2M
5	Explain Mollier chart.	L2	3M
6	What is Pure Substance?	L3	2M
7	What is throttling process?	L4	3M
8	Explain Dalton's Law of partial pressure	L3	2M
9	What is Mean Effective Pressures	L4	2M
10	Draw the P-V diagrams for Sterling, Atkinson and Ericsson Cycles	L2	3M

PART - B		Bloom's Level	50Marks
ANSWER ALL THE QUESTIONS			
11. i. (a)	Explain in detailed about extensive and intensive property of a system.	L3	4M
(b)	The piston of an oil engine, of area 0.0045 m2, moves downwards 75 mm, drawing in 0.00028 m3 of fresh air from the atmosphere. The pressure in the cylinder is uniform during the process at 80 kPa, while the atmospheric pressure is 101.325 kPa, the difference being due to the flow resistance in the induction pipe and the inlet valve. Estimate the displacement work done by the air finally in the cylinder	L4	6M
[OR]			
ii. a)	what are the Principles of Thermometry	L2	4M
b)	If a gas of volume 6000 cm3 and at pressure of 100 kPa is compressed quasi-statically according to PV^2 = constant until the volume becomes 2000 cm^3, determine the final pressure and the work transfer	L4	6M
12.i.(a)	Define and explain Availability and irreversibility.	L2	4M
(b)	A heat engine operating between two reservoirs at 1000 K and 300 K is used to drive a heat pump which extracts heat from the reservoir at 300 K at a rate twice that at which the engine rejects heat to it. If the efficiency of the engine is 40% of the maximum possible and the COP of the heat pump is 50% of the maximum possible, what is the temperature of the reservoir to which the heat pump rejects heat? What is the rate of heat rejection from the heat pump if the rate of heat supply to the engine is 50 kW?	L5	6M
[OR]			
ii. a)	State and prove Clausius inequality	L3	5M

P.T.O

b)	Air expands in a turbine adiabatically from 500 kPa, 400 K and 150 m/s to 100 kPa, 300 K and 70 m/s. The environment is at 100 kPa, 17°C. Calculate per kg of air A)The maximum work output B) The actual work output	L5	5M
13.i.(a)	Explain, how to find out the dryness fraction by using throttling calorimeter	L3	4M
(b)	Find the internal energy of 1 kg of super heated steam at a pressure of 12 bar and temperature of 250^{O} C. If the steam is expanded t0 1.2 bar and dryness fraction 0.9, find the change in internal energy	L4	6M
	[OR]		
ii. a)	Derive Clausius – Clapeyron Equation	L3	5M
b)	Find the specific volume , enthalpy and internal energy of wet steam at 20 bar, dryness fraction 0.8	L5	5M
14.i. a)	Derive equation for Heat and Work in Polytropic process	L3	5M
(b)	A sample of steam from a boiler drum at 3 MPa is put through a throttling calorimeter in which the pressure and temperature are found to be 0.1 MPa, 120°C. Find the quality of the sample taken from the boiler.	L4	5M
	[OR]		
ii. a)	Derive equation for Entropy change of an ideal gas,	L3	5M
	Methane has a specific heat at constant pressure given by Cp = 17.66+0.06188 T kJ/kg mol K, when 1 kg of methane is heated at constant volume from 27 to 500°C. If the initial pressure of the gas is 1 atm, calculate the final pressure, the heat transfer, the work done and the change in entropy.	L4	5M
15.i. a)	Derive Dual combustion cycleefficiency with p-v and T-s diagrams	L4	5M
b)	A Diesel cycle has a compression ratio of 14 and cut off takes place at 6%of the stroke. Find the air standard efficiency	L5	5M
	[OR]		
ii. a)	DeriveOtto cycle efficiency with p-v and T-s diagrams.	L3	5M
b)	An engine equipped with a cylinder having a bore of 15 cm and a stroke of 45 cm operates on an Otto cycle. If the clearance volume is 2000 cm3, compute the air standard efficiency.	L5	5M
	VJIT(A)		

15 SAMPLE COPIES OF ASSIGNMENTS

Roll No. 17911A0317 Thermodynamics Assignment - I (5)

1 Write steady flow energy equation SFEE. What are the applications of SFEE?

Ans:

$$\dot{m}_1\left[h_1+\frac{V_1^2}{2}+gZ_1\right]+\frac{dQ}{dt}=\dot{m}_2\left[h_2+\frac{V_2^2}{2}+gZ_2\right]+\frac{dW}{dt} \quad -(1)$$

$$\left(h_1+\frac{V_1^2}{2}+gZ_1\right)+\frac{dQ}{dm_1}=\left[h_2+\frac{V_2^2}{2}+gZ_2\right]+\frac{dW}{dm_2} \quad -(2)$$

Applications:-

1. Turbine
2. Nozzle
3. Diffuser
4. compressor
5. Boiler etc

2 Explain thermodynamic equilibrium?

Ans: The system is said to be in thermodynamic equilibrium when no change in its macroscopic properties is registered if system is isolated from surroundings

+ A system will be in state of T.D equilibrium if the following conditions are satisfy

Mechanical equilibrium:-

If there is no unbalanced force within the system or between system and surroundings then system is said to be in state of mechanical equilibrium

+ In mechanical equilibrium pressure is uniform within the system

Chemical equilibrium:-

If there is no chemical reaction or transfer of matter from one path of system to another like diffusion or solution then system is said to be in chemical equilibrium

Thermal equilibrium:-

When a system is existing in mechanical and chemical equilibrium is separated from its surroundings by diathermal wall and there is no change in any property of the system then the system is said to be in thermal equilibrium

* when a system is not in T.D equilibrium the state of system cannot be defined

3. A piston cylinder device operates at 1kg of fluid at 20atm pressure. The initial volume is $0.04 m^3$. The fluid is allowed to expand reversibly according to the law $PV^{1.45} = C$ so that the volume is doubled. The fluid is then cooled at constant pressure until the piston keeping the position unaltered heat is added reversibly to restore it to the internal pressure. Calculate the work done in cycle?

Ans Given data

$m = 1 kg$

$P_1 = 20 Atm = 20 \times 1.01325 \times 10^5$ ~~bar~~

$V_1 = 0.04 m^3$

$n = 1.45$

$V_2 = 2(V_1) = 0.08 m^3$

Process 1-2

$$W\cdot D = \frac{P_1V_1 - P_2V_2}{n-1}$$

$$P_1V_1^{1.45} = P_2V_2^{1.45}$$

$$P_2 = \frac{P_1V_1}{V_2}$$

$$P_2 = 20.01325\times10^5 \left(\frac{1}{2}\right)^{1.45}$$

$$P_2 = 7.417\times10^5$$

$$W-D = \frac{20\times01325\times10^5\times0.04 \times 7.417\times10^5\times0.08}{1.45-1}$$

$$W\cdot D = 48.26\ KJ$$

process 2-3 $\quad W_{2-3} = P_2(V_3 - V_2)$

$$= 7.417\times10^5(0.04-0.08)$$

$$= -29.66\ KJ$$

~~The WD~~

process 3-1 $\quad (V=C)$ So $WD = 0$

The total workdone by the system for the cycle

$$W = W_{1-2} + W_{2-3} + W_{3-1}$$

$$= 48.26 + (-29.66) + 0$$

$$WD = 18.66\ KJ$$

(1)

4. Define Irreversibility. What are the causes of Irreversibility?

Ans: A process, if it passes through a series of non-equilibrium points

+ These state cannot be plotted on P-V graph because they do not have definite value

* An Ir-reversible process carried out with finite temp. difference are Ir-reversible process
* An spontanouse (or) real process are Ir-reversible process

Causes for Ir-reversibility:-

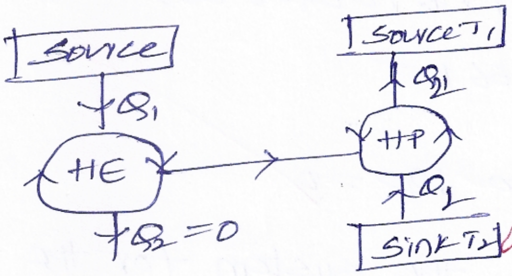
1. Lack of equilibrium in system or between system and surroundings.

Dissipative effect:

The presence of dissipative effects like friction viscosity, Resistance, Inelasticity make Ir-reversible

5. prove the equivalence of kelvin planck and clausius statement?

