POORNIMA
COLLEGE OF ENGINEERING

COURSE FILE

COURSE: Bachelor of Technology (B. Tech.)

SEMESTER: VII

SUBJECT: I C Engine

SUBJECT CODE: 7ME5-11

SESSION: 2020-2021

NAME OF FACULTY: Dr. Narayan Lal Jain

DEPARTMENT: Mechanical Engineering

ISI-6, RIICO Institutional Area, Sitapura, Jaipur-302022 (Rajasthan)

Phone - 9928555222

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Sitapura, JAIPUR

Vision & Mission Statements of the Institute

Vision of Institution

To create knowledge based society with scientific temper, team spirit and dignity of labor to face the global competitive challenges

Mission of Institution

To evolve and develop skill based systems for effective delivery of knowledge so as to equip young professionals with dedication & commitment to excellence in all spheres of life

Vision & Mission Statements of the Department

Vision of Department

To be recognized for quality education in the field of Mechanical Engineering and identified for its innovation & excellence

Mission of Department

• To provide education that transforms students through rigorous teaching and thought process to fulfill the needs of the society and industry

• To collaborate with leading industry partners and other academic & research institutes around the world to strengthen the education and research ecosystem.

• To prepare students with life-long learning for their career by fostering in them the ethical & technical capabilities pertinent to mechanical & allied engineering.

PEO of the Department

Program Educational Objectives (PEOs)

PEO 1: Graduate will have Fundamental & multidisciplinary knowledge with an ability to analyze, design, innovates and handles the realistic problems.

PEO 2: Graduate will possess ethical conduct, sense of responsibility to serve society and protect the environment.

PEO 3: Graduate will have strong foundation in academics, leadership qualities and lifelong learning for a prosperous professional career.

Program Outcomes (PO)

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSOs)

PSO1. Design, analyze and innovate solutions to technical issues in Thermal, Production and Design Engineering.

PSO2. Exhibit the knowledge and skills in the field of Mechanical & Allied engineering concepts.

PSO3. Apply the knowledge of skills in HVAC&R and Automobile engineering.

MAPPING OF THE INSTITUTE MISSION STATEMENT WITH OF INSTITUTES VISION STATEMENT

To **evolve and develop skill based systems** for **effective delivery of knowledge** so as to equip young professionals with **dedication & commitment** to excellence in all spheres of life	To create knowledge based society with **scientific temper**, **team spirit** and **dignity of labor** to face the global competitive challenges		
	IV1: Scientific temper	**IV2:** Team spirit	**IV3:**Dignity of labor
IM1: Evolve and develop skill based systems	2	3	2
IM2: Effective delivery of knowledge	3	1	1
IM3: Dedication &Commitment	1	2	3

MAPPING OF THE DEPARTMENT VISION STATEMENT WITH OF INSTITUTES MISSION STATEMENT

To be recognized for quality education in the field of Mechanical Engineering and identified for its innovation & excellence	**To evolve and develop skill based systems for effective delivery of knowledge so as to equip young professionals with dedication & commitment to excellence in all spheres of life**		
	IM1: Evolve and develop skill based systems	**IM2: Effective delivery of knowledge**	**IM3: Dedication & Commitment**
DV1: To be recognized for quality education	**3**	**3**	**3**
DV2: To be identified for innovation	**3**	**2**	**3**
DV3: To be identified for excellence	**3**	**3**	**3**

MAPPING OF DEPARTMENTS MISSION STATEMENT WITH DEPARTMENTS VISION STATEMENT

Key Phrases of the Mission Statement of the Department	To be recognized for **quality education** in the field of Mechanical Engineering and identified for its **innovation & excellence**		
	DV1: To be recognized for quality education	**DV2: To be identified for innovation**	**DV3: To be identified for excellence**
DM1:- To provide **education** that transforms students through rigorous teaching and **thought process** to fulfill the needs of the society and industry.	3	2	2
DM2:- To **collaborate** with leading industry partners and other academic & research institutes around the world to strengthen the education and research ecosystem.	2	3	2
DM3:- To prepare students with **life-long** learning for their career by fostering in them the **ethicaltechnical** capabilities pertinent to mechanical & allied engineering.	3	2	3

