SRM UNIVERSITY
(Under section 3 of UGC Act 1956)

Faculty of Engineering & Technology, SRM University, Kattankulathur – 603203
School of Mechanical Engineering

Department of Mechanical Engineering

Course plan

Course code : ME1152 Date : 3/12/14
Course title : Internal Combustion Engines
Semester : IV
Academic year / semester : 2014-15 / Even (January – May 2015)

Section details:

Section	Class Room no	Details of Faculty member				
		Name	Room No.	Intercom No.	e-mail id	Student contact time
Mech –		Dr. M. Cheralathan	MEB304	1804	cheralathan.m@ktr.srmuniv.ac.in	Wednesday 12:45PM-1:30PM
Mech -		Mr.M.Sivashankar	H313	-	sivashankar.m@ktr.srmuniv.ac.in	
Mech -		Mr. R.K.Barathraj	MEB404	1806	barathraj.k@ktr.srmuniv.ac.in	

Direct assessment details:

Name of assessment	Marks	Topics (Tentative)	Tentative date	Duration
Cycle test - I	10	Components Of IC Engines And Performance, Unit-II- Desirable air-fuel ratio for starting, warm-up, acceleration, idling and normal operation. Carburetors	05/02/2015	100 minutes
Surprise test	05	Cooling system, Lubrication system	20/02/2015	30 – 45 min
Cycle test - II	10	Engine auxillary systems, combustion in SI engines	05/03/2015	100 minutes
Model examination	20	Entire Syllabus	15/04/2015	3 hours
End semester examination	50	Entire Syllabus	30/04/2015	3 hours
Attendance	05	N/A		

1. EXPECTED LEARNING OUTCOMES OF THE COURSE

		L	T	P	C
ME0052	INTERNAL COMBUSTION ENGINES	3	0	0	3
	Prerequisite				
	Nil				

Student outcomes	Program Educational Objectives			
	1. Apply / improve their knowledge in basic sciences for excelling in various disciplines of Mechanical Engineering with the emphasis on Design, Thermal and Manufacturing.	2. Enhance professional practice to meet the global standards with ethical and social responsibility.	3. Solve industrial, social, and environmental problems with modern engineering tools.	4. Develop skills to work in teams, think intellectually and pursue life-long learning.
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability		X	X	
(e) an ability to identify, formulate, and solve engineering problems	X		X	
(j) a knowledge of contemporary issues			X	

Course designed by		**Department of Mechanical Engineering**									
1	**Student outcome**	**a**	**B**	**C**	**D**	**e**	**F**	**g**	**h**	**i**	**j**	**k**
				×		×					×	

2	**Category**	**GENERAL (G)**	**BASIC SCIENCES (B)**	**ENGINEERING SCIENCES AND TECHNICAL ART (E)**	**PROFESSIONAL SUBJECTS (P)**
					X

3	**Broad area (for professional courses only, i.e 'under P' category)**	**Manufacturing**	**Design**	**Thermal**	**General**		
				X			
4	**Course Coordinator**	Dr. M. Cheralathan					

2.Syllabus of the course

ME1152 INTERNAL COMBUSTION ENGINES

PURPOSE

On completion of this course, the students are expected to understand the fundamental principle, operation, performance of IC Engines, auxiliary systems, combustion of SI & CI engines, various fuels used and engine emissions.

INSTRUCTIONAL OBJECTIVES

1. Acquire the knowledge of engine components and fuel air cycles.
2. Understand the working of engine auxiliary systems.
3. Understand the combustion aspects of SI Engines
4. Understand the combustion aspects of CI Engines.
5. Know the various alternate fuels, engine emissions, measuring and control techniques

UNIT I - COMPONENTS OF IC ENGINES AND PERFORMANCE (9 hours)

Classification of Internal combustion Engine, Function and operation of Two stroke and Four stroke engines, Comparison of SI and CI and two stroke and four stroke engines, Effects of supercharging and supercharging Types - centrifugal, roots, vane, Types of scavenging process- Design and Performance data, Efficiency, Specific fuel consumption, IMEP determination -Simple calculations - Performance characteristics, Heat balance calculations, Fuel air cycles and their significance, Comparison of air-standard and fuel air cycles.

UNIT II - ENGINE AUXILIARY SYSTEMS (9 hours)

Desirable air- fuel ratios for starting, warm up, acceleration, idling and normal operation, Necessity of Carburetors and their function and types, Function and classification of injection systems, Injection pump, governor and nozzle types, Description of construction and function of Electronic injection system and MPFI systems, Energy requirement of ignition system, need, Types - Battery and Magneto ignition types, Ignition timing and engine parameters, Engine oil properties, lubrication system types - mist, wet sump and dry sump lubrication systems, Types of cooling systems - Direct and Indirect - Coolant and antifreeze solutions.