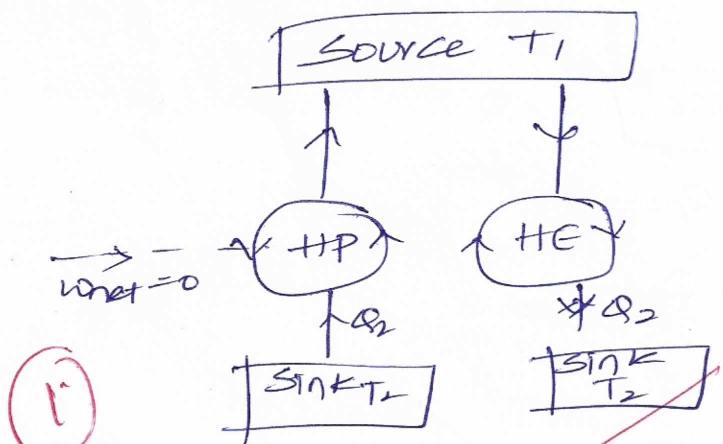
Ans- voilation of K-P statement



* PMM-2 is violating kelvin planck statement
* The network output of a heat engine is supplied to heat pump as work input. Hence the heat pump is operating in a cycle without work input for external source this violating clausius statement
* so combined system of heat engine and heat pump working in cycle transfering heat from sink T_2 at T_1 without the help of external work

thus violating clausius statement

Hence violation of K-P statement leads to the clausius statement



Consider a heat pump which transfer the heat from low temp. to high temp. without any external work these clausius statement.

* Consider a cycle engine operating between the same engine as working such that it heat draws the same amount of heat from heat pump to perform cycle. Therefore the source for heat engine can be eliminated hence the combined system of heat engine and heat pump together act as heat engine operating in a cycle producing network by exchange heat with only one reservoir voilating the kelvin planck statement.

ROLL NO: 17911A0313 — Thermodynamics Assignment-2 — (5) [signature]

1. DEFINE a) Critical point b) Triple point c) Dryness fraction of steam.

a. Critical point:-

Critical point is defind as the liquid and vapour phase of the same substance coexist is known as critical point.

b. Triple point:-

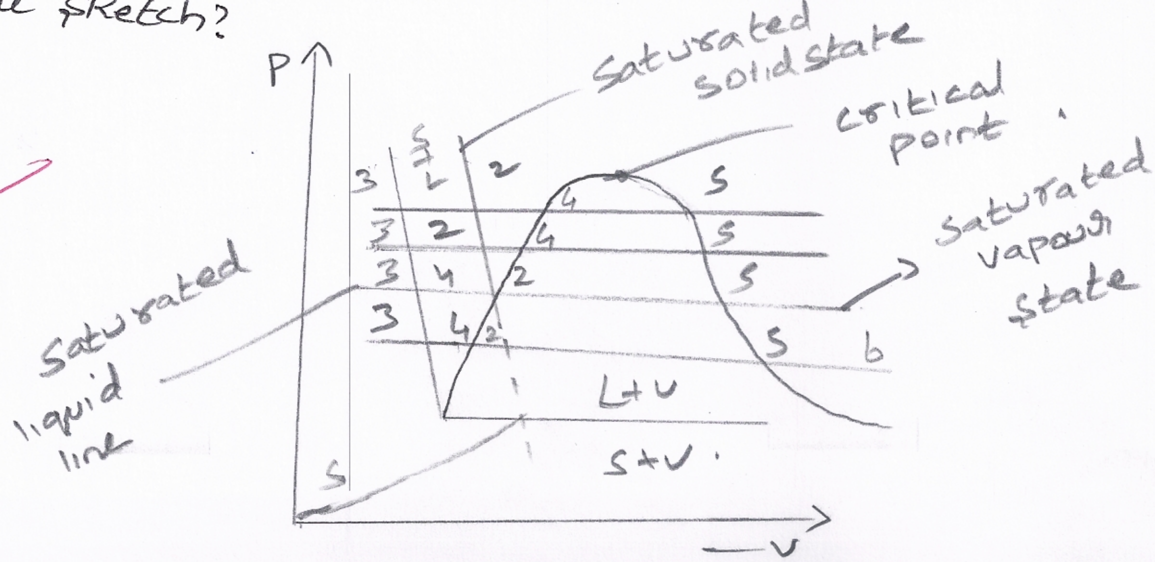
Triple point is a line on the p-v diagram. of All the 3 phase, solid, liqued and gas exist in equilibrium at Triple point.

c. Dryness fraction of steam:-

Dryness fraction is defind as the ratio of mass of dry steam (vapour) to combined mass of dry steam (vapour) & mass of liqued in mixture.

2. Explain P-V Diagram for pure water. With a neat sketch?

(1)



1-2:-

Temperature of ice increase from -10°c to 0°c

2-3:-

Ice melts into water at constant temperature of 0°c

There is a decrease in volume which is a peculiarity of water

3-4:-

· Temperature of water increase from 0°c to 100°c

· volume of water increase because of thermal expansion.

4-5:-

· Water start boiling state 4, end at state 5

· The phase change occur at constant temp of 100°c. There is a large increase in volume.

5-6:-

vapour is heated to 250°c volume of vapour increase.

1

3. State and prove Dalton's law of partial pressure

A) Let us imagine a homogeneous mixture of inert ideal gases at a temperature 'T', a pressure 'P' and a volume V. Let us suppose there are n_1 moles of gas A_1, n_2 moles of gas A_2, --- and up to n_c moles of gas A_c (fig 10.8). Since there is no chemical reaction, the mixture is a state of equilibrium with the equation of state.

$$PV = (n_1 + n_2 + --- n_c)\bar{R}T$$

where $\bar{R} = 8.3143$ kJ/kg mol K

$$\therefore P = \frac{n_1 \bar{R} T}{V} + \frac{n_2 \bar{R} T}{V} + --- + \frac{n_c \bar{R} T}{V}$$

The expansion $\frac{n_k \bar{R} T}{V}$ represents the pressure that the kth gas would exert if it occupied the volume V alone at temperature T. This is called the partial pressure of the kth gas and is denoted by P_K. Thus

(1)

$$P_1 = \frac{n_1 \bar{R} T}{V}, P_2 = \frac{n_2 \bar{R} T}{V}, --- P_c \frac{n_c \bar{R} T}{V}$$

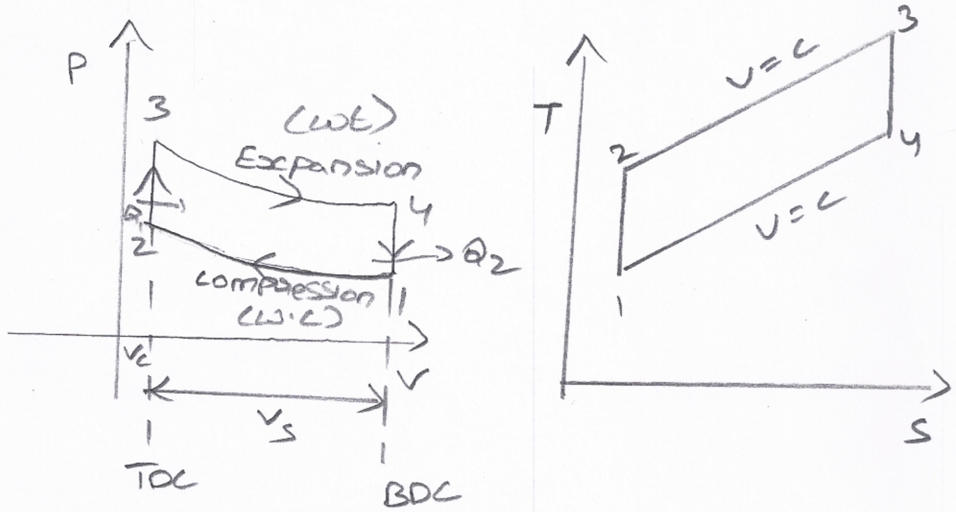
$$(P = P_1 + P_2 + --- + P_c)$$

This is known as Dalton's law of partial pressure which state the total pressure of a mixture.

4. Derive air standard Efficiency of otto cycle?

A. <u>otto cycle</u> :- (<u>constant volume</u>)

<u>PV - TS</u> <u>diagram</u>:-



<u>sequence of operations</u>:-

1-2 →

Isentropic compression of air
(work is done on the system) (-)

2-3 →

heat is added to air at constant volume.
(heat is added)

3-4 →

Isentropic expansion of air
(work is done by the system) (+)

4-1 →

Heat is rejected at constant volume.