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MAPPING OF PEOs STATEMENT WITH MISSION STATEMENT OF THE DEPARTMENT

PEOs	PEO Statements	M1	M2	M3
PEO 1	Graduate will have Fundamental & multidisciplinary knowledge with an ability to analyze, design, innovate and handle the realistic problems.	3	2	2
PEO 2	Graduate will Possess ethical conduct, sense of responsibility to serve society and protect the environment.	2	2	3
PEO 3	Graduate will have strong foundation in academics, leadership qualities and lifelong learning for a prosperous professional career.	2	3	2

MAPPING OF DEPARTMENT PSOs STATEMENT WITH DEPARTMENT MISSION STATEMENT

PSO Statements	Key Phrases of the Mission of the Department		
	DM1:- To **provide education** that transforms students through rigorous teaching and thought process **to fulfill the needs of the society and industry.**	DM2:- To collaborate with **leading industry partners and other academic & research institutes** around the world **to strengthen the education and research ecosystem.**	DM3:- To prepare students with **life-long learning** for their career by fostering in them the **ethical & technical capabilities** pertinent to **mechanical & allied engineering.**
PSO1:-Design, analyze and innovate solutions to technical issues in **Thermal, Production and Design Engineering.**	**3**	**3**	**3**
PSO2:-Exhibit the **knowledge and skills in the field of Mechanical & Allied engineering** concepts	**3**	**2**	**3**
PSO3:-Apply the knowledge of skills in HVAC & R and Automobile engineering	**3**	**3**	**3**

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MAPPING OF DEPARTMENT PEO STATEMENT WITH POs STATEMENT AND DEPARTMENT PSOs

PEOs / POs & PSOs	**PEO 1**: Graduates will have good fundamental & multidisciplinary knowledge with an ability to analyze, design, innovate and handle the realistic problems	**PEO 2**: Graduates will possess ethical conduct, sense of responsibility to serve society and protect the environment.	**PEO 3**: Graduates will have a strong foundation in academics, leadership qualities and lifelong learning for a prosperous professional career
1. Engineering knowledge:	**3**	**-**	**2**
2. Problem analysis:	**3**	**-**	**2**
3. Design/development of solutions:	**3**	**-**	**2**
4. Conduct investigations of complex problems:	**3**	**-**	**2**
5. Modern tool usage:	**3**	**-**	**2**
6. The engineer and society:	**2**	**3**	
7. Environment and sustainability:	**2**	**3**	**2**
8. Ethics:		**3**	**3**
9. Individual and team work:	**1**	**2**	**3**
10. Communication:	**1**	**2**	**3**
11. Project management and finance:	**1**	**2**	**3**
12. Life-long learning:	**2**	**2**	**3**
PSO1: Design, analyze and innovate solutions to technical issues in Thermal, Production and Design Engineering.	**3**	**-**	**2**
PSO2: Exhibit the knowledge and skills in the field of Mechanical & Allied engineering concepts	**3**	**2**	**2**
PSO3: Apply the knowledge of skills in HVAC&R and Automobile engineering	**3**	**3**	**3**

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MAPPING OF DEPARTMENT PSOs WITH DEPARTMENT PEOs

PSO / PEO	**PSO1:** Design, analyze and innovate solutions to technical issues in Thermal, Production and Design Engineering.	**PSO2:** Exhibit the knowledge and skills in the field of Mechanical & Allied engineering concept	**PSO3:**Apply the knowledge of skills in HVAC&R and Automobile engineering
PEO 1: Graduates will have good fundamental & multidisciplinary knowledge with an ability to analyze, design, innovate and handle the realistic problems.	**3**	**3**	**2**
PEO 2: Graduates will possess ethical conduct, sense of responsibility to serve society and protect the environment.	**1**	**2**	**3**
PEO 3: Graduates will have a strong foundation in academics, leadership qualities and lifelong learning for a prosperous professional career.	**1**	**1**	**3**

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POORNIMA
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7ME5-11: I. C. Engines

Credit: 3 **Max. Marks: 150 (IA: 30, ETE:120)**

3L+0T+0P **End Term Exam: 3 Hours**

1

Introduction: Objective, scope and outcome of the course.

2

History of IC engines: Nomenclature, Classification & Comparisons & CI, 4stroke- 2 stroke, First Law analysis, Energy Balance. Fuel- air cycles, Actual cycles.

3

Testing & Performance: Performance parameters, Measurement of operating parameters e.g. speed, fuel & air consumption, Powers, IHP, BHP, FHP, Efficiencies Thermal, Mechanical, Volumetric, Emission Measurement, Indian & International standards of Testing, Emission.

