

**DEPARTMENT OF MECHANICAL ENGINEERING**

**NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI**

<b>COURSE PLAN – PART I</b>			
<b>Name of the programme and specialization</b>	<b>M. Tech. THERMAL POWER ENGINEERING</b>		
<b>Course Title</b>	<b>ADVANCED IC ENGINES</b>		
<b>Course Code</b>	<b>ME 643</b>	<b>No. of Credits</b>	<b>3</b>
<b>Course Code of Pre-requisite subject(s)</b>	-		
<b>Session</b>	<b>July 2021</b>	<b>Section (if, applicable)</b>	-
<b>Name of Faculty</b>	<b>Dr. R. Anand</b> Associate Professor	<b>Department</b>	<b>Mechanical</b>
<b>Email</b>	<b>anandachu@nitt.edu</b>	<b>Telephone No.</b>	<b>0431 2503423</b>
<b>Name of Course Coordinator(s) (if, applicable)</b>	-		
<b>E-mail</b>	-	<b>Telephone No.</b>	-
<b>Course Type</b>	<input checked="" type="checkbox"/> <b>Core course</b> <input type="checkbox"/> <b>Elective course</b>		
<b>Syllabus (approved in BoS)</b>			
<p>Combustion process in SI and CI engines, Combustion chambers and abnormal combustion.</p> <p>Composition and effect of Fossil and Alternative Fuels in IC Engine.</p> <p>IC Engine Modelling – Zero-dimensional, Two zone and Multi zone modelling</p> <p>Instrumentation to study the combustion process in engines such as Particle image velocimetry</p> <p>Holographic PIV, Spray visualization, Phase Doppler interferometry for spray characterization</p> <p>Pollutant formation in SI and CI engines and Control measures such as DOC, DPF, SCR and LNT</p>			
<b>COURSE OBJECTIVES</b>			
<ol style="list-style-type: none"> <li>1. Learn to classify different types of internal combustion engines and their applications.</li> <li>2. Apply principles of thermodynamics, fluid mechanics, and heat transfer to the design and analysis of engines and engine components.</li> <li>3. Become aware of the relevance of environmental and social issues on the design process of internal combustion engines.</li> </ol>			

4. Develop mathematical methods for designing components and systems 5. Apply numerical methods to perform design calculations. 6. Advance proficiency in professional communications and interactions.									
COURSE OUTCOMES (CO)									
Course Outcomes			Aligned Programme Outcomes (PO)						
At the end of the course student will be able to 1. Understand the combustion phenomena in SI and CI engines. 2. Study the characteristics of fossil and alternative fuels and their effect on the performance of IC engines. 3. Explain the recent technologies to tradeoff engine performance and emission characterization. 4. Explain the advanced imaging techniques to study the combustion and spray characteristics of the fuel. 5. Identify the exhaust pollutants and measurement techniques.			POs/COs		Course Outcomes (Cos)				
			Programme Outcomes (POs)		CO1	CO2	CO3	CO4	CO5
				PO1	H	H	H	H	H
				PO2	H	H	H	M	M
				PO3	M	H	L	L	L
				PO4	L	M	M	L	L
				PO5	L	L	L	M	M
				PO6	M	H	M	H	H
				PO7	H	M	H	H	H
				PO8	H	M	H	M	H
				PO9	M	L	H	H	H
				PO10	L	L	M	H	M
PO11	L	M	L	M	H				

COURSE PLAN – PART II			
COURSE OVERVIEW			
This course studies the fundamentals of how the design and operation of internal combustion engines affect their performance, efficiency, fuel requirements, and environmental impact. Measuring techniques for the analyzing of engines as well as engine control are presented. Spray characterization techniques such as PIV and PD are discussed. Fuel aspects with emphasis on engine performance and emissions are presented.			
COURSE TEACHING AND LEARNING ACTIVITIES			
S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	1 <sup>st</sup> week	Combustion in SI engines	PPT
2	2 <sup>nd</sup> week	Combustion in CI engines and types of combustion chamber	PPT
3	3 <sup>rd</sup> week	Alternative fuels-liquid (Alcohol, Methanol and Ethanol) and gaseous (LPG, CNG and Hydrogen) fuels	PPT
4	4 <sup>th</sup> week	Effect of alternative fuels on IC engine performance and emission characteristics	PPT
5	5 <sup>th</sup> week	IC Engine Modelling - Introduction	PPT