(1)

Derivation of η_{th} of otto cycle:-

$$\eta_{th} = \frac{\text{Net work done}}{\text{Heat supply}}$$

$$= \frac{W_E - W_C}{Q_1}$$

$$= \frac{Q_1 - Q_2}{Q_1} = 1 - \frac{Q_2}{Q_1}$$

Q_1 = process 2-3 $(V=C)$

$$Q_1 = mc_v (T_3 - T_2)$$

Q_2 = process 4-1 $(V=C)$

$$Q_2 = mc_v (T_4 - T_1)$$

$$\eta_{th} = 1 - \frac{Q_2}{Q_1} \quad \text{——} (1)$$

$$= 1 - \frac{mc_v (T_4 - T_1)}{mc_v (T_3 - T_2)}$$

$$\eta_{th} = 1 - \frac{T_4 - T_1}{T_3 - T_2} \quad \text{——} (2)$$

process - 1—2

isentrophic process

(s = c)

$$TV^{\gamma-1} = c$$

$$T_1 V_1^{\gamma-1} = T_2 V_2^{\gamma-1}$$

$$\frac{T_2}{T_1} = \left(\frac{V_1}{V_2}\right)^{\gamma-1} = \gamma_k^{\gamma-1} \quad \text{—— (3)}$$

3-4- Isentrophic process (s=c)

$$TV^{\gamma-1} = c$$

$$T_3 V_3^{\gamma-1} = T_4 V_4^{\gamma-1}$$

$$\frac{T_3}{T_4} = \left(\frac{V_4}{V_3}\right)^{\gamma-1} = \left(\frac{V_1}{V_2}\right)^{\gamma-1} = (\gamma_k)^{\gamma-1} \quad \text{—— (4)}$$

equation (3) - (4)

$$\frac{T_2}{T_1} = \frac{T_3}{T_4}$$

$$\frac{T_3}{T_2} = \frac{T_4}{T_1}$$

$$\frac{T_3}{T_2} - 1 = \frac{T_4}{T_1} - 1$$

$$\frac{T_3 - T_2}{T_2} = \frac{T_4 - T_1}{T_1}$$

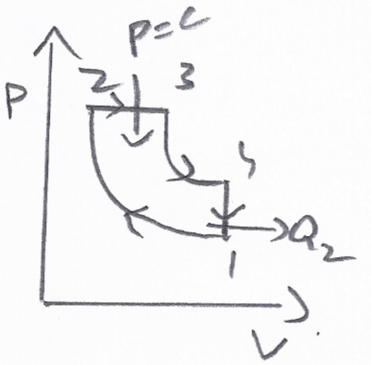
$$\frac{T_4 - T_1}{T_3 - T_2} = \frac{T_1}{T_2}$$

from 1 -> 2

$$\frac{T_2}{T_1} = \left(\frac{V_1}{V_2}\right)^{\gamma-1} = (r_k)^{\gamma-1}$$

$$\boxed{(\eta_{th})_{otto} = \frac{1}{(r_k)^{\gamma-1}}} \quad \text{—— (5)}$$

5. A Diesel Engine has a compression Ratio of 14. Cut-off takes place at 6% of the stroke. find the Air standard Efficiency?



$r_c = \frac{V_3}{V_2}$ -> cut off ratio

$r_k = \frac{V_1}{V_2} = 14$

$k = 0.06\%$

$$\boxed{r_c = 1 + k(r_k - 1)}$$

$= 1 + 0.06(14-1)$

$r_c = 1.78$

$$\eta_{th} = 1 - \frac{1}{(r_k)^{\gamma-1}}\left[\frac{r_c^{\gamma} - 1}{\gamma(r_c - 1)}\right]$$

$$= 1 - \frac{1}{(14)^{1.4-1}}\left[\frac{(1.78)^{1.4} - 1}{1.4(1.78-1)}\right]$$

$\eta_{th\ diesel} = 60.4\%$ //

16 ASSESSMENT SHEET
CO - WISE
(DIRECT ATTAINMENT)

CO ATTAINMENT		
Batch: 2017-2021	**Year-Sem: II-I**	**Course: TD**

Mid 1												
TD_M1	**Part A**			**Part B**			**Assignment**					**Total Marks**
Roll No:	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**A_Q1**	**A_Q2**	**A_Q3**	**A_Q4**	**A_Q5**	
17911A0301	2	2	2	5	4	4	1	1	1	1	1	24
17911A0302	2	2		2	2	2	1			1	1	13
17911A0303	1	2	2	2	2	4	1	1	1		1	17
17911A0304	2	2	2	5	5	4	1	1	1	1	1	25
17911A0305	2	2	2	5	5	4	1	1	1	1	1	25
17911A0306	2	2	2	3	3	3	1	1	1	1	1	20
17911A0307		1	1						1			3
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17911A0311	1	2	2	2	2	2	1	1	1		1	15
17911A0312	2	2	2	3	3	3	1	1	1	1	1	20
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17911A0315	2	2	2	3	3	3	1	1	1	1	1	20
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17911A0317	2	2	2	3	3	3	1	1	1	1	1	20
17911A0319		2	2	2	2	3	1			1	1	14
17911A0320	2	2	2	4	4	4	1	1	1	1	1	23
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17911A0392	2		1	1	1	2	1		1			9
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17911A03A2	1	2	2	2	2	3	1	1	1		1	16
17911A03A3	1	2				1	1		1			6
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17911A03B8		1	2	1	1	1	1		1			8
17911A03B9	2	2	2	3	3	4	1	1	1	1	1	21
17911A03C0		2	2	1	1	3	1			1	1	12
17911A03C1	2	1	2	2	2	3	1	1	1		1	16
17911A03C2	2	2	2	4	3	4	1	1	1	1	1	22
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17911A03C4	2		2	1	1	1	1			1	1	10
17911A03C5	2		1	1	1	1	1		1			8
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17911A03D0	1	2	2	3	3	3	1	1	1		1	18
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17911A03E3	2	2	1	2	2	4	1	1	1		1	17
17911A03E4	2	2	2	3	3	4	1	1	1	1	1	21
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17911A03F8	2	2	2	5	5	4	1	1	1	1	1	25
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17911A03L3	1		1			1			1			4
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17911A03M2	1	2	2	3	3	4	1	1	1		1	19
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18915A0330	2	2	2	3	3	3	1	1	1	1	1	20
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18915A0353	2	1	2	3	3	3	1	1	1		1	18
No of students attempted	231	230	234	230	230	244	256	256	256	256	256	
No of students who scored >= 60% Marks	162	197	202	143	143	222	245	188	230	123	214	
% of students who scored >= 60% Marks	70	86	86	62	62	91	96	73	90	48	84	
Attainment	3	3	3	2	2	3	3	3	3	0	3	