4

Fuel & Combustion: Combustion in CI & SI engines, Ignition Limits, Stages of combustion, Combustion parameters. Delay period and Ignition Lag, Turbulence and Swirl, Effects of engine variables on combustion parameters, abnormal combustion in CI & SI engines, Detonation & knocking, Theories of detonation, Control of abnormal combustion, Combustion chamber design principles, Types of combustion chamber.

5

Alternative Fuels: Methanol, Ethanol, Comparison with gasoline, Manufacturing, Engine performance with pure Methanol, Ethanol &blends, Alcohols with diesel engine, Vegetable oils, Bio gas.

6

Engine Systems & Components: Fuel System (SI Engine), Carburetion & Injection, process & parameters, properties of A/F mixture, Requirements of A/F ratios as per different operating

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conditions, Carburetors, types, Aircraft carburetor, comparison of carburetion & injection, F/A ratio calculations.

7

CI engine: Mixture requirements & constraints, Method of injection, Injection systems, CRDI etc. system components, pumps injectors.

8

Ignition system: Conventional & Modern ignition systems Magneto v/s Battery, CB point v/s Electronic ignition, Fuel Ignition Energy requirements. Spark advance, centrifugal, vacuum Firing order, spark plugs.

9

Engine Friction & Lubrication: Determination of friction, Lubrication principles, Types of lubrication, Places of lubrication Bearings and piston rings etc., Functions of Lubrication, Properties, Rating and Classification of lubricating oil, Additives, Lubrication systems. Engine Cooling: Requirements of cooling, Areas of heat flow, High temperature regions of combustion chamber. Heat Balance, Cooling Systems, Air, Water Cooling, Cooling system components.

10

Supercharging: Objectives, Thermodynamic cycle & performance of super charged SI & CI engines, Methods of super charging, Limitations, Two stroke engines: Comparison of 4s & 2s engines construction & valve lining scavenging. Process parameters, systems, supercharging of 2 stroke engines.

11

Dual & Multi fuel engines: Principle, fuels, Combustion, performance Advantages, Modification in fuel system.

12

Special Engines: Working principles of Rotary, Stratified charge, Free piston, Variable compression ratio engines.

POORNIMA
COLLEGE OF ENGINEERING

(Odd Semester-2020-21)
ABC Analysis

Course: B. Tech. | **Class/Section: III Year (A+B)** | **Date: 2/07/2020**
Name of Faculty: Dr. Narayan Lal Jain | **Name of Subject: I C Engine** | **Subject Code: 7ME5-11**

Unit No.	Category A (Hard topics)	Category B (Topics with average hardness level)	Category C (Easy to understand topics)
2	First Law analysis, Energy Balance.	Fuel- air cycles, Actual cycles.	History of IC engines: Nomenclature, Classification & Comparisons & CI, 4stroke- 2 stroke
3	Measurement of operating parameters e.g. speed, fuel & air consumption, Powers, IHP, BHP, FHP,	Efficiencies Thermal, Mechanical, Volumetric, Emission Measurement, Indian & International standards of Testing, Emission.	Performance parameters
4	Detonation & knocking, Theories of detonation, Control of abnormal combustion	Combustion in CI & SI engines, Ignition Limits, Stages of combustion, Combustion parameters. Delay period and Ignition Lag, Turbulence and Swirl, Effects of engine variables on combustion parameters, abnormal combustion in CI & SI engines	Combustion chamber design principles, Types of combustion chamber
5	Engine performance with pure Methanol, Ethanol & blends, Alcohols with diesel engine,	Vegetable oils, Bio gas.	Methanol, Ethanol, Comparison with gasoline, Manufacturing.

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6	Aircraft carburetor, comparison of carburetion & injection, F/A ratio calculations.	Injection, process & parameters, properties of A/F mixture, Requirements of A/F ratios as per different operating conditions.	Fuel System (SI Engine), Carburetion Type
7	Mixture requirements & constraints	Injection systems, CRDI etc. system components, and pumps injectors.	Method of injection,
8	Magneto v/s Battery, CB point v/s Electronic ignition, Fuel Ignition Energy requirements.	Spark advance, centrifugal, vacuum Firing order, spark plugs.	Conventional & Modern ignition systems
9	Bearings and piston rings Areas of heat flow, High temperature regions of combustion chamber. Heat Balance, Cooling Systems,	Engine Friction & Lubrication: Determination of friction	Lubrication principles, Types of lubrication, Places of lubrication ., Functions of Lubrication, Properties, Rating and Classification of lubricating oil, Additives, Lubrication systems. Air, Water Cooling, Cooling system components. Requirements of cooling
10	Scavenging. Process parameters, systems, supercharging of 2 stroke engines.	Thermodynamic cycle & performance of super charged SI & CI engines	Objectives , Methods of super charging, Limitations, Two stroke engines: Comparison of 4s & 2s engines construction & valve lining
11	Principle, fuels, Combustion,	Performance, Modification in fuel system.	Advantages
12	Variable compression ratio engines	Stratified charge, Free piston	Working principles of Rotary

