Academic Course Description

BHARATH UNIVERSITY
Faculty of Engineering and Technology
Department of Mechanical Engineering
BME402-THERMAL ENGINEERING-I
(Fourth SEMESTER,2015-2016(Even Sem)

Course (catalog) description

To integrate the concepts, laws and methodologies from the first course in thermo dynamics into analysis of cyclic processes

To apply the thermodynamic concepts into various thermal application like IC engines, Steam Turbines, Compressors and Refrigeration and Air conditioning systems

Compulsory/Elective course **:** **C**ompulsory

Credit & contact hours : 4 & 60

Course Coordinator : V.SRINIVASAN

Instructors :

Name of the instructor	Class handling	Office location	Office phone	Email (domain:@ bharathuniv.ac.in	Consultation
D.RAVI	2A	JR101		Ravivsravi.aero@gmail.com	9.00am-9.50 am
S.MANAVALAN	2B	JR102		Manavalan.mech@bharathuniv.ac.in	1.30pm-2.20pm
J.MANIKANDAN	2C,2D	JR103, JR104		Manikandan.Mech@bharathuniv.ac.in	11.40pm-12.30pm, 2.20pm-3.10pm

Relationship to other courses:

Pre –requisites **:** Thermodynamics

Assumed knowledge : To apply the thermodynamic concepts into various thermal application

Following courses : Thermal Engineering-II, Refrigeration and air conditioning

Syllabus Contents

Use of Steam tables, Mollier Chart, Psychrometric and Refrigerant tables in the Examination is permitted.

UNIT I STEAM NOZZLES **12**

Flow of steam through nozzles, Shape of nozzles, Effect of friction, Critical pressure ratio, Super saturated flow

UNIT II STEAM TURBINES **12**

Working principles, Simple impulse(De laval) turbine, Reaction turbine, velocity and pressure compounded turbines, Height of blades of turbines, multi stage turbine, Radial flow turbines, Governing of steam turbines(Derivations not included)

UNIT III AIR POWER CYCLES **12**

Construction & working of 2 stroke and 4 stroke engines, Otto, Diesel and dual cycles-air standard efficiency, Mean effective pressure and power, Brayton with reheat, intercooling and regeneration, Erricson, Stirling, Atkinson cycles.

UNIT IV VAPOUR POWER AND COMBINED CYCLES **12**

Rankine, Modified Rankine, Reheat, Regeneration cycles, Binary vapour power cycles, Cogeneration principles & Applications.

UNIT V REFRIGERATION CYCLES **12**

Air refrigeration cycles, Vapour compression refrigeration cycle, sub cooling and superheating cycles, vapour absorption cycles.

Total : 60

Computer usage:

Professional component

General	-	0%
Basic Sciences	-	10%
Engineering sciences & Technical arts	-	100%
Professional subject	-	100%

Broad area : Thermal

Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	February 2nd week	Session 1 to 14	2 Periods
2	Cycle Test-2	March 2nd week	Session 15 to 28	2 Periods
3	Model Test	April 3rd week	Session 1 to 45	3 Hrs
5	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

To integrate the concepts, laws and methodologies from the first course in thermo dynamics into analysis of cyclic processes To apply the thermodynamic concepts into various thermal application like IC engines, Steam Turbines, Compressors and Refrigeration and Air conditioning systems	Correlates to program outcome		
	H	M	L
Upon completion of this course, the students can able to apply the different gas power cycles	a,c,l	b	f,g,h,i,j,k
Use of them in IC and R&AC applications.	a,c,i	b	f,g,h,i
Study of Steam Turbines	a	b,c	h
Study of vapour power cycles	a,c	b	f,g,h,i
Study of rankine power cycles and its application	a,h,l	b	
Understand the concept of refrigeration and its application	a,c,l	b	f,g,h,i

H: high correlation, M: medium correlation, L: low correlation

Draft Lecture Schedule

Session No	Topics to be covered	Problem solving Yes/no	Text/chapter
UNIT-I STEAM NOZZLES			
1	Shape of nozzles, velocity of steam leaving the nozzle, effect of friction	NO	[T1]/CHAPTER-18
2	Mass flow rate of steam through the nozzle, critical pressure ratio and its significance, supersaturated flow	NO	
3	Problems on steam nozzles (convergent & convergent-divergent nozzles)	YES	
4	Problems on nozzles (convergent-divergent nozzles)	YES	
5	Problems on nozzles (convergent-divergent nozzles)	YES	
5	Problems on supersaturated flow	YES	
6	Effect of friction	NO	
7	Critical pressure ratio	NO	
8	Tutorial I	YES	

Session No	Topics to be covered	Problem solving Yes/No	Text/chapter
9	Mollier chart	NO	[T1]/CHAPTER-18
10	Tutorial 2	YES	
11	Tutorial 3	NO	
12	Tutorial 4	YES	
	UNIT-II STEAM TURBINES		
14	Impulse and reaction principles	NO	[T1]/CHAPTER-18
15	compounding of impulse turbines	NO	
16	Velocity diagram of simple Turbine	NO	
17	Tutorial 5	YES	
18	multistage turbines, Problems	YES	
19	Velocity of Reaction Turbine	NO	
20	Axial flow turbines	NO	
21	Height of blades of turbines	NO	
22	Governing Turbines	NO	
23	Tutorial 6	YES	
24	Tutorial 7	YES	