Mid 2												
TD_M2	Part A			Part B			Assignment					Total Marks
Roll No:	Q1	Q2	Q3	Q4	Q5	Q6	A_Q1	A_Q2	A_Q3	A_Q4	A_Q5	
17911A0301	2	2	2	3	3	5	1	1	1	1	1	22
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17911A0303	2	2		2	2	2	1			1	1	13
17911A0304	2	2	2	3	3	4	1	1	1	1	1	21
17911A0305	2	2	2	4	5	5	1	1	1	1	1	25
17911A0306	2	2	2	3	3	5	1	1	1	1	1	22
17911A0307	2		1			2	1		1			7
17911A0308	2	2	1	3	3	4	1	1	1		1	19
17911A0309	1	2	2	2	2	4	1	1	1		1	17
17911A0311	2	2	2	3	3	4	1	1	1	1	1	21
17911A0312	1	2	2	3	3	4	1	1	1		1	19
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17911A0314	1	2					1		1			5
17911A0315	1	2	2	2	2	3	1	1	1		1	16
17911A0316			2									2
17911A0317		2	2	2	2	3	1			1	1	14
17911A0319		2	2	1	1	1	1			1	1	10
17911A0320	2	2	2	4	4	4	1	1	1	1	1	23
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17911A0322	2	2	2	4	4	4	1	1	1	1	1	23
17911A0323												AB
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17911A0327	1	2	2	3	3	4	1	1	1		1	19
17911A0328	2	2	2	3	3	5	1	1	1	1	1	22
17911A0329	2	2	1	3	3	3	1	1	1		1	18
17911A0330	2	2	2	3	3	4	1	1	1	1	1	21
17911A0331	2	2	2	4	4	5	1	1	1	1	1	24
17911A0332	2	2	2	4	4	4	1	1	1	1	1	23
17911A0333	2	2	2	4	4	4	1	1	1	1	1	23
17911A0334	2		1				1		1			5
17911A0335	2		1	1	1	2	1		1			9
17911A0336	2	2	2	3	3	4	1	1	1	1	1	21
17911A0337	2	2	2	4	5	5	1	1	1	1	1	25
17911A0338	2	2	2	4	4	4	1	1	1	1	1	23
17911A0339	2	2	2	4	5	5	1	1	1	1	1	25
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17911A0343	2	2	2	4	4	5	1	1	1	1	1	24
17911A0344	2	2		2	2	2	1			1	1	13
17911A0345	1	2		1	1	2	1		1			9
17911A0346	2	2	1	2	2	3	1	1	1		1	16
17911A0347	2	2	2	3	3	5	1	1	1	1	1	22
17911A0349	1	2	2	3	3	3	1	1	1		1	18
17911A0350	2	2	2	4	4	5	1	1	1	1	1	24
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17911A0354	2	2	2	4	5	5	1	1	1	1	1	25
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17911A0356	2	2	2	4	5	5	1	1	1	1	1	25
17911A0358	1	2	2	3	3	3	1	1	1		1	18
17911A0359	2	2	2	4	4	5	1	1	1	1	1	24

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17911A0363		1	2	1	1	2	1		1			9
17911A0364		1	2				1		1			5
17911A0365	2		2	2	2	2	1			1	1	13
17911A0367	2	2	1	2	2	4	1	1	1		1	17
17911A0368	1	2	2	2	2	3	1	1	1		1	16
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17911A0371	1	2	2	3	3	3	1	1	1		1	18
17911A0372	1	2	2	2	2	4	1	1	1		1	17
17911A0373	2	2		1	1	1	1			1	1	10
17911A0374	2	1	2	3	3	3	1	1	1		1	18
17911A0375	2	2	2	3	3	3	1	1	1	1	1	20
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17911A0377	2	1	2	2	2	3	1	1	1		1	16
17911A0378									1			1
17911A0379		2	2	1	1	1	1			1	1	10
17911A0380	2	2	2	3	3	5	1	1	1	1	1	22
17911A0381	2	1	2	3	3	4	1	1	1		1	19
17911A0382	2	2	2	4	5	5	1	1	1	1	1	25
17911A0383	2	2		2	2	3	1			1	1	14
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17911A0385	1	2	2	3	3	3	1	1	1		1	18
17911A0386	1	2	2	2	2	2	1	1	1		1	15
17911A0387	2	2	2	3	3	4	1	1	1	1	1	21
17911A0388	2	2	2	3	3	5	1	1	1	1	1	22
17911A0389	2	2	2	3	3	5	1	1	1	1	1	22
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17911A0391	2		2	2	2	2	1			1	1	13
17911A0392	2		1			2	1		1			7
17911A0393	2	2	1	3	3	3	1	1	1		1	18
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17911A0395	2	2	2	3	3	5	1	1	1	1	1	22
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17911A0397	2	2	2	4	5	5	1	1	1	1	1	25
17911A0398	2	1	2	2	2	4	1	1	1		1	17
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17911A03A1	2	2	2	4	4	5	1	1	1	1	1	24
17911A03A2	1	2	2	2	2	3	1	1	1		1	16
17911A03A3	2	2		2	2	3	1			1	1	14
17911A03A4	2	2	2	3	3	3	1	1	1	1	1	20
17911A03A5	1	2	2	2	2	4	1	1	1		1	17
17911A03A6	1	2	2	3	3	3	1	1	1		1	18
17911A03A7	2	2		1	1	2	1			1	1	11
17911A03A8		2	2	1	1	2	1			1	1	11
17911A03A9	2	2	2	3	3	4	1	1	1	1	1	21
17911A03B0	1	2	2	2	2	3	1	1	1		1	16
17911A03B1	2	2		1	1	2	1			1	1	11
17911A03B2	2	2		2	2	3	1			1	1	14
17911A03B3	1	2	2	3	3	4	1	1	1		1	19
17911A03B4	1	2	2	2	2	2	1	1	1		1	15
17911A03B5	2	2	2	3	3	3	1	1	1	1	1	20
17911A03B6	2	2	2	3	3	5	1	1	1	1	1	22
17911A03B7	2	2	2	4	5	5	1	1	1	1	1	25

17911A03B8	2	1	2	2	2	3	1	1	1		1	16
17911A03B9	2	1	2	2	2	4	1	1	1		1	17
17911A03C0		2	2	1	1	1	1			1	1	10
17911A03C1	2	1	2	3	3	3	1	1	1		1	18
17911A03C2	2	2	2	3	3	3	1	1	1	1	1	20
17911A03C3		1	2			2	1		1			7
17911A03C4	2		1			1	1		1			6
17911A03C5	2		1			1	1		1			6
17911A03C6	2		2	2	2	2	1			1	1	13
17911A03C7	2	2	2	3	3	4	1	1	1	1	1	21
17911A03C8	1	2	2	3	3	3	1	1	1		1	18
17911A03C9	2	2		1	1	3	1			1	1	12
17911A03D0	2	2	2	3	3	5	1	1	1	1	1	22
17911A03D1		2	2	1	1	2	1			1	1	11
17911A03D2		2	2	2	2	2	1			1	1	13
17911A03D3	2	2	2	4	4	5	1	1	1	1	1	24
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17911A03D5	2	2		1	1	3	1			1	1	12
17911A03D6	2	2	2	3	3	4	1	1	1	1	1	21
17911A03D7	2	2	1	3	3	4	1	1	1		1	19
17911A03D8	2		2	1	1	2	1			1	1	11
17911A03D9	2	2	2	4	4	4	1	1	1	1	1	23
17911A03E0	2		1	1	1	1	1		1			8
17911A03E1	2	2	2	4	4	4	1	1	1	1	1	23
17911A03E2	2		2	1	1	2	1			1	1	11
17911A03E3	2		2	1	1	2	1			1	1	11
17911A03E4	2	2	2	4	4	4	1	1	1	1	1	23
17911A03E5	2	2	2	3	3	5	1	1	1	1	1	22
17911A03E6	2		2	1	1	2	1			1	1	11
17911A03E7	2	2	2	3	3	5	1	1	1	1	1	22
17911A03E8	2		2	2	2	3	1			1	1	14
17911A03E9	2	2		1	1	3	1			1	1	12
17911A03F0	1		1						1			3
17911A03F1	2	2		1	1	3	1			1	1	12
17911A03F2	2	2	2	3	3	5	1	1	1	1	1	22
17911A03F3		2	2	1	1	1	1			1	1	10
17911A03F4	2	1	2	3	3	4	1	1	1		1	19
17911A03F5	2	1	2	2	2	4	1	1	1		1	17
17911A03F6	2	2	2	3	3	3	1	1	1	1	1	20
17911A03F7		1	2	1	1	1	1		1			8
17911A03F8	2	2	2	4	5	5	1	1	1	1	1	25
17911A03F9	1	2	2	3	3	3	1	1	1		1	18
17911A03G0	1	2	2	2	2	4	1	1	1		1	17
17911A03G1	1	2	2	3	3	4	1	1	1		1	19
17911A03G2	1	2	2	2	2	3	1	1	1		1	16
17911A03G3	2	2		2	2	3	1			1	1	14
17911A03G4	2	2		1	1	3	1			1	1	12
17911A03G5	2	1	2	3	3	4	1	1	1		1	19
17911A03G6	2	1	2	3	3	4	1	1	1		1	19
17911A03G7		1	1			1			1			4
17911A03G8	2		1			1	1		1			6
17911A03G9		1	1									2
17911A03H0	2		2	1	1	2	1			1	1	11
17911A03H1	2	2	2	3	3	3	1	1	1	1	1	20
17911A03H2	2		2	1	1	1	1			1	1	10
17911A03H3	2	2	1	3	3	3	1	1	1		1	18