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF MECHANICAL ENGINEERING

Course Outcomes and Mapping with POs and PSOs

COURSE: B. Tech. **SEMESTER: VII** **SESSION: 2020-2021**

SUBJECT: I C Engine **SUBJECT CODE: 7ME5-11**

NAME OF FACULTY: Dr. Narayan Lal Jain

Course Outcomes

7ME5-11.1	Explain the fundamental concepts and working of I C engine systems and its Components.
7ME5-11.2	Identify fuel metering, fuel supply, lubricating and Ignition systems for I C engines.
7ME5-11.3	Analyze the performance, emission and combustion characteristics of I C engines

CO-PO-PSO Mapping: Mapping Levels: 1- Low, 2- Moderate, 3-Strong

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3													2	1
CO2		2											3	2	2
CO3		3											2	3	

CO-PO MAPPING JUSTIFICATION

7ME5-11	**CO1**	**PO1**	Students will **apply the knowledge** of basic of I C engine for the solution of I C Engine related problems
	CO2	**PO2**	Students will **identify** the I C engine problems to obtain substantial solutions
	CO3	**PO3**	Students will **analyze** various performance parameters for improvement in I C engine

CO-PSO MAPPING JUSTIFICATION

7ME5-11	**CO1**	**PSO2**	Students will exhibits the knowledge of IC engine to formulate the **allied mechanical** engineering branch i.e. automobile assembly
		PSO3	Student will utilize basic concept of IC Engine in understanding Automobile Engineering

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	CO2	**PSO1**	Students will analyze the thermal related problems in IC engine
		PSO2	Students will identify the problems in Thermal related in IC engine
		PSO3	Student will analyze the automobile problem using knowledge of various IC engine systems
	CO3	**PSO1**	Students will enhance the performance of IC engine in form thermal Efficiency
		PSO2	Students will analyze the various emission characteristics to formulate it in automobile

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COURSE FILE

COURSE: Bachelor of Technology (B. Tech.)

SEMESTER: VII

SUBJECT: I C Engine

SUBJECT CODE: 7ME5-11

SESSION: 2020-2021

NAME OF FACULTY: Dr. Narayan Lal Jain

DEPARTMENT: Mechanical Engineering

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PEO of the Department

Program Educational Objectives (PEOs)

PEO 1: Graduate will have Fundamental & multidisciplinary knowledge with an ability to analyze, design, innovates and handles the realistic problems.

PEO 2: Graduate will possess ethical conduct, sense of responsibility to serve society and protect the environment.

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Program Outcomes (PO)

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

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Program Specific Outcome (PSOs)

PSO1. Design, analyze and innovate solutions to technical issues in Thermal, Production and Design Engineering.

PSO2. Exhibit the knowledge and skills in the field of Mechanical & Allied engineering concepts.

PSO3. Apply the knowledge of skills in HVAC&R and Automobile engineering.

MAPPING OF THE INSTITUTE MISSION STATEMENT WITH OF INSTITUTES VISION STATEMENT

To **evolve and develop skill based systems** for **effective delivery of knowledge** so as to equip young professionals with **dedication & commitment** to excellence in all spheres of life	To create knowledge based society with **scientific temper**, **team spirit** and **dignity of labor** to face the global competitive challenges		
	IV1: Scientific temper	**IV2:** Team spirit	**IV3:**Dignity of labor
IM1: Evolve and develop skill based systems	2	3	2
IM2: Effective delivery of knowledge	3	1	1
IM3: Dedication &Commitment	1	2	3

