

**NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI**

This course outline template acts as a guide for writing your course outline. As every course is different, please feel free to amend the template/ format to suit your requirements.

<b>COURSE OUTLINE TEMPLATE</b>			
<b>Course Title</b>	<b>THERMAL ENGINEERING</b>		
<b>Course Code</b>	<b>MEPC16</b>	<b>No. of Credits</b>	<b>3</b>
<b>Department</b>	<b>MECHANICAL</b>	<b>Faculty</b>	<b>Dr.M.UDAYAKUMAR</b>
<b>Pre-requisites Course Code</b>	<b>MEPC11</b>		
<b>Course Coordinator(s) (if, applicable)</b>	<b>NIL</b>		
<b>Other Course Teacher(s)/Tutor(s) E-mail</b>	<b>NIL</b>	<b>Telephone No.</b>	<b>9487257871</b>
<b>Course Type</b>	<b>Core course</b>		
<b>COURSE OVERVIEW</b>			
<ul style="list-style-type: none"> <li>• <b>Apply the laws of thermodynamics to analyse the performance of single /multi stage reciprocating air compressors to obtain expressions for work done, and volumetric efficiency.</b></li> <li>• <b>Study in detail various systems and subsystems of internal combustion engines</b></li> <li>• <b>Analyse the performance and emission characteristics of SI and CI engines.</b></li> <li>• <b>Study formation of CO, NOx and unburnt HC in ic engines and Control of emissions</b></li> </ul>			
<b>COURSE OBJECTIVES</b>			
<ol style="list-style-type: none"> <li>1. <b>To familiarize with the types of air compressors, working principle of two stroke and four stroke engines</b></li> <li>2. <b>To learn various systems and sub systems of IC engines.</b></li> <li>3. <b>Analyse the performance and emission characteristics of SI and CI engines.</b></li> </ol>			

<b>COURSE OUTCOMES (CO)</b>			
<b>Course Outcomes</b>			<b>Aligned Programme Outcomes (PO)</b>
<p>On completion of the course, the students will be able to:</p> <p>At the end of the course student will</p> <ol style="list-style-type: none"> <li>1. Be able to carry out thermodynamic analysis on compressors</li> <li>2. Possess knowledge of various I c engine systems and subsystems.</li> <li>3. Have capability to perform tests on compressors and ic engines, study the performance trends and carry out analysis.</li> </ol>			<b>PO-1, PO-2, PO-3, PO-4, PO-5, PO-6, PO-7, PO-8, PO-9, PO-10, PO-11, PO-12</b>
<b>COURSE TEACHING AND LEARNING ACTIVITIES</b>			
<b>S.No.</b>	<b>Week</b>	<b>Topic</b>	<b>Mode of Delivery</b>
<b>1</b>	<b>WEEK-1</b>	<b>Introduction to Thermal Engineering, Review of thermodynamics, Rec. compressor geometry, terminology and work done and vol. efficiency</b>	<b>Chalk and Talk and ppts</b>
	<b>WEEK-2</b>	<b>Multi stage compression, intermediate pr between stages, min. work with perfect i.c.</b>	<b>-do-</b>
	<b>WEEK-3</b>	<b>Mechanical effcincy, cy. Dimensions, problems. Introduction to IC engines</b>	<b>-do-</b>
	<b>WEEK-4</b>	<b>4-s cycle SI and CI engines. Valve timing, deviation between actual and p-v diagrams. mep s. perf. curves</b>	<b>-do-</b>
	<b>WEEK-5</b>	<b>2-s cycle engines, port timing diagram, scavenging. Problems on performance</b>	<b>-do-</b>
	<b>WEEK-6</b>	<b>Fuel air requirements, carburetor, improvements, MPFI- k-jetronics, M-Jetronics, Lamda sensor, feedback</b>	<b>-do-</b>