6	6 <sup>th</sup> week	Zero-dimensional, Two zone and Multi zone modelling	PPT
7	7 <sup>th</sup> week	Instrumentation to study the combustion process in engines	PPT
8	8 <sup>th</sup> week	Particle image velocimetry	PPT
9	9 <sup>th</sup> week	Holographic PIV	PPT
10	10 <sup>th</sup> week	Spray visualization	PPT
11	11 <sup>th</sup> week	Phase Doppler interferometry for spray characterization	PPT
12	12 <sup>th</sup> week	Pollutant formation in SI and CI engines	PPT
13	13 <sup>th</sup> week	Control measures such as DOC, DPF, SCR and LNT	PPT

#### COURSE ASSESSMENT METHODS

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Cycle Test - 1	After 7 <sup>th</sup> week	60 Minutes	25
2	Cycle Test - 2	After 12 <sup>th</sup> week	60 Minutes	25
3	Assignment / Seminar Presentation			20
4	Compensation Assessment	December 2 <sup>nd</sup> week	60 Minutes	25
5	Final Assessment	December 3 <sup>rd</sup> week	180 Minutes	30

#### ESSENTIAL READINGS: Textbooks, reference books, etc.

1. Heywood, JB., *Internal Combustion Engine Fundamentals*, McGraw-Hill, 1988.
2. Gill, PWS., Smith, JR., and Ziurys, J., *Fundamentals of internal combustion engines*, Oxford and IBH, New Delhi, 1959.
3. Taylor, CF., *The Internal combustion Engine in theory and practice*, MIT Press, Cambridge, 1985.
4. Obert, EF., *Internal Combustion Engines and Air Pollution*, Intext Educational Publishers, New York, 1973.
5. Bechtold, RL., *Alternative Fuels Guidebook, Properties, Storage, Dispensing, and Vehicle Facility Modifications*, SAE Publications, 1997.
6. Patterson DJ., and Henein NA., *Emission from Combustion engines and their control*, Ann Arbor science publishers, 1981.
7. Heisler, H., *Advanced Engine Technology*, ISBN 0340568224, SAE Publications, 1995.
8. Lumley, JL., *Engines: An Introduction*, Cambridge University Press, 1999.

#### COURSE EXIT SURVEY

1. Students can meet the faculty at any stage in the course duration in case he/she finds difficulty in understanding the concept.

2. Feedback form issued to students to express their comments about the course after completing the syllabus. Students are requested to give genuine feedback about the course.
3. Student knowledge about the topic covered in this course will be judged based on the marks obtained in the written examinations.

## **COURSE POLICY**

### **MODE OF CORRESPONDENCE**

- Students must attend all the classes regularly.
- The Institute follows relative grading with flexibility given to teachers to decide the mark ranges for grades.
- All assessment of a course will be done on the basis of marks.

### **COMPENSATION ASSESSMENT POLICY**

Students who absent for Written test - I & II for genuine reasons may be permitted for writing compensation assessment. The syllabus for the compensation assessment will be for those prescribed for the written test I & II and prior approval from the faculty in-charge is mandatory for appearing compensation assessment.

### **ATTENDANCE POLICY**

- **At least 75% attendance in each course is mandatory.**
- **A maximum of 10% shall be allowed under On Duty (OD) category.**
- Students with **less than 65% of attendance** shall be prevented from writing the final assessment and **shall be awarded 'V' grade.**


### **ACADEMIC DISHONESTY & PLAGIARISM**

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.

### **ADDITIONAL INFORMATION**

- Students can reach course faculty by fixing appointment through E-mail: anandachu@nitt.edu or phone (9444838909)

### **FOR APPROVAL**

  
**Dr. R. Anand**  
Course Faculty

  
30/09/2021  
**CC-Chairperson**

  
30/09/2021  
**Head of the Department**

**Guidelines:**

- a) The number of assessments for a course shall range from 4 to 6.
- b) **Every course shall have a final assessment on the entire syllabus with at least 30% weightage.**
- c) **One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered.**
- d) **The passing minimum shall be as per the regulations.**

B.Tech. Admitted in					P.G.
2019	2018	2017	2016	2015	
35% or class average/2 whichever is greater.			Peak/3 or class average/2 whichever is lower		40%

- e) **Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.**
- f) **Absolute grading policy shall be incorporated if the number of students per course is less than 10.**
- g) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.