MAPPING OF THE DEPARTMENT VISION STATEMENT WITH OF INSTITUTES MISSION STATEMENT

To be recognized for quality education in the field of Mechanical Engineering and identified for its innovation & excellence	**To evolve and develop skill based systems for effective delivery of knowledge so as to equip young professionals with dedication & commitment to excellence in all spheres of life**		
	IM1: Evolve and develop skill based systems	**IM2: Effective delivery of knowledge**	**IM3: Dedication & Commitment**
DV1: To be recognized for quality education	**3**	**3**	**3**
DV2: To be identified for innovation	**3**	**2**	**3**
DV3: To be identified for excellence	**3**	**3**	**3**

MAPPING OF DEPARTMENTS MISSION STATEMENT WITH DEPARTMENTS VISION STATEMENT

Key Phrases of the Mission Statement of the Department	To be recognized for **quality education** in the field of Mechanical Engineering and identified for its **innovation & excellence**		
	DV1: To be recognized for quality education	**DV2: To be identified for innovation**	**DV3: To be identified for excellence**
DM1:- To provide **education** that transforms students through rigorous teaching and **thought process** to fulfill the needs of the society and industry.	3	2	2
DM2:- To **collaborate** with leading industry partners and other academic & research institutes around the world to strengthen the education and research ecosystem.	2	3	2
DM3:- To prepare students with **life-long** learning for their career by fostering in them the **ethicaltechnical** capabilities pertinent to mechanical & allied engineering.	3	2	3

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MAPPING OF PEOs STATEMENT WITH MISSION STATEMENT OF THE DEPARTMENT

PEOs	PEO Statements	M1	M2	M3
PEO 1	Graduate will have Fundamental & multidisciplinary knowledge with an ability to analyze, design, innovate and handle the realistic problems.	3	2	2
PEO 2	Graduate will Possess ethical conduct, sense of responsibility to serve society and protect the environment.	2	2	3
PEO 3	Graduate will have strong foundation in academics, leadership qualities and lifelong learning for a prosperous professional career.	2	3	2

MAPPING OF DEPARTMENT PSOs STATEMENT WITH DEPARTMENT MISSION STATEMENT

PSO Statements	Key Phrases of the Mission of the Department		
	DM1:- To **provide education** that transforms students through rigorous teaching and thought process **to fulfill the needs of the society and industry.**	DM2:- To collaborate with **leading industry partners and other academic & research institutes** around the world **to strengthen the education and research ecosystem.**	DM3:- To prepare students with **life-long learning** for their career by fostering in them the **ethical & technical capabilities** pertinent to **mechanical & allied engineering.**
PSO1:-Design, analyze and innovate solutions to technical issues in **Thermal, Production and Design Engineering.**	**3**	**3**	**3**
PSO2:-Exhibit the **knowledge and skills in the field of Mechanical & Allied engineering** concepts	**3**	**2**	**3**
PSO3:-Apply the knowledge of skills in HVAC & R and Automobile engineering	**3**	**3**	**3**

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MAPPING OF DEPARTMENT PEO STATEMENT WITH POs STATEMENT AND DEPARTMENT PSOs

PEOs / POs & PSOs	**PEO 1**: Graduates will have good fundamental & multidisciplinary knowledge with an ability to analyze, design, innovate and handle the realistic problems	**PEO 2**: Graduates will possess ethical conduct, sense of responsibility to serve society and protect the environment.	**PEO 3**: Graduates will have a strong foundation in academics, leadership qualities and lifelong learning for a prosperous professional career
1. Engineering knowledge:	**3**	**-**	**2**
2. Problem analysis:	**3**	**-**	**2**
3. Design/development of solutions:	**3**	**-**	**2**
4. Conduct investigations of complex problems:	**3**	**-**	**2**
5. Modern tool usage:	**3**	**-**	**2**
6. The engineer and society:	**2**	**3**	
7. Environment and sustainability:	**2**	**3**	**2**
8. Ethics:		**3**	**3**
9. Individual and team work:	**1**	**2**	**3**
10. Communication:	**1**	**2**	**3**
11. Project management and finance:	**1**	**2**	**3**
12. Life-long learning:	**2**	**2**	**3**
PSO1: Design, analyze and innovate solutions to technical issues in Thermal, Production and Design Engineering.	**3**	**-**	**2**
PSO2: Exhibit the knowledge and skills in the field of Mechanical & Allied engineering concepts	**3**	**2**	**2**
PSO3: Apply the knowledge of skills in HVAC&R and Automobile engineering	**3**	**3**	**3**

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MAPPING OF DEPARTMENT PSOs WITH DEPARTMENT PEOs