	WEEK-7	Battery ignition system, magneto ignition system comparison with ECU. Diesel fuel pump and nozzle	-do-
	WEEK-8	Lubrication, different types, components. Combustion in SI engines, abnormal combustion, knocking in SI engines & factors	-do-
	WEEK-9	Fuel rating for SI engines, RON, MON Testing . combustion in CI engines, 3-phases of combustion.	-do-
	WEEK-10	Diesel fuel rating . cetane number, cooling in ic engines. Turbocharging and super charging types	-do-
	WEEK-11	Engine Testing for performance, heat balance, Morse test and problems.	-do-
	WEEK-12	Pollutant formation: CO, NOx and unburnt HC – Mechanisms, control, catalytic control	-do-
	WEEK-13	Comparison-SI and CI, DI and IDI, constant speed-variable speed engines. Alternative fuels. Engine indicator and its use in performance stu	-do-
	WEEK-14		
<b>COURSE ASSESSMENT METHODS</b>			
<b>S.No.</b>	<b>Mode of Assessment</b>	<b>Week/Date</b>	<b>Duration</b>
			<b>% Weightage</b>

1	Cycle Test-1	7 <sup>th</sup> week	1 Hour	20%
2	Cycle Test-1	12 <sup>th</sup> week	1 Hour	20%
3	Retest	14 <sup>th</sup> week	1 Hour	
4	Seminar	9 <sup>th</sup> week – 14 <sup>th</sup> week		10%
5			3 Hour	50%
<b>Total = 100 Marks</b>				
<b>ESSENTIAL READINGS : Textbooks, reference books Website addresses, journals, etc</b>				
<ol style="list-style-type: none"> <li>1. J.B.Heywood, “ IC Engines Fundamentals,” 2 Ed., McGraw Hill, 2012</li> <li>2. V. Ganesan, “ Internal Combustion Engines” 4<sup>th</sup> Ed. Tata McGraw Hill 2014</li> </ol>				

<b>COURSE EXIT SURVEY (mention the ways in which the feedback about the course is assessed and indicate the attainment also)</b>
<ol style="list-style-type: none"> <li>1. Feedback from students during class committee meeting</li> <li>2. Anonymous feedback through questionnaire ( as followed currently)</li> </ol>

<b>COURSE POLICY (including plagiarism, academic honesty, attendance, etc.)</b>
<ol style="list-style-type: none"> <li>1. Test 1 and Test2 will be conducted in the class. Use of approved Tables and scientific calculator permitted</li> <li>2. 75% attendance compulsory for wring the end semester examination</li> </ol>
<b>ADDITIONAL COURSE INFORMATION</b>
The Faculty is available for consultation after the class hours in the Mech. Engg. Dept. Faculty may also be contacted on mobile : 9487257871
<b>FOR SENATE'S CONSIDERATION</b>
<p>Course Faculty _____ CC-Chairperson _____ HOD</p> <p>_____</p>

Course Content

Reciprocating air compressors - types - construction - work of compression without clearance - effect of clearance – Multistaging - optimum intermediate pressure for perfect inter cooling - Compressor efficiencies and mean effective pressure.

Working of two and four stroke engines - valve and port timing diagrams - Deviation of engine indicator diagram from air standard cycles - Fuel air cycles and their analysis, Comparison of air standard and fuel air cycles - Losses in actual cycles.

I.C. engines fuels and rating -SI engine air fuel mixture requirements - Performance curve of an automobile carburetor - Diesel injection systems - types - Jerk type pump - Injection pump governors. Types of nozzles - Introduction to petrol injection.

Battery Ignition - magneto ignition and transistorized coil ignition - Combustion in SI engines - Knock in SI engines - effect of engine variables on knock - Combustion in CI engines - knock in CI engines - combustion chambers for SI and CI engines.

I.C. Engine testing - Measurement of friction power - Indicated power - Electronic Indicator-Brake power - dynamometers - Instruments for measuring emission of NO<sub>x</sub>, CO, Unburnt HC and smoke - engine efficiencies - Heat balance - Scavenging in two stroke engines.