17911A03H4	2	2	2	3	3	4	1	1	1	1	1	21
17911A03H5	2	2		1	1	2	1			1	1	11
17911A03H6	1	2	2	2	2	2	1	1	1		1	15
17911A03H7		1	2			2	1		1			7
17911A03H8	2	2	2	3	3	5	1	1	1	1	1	22
17911A03H9	2	2	2	4	4	4	1	1	1	1	1	23
17911A03J1	2	2	2	4	5	5	1	1	1	1	1	25
17911A03J2												AB
17911A03J3	2	2		2	2	3	1			1	1	14
17911A03J4	2	2	2	3	3	3	1	1	1	1	1	20
17911A03J5	2		2	2	2	2	1			1	1	13
17911A03J6	2	2	1	2	2	4	1	1	1		1	17
17911A03J7	2	2	2	3	3	3	1	1	1	1	1	20
17911A03J8	2		2	1	1	1	1			1	1	10
17911A03J9	2	1	2	3	3	4	1	1	1		1	19
17911A03K0		2	2	2	2	3	1			1	1	14
17911A03K1	2	2	2	4	4	4	1	1	1	1	1	23
17911A03K2	2	1	2	3	3	4	1	1	1		1	19
17911A03K3	2	2	2	4	4	4	1	1	1	1	1	23
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17911A03K6	1	2	2	3	3	3	1	1	1		1	18
17911A03K7	2	2	2	3	3	5	1	1	1	1	1	22
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17911A03K9	1	2	2	2	2	2	1	1	1		1	15
17911A03L0	2	2	2	4	5	5	1	1	1	1	1	25
17911A03L1	2	2		1	1	1	1			1	1	10
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17911A03L4	1	2	2	3	3	4	1	1	1		1	19
17911A03L5	2	2	2	3	3	5	1	1	1	1	1	22
17911A03L6	2	2	2	3	3	5	1	1	1	1	1	22
17911A03L7	2	2	2	4	4	5	1	1	1	1	1	24
17911A03L8		1	2			2	1		1			7
17911A03L9		1	2	1	1	1	1		1			8
17911A03M0	2	1	2	3	3	4	1	1	1		1	19
17911A03M1	1	2	2	2	2	2	1	1	1		1	15
17911A03M2	2	2		2	2	2	1			1	1	13
17911A03M3	2		2	1	1	2	1			1	1	11
17915A0342	2	2	1	3	3	4	1	1	1		1	19
18915A0301	2	2	2	4	4	4	1	1	1	1	1	23
18915A0302	2	2	2	3	3	5	1	1	1	1	1	22
18915A0303	2	2	2	4	4	5	1	1	1	1	1	24
18915A0304	2	2	2	3	3	3	1	1	1	1	1	20
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18915A0306	2	2	2	4	4	5	1	1	1	1	1	24
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18915A0308	2	2	2	3	3	4	1	1	1	1	1	21
18915A0310	2	2	2	3	3	5	1	1	1	1	1	22
18915A0311	1	2	2	3	3	3	1	1	1		1	18
18915A0312	2	2	2	3	3	5	1	1	1	1	1	22
18915A0313	2	1	2	2	2	2	1	1	1		1	15
18915A0314	2	1	2	3	3	4	1	1	1		1	19
18915A0315	2	2	2	4	5	5	1	1	1	1	1	25
18915A0316		2	2	2	2	2	1			1	1	13
18915A0317	2	2	2	4	4	5	1	1	1	1	1	24
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18915A0319	1	2	2	2	2	4	1	1	1		1	17
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18915A0321	1	2	2	3	3	3	1	1	1		1	18
18915A0322	1	2	2	3	3	3	1	1	1		1	18
18915A0323	2	2	2	3	3	4	1	1	1	1	1	21
18915A0324	1	2	2	2	2	2	1	1	1		1	15
18915A0325	1	2	2	3	3	3	1	1	1		1	18
18915A0326	2	2		1	1	3	1			1	1	12
18915A0327	1	2	2	2	2	3	1	1	1		1	16
18915A0328	2	2		2	2	3	1			1	1	14
18915A0329	2	2	1	2	2	4	1	1	1		1	17
18915A0330	2	2	2	3	3	4	1	1	1	1	1	21
18915A0331	2	2	2	3	3	4	1	1	1	1	1	21
18915A0332	2	1	2	3	3	3	1	1	1		1	18
18915A0333	2	1	2	3	3	3	1	1	1		1	18
18915A0334	2	2	2	3	3	5	1	1	1	1	1	22
18915A0335	2	1	2	2	2	2	1	1	1		1	15
18915A0336	1	2	2	2	2	4	1	1	1		1	17
18915A0337	2	2	2	3	3	4	1	1	1	1	1	21
18915A0338	2	2	2	3	3	4	1	1	1	1	1	21
18915A0339	1	2	2	2	2	2	1	1	1		1	15
18915A0340	2	2		2	2	3	1			1	1	14
18915A0341	1	2	2	2	2	4	1	1	1		1	17
18915A0342	2	2		2	2	3	1			1	1	14
18915A0343	2	2	2	4	4	5	1	1	1	1	1	24
18915A0344	1	2	2	2	2	2	1	1	1		1	15
18915A0345	2	2		1	1	2	1			1	1	11
18915A0346	2	2		1	1	3	1			1	1	12
18915A0347	1	2	2	3	3	3	1	1	1		1	18
18915A0348	1	2	2	2	2	3	1	1	1		1	16
18915A0349	2	2	2	3	3	3	1	1	1	1	1	20
18915A0350	2	2	2	3	3	4	1	1	1	1	1	21
18915A0351	2	2	2	3	3	4	1	1	1	1	1	21
18915A0352	2	2	2	3	3	5	1	1	1	1	1	22
18915A0353	2	2	2	3	3	3	1	1	1	1	1	20
No of students attempted	233	229	223	235	235	245	256	256	256	256	256	
No of students who scored >= 60% Marks	185	197	199	140	140	228	249	175	202	155	229	
% of students who scored >= 60% Marks	79	86	89	60	60	93	97	68	79	61	89	
Attainment	3	3	3	2	2	3	3	2	3	2	3	

External	
Roll No:	**External Marks**
17911A0301	66
17911A0302	11
17911A0303	43
17911A0304	63
17911A0305	57
17911A0306	57
17911A0307	10
17911A0308	44
17911A0309	58
17911A0311	60
17911A0312	60
17911A0313	62
17911A0314	18
17911A0315	59
17911A0316	AB
17911A0317	65
17911A0319	28
17911A0320	62
17911A0321	58
17911A0322	57
17911A0323	26
17911A0324	27
17911A0325	69
17911A0327	58
17911A0328	61
17911A0329	63
17911A0330	65
17911A0331	65
17911A0332	60
17911A0333	57
17911A0334	26
17911A0335	14
17911A0336	59
17911A0337	69
17911A0338	60
17911A0339	64
17911A0340	62
17911A0341	67
17911A0342	58
17911A0343	63
17911A0344	30
17911A0345	34
17911A0346	26
17911A0347	59
17911A0349	68
17911A0350	57
17911A0351	60
17911A0352	59
17911A0354	65
17911A0355	59
17911A0356	65
17911A0358	67
17911A0359	61
17911A0360	35

17911A0361	42
17911A0362	8
17911A0363	44
17911A0364	0
17911A0365	30
17911A0367	42
17911A0368	43
17911A0369	33
17911A0371	42
17911A0372	61
17911A0373	35
17911A0374	60
17911A0375	68
17911A0376	30
17911A0377	59
17911A0378	4
17911A0379	8
17911A0380	61
17911A0381	58
17911A0382	59
17911A0383	3
17911A0384	62
17911A0385	62
17911A0386	67
17911A0387	68
17911A0388	63
17911A0389	64
17911A0390	64
17911A0391	28
17911A0392	2
17911A0393	61
17911A0394	16
17911A0395	61
17911A0396	66
17911A0397	61
17911A0398	57
17911A0399	65
17911A03A0	57
17911A03A1	68
17911A03A2	58
17911A03A3	3
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17911A03A5	58
17911A03A6	62
17911A03A7	37
17911A03A8	28
17911A03A9	66
17911A03B0	58
17911A03B1	65
17911A03B2	63
17911A03B3	58
17911A03B4	62
17911A03B5	12
17911A03B6	68
17911A03B7	66
17911A03B8	10

