SCHEME OF COURSE WORK

Course Details:

Course Title	Advanced IC Engines		
Course Code	19ME2253	**L P C**	**3 0 3**
Program:	M.Tech.		
Specialization:	THERMAL ENGINEERING		
Semester	I		
Prerequisites	Thermodynamics, Thermal Engineering		
Courses to which it is a prerequisite	**:NO**		

Course Outcomes (COs):

At the end of the course, the student will be able to

1	Explain the design and operating parameters of an engine and analyze thermodynamic concepts of fuel-air cycles.
2	Summarize the concepts of volumetric efficiency , turbocharging and supercharging
3	Explain the concepts of types of charge motion within the cylinder and flow in intake manifold
4	Analyze different stages of combustion in SI & CI engines and explain the formation of different pollutants, their effect and their treatment.
5	Discuss the concepts of modern trends in IC engines

Program Outcomes (POs)

At the end of the programme, the students in THERMAL ENGINEERING will be able to

PO Code	Program Outcome (PO)
PO 1	exhibit in-depth knowledge in thermal engineering specialization
PO 2	think critically and analyze complex engineering problems to make creative advances in theory and practice
PO 3	solve problem, think originally and arrive at feasible and optimal solutions with due consideration to public health and safety of environment
PO 4	use research methodologies, techniques and tools, and will contribute to the development of technological knowledge
PO 5	apply appropriate techniques, modern engineering tools to perform modeling of complex engineering problems with knowing the limitations
PO 6	understand group dynamics, contribute to collaborative multidisciplinary scientific research
PO 7	demonstrate knowledge and understanding of engineering and management principles and apply the same with due consideration to economical and financial factors
PO 8	communicate complex engineering problems with the engineering community and society, write and present technical reports effectively
PO 9	engage in life-long learning with a high level of enthusiasm and commitment to improve knowledge and competence continuously
PO 10	exhibit professional and intellectual integrity, ethics of research and scholarship and will realize the responsibility towards the community
PO 11	examine critically the outcomes of actions and make corrective measures

Course Outcome Versus **Program Outcomes:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M		M	S			M					
CO2	M	S		S			M					
CO3	M	S	S	S		M	M					
CO4		S	S	S			M					
CO5		S	S	S			M					

S - Strongly correlated, *M - Moderately* correlated, *Blank - No correlation*

AssessmentMethods	Assignment / Quiz / Seminar / Case Study / Mid-Test / End

Teaching-Learning and Evaluation

Week	TOPIC / CONTENTS	Course Outcomes	Sample questions	TEACHING-LEARNING STRATEGY	Assessment Method & Schedule
1	Engine types, operations, design, operating parameters, fuel air mixtures, Fuel air cycle analysis	CO1	1. Compare between fuel –air cycle and actual cycle 2. Discuss about stratified charge engines	▫ Lecture ▫ Problem solving	Assignment (Week 4 - 6) Mid-Test 1 (Week 9)
2	Propeties of working fluids, characterization of flames, availability analysis of engine , ideal models of engine cycle	CO1	1. Give a brief discussion on characterization of flames 2. Derive an expression for availability of engine process	▫ Lecture / Discussion	Mid-Test 1 (Week 9)
3	Gas exchange process- Volumetric efficiency- factors effecting it, , residual gas	CO2	1. Explain different factors effecting the volumetric efficiency 2. Give a short notes on Ram Effect	▫ Lecture	Seminar (Week 3 – 4) Mid-Test 1 (Week 9)
4	Temperature variation, exhaust gas flow, turbo charging, flow through valves	CO2	1. Explain about flow through valves and their effect on volumetric efficiency 2. Explain turbo charging	▫ Lecture / Discussion	Assignment (Week 4 - 6) Mid-Test 1 (Week 9)
5	Valve lift, valve timing, valve diameter, their effect on volumetric efficiency, Super charging	CO2	1. Explain about the effect of valve diameter on volumetric efficiency. 2. Explain super charging	▫ Lecture/ Discussion	Assignment (Week 4 - 6) Mid-Test 1 (Week 9)
6	Charge motion- Turbulence, swirl, squish, crevice flows, blowby	CO3	1. Differentiate between swirl and turbulence 2. Explain blowby	▫ Lecture	Mid-Test 1 (Week 9)
7	Charge motion- Turbulence, swirl, squish, crevice flows, blowby	CO3	1. Differentiate between swirl and turbulence 2. Explain blowby	▫ Lecture/ Discussion	Mid-Test 1 (Week 9)
8	Carburetors	CO3	1. Explain the defects in carburetor 2. Explain different compensating devices for carburetors	▫ Lecture/ Discussion	Mid-Test 1 (Week 9)

9	**Mid-Test 1**	CO1, CO2, CO3			
10	Fuel injection systems, flow pas throttle plate,	CO3	1. Explain solid fuel injection. 2. Explain about throttle body injection	▫ Lecture ▫ Discussion	Seminar (Week 10) Mid-Test 2 (Week 18)
11	Flow in intake manifolds	CO3	1. Explain about the charge motion across throttle plate. 2. Explain about charge motion in intake manifolds	▫ Lecture ▫ Discussion	Mid-Test 2 (Week 18)
12	SI Engine Combustion, stages, mixture requirement, Factors, factors effecting the flame propagation	CO4	1. Explain different stages of combustion. 2. Explain the factors effecting the flame propagation	▫ Lecture ▫ Discussion	Assignment (Week 14 - 16) (Mid-Test 2 (Week 18)
13	Abnormal combustion, factors effecting it, types of abnormal combustion	CO4	1. Explain knock in SI engine 2. Explain the theories of detonation	▫ Lecture ▫ Discussion	Seminar (Week 13) (Mid-Test 2 (Week 18)
14	CI Engine combustion- stages, factors effecting the ignition delay	CO4	Different factors effecting the ignition delay	▫ Lecture	Assignment (Week 14 - 16) (Mid-Test 2 (Week 18)
15	Fuel spray behavior, Mixing –controlled combustion	CO4	Explain the fuel spray behavior for CI Engine	▫ Lecture	Assignment (Week 14 - 16) (Mid-Test 2 (Week 18)
16	Pollutants formation- CO, CO2, NOx, HC in SI and CI Engines, Aftertreatment devices- CATCONs	CO4	Explain the formation of HC Explain the tradeoff between NOx and HC.	▫ Lecture	Assignment (Week 14 - 16) (Mid-Test 2 (Week 18)
17	Modern Trends in IC engines- HCCI, VCR, GDI	CO5	Explain the concepts of GDI Give a short notes on HCCI engines	▫ Lecture	Assignment (Week 14 - 16) (Mid-Test 2 (Week 18)
18	**Mid-Test 2**	**C03,CO4, C O5**			
19/20	**END EXAM**				