

<p>Academic Course Description BHARATH UNIVERSITY Faculty of Engineering and Technology Department of Mechanical Engineering BME 001- ADVANCED INTERNAL COMBUSTION ENGINEERING Fifth Semester, 2016-17 (odd Semester)</p>
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Course (catalog) description

Update the knowledge in engine exhaust emission control and alternate fuels and enable the students to understand the recent developments in IC Engines.

Compulsory/Elective course: Elective for Mechanical Engineering students

Credit & contact hours : 3 & 45

Course Coordinator : Dr.V.Balambika

Instructor(s) :

Name of the instructor	Class handling	Office location	Office phone	Email (domain: @bharathuniv.ac.in)	Consultation
MR.Jose Anandh Vino	Third year MECH	SK 001, SK 002		joseanandhvino.mech@bharathuniv.ac.in	9.00 - 9.50 AM
Dr.V.Balambika	Third year MECH	SK 003		balambikav.mech@bharathuniv.ac.in	12.45 - 1.15 PM

Relationship to other courses

Pre-requisites : Basic Mechanical Engineering

Assumed knowledge : Fundamentals of construction and operation of I.C. Engines.

Following courses : Nil

Syllabus Contents**UNIT I SPARK IGNITION ENGINES:****9**

Spark ignition engine mixture requirements - Feedback control carburetors - Fuel-Injection systems - Monopoint and Multipoint injection - Stages of combustion - Normal and Abnormal combustion - Factors affecting knock - Combustion chambers -Introduction to Thermodynamic Analysis of S.I.Engine combustion.

UNIT II COMPRESSION IGNITION ENGINES**9**

Direct and Indirect systems - combustion chamber - Fuel spray behaviour - Spray structure, Spray Penetration and Evaporation - air motion - Turbocharging - Introduction to Thermodynamic analysis of C.I.Engine combustion.

UNIT III POLLUTANT FORMATION CONTROL**9**

Pollutants - Sources and types - Formation of Nox, Hydrocarbon Emission Mechanism - Carbon monoxide formation - Particulate emissions - Methods of Controlling Emissions - Catalytic converters and particulate Traps - Methods of Measurement and driving cycles.

UNIT IV : ALTERNATE FUELS**9**

Alcohol, Hydrogen, Natural gas and Liquefied petroleum gas - Properties, Suitability, Engine Modifications, Merits and Demerits on fuels.

UNIT V : RECENT TRENDS**9**

Lean Burn Engines - Stratified charge Engines - Gasoline Direct Injection Engine - homogeneous charge compression ignition - Plasma ignition - Measurement techniques.

TOTAL 45 HOURS**Text book(s) and/or required materials****TEXT BOOKS**

1. R.B.Mathur and R.P.Sharma- Internal Combustion Engines, Dhanpat Rai & Sons, 1994.
2. V. Ganesan-Internal Combustion Engines - Tata McGraw Hill, 2003.
- 3 . K.K.Ramalingam-Internal Combustion engines, Scitech Publications India(P) Ltd. 2000.

REFERENCES

1. John B. Heywood, Internal Combustion Engine Fundamentals, McGraw Hill International Editions, 1998
2. <https://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/28890yy.pdf>

Computer usage: Nil**Professional component**

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

Broad area : | Management**Test Schedule**

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	August 1 st week	Session 1 to 14	2 Periods
2	Cycle Test-2	September 2 nd week	Session 15 to 28	2 Periods
3	Model Test	October 2 nd week	Session 1 to 45	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

Familiarize the students with the fundamental concepts of Management and to highlight the approaches in organization behavior	Correlates to program outcome		
	H	M	L
Will update the knowledge about spark ignition engine.	a	f,l,j	g
Will update the knowledge about compression ignition engine.	c	a,e,d	i
Will understand about catalytic convertor	d	a	h
Will understand the concept of alternate fuels .	e,j	a,e,g	i
Understand the different recent engines	a	i	b
Will gain confidence about gasoline engine	f		

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

Draft Lecture Schedule

Session	Topics	Problem Solving (Yes/No)	Text / Chapter
1.	Construction and operation of spark ignition engines	No	[T2] chapter - 5, [R1] chapter -3
2.	Air/fuel mixture requirement of S.I. engines	No	
3.	Carburetors and feed back control	No	
4.	Fuel injection system, Monopoint and Multipoint injection system	No	
5.	Stages of combustion,	No	
6.	Normal and abnormal combustion	No	
7.	Factors affecting Knock	No	
8.	Types of combustion chamber	No	
9.	Introduction to thermodynamic analysis of S.I. Engine combustion chambers	Yes	
10.	Construction and operation of C.I. Engines	No	
11.	Direct and Indirect injection system	No	
12.	Types of C.I. Engine combustion chamber	No	
13.	Combustion process in C.I. Engines	No	
14.	Fuel spray behaviour	No	
15.	Fuel spray penetration and evaporation	No	
16.	Swirl and other air motions	No	
17.	Turbocharging	No	
18.	Introduction to thermodynamic analysis of C.I. Engine combustion	Yes	
UNIT 3 pollutant formation and control			
19.	Sources of pollutants	No	[T2] chapter – 6, [R1] chapter - 8
20.	Major types of pollutants	No	
21.	Mechanism of formation of Nox	No	
22.	Hydrocarbon emission mechanism	No	
23.	Carbon monoxide formation	No	
24.	Particulate emissions	No	

25.	Methods of controlling emissions	No	
26.	Catalytic convertors	No	
27.	Methods of pollution measurement and driving cycles.	No	
UNIT 4 Alternate fuels			
28.	Types of alternative fuels	No	[T2] chapter– 4, [R1] chapter–2
29.	Alcohols as alternative fuels	No	
30.	Hydrogen as alternative fuels	No	
31.	Natural gas as alternative fuels	No	
32.	LPG as alternative fuels	No	
33.	Biodiesel as alternative fuels	No	
34.	Properties and suitability of alternative fuels	No	
35.	Engine modifications	No	
36.	Merits and demerits of alternative fuels.	No	
UNIT 5 Recent trends			
37.	Lean Burn S.I. Engines	No	
38.	Stratified charge engines	No	
39.	Gasoline direct injection engines	No	
40.	Homogeneous charge engines	No	
41.	Multipoint fuel injection engines	No	[T2] chapter– 5,6
42.	Measurement of BP	yes	[R1] chapter–7
43.	Measurement of IP	yes	
44.	Measurement of FP	yes	
45.	Measurement of A/F ratio	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.
- 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 Assignment / Seminar / Online	-	10%
Test / Quiz	-	5%
Attendance	-	5%
Final exam	-	70%

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 graduates are 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
MR.Jose Anandh Vino	
Dr.V.Balambika	

Course Coordinator

Dr.V.Balambika

HOD/MECH