17911A03B9	63
17911A03C0	21
17911A03C1	63
17911A03C2	67
17911A03C3	11
17911A03C4	7
17911A03C5	18
17911A03C6	21
17911A03C7	67
17911A03C8	64
17911A03C9	31
17911A03D0	57
17911A03D1	16
17911A03D2	10
17911A03D3	64
17911A03D4	8
17911A03D5	6
17911A03D6	63
17911A03D7	59
17911A03D8	30
17911A03D9	68
17911A03E0	32
17911A03E1	66
17911A03E2	18
17911A03E3	28
17911A03E4	66
17911A03E5	57
17911A03E6	29
17911A03E7	59
17911A03E8	63
17911A03E9	69
17911A03F0	27
17911A03F1	65
17911A03F2	57
17911A03F3	36
17911A03F4	57
17911A03F5	61
17911A03F6	63
17911A03F7	8
17911A03F8	65
17911A03F9	61
17911A03G0	63
17911A03G1	63
17911A03G2	0
17911A03G3	33
17911A03G4	37
17911A03G5	64
17911A03G6	57
17911A03G7	0
17911A03G8	5
17911A03G9	41
17911A03H0	26
17911A03H1	61
17911A03H2	29
17911A03H3	69
17911A03H4	67

17911A03H5	12
17911A03H6	62
17911A03H7	11
17911A03H8	60
17911A03H9	59
17911A03J1	64
17911A03J2	0
17911A03J3	15
17911A03J4	67
17911A03J5	67
17911A03J6	60
17911A03J7	65
17911A03J8	4
17911A03J9	58
17911A03K0	67
17911A03K1	63
17911A03K2	62
17911A03K3	62
17911A03K5	38
17911A03K6	62
17911A03K7	60
17911A03K8	64
17911A03K9	60
17911A03L0	68
17911A03L1	12
17911A03L2	1
17911A03L3	18
17911A03L4	60
17911A03L5	57
17911A03L6	68
17911A03L7	66
17911A03L8	5
17911A03L9	9
17911A03M0	63
17911A03M1	58
17911A03M2	68
17911A03M3	47
17915A0342	64
18915A0301	65
18915A0302	69
18915A0303	60
18915A0304	AB
18915A0305	26
18915A0306	59
18915A0307	63
18915A0308	65
18915A0310	68
18915A0311	67
18915A0312	69
18915A0313	69
18915A0314	29
18915A0315	61
18915A0316	28
18915A0317	68
18915A0318	68
18915A0319	62

18915A0320	63
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18915A0322	26
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18915A0328	59
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18915A0333	57
18915A0334	63
18915A0335	69
18915A0336	63
18915A0337	67
18915A0338	69
18915A0339	63
18915A0340	42
18915A0341	66
18915A0342	58
18915A0343	58
18915A0344	67
18915A0345	42
18915A0346	29
18915A0347	67
18915A0348	64
18915A0349	63
18915A0350	63
18915A0351	57
18915A0352	60
18915A0353	63
No of students attempted	250
No: of students who scored more than 60%	172
% of students who scored more than 60%	69
Attainment	2

CO	Method	Value	Average	Attainment Level (Internal)	Attainment Level (External)	CO Direct Attainment (25%Int+75%Ext)
CO1	M1_D_Q1	3	2.75	2.57	2.00	**2.14**
	M1_D_Q4	2				
	M1_A_Q1	3				
	M1_A_Q2	3				
CO2	M1_D_Q2	3	2.00			
	M1_D_Q5	2				
	M1_A_Q3	3				
	M1_A_Q4	0				
CO3	M1_D_Q3	3	2.83			
	M1_D_Q6	3				
	M1_A_Q5	3				
	M2_D_Q1	3				
	M2_D_Q4	2				
	M2_A_Q1	3				
CO4	M2_D_Q2	3	2.50			
	M2_D_Q5	2				
	M2_A_Q2	2				
	M2_A_Q3	3				
CO5	M2_D_Q3	3	2.75			
	M2_D_Q6	3				
	M2_A_Q4	2				
	M2_A_Q5	3				

Direct CO Attainment	2.14
Indirect CO Attainment	2.64
Overall CO Attainment (0.8 * Direct Attainment+ 0.2 * Indirect Attainment)	2.24

17 COURSE END SURVEY FORM

VIDYA JYOTHI INSTITUTE OF TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE INDIRECT ATTAINMENT REPORT

Batch: 2017-21
Year-Sem: II-I
Course: TD (C205)

Back

Course Indirect Attainment: 2.64

Students Participated: 203 **Total Students:** 256 **Survey Date:** 03-11-2018

Roll Number	CO1	CO2	CO3	CO4	CO5
Anonymous	1	3	3	3	3
Anonymous	1	3	3	3	3
Anonymous	2	3	3	3	3
Anonymous	3	3	3	3	3
Anonymous	2	3	3	3	3
Anonymous	2	3	3	3	3
Anonymous	3	3	3	3	3
Anonymous	2	2	3	3	3
Anonymous	3	3	3	3	3
Anonymous	1	3	3	3	3
Anonymous	1	3	3	1	3
Anonymous	1	3	3	1	3
Anonymous	1	2	3	2	3
Anonymous	2	2	3	1	3
Anonymous	3	2	3	1	3

18 TOPICS COVERED UNDER CONTENT BEYOND SYLLABUS

CONTENT BEYOND SYLLABUS

COURSE: THERMODYNAMICS

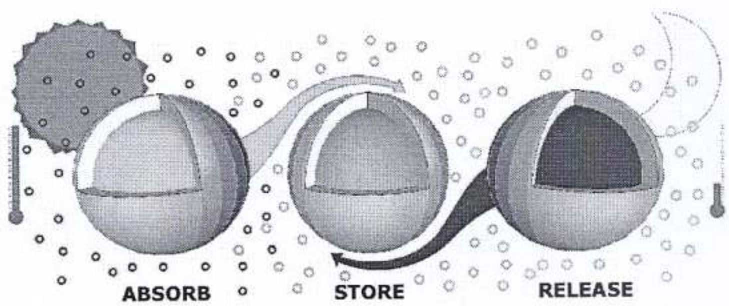
TOPIC: PHASE CHANGE MATERIAL

There are three main approaches for thermal energy storage are:

- Sensible heat storage (SHS)
- Latent heat storage (LHS) and
- Thermochemical energy storage (TCS)

Latent heat storage using phase change material (PCM) is regarded as one of the most effective and attractive thermal energy storage methods

Phase change materials (PCMs) can absorb, storeand release large amounts of latent heat over a defined temperature range when the material changes phase or state.

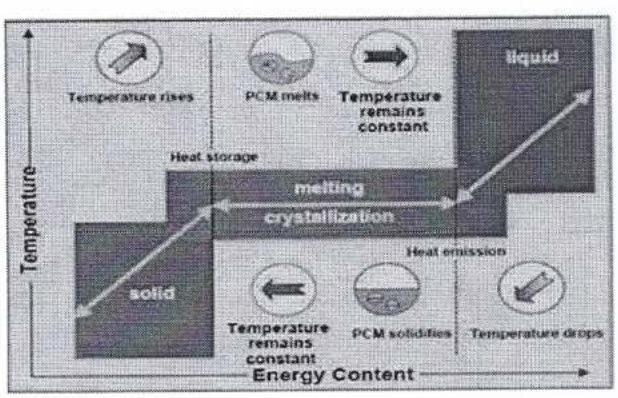


The energy released or absorbed by phase transition from solid to liquid, or vice versa, the heat of fusion is generally much higher than the sensible heat.

Hence, compared to sensible heat storage materials, PCM can absorb (during melting) and release (during solidification) more energy per unit weight at a relatively constant temperature.

The amount of stored energy depends on the mass and latent heat of fusion.

By melting and solidifying at the phase change temperature (PCT), a PCM is capable of storing and releasing large amounts of energy compared to sensible heat storage.

