Academic Course Description

> **BHARATH UNIVERSITY**
> Faculty of Engineering and Technology
> Department of Electrical and Electronics Engineering
> **BME405 & Thermal Engineering &Fluid Mechanics**
> **FourthSemester (Even Semester)**

Course (catalog) description

To understand the concepts of Energy in general and Heat and Work in particular, to understand the fundamentals of quantification and grade of energy, to understand fluid statics and fluid dynamics and to study the applications of mass, momentum and energy equation in fluid flow

Compulsory/Elective course: Compulsory for EEE students

Credit hours& contact hours :　　3 &45 hours

Course Coordinator　　:　　Mr.Ravi

Instructors　　**:**　　Mr.Ravi

Name of the instructor	Class handling	Office location	Office phone	Email (domain:@ bharathuniv.ac.in	Consultation
Mr.Ravi	Second year EEE	KS 101	**04422290125**	hod.mech@**bharathuniv.ac.in**	12.30-1.30 PM

Relationship to other courses:

Pre –requisites　　　: BME 203 (Basic Mechanical Engineering)

Syllabus Contents

UNIT I　　BASIC CONCEPTS AND LAWS OF THERMODYNAMICS　9
Systems zeroth law, first law of thermodynamics – concept of internal energy and enthalpy applications of closed and open systems, second law of thermodynamics – concept of entropy – clausius inequality and principle of increase in irreversible processes.

UNIT II　　IC ENGINE AND COMPRESSORS　　　　　　9
Basic IC engine and gas turbine cycles, compressors – single stage Multi stage, reciprocating, vane gear, roots, compressor(constructional features and applications only).

UNIT III　　THERMODYNAMICS OF REFRIGERATORS AND PUMPS　　9
Properties of steam – Rankine cycle – one dimensional flow through nozzles and applications to jet and rocket propulsions – basic thermodynamics of refrigerators and heat pumps.

UNIT IV　　BASIC CONCEPTS AND FLOW OF FLUIDS　　　　9
Introduction – classification – types of fluids – properties – properties – law of pressure – manometer – mechanical gauges – types of fluid flow – continuity equation – energy equation – Beroulli's theorem – orifice and mouth piece.

UNIT V DIMENSIONAL AND MODEL ANALYSIS 9

Introduction – dimensional analysis – Rayleigh's method and Bukingham's method – similitude dimensionless numbers – model studies, pump turbines – type of pumps – reciprocating pumps – constructional details – coefficient of discharge – slip – power required – centrifugal pump – working principle – working principle.

Text book(s) and/or required materials

1. Nag P.K, "Engineering Thermodynamics", Tata McGraw Hill, Fourth Edition, 1993.
2. Kothandaraman C.P, "Thermal Engineering", Dhanpat Rai and Co, 2013
3. Kumar K.L. "Fluid Mechanics" Eurasia Publishers, 1990.
Rajput R.K., "Fluid Mechanics and Hydraulic Machines", S. Chand & Co. India, 1998

Reference Books:

1. Shames I.H. "Mechanics of Fluids", Kogakusha Publications. Tokyo 1998.
2. Reynolds, "Thermodynamics", McGraw Hill Publications, 1996

Computer usage:

Professional component

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

Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	February 2 nd week	Session 1 to 18	2 Periods
2	Cycle Test-2	March 2nd week	Session 19 to 36	2 Periods
3	Model Test	April 3rd week	Session 1 to 45	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

To understand the concepts of Energy in general and Heat and Work in particular, to understand the fundamentals of quantification and grade of energy, to understand fluid statics and fluid dynamics and to study the applications of mass, momentum and energy equation in fluid flow	Correlates to program outcome		
	H	**M**	**L**
1. To understand a thermodynamic system, closed and open systems, state, equilibrium, process, cycle and system properties, thermo dynamic laws and apply it to solve problems.		C,e,g,j,l	a
2. To study and analyze the efficiency of IC engines and compressor and to solve problems.	E,f,l	G,h,j	a
3. To understand the thermodynamics of refrigerators and heat pumps	B,e,f,l	j	A,g,h
4. To study the fluid flow and the various theorems and concepts associated with that.	B,e,f,l	A,h,j	C,g
5. Ability to understand to identify, formulate, and to solve problems of dimensional analysis, pumps and turbines	E	B,c,g,j,l	A,k