UNIT III - COMBUSTION IN SI ENGINES (9 hours)

Homogeneous and heterogeneous mixture, Combustion in spark ignition engines, Stages of combustion in spark ignition engines, Flame front propagation, Factors influencing flame speed, Rate of pressure rise, Phenomenon of knock in SI engines, Effect of engine variables on knock, Combustion chambers for SI engines - Smooth engine operation, High power output and thermal efficiency, Stratified charge engine.

UNIT IV - COMBUSTION IN CI ENGINES (9 hours)

Combustion in CI engine, Stages of combustion in CI engines, Factors affecting the delay period - compression ratio, engine speed, output, atomization and duration of injection, quality of fuel, intake temperature, intake pressure, Phenomenon of knock in CI engines, Comparison of knock in SI and CI engines, Air motion - Swirl - Squish.

UNIT V - ALTERNATE FUELS AND EMISSION (9 hours)

Alternate Fuels -Alcohol, Methanol, Ethanol, Gaseous fuel - Hydrogen, CNG, LPG, Biodiesel - production, advantages & disadvantages. Air pollution due to IC engines, Hydrocarbon emission and their reasons, Formation of oxides of nitrogen, CO, Particulates, aldehydes, sulphur, lead and phosphorus emissions, catalytic converter, exhaust gas recirculation, Flame ionization detector, NDIR, smoke types - measuring device. Emission standards. **TOTAL- 45**

TEXT BOOKS

1. Ganesan.V, *"Internal Combustion Engines"*, Tata McGraw-Hill, New Delhi,2009
2. Ramalingam.K.K, *"Internal Combustion Engines- Theory and practice"*,SciTech publications India Pvt. Ltd., Chennai, 2010.

REFERENCES

1. Thipse.S.S, *"Internal Combustion Engines"*, Jaico Publication House., 2010.
2. Thipse.S.S, *"Alternate Fuels"*, Jaico Publication House., 2010.
3. Mathur.M.L and Sharma.R.P, *"A course in Internal Combustion Engines"*, Dhanpat Rai & Sons, New Delhi, 2010.
4. Heywood.J.B, *"Internal Combustion Engine Fundamentals"*, McGraw Hill International, New York, 2008
5. Domkundwar.V.M, *"A course in Internal Combustion Engines"*, Dhanpat Rai & Sons, 2010.

3. SESSION PLAN

ME1152 INTERNAL COMBUSTION ENGINES

SESSION NO	Title / Details of the chapter	References
	COMPONENTS OF IC ENGINES AND PERFORMANCE	
1	Classification of Internal combustion Engine, S.I and C.I Engine Nomenclature and components – materials	T_1 ,chapter 1.1,1.2,1.5 T_2 ,chapter 1.2,1.3,1.4
2	Function and operation of Two stroke and Four stroke engines. Comparison of SI and CI and two stroke and four stroke engines	T_1 ,chapter 1.3 T_2 ,chapter 1.5,1.6
3	Basic concepts, effects and types of supercharging.	T_1 ,chapter 19.1,19.2,19.3 T_2 ,chapter 10.5,10.6
4	Basic concepts and Different methods of scavenging systems	T_1 ,chapter 20.7 T_2 ,chapter 10.1,10.2
5	Determination of IMEP, ISFC, BSFC and efficiency – simple calculations	T_1 ,chapter 17.5,17.11
6	Tutorial –Engine Performance	T_1 ,chapter 17.13,17.15
7	Performance and Characteristics of IC engines	T_1 ,chapter 17
8	Basic concepts of Heat balance and Heat balance sheet calculations	T_1 ,chapter17.31,17.34
9	Fuel air cycles and their significance, Comparison of air standard and fuel air cycles	T_1 ,chapter 4.2,5.2
	ENGINE AUXILLARY SYSTEMS	
10	Desirable air- fuel ratios for starting, warm up, acceleration, idling and normal operation	T_1 ,chapter 8.6,8.7
11	Necessity of Carburetors and their function and types	T_1 ,chapter 8.8,8.13
12	Description of construction and function of Gasoline injection system and MPFI systems	T_1 ,chapter10.2,10.4
13	Description of construction and function of various fuel injection system for diesel engines	T_1 ,chapter 9.9,9.10
14	Construction and working of injection pumps, Nozzles and their types	T_1 ,chapter 9.10.1
15	Basic study of ignition system, need, Battery and Magneto ignition types	T_1 chapter 11.4,11.5, 11.6,11.7,11.11 T_2 ,chapter 5.1,5.10
16	Engine oil properties, lubrication system, need and their types	T_1 ,chapter 13.7
17	Study of lubrication system, need and their types	T_1 ,chapter 13.9
18	Various methods of cooling system in IC Engine with neat sketch, Coolant and antifreeze solutions	T_1 ,chapter 14.9,14.10,14.11.14.12