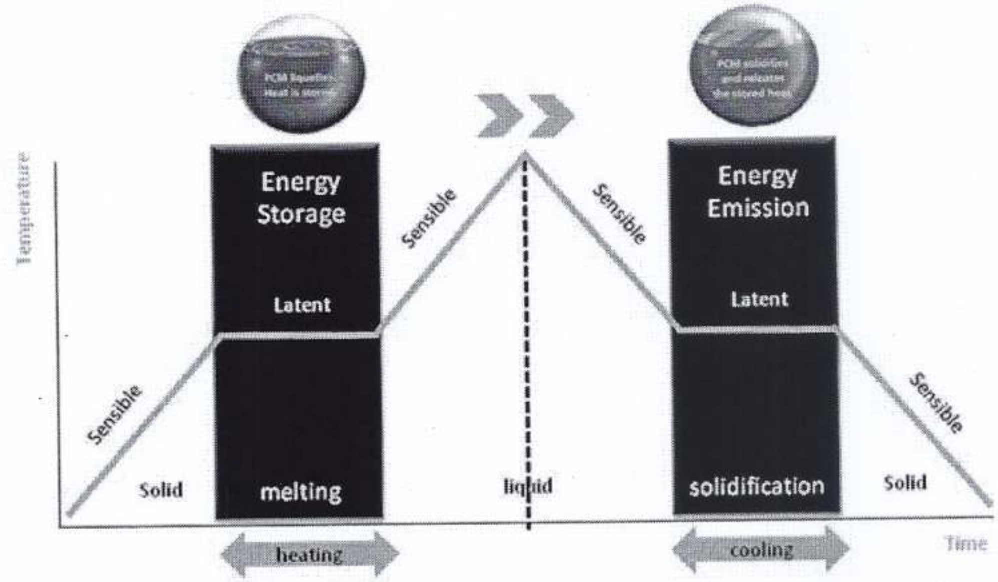


Heat is absorbed or released when the material changes from solid to liquid and vice versa or when the internal structure of the material changes.

PCMs are accordingly referred to as latent heat storage (LHS) materials.

Ice, for example, requires 333.55 J/g to melt, but then water will rise one degree further with the addition of just 4.18 J/g.

Water/ice is therefore a very useful phase change material and has been used to store winter cold to cool buildings in summer since at least the time of the Achaemenid Empire.



APPLICATIONS OF PHASE CHANGE MATERIALS (PCMs):

PCMs are used in many different commercial applications where energy storage and/or stable temperatures are required.

Some of the applications of PCMs are listed below:

- Thermal storage in buildings
- Heating/cooling of water
- Solar energy storage
- Smart textiles
- Biomaterials and biomedical applications
- Electronics
- Automotive industry
- Space applications
- Food industry

GAP ANALYSIS-THERMODYNAMICS

To bridge the gap between Classical Thermodynamics and Computational Thermodynamics, a seminar has been arranged in the Department on 08-08-2016 on the topic, Computational Thermodynamics.

Eminent Professor Mr. M. Bhagvath Rao, Director AGI has been invited to talk on this topic. He discussed about various aspects of Computational Thermodynamics and gave new insights which has benefited the students and faculty immensely.

19 INNOVATIONS IN TEACHING

Vidya Jyothi Institute of Technology

(An Autonomous Institution)

(Accredited by NAAC, Approved by AICTE New Delhi & Permanently Affiliated to JNTUH)

Aziznagar Gate, C.B. Post, Hyderabad-500 075

Innovative/ Student Centric Teaching Method Form

Faculty Name: Mrs. Emeema

Course: Thermodynamics

Class-Section: II

Mode of Innovative Teaching: PPT

Description about the mode: PowerPoint can be an effective tool to present material in the classroom and encourage student learning. You can use PowerPoint to project visuals that would otherwise be difficult to bring to class. For example, in an anthropology class, a single PowerPoint presentation could project images of an anthropological dig from a remote area, questions asking students about the topic, a chart of related statistics, and a mini quiz about what was just discussed that provides students with information that is visual, challenging, and engaging.

Topic Handled: Otto cycle and Diesel cycle.

Outcome of the teaching mode: The concepts of Otto and Diesel cycles were understood along with their differences.

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Aziznagar Gate, C.B. Post, Hyderabad-500 075

Innovative/ Student Centric Teaching Method Form

Faculty Name: Mrs. Emeema

Course: Thermodynamics

Class-Section: II Year

Mode of Innovative Teaching: Seminar

Description about the mode:

In this method students are identified to give seminar presentation on various topics in thermodynamics. The students are expected to prepare the topic and deliberate with the rest of the students in the presence of the faculty members.

Topic Handled:

The students have been given a topic namely OTTO-Cylce in thermodynamics course. The following students who have presented the topic are

1) 19911A0316 2) 19911A0338 3) 20915A0302

The topic was presented in the following salient features medium used in the engine cylinder i.e. air, the processes employed including constant volume, adiabatic process. The cycle is represented on P-V & T-S diagrams. The method presented by them was clear and the queries of the students were answered at the same time.

Outcome of the teaching mode:

This method improved communication and presentation skills. Along with this self-learning ability of the students has increased which is a positive sign of Teaching-Learning process. It also encouraged the other students to follow suit.

Innovative/ Student Centric Teaching Method Form

Faculty Name: Mrs. Emeema

Course: Power Plant Engineering

Class-Section: IV

Mode of Innovative Teaching: Debate

Description about the mode:

In this method, the faculty gives a topic to the students of entire class to debate pro's and con's and come to a conclusion.

Topic Handled:

The faculty members asked the students to debate upon hydro-electric and thermal power plants along with their applications, benefits and limitations.

Outcome of the teaching mode:

Students could appreciate the concept of power generation using hydro-electric and thermal power plants in depth. The applicability, benefits and limitations were discussed thoroughly.

INNOVATION IN TEACHING

2018-19 COLLABORATIVE LEARNING

TOPIC: NUCLEAR POWER PLANT

To understand and appreciate different types of Nuclear Reactors, the innovative Teaching-Learning method named Collaborative learning was implemented.

The intention is to enhance the knowledge base of each individual, develop scientific temper, utilize time, energy and facilities available in the right direction and to inculcate team spirit.

The major task was to learn about the 5 types of Nuclear Reactors.

1. **Pressurized Water Reactor (PWR)**
2. **Boiling Water Reactor (BWR)**
3. **CANDU (Canadian-Deuterium-Uranium) Reactor**
4. **Gas-Cooled Reactor**
5. **Liquid Metal Cooled Reactor**

Students in the entire class were divided into 5teams.Each team was assigned one type of Nuclear Reactor.

The task given to each team:

- Collect information about the Nuclear Reactor assigned to them
- Discuss its working, implementation, advantages and limitations.
- Get an understanding of the functioning of the reactor.
- Prepare a Power Point Presentation
- Present it in the class

Each team was given the liberty to sit together and discuss, browse the internet, visit the library for collecting the required information and to consult the faculty.

At the end of the presentation by each team, a group discussion was also conducted which enabled the students to interact with the other teams, raise their doubts and get clarification.

The Power Point Presentation of one Nuclear Reactor and a picture of the Group Discussion held in the class are attached.

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Innovative/ Student Centric Teaching Method Form

Faculty Name: Mrs. Emeema

Course: Power Plant Engineering

Class-Section: IV

Mode of Innovative Teaching: PPT

Description about the mode: PowerPoint can be an effective tool to present material in the classroom and encourage student learning. You can use PowerPoint to project visuals that would otherwise be difficult to bring to class. For example, in an anthropology class, a single PowerPoint presentation could project images of an anthropological dig from a remote area, questions asking students about the topic, a chart of related statistics, and a mini quiz about what was just discussed that provides students with information that is visual, challenging, and engaging.

Topic Handled: Working principle of Nuclear Power Plant was discussed with PPT.

Outcome of the teaching mode: The working principle of nuclear power plant was clearly understood by the students.