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

Draft Lecture Schedule

S.NO	Topics	Problem solving (Yes/No)	Text / Chapter
UNIT I	**BASIC CONCEPTS AND LAWS OF THERMODYNAMICS**		
1.	Systems zeroth law	Yes	T1,R2
2.	first law of thermodynamics	Yes	
3.	first law of thermodynamics	Yes	
4.	concept of internal energy and enthalpy applications of closed and open systems	Yes	
5.	concept of internal energy and enthalpy applications of closed and open systems	Yes	
6.	second law of thermodynamics	Yes	
7.	concept of entropy	Yes	
8.	clausius inequality and principle of increase in irreversible processes	Yes	
9.	clausius inequality and principle of increase in irreversible processes	Yes	
UNIT II	**IC ENGINE AND COMPRESSORS**		
10.	Basic IC engine and gas turbine cycles	Yes	T2,T1
11.	Basic IC engine and gas turbine cycles	Yes	
12.	compressors	Yes	
13.	single stage Multi stage	Yes	
14.	single stage Multi stage	Yes	
15.	reciprocating	Yes	
16.	vane gear	Yes	
17.	roots	Yes	
18.	compressor(constructional features and applications only)	Yes	
UNIT III	**THERMODYNAMICS OF REFRIGERATORS AND PUMPS**		
19.	Properties of steam	Yes	T3,T1
20.	Properties of steam	Yes	
21.	Rankine cycle	Yes	
22.	Rankine cycle	Yes	
23.	one dimensional flow through nozzles and	Yes	

	applications to jet and rocket propulsions		
24.	one dimensional flow through nozzles and applications to jet and rocket propulsions	Yes	
25.	one dimensional flow through nozzles and applications to jet and rocket propulsions	Yes	
26.	basic thermodynamics of refrigerators and heat pumps	Yes	
27.	basic thermodynamics of refrigerators and heat pumps	Yes	
UNIT IV	**BASIC CONCEPTS AND FLOW OF FLUIDS**		
28.	Introduction	**Yes**	T1,R1
29.	classification	**Yes**	
30.	types of fluids	**Yes**	
31.	properties	**Yes**	
32.	law of pressure ,manometer	**Yes**	
33.	mechanical gauges – types of fluid flow	**Yes**	
34.	continuity equation	**Yes**	
35.	energy equation – Beroulli's theorem	**Yes**	
36.	orifice and mouth piece.	**Yes**	
UNIT V	**DIMENSIONAL AND MODEL ANALYSIS**		
37.	Introduction – dimensional analysis	**Yes**	T2,T1
38.	Rayleigh's method and Bukingham's method	**Yes**	
39.	similitude dimensionless numbers	**Yes**	
40.	model studies, pump turbines	**Yes**	
41.	type of pumps	**Yes**	
42.	reciprocating pumps	**Yes**	
43.	constructional details – coefficient of discharge	**Yes**	
44.	slip – power required – centrifugal pump	**Yes**	
45.	working principle – working principle.	**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	-	05%
Cycle Test – II	-	05%
Model Test	-	10%
Attendance	-	05%
SEMINAR&ASSIGNMENT	-	05%
Final exam	-	70%

Prepared by: Mr.Ravi   **Date:**

Addendum

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

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

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

c) An 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) An ability to design and conduct experiments, as well as to analyze and interpret data.

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

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

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

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

i) An ability to function on multidisciplinary teams.

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

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

.

Program Educational Objectives

PEO1: PREPARATION
Electrical Engineering Graduates are in position with the knowledge of Basic Sciences in general and Electrical Engineering in particular so as to impart the necessary skill to analyze and synthesize electrical circuits, algorithms and complex apparatus.

PEO2: CORE COMPETENCE
Electrical Engineering Graduates have competence to provide technical knowledge, skill and also to identify, comprehend and solve problems in industry, research and academics related to power, information and electronics hardware.

PEO3: PROFESSIONALISM
Electrical Engineering Graduates are successfully work in various Industrial and Government organizations, both at the National and International level, with professional competence and ethical administrative acumen so as to be able to handle critical situations and meet deadlines.

PEO4: SKILL
Electrical Engineering Graduates have better opportunity to become a future researchers/ scientists with good communication skills so that they may be both good team-members and leaders with innovative ideas for a sustainable development.

PEO5: ETHICS
Electrical Engineering Graduates are framed to improve their technical and intellectual capabilities through life-long learning process with ethical feeling so as to become good teachers, either in a class or to juniors in industry.

Course Teacher	Signature
Mr.Ravi	

Course Coordinator   **HOD/EEE**
(Mr.Ravi)   ()