PSO / PEO	**PSO1:** Design, analyze and innovate solutions to technical issues in Thermal, Production and Design Engineering.	**PSO2:** Exhibit the knowledge and skills in the field of Mechanical & Allied engineering concept	**PSO3:**Apply the knowledge of skills in HVAC&R and Automobile engineering
PEO 1: Graduates will have good fundamental & multidisciplinary knowledge with an ability to analyze, design, innovate and handle the realistic problems.	**3**	**3**	**2**
PEO 2: Graduates will possess ethical conduct, sense of responsibility to serve society and protect the environment.	**1**	**2**	**3**
PEO 3: Graduates will have a strong foundation in academics, leadership qualities and lifelong learning for a prosperous professional career.	**1**	**1**	**3**

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POORNIMA
COLLEGE OF ENGINEERING

BLOWN UP SYLLABUS

Campus :PCE **Course: B.Tech** **Class/section: IV Year (A+B)** **Date: 10/ 07/2020**		
Name of Faculty: Dr. Narayan Lal Jain **Name of Subject : I C Engine** **SUBJECT(CODE): 7ME5-11**		
S.NO.	**TOPIC AS PER UNIVERSITY SYLLABUS**	**BLOWN UP TOPICS (1X10 TIMES UNIV. SYLLABUS)**
1	1	1.Zero Lecture
2	**Introduction :** Historical & Modern Development, Nomenclature, Classification & Comparison: SI & CI, 4 stroke – 2 stroke, First Law analysis, Energy Balance. Fuel- air cycles, Actual cycles Energy Balance.	2.1.1 Introduction 2.1.2 Historical 2.1.3 Modern Development 2.1.4 Nomenclature 2.1.5 Classification & Comparison : SI & CI 2.1.6 4 stroke – 2 stroke 2.1.7 First Law analysis 2.1.8 Energy Balance.
3	Testing & Performance: Performance parameters, Measurement of operating parameters e.g. speed, fuel & air consumption, Powers, IHP, BHP, FHP, Efficiencies Thermal, Mechanical, Volumetric, Emission Measurement, Indian & International standards of Testing, Emission.	3.1.1 Measurement of operating parameters: 3.1.1.1 Speed 3.1.1.2 fuel & air consumption 3.1.1.3 Powers IHP, BHP, FHP 3.1.1.4 Efficiencies Thermal, Mechanical, Volumetric 3.2.2 Emission Measurement 3.2.3 Numerical problems
4.1	Combustion in CI & SI engines	4.1.1 Introduction 4.1.2 Ignition Limits 4.1.3 Stages of combustion 4.1.4 Combustion parameters 4.1.5 Delay period and Ignition Lag 4.1.6 Turbulence and Swirl 4.1.7 Effects of engine variables on combustion parameter

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4.2	Abnormal combustion in CI & SI engines	4.2.1 Introduction 4.2.2 Abnormal combustion in CI & SI engines
4.3	Detonation & knocking	4.3.1 Theories of detonation 4.3.2 Control of abnormal combustion
4.4	Combustion chamber	4.4.1 Design principles 4.4.2 Types of combustion chamber
5	Alternative Fuels: Methanol, Ethanol, Comparison with gasoline, Manufacturing, Engine performance with pure Methanol, Ethanol &blends, Alcohols with diesel engine, Vegetable oils, Bio gas.	5.1.1 Methanol 5.2.2 Ethanol 5.3.3 Comparison with gasoline 5.4.4 Manufacturing of fuels 5.5.5 Engine performance with pure Methanol 5.6.6 Ethanol & blends 5.7.7 Alcohols with diesel engine 5.8.8 Vegetable oils 5.9.9 Bio gas.
6	Engine Systems & Components Fuel System (SI Engine),	6.1.1 Introduction 6.1.2 Combustion & Injection 6.1.3 process & parameters properties of A/F mixture 6.1.4 Requirements of A/F per different operating conditions. 6.1.5 Carburetion & Carburetors, types 6.1.6 Aircraft carburetor 6.1.7 comparison of carburetion & injection 6.1.8 F/A ratio calculations 6.1.9 Numerical problems.
7	CI engine : Mixture requirements & constraints	7.1.1 Mixture requirements & constraints 7.1.2 Method of injection 7.1.3 Injection systems 7.1.4 system components 7.1.5 pumps injectors.
8	Ignition system: Conventional & Modern ignition systems	8.1.1 Conventional & Modern ignition systems Magneto v/s Battery, 8.1.2 CB point v/s Electronic ignition 8.1.3 Fuel Ignition Energy requirements. 8.1.4 Spark galvanic 8.1.5 centrifugal 8.1.6 vacuum Firing order 8.1.7 spark plugs.