Session No	Topics to be covered	Time Ref	Teaching Aids

UNIT-II AIR POWER CYCLES			
25	Introduction, Air standard cycles – Otto cycle – Air standard efficiency, mean effective pressure, Characteristics & applications	NO	[T1]/CHAPTER 21, [R1]/CHAPTER-13
26	Diesel cycle – Air standard efficiency, mean effective pressure, Characteristics & applications	NO	
27	Dual cycle – Air standard efficiency, mean effective pressure, Characteristics & applications	NO	
28	Problems on Otto cycle	YES	
29	Problems on Diesel cycle	YES	
30	Problems on Dual cycle	YES	
31	Comparison of various cycles, Brayton cycle – Air standard efficiency, Characteristics & applications	NO	
32	Problems on Brayton cycle	YES	
33	Introduction, Air standard cycles – Otto cycle – Air standard efficiency, mean effective pressure, Characteristics & applications	NO	
34	Tutorial 8	YES	
35	Tutorial 9	YES	
36	Tutorial 10	NO	
UNIT-IV VAPOUR POWER AND COMBINED CYCLES			
37	Rankine cycles - introduction	NO	[R1]/CHAPTER-12
38	Rankine cycle applications and modified Rankine cycles	NO	
39	Problems on Rankine cycles	YES	
40	Reheat rankine Cycles	NO	
41	Problems on Reheat Rankine cycles	YES	

Session No	Topics to be covered	Problem solving Yes/no	Teaching Aids
UNIT-I STEAM NOZZLES			
42	Multistage reheat Rankine cycles	NO	[R1]/CHAPTER-12
43	Regeneration Rankine Cycles	NO	
44	Binary Vapour power cycles	NO	
45	Cogeneration principles and its applications	NO	
46	Tutorial 11	YES	
47	Tutorial 12	YES	
48	Case study	NO	
UNIT-V REFRIGERATION CYCLES			
50	Refrigeration – applications	NO	[T1]/CHAPTER-26, [R1]/CHAPTER 14
51	Types of refrigeration cycles,simple vapour cycles	NO	
52	Simple Vapour compression systems	NO	
53	Vapour compression system with sub-cooling and super heating, performance parameters	NO	
54	Problems on vapour compression cycle	YES	
55	Problems on vapour compression cycle	YES	
56	Vapour absorption system-Ammonia- water	NO	
57	Lithium bromide – water systems		
58	comparison of vapour absorption and compression systems	YES	
59	Psychrometry – processes, chart	NO	
60	Case study	YES	

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures
- Tutorials, which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material.
- Laboratory sessions, which support the formal lecture material and also provide the student with practical construction, measurement and debugging skills.
- Small periodic quizzes, to enable you to assess your understanding of the concepts.

Evaluation Strategies

Cycle Test – I	-	5%
Cycle Test – II	-	5%
Model Test	-	10%
Assignment / Seminar / Online Test / Quiz	-	5%
Attendance	-	5%
Final exam	-	70%

Prepared by : V.SRINIVASAN

Addendum

ABET Outcomes expected of graduates of B.Tech / MECH / program by the time that they graduate:

a) The ability to apply knowledge of mathematics, science, and engineering fundamentals.

b) The ability to identify, formulate and solve engineering problems.

c) The ability to design a system, component, or process to meet the desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

d) The ability to design and conduct experiments, as well as to analyze and interpret data

e) The ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

f) The ability to apply reasoning informed by the knowledge of contemporary issues.

g) The ability to broaden the education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

h) The ability to understand professional and ethical responsibility and apply them in engineering practices.

i) The ability to function on multidisciplinary teams.

j) The ability to communicate effectively with the engineering community and with society at large.

k) The ability in understanding of the engineering and management principles and apply them in project and finance management as a leader and a member in a team.

l) The ability to recognize the need for, and an ability to engage in life-long learning.

Program Educational Objectives

PEO1: PREPARATION:
Mechanical Engineering graduatesare enthusiastic to provide strong foundation in mathematical, scientific and engineering fundamentals necessary to analyze, formulate and solve engineering problems in the field of Mechanical Engineering.

PEO2: CORE COMPETENCE:
Mechanical Engineering graduates have competence to enhance the skills and experience in defining problems in the field of Mechanical Engineering and Technology design and implement, analyzing the experimental evaluations, and finally making appropriate decisions.

PEO3: PROFESSIONALISM:
Mechanical Engineering graduates made competence to enhance their skills and embrace new thrust areas through self-directed professional development and post-graduate training or education.

PEO4: PROFICIENCY:
Mechanical Engineering graduates became skilled to afford training for developing soft skills such as proficiency in many languages, technical communication, verbal, logical, analytical, comprehension, team building, inter personal relationship, group discussion and leadership skill to become a better professional.

PEO5: ETHICS:
Mechanical Engineering graduates are morally merged to apply the ethical and social aspects of modern Engineering and Technology innovations to the design, development, and usage of new products, machines, gadgets, devices, etc.

BME402-THERMAL ENGINEERING -I

Course Teacher	Signature
D.RAVI	
S.MANAVALAN	
J.MANIKANDAN	

Course Coordinator
V.SRINIVASAN

HOD/MECH