	COMBUSTION IN SI ENGINES	
19	Homogeneous and heterogeneous mixture, Combustion in spark ignition engines	T_1 ,chapter 12.2,12.3,12.4
20	Stages of combustion in spark ignition engines	T_1 ,chapter 12.5
21	Flame front propagation, Factors influencing flame speed, Rate of pressure rise	T_1 ,chapter 12.6,12.7,12.8 T_2 ,chapter 3.3
22	Description of normal and abnormal combustion ,Effect of knocking combustion,	T_1 ,chapter 12.9,12.10 T_2 ,chapter 3.5
23	Pre-Ignition, Knock and engine variables	T_1 ,chapter 12.11
24	Knock reduction in SI Engine.	T_1 ,chapter 12.10.1
25	Features of combustion chamber in SI engine	T_1 ,chapter 12.12
26	Design consideration of combustion chamber in SI engine	T_1 ,chapter 12.12.1,12.12.2
27	Stratified charged engine.	T_2 ,chapter 8.5 R_3 ,chapter 21.4,21.5
	COMBUSTION IN CI ENGINES	
28	Combustion in CI engine,	T_1 ,chapter 12.13
29	Various stages of combustion in CI engine	T_1 ,chapter 12.14 T_2 ,chapter 6.4
30	Delay period and its effects	T_1 ,chapter 12.14.1 T_2 ,chapter 6.5
31	Effects of diesel knock	T_2 ,chapter 6.6 R_3 ,chapter 6.6
32	Factors influencing diesel knock	T_1 ,chapter 12.15
33	Knock reduction in CI Engine.	T_2 ,chapter 6.6 R_3 ,chapter 6.7
34	Features of combustion chamber in CI engine	T_1 ,chapter 12.18
35	Comparison of knock in SI and CI engines	T_1 ,chapter 12.17
36	Air motion, swirl and squish	T_2 ,chapter 6.3 T_1 ,chapter 12.13
	ALTERNATE FUELS AND EMISSION	
37	Alternate fuels-liquid(Alcohol, Methanol, Ethanol) and gaseous(Hydrogen, CNG, LPG) fuels	T_1 ,chapter 7.4,7.5,7.7,7.8
38	Biodiesel - production, advantages & disadvantages	T_1 ,chapter 7.9
39	Air pollution due to IC engines, Hydrocarbon emission and their reasons	T_1 ,chapter 15.4,15.6
40	Formation of oxides of nitrogen, CO, hydrocarbons and their effects	T_1 ,chapter 15.8,15.9 T_2 ,chapter 8.9,8.10,8.11
41	Formation of Particulates, aldehydes, sulphur, lead and phosphorus emissions and their effects	T_1 ,chapter 15.11,15.12 T_2 ,chapter 8.8

42	catalytic converter, exhaust gas recirculation	T_1 ,chapter 15.14,15.17
43	Exhaust gas analysis, non dispersive infra red gas analyzer, Flame ionization detector,	T_1 ,chapter 16.9.2
44	Gas chromatography, chemiluminescent analyzer	T_1 ,chapter ,16.9.1
45	Smoke types –Measuring device, Emission standards, national and international limits	T_1 ,chapter 16.10,15.3 T_2 ,chapter 8.7

TEXT BOOKS

1. Ganesan.V, *"Internal Combustion Engines"*, Tata McGraw-Hill, New Delhi, 2009.
2. Ramalingam.K.K, *"Internal Combustion Engines- Theory and practice"*, SciTech publications India Pvt. Ltd., Chennai, 2010.

REFERENCES

1. Thipse.S.S, *"Internal Combustion Engines"*, Jaico Publication House., 2010.
2. Thipse.S.S, *"Alternate Fuels"*, Jaico Publication House., 2010.
3. Mathur.M.L and Sharma.R.P, *"A course in Internal Combustion Engines"*, Dhanpat Rai & Sons, New Delhi, 2010.
4. Heywood.J.B, *"Internal Combustion Engine Fundamentals"*, McGraw Hill International, New York, 2008.
5. Domkundwar.V.M, *"A course in Internal Combustion Engines"*, Dhanpat Rai & Sons, 2010.

Name & Signature of Faculty:

Section	Name	Signature
Mech -	Dr.M.Cheralathan	
Mech -	Mr.M.Sivashankar	
Mech-	Mr.R.K.Barathraj	

3/11/14

Dean/Mechanical