GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Mechanical (I.C.Engine And Automobile Engineering)

Subject Code : ME02080051

Course / Subject Name : High Speed Diesel Engines

w. e. f. Academic Year:	2024-25
Semester:	2
Category of the Course:	Professional Elective Course

Prerequisite:	Basic fundamentals knowledge of Internal combustion engines at undergraduate level.
Rationale:	This subject is in extension to fundamentals of internal combustion engines. The subject focuses on imparting knowledge and operations regarding diesel engines and its components with use of Supercharging and Turbocharging of diesel engines. This course imparts detailed study on Performance and maintenance of special featured diesel engines for agricultural, marine, automotive and small and large Industrial applications.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Basic Understanding of diesel engine, basic, thermodynamic analysis and effect of various performance parameters on engine performance.	U
2	Understanding combustion chamber process its types constructional features in diesel engine	R
3	Knowledge of various components of diesel engine	R
4	Understand, selection phenomena of Supercharging and Turbocharging of diesel Engine	N
5	Performance analysis, maintenance of diesel engine and special features of agricultural marine, automotive and small and large Industrial applications.	A

Teaching and Examination Scheme:

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Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Introduction of diesel engine- concept of low, medium and high speed diesel engine concept. Basic operations (four stroke); thermodynamic cycles (Ideal and actual); various losses; limitations; compression ratio; Combustion stages; Delay period. Factors affecting delay period and its effect on engine performance of engine.	08	19
2.	Introduction of combustion chamber in diesel engine; combustion chamber requirements; types of air motion; Swirl flow and swirl ratio; types of swirl; Types, design and constructional features and relative merits of open, pre-combustion, swirl, air cell and energy cell combustion chamber; M-combustion chamber; latest developments of combustion chamber.	08	19
3.	Functions of components; Plunger and distributor pumps; pressure valves; Fuel injector; types of injection nozzle; spray characteristics; valve opening and closing pressures; quantity and duration of fuel injection; injection timing; nozzle cooling.	09	19
4.	Supercharging and Turbocharging of diesel engine; necessity and limitations; Turbochargers for automotive diesel engines, Small industrial and marine engine turbochargers, Large industrial and marine engine turbochargers. Principles of pulse and pulse converter turbocharging.	10	24

5	Performance and maintenance of diesel engine; piston cooling; Cavitation in cooling system; Engine with different types of combustion chamber; Multi fuel engines; pilot injection; special features of agricultural and industrial engines.	10	19
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	**20**	**35**	**25**	**--**	**--**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Diesel engine reference book, second edition- Butterworth and Heinemann edited by Bernard challen and Rodica Baranescu.
2. Diesel Engine Operation and Maintenance,V.L.Maleev,
3. Introduction to Internal Combustion Engines", Richard Stone, McMillan,London
4. Internal Combustion Engines Fundamentals – John B. Heyhood, McGrawHill
5. High Speed Diesel Engines,A.W.Judge,
6. high Speed Diesel Engines,P.M.Heldt,
7. Combustion engine processes,Lichty,
8. Supercharging,Vincent
9. Diesel engine system Design- Woodhead Publishing Limited, 2011, Qianfan Xin

(b) Open-source software and website:

1. E-materials available at the website of NPTEL- http://nptel.ac.in/

Suggested Course Practical List: If any

1. To Study delay period, factor affecting and its effect on engine performance.
2. To compare thermodynamically ideal and actual cycles.
3. To study and demonstrate different types of combustion chamber used in the latest IC engine.

4. To study the swirl in a high-speed diesel engine.
5. To study and demonstrate the plunger and distributor pumps and nozzles.
6. To study the turbocharging system used in Bus and Trucks.
7. To study of Bi-fuel engines.
8. To study maintenance of high-speed diesel engines by visiting any automotive workshop.

List of Laboratory/Learning Resources Required:

- Necessary Engine Lab with cut section of engine with its sub system parts and apparatus are to be provided for conducting above said practical in a group of maximum four students.

Suggested Project List:

The following project ideas are designed to provide practical experience and deeper understanding of the concepts covered in the "High Speed Diesel Engines" course. These projects aim to address real-world challenges and innovations in the field of High Speed Diesel Engines applications.

Project 1: Comparative study of engine specifications of agricultural, marine, automotive and small and large Industrial applications.

Project 2: Comparative study of turbocharger specifications of agricultural, marine, automotive and small and large Industrial applications.

Project 3: Importance of two stroke and four stoke engine in marine applications with its specifications.

Project 4: Comparative study of injection system and engine chamber design of agricultural, marine, automotive and small and large Industrial applications.

Project 5: Application of Matching of turbo-charger.

These projects aim to provide practical experience and enhance understanding of key concepts in High Speed Diesel Engines, preparing students for future challenges and innovations in the said field.

Suggested Activities for Students: Engaging students in practical activities is crucial for enhancing their understanding and skills in the field of High Speed Diesel Engines. Here are suggested activities that can complement the theoretical learning and laboratory experiments:

1. Field Trips and Industry Visits of specific application of said subjects:
2. Guest Lectures and Expert Talks:
3. Technical Workshops and Hands-on Training:
4. Design and Innovation Challenges:
5. Research Projects on Emerging Technologies:

6. Case Studies and Problem-Based Learning:
7. Simulation Exercises:
8. Public Awareness Campaigns:
9. Hackathons and Prototyping Events:
10. Internships and Industry Projects:

These activities are designed to complement classroom learning and laboratory experiments, providing students with a holistic educational experience in the field of electrical and hybrid vehicles. They promote practical skills development, critical thinking, and preparation for future careers in the evolving automotive industry.

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