BME006 - COMBUSTION ENGINEERING

Academic Course Description

BHARATH UNIVERSITY
Faculty of Engineering and Technology
Department of Mechanical Engineering
BME006 - COMBUSTION ENGINEERING
Sixth Semester, 2015-16 (Even Semester)

Course (catalog) description

- To understand and analyze the combustion with emphasis on engineering applications.

Compulsory/Elective course **:** Elective

Credit & contact hours : 3 & 45

Course Coordinator : Mr.Thirumavalavan

Instructors :

Name of the instructor	Class handling	Office location	Office phone	Email (domain:@ bharathuniv.ac.in	Consultation
R.Sabarish	VI Sem Mech	JR201		Sabarishr.mech@bharathinv.ac.in	10.50 - 11.40 AM
Mr.Thirumavalavan	VI Sem Mech	JR202		Thirumavalavans.mech@bharathuniv.ac.in	11.40 -12.30 PM

Relationship to other courses:

Pre –requisites **:** IC ENGINES

Assumed knowledge : To understand and analyze the combustion with emphasis on engineering applications.

Following courses : Nil

Syllabus Contents

UNIT I CHEMICAL REACTIONS 9

Fuels and combustion, Theoretical and actual combustion processes, Enthalpy of formation and enthalpy of combustion, First law analysis of Reacting systems, Adiabatic flame temperature, Entropy change of reacting systems, Second law analysis of reacting systems, problems

UNIT II COMBUSTION OF GASEOUS AND VAPORIZED FUELS 9

Review of types of fuels, Types of flames, Energy balance and furnace efficiency, Burner type, Emissions from gas-fired furnaces, Emissions control, Chamber design, Detonation

UNIT III COMBUSTION OF LIQUID FUELS 9

Spray combustion in furnace, spray formation and droplet behaviour, Gas turbine operating parameters, combustor design, ignition delay, and detonation of liquid fuel sprays

UNIT IV COMBUSTION OF SOLID FUELS 9

Drying of solid fuels, devolatilization of solid fuels, stoker-fired boilers, Refuse and biomass fired boilers, Pulverized coal-burning systems, Pulverized coal combustion, Emission from pulverized coal, Problems

UNIT V FLUIDIZED BED COMBUSTION 9

Fluidization fundamentals, combustion in bubbling bed, atmospheric fluidized bed combustion systems, circulating fluidized beds, pressurized fluidized bed combustion, problems.

TEXTBOOK:

1. Yunus.A.Cengel- A textbook of Thermodynamics

REFERENCES:

1. Gary.L.Borman, Combustion Engineering-McGraw Hill international Edition,1998
2. Roger.A.Strehlow-Combustion fundamentals- McGraw Hill international Edition,1989.
3. www.goodreads.com/book/show/3785353-**combustion-engineering**

Computer usage:

Professional component

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

Broad area: Combustion in engines

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 3nd week	Session 1 to 45	3 Hrs
4 1	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

Student Outcomes (SOs) from Criterion 3 covered by this Course	Correlates to program outcome		
	H	**M**	**L**
1. Understand various types of fuels and its ppts	a		
2. Understand the concept of gaseous fuels	a,c		g
3. Will able to differentiate gaseous and liquid fuels	a,c	e,f	i,k
4. Will understand the concept of solid fuels	a,c		l
5. Student learns about fluidized bed combustion	a	f,h	
6. Student understands the fundamentals in combustion of fuels.	a,c		l

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

Draft Lecture Schedule

S.NO	Topics	Problem solving (Yes/No)	Text / Chapter
UNIT I CHEMICAL REACTIONS			
1	Fuels and combustion,	yes	T1 & R1
2	Theoretical and actual combustion processes,	yes	

3	Enthalpy of formation and enthalpy of combustion,	yes	
4	First law analysis of Reacting systems,	yes	
5	Adiabatic flame temperature,	yes	
6	Entropy change of reacting systems,	yes	
7	Second law analysis of reacting systems,	yes	
8	Problems	yes	
9	problems	Yes	
UNIT II COMBUSTION OF GASEOUS AND VAPORIZED FUELS			
10	Review of types of fuels,	yes	
11	Types of flames,	yes	
12	Energy balance and furnace efficiency,	yes	
13	Burner type,	yes	
14	Emissions from gas	yes	T1 & R3
15	fired furnaces,	yes	
16	Emissions control,	yes	
17	Chamber design,	yes	
18	Detonation	yes	
UNIT III COMBUSTION OF LIQUID FUELS			
19	Spray combustion in furnace,	yes	
20	spray formation and droplet behaviour,	yes	
21	spray formation and droplet behaviour,	yes	
22	Gas turbine operating parameters,	yes	
23	Gas turbine operating parameters,	yes	T1 & R2
24	combustor design,	yes	
25	combustor design,	yes	
26	ignition delay,	yes	
27	detonation of liquid fuel sprays	yes	
UNIT IV COMBUSTION OF SOLID FUELS			
28	Drying of solid fuels,	yes	
29	devolatilization of solid fuels,	yes	
30	stoker-fired boilers,	yes	
31	Refuse and biomass fired boilers,	yes	
32	Pulverized coal-burning systems,	yes	T1 & R1
33	Pulverized coal combustion,	yes	
34	Emission from pulverized coal,	yes	
35	Problems	yes	
36	Problems	yes	
UNIT V FLUIDIZED BED COMBUSTION			
37	Fluidization fundamentals,	yes	
38	combustion in bubbling bed,	yes	
39	atmospheric fluidized bed combustion systems,	yes	
40	atmospheric fluidized bed combustion systems,	yes	T1 & R3
41	circulating fluidized beds,	yes	
42	pressurized fluidized bed combustion,	yes	
43	pressurized fluidized bed combustion,	yes	

44	problems.	yes	
45	problems	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 R.Sabarish

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.

Course Teacher	Signature
R.Sabarish	
Mr.Thirumavalavan	

Course Coordinator **HOD/MECH**
Mr.Thirumavalavan