CANDU (CANADIAN- DEUTERIUM URANIUM) REACTOR

CANDU REACTOR

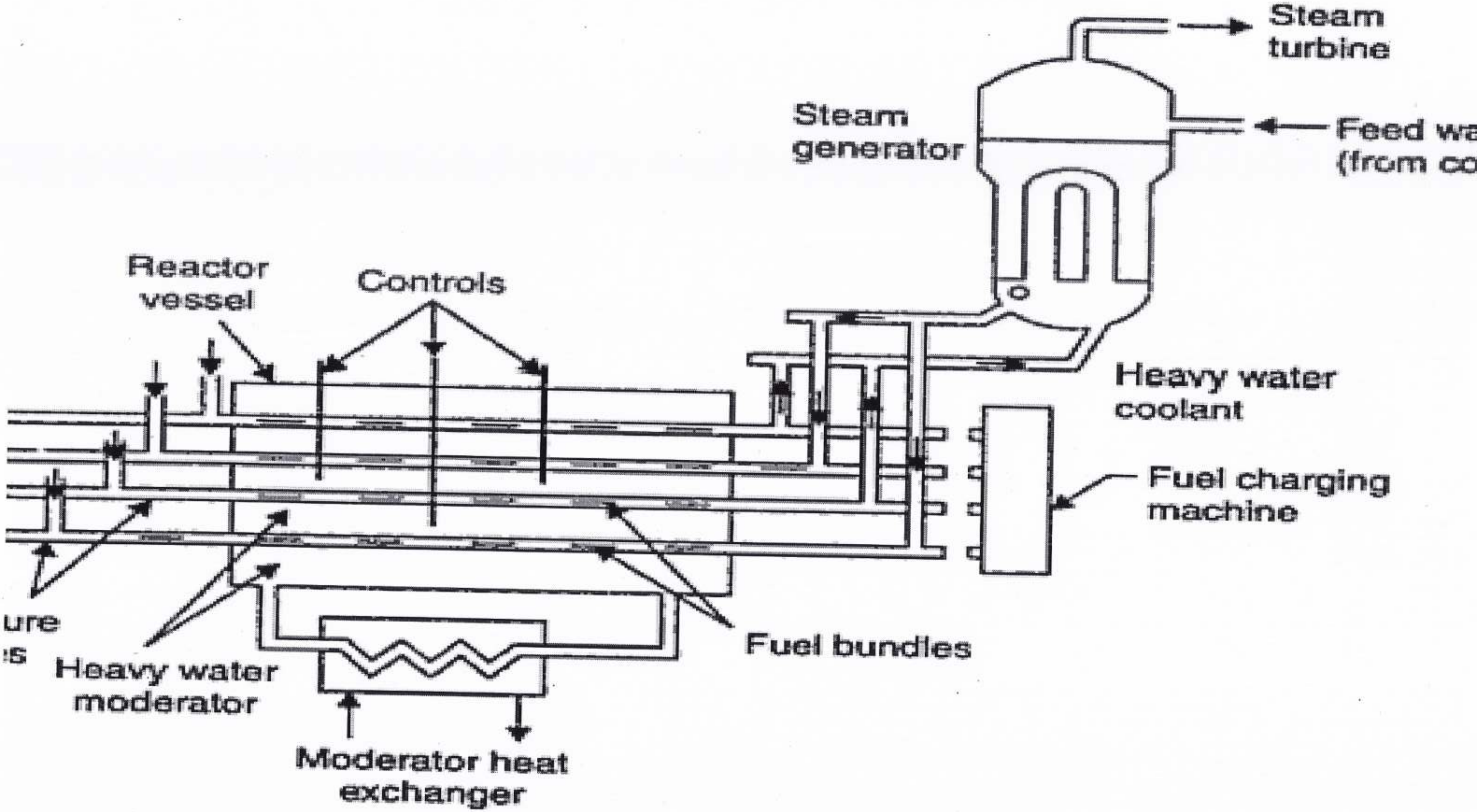


Fig. 7.14. CANDU reactor.

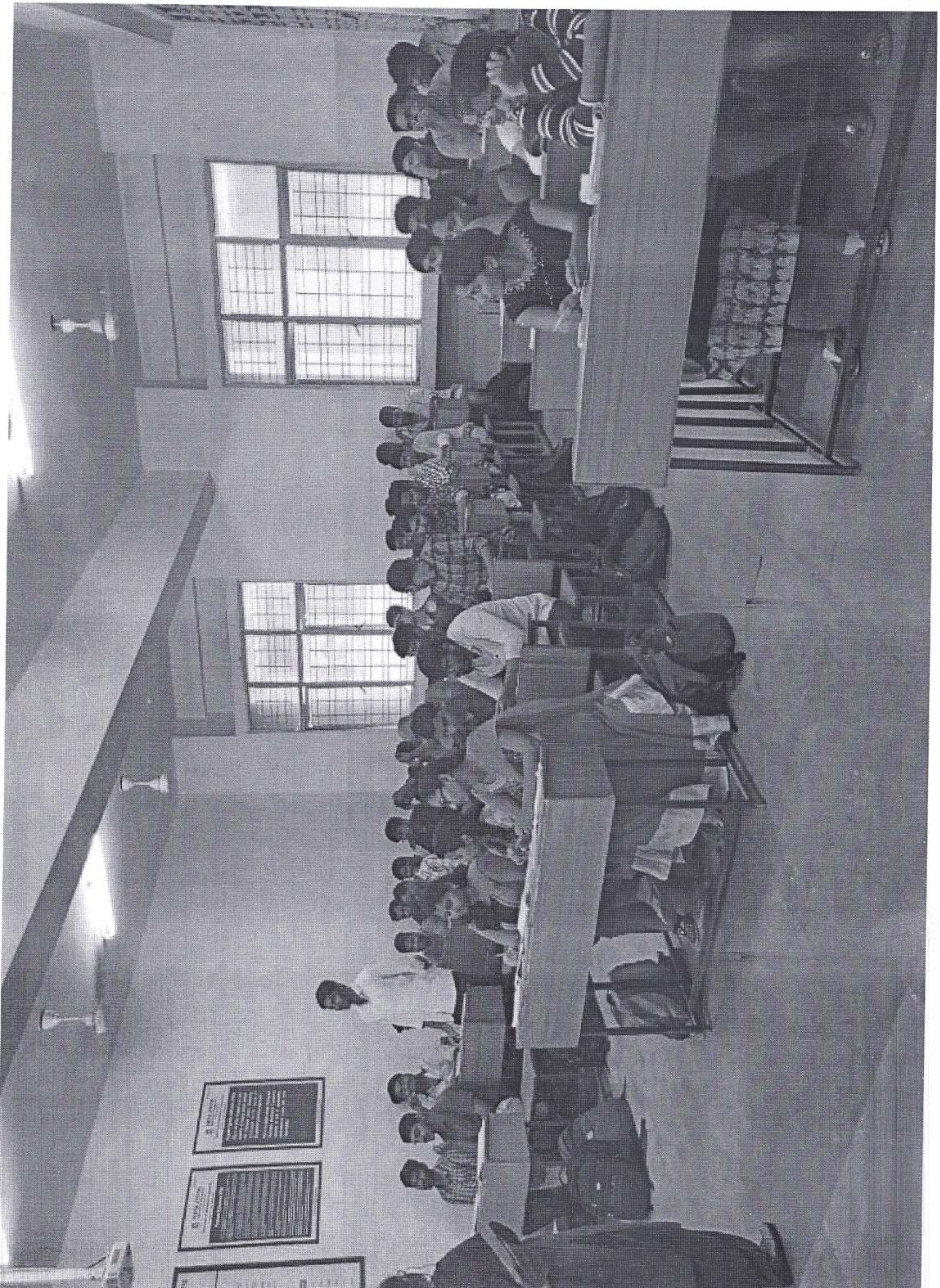
CANDU (CANADIAN- DEUTERIUM URANIUM) REACTOR

- CANDU is a Thermal Nuclear Power Reactor
- **Heavy water D_2O is: The moderator, Coolant and Neutron Reflect**
- This Reactor was developed in Canada
- U^{235} is used as fuel
- Moderator & Coolant are kept separate
- The entire vessel containing moderator does not have to withstand high pressure
- High pressure is maintained only in the pressure tubes containing coolant

DESCRIPTION OF CANDU REACTORS...1

REACTOR VESSEL AND CORE

- The reactor vessel is a steel cylinder with a horizontal axis. The length and diameter of a typical cylinder being 6 m and 8 m respectively.
- The vessel is penetrated by some 380 horizontal channels called pressure tubes because they are designed to withstand a high internal pressure.
- The channels contain the fuel elements, and the pressurized coolant flows along the channels and around the fuel elements to remove the heat generated by fission.
- Coolant flows in the opposite directions in adjacent channels..



20. COURSE CLOSURE REPORT

Regulation: R15

Academic Year: 2018 - 2019

Program: B.Tech (Mechanical Engineering)

Year/Sem: II / I

Course Name: Thermodynamics

Course Code: A13309

Contact Hours: 4Lectures/1Tutorial/4Credits

No. of Students: 250

No. of lecture classes taken	52
No. of tutorial classes taken	14
Course delivery modes	Lectures, Demonstration
Technology utilization	Power Point / OHP Slides
Assessment Tools	Internal Mid Examinations, Assignments, JNTU End Exam

OVERALL ATTAINMENT (80% DIRECT + 20% INDIRECT)	
DIRECT	2.14
INDIRECT	2.64
OVERALL ATTAINMENT	2.24