9.1	Engine Friction & Lubrication: Determination of friction Rating and Classification of lubricating oil, Additives	9.1.1 Introduction 9.1.2 Determination of friction 9.1.3 Lubrication principles 9.1.4 Types of lubrication 9.1.5 Places of lubrication Bearings and piston rings etc., 9.1.6 Functions of Lubrication 9.1.7 Properties 9.1.8 Rating and Classification of lubricating oil, Additives 9.1.9 Lubrication systems
9.2	Engine Cooling:	9.2.1 Requirements of cooling 9.2.2 Areas of heat flow 9.2.3 High temperature regions of combustion chamber. 9.2.4 Heat Balance 9.2.5 Cooling Systems 9.2.5.1 Air cooling 9.2.5.2 Water Cooling, 9.2.6 Cooling system components.
10.1	Supercharging : Objectives, Thermodynamic cycle & performance of super charged SI & CI engines Methods of super charging, Limitations	10.1.1 performance of super charged SI & CI engines 10.1.2Methods of super charging, Limitations
10.2	Two stroke engines : Comparison of 4s & 2s engines construction & valve lining Scavenging. Process parameters, systems, supercharging of 2 stroke engines	10.2.1 Comparison of 4s & 2s engines construction & valve lining 10.2.2 Scavenging. Process parameters, systems, supercharging of 2 stroke engines
11	Dual & Multi fuel engines: Principle, fuels, Combustion, performance Advantages, Modification in fuel system.	11.1.1 Introduction 11.1.2 Principle, fuels, Combustion, performance Advantages, 11.1.3 Modification in fuel system.
12	Special Engines: Working principles of Rotary, Stratified charge, Free piston, Variable compression ratio engines	12.1.1 Working principles of Rotary, Stratified charge, 12.1.2.Free piston, 12.1.3Variable compression ratio engines.

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE PLAN (Deployment)

Campus: Poornima College of Engineering **Class/Section: 3rd Year** **Date: 10 July 2021**
Course: B.Tech.
Name of Faculty: Dr. Narayan Lal Jain **Name of Subject : Internal Combustion Engine** **Code: 7ME5-11**

- **Coverage of Units by lectures**
- **Solving Numerical Problems**
- **By assignments**

Lect. No.	Unit/Module No.	Topics, Problems, Applications	CO	Target Date of Coverage	Actual Date of Coverage	Teaching method	Ref. Book/Journal with Page No.
1.	1	Zero Lecture and objective and scope of subject		13/07/2020	13/07/2020	Chalkboard PPT	
2.	2	2.1.1 Introduction 2.1.2 Historical 2.1.3 Modern Development	CO1-3	16/07/2020	16/07/2020	PPT Chalk and Talk	T1 Page 10 -12
3.		2.1.4 Nomenclature 2.1.5 Classification & Comparison : SI & CI 2.1.6 4 stroke – 2 stroke	CO1	18/07/2020	18/07/2020	Chalk and Talk	T1 Page 15 -18
4.		2.1.7 First Law analysis 2.1.8 Energy Balance.	CO1	19/07/2020	19/07/2020	Chalk and Talk	T1 Page 19 -21
5.	3	3.1.1 Measurement of operating parameters:	CO2	23/07/2020	24/07/2020	Chalk and Talk	T1 Page 22 -25 R1 Page 12-18

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		3.1.1.1 Speed 3.1.1.2 fuel & air consumption					
6.		3.1.1.3 Powers IHP, BHP, FHP 3.1.1.4 Efficiencies Thermal, Mechanical, Volumetric	CO2	25/07/2020	29/07/2020	Chalk and Talk	T1 Page 26 -28 R1 Page 20-22
7.		3.2.2 Emission Measurement 3.2.3 Numerical problems	CO2	29/07/2020	29/07/2020	Chalk and Talk	T1 Page 29 -30 R2 Page 32-34
8.	4	Combustion in CI & SI engines 4.1.1 Introduction 4.1.2 Ignition Limits 4.1.3 Stages of combustion	CO1	01/08/2020	01/08/2020	PPT Chalk and Talk	T1 Page 32 -34 R2 Page 36-42
9.		4.1.4 Combustion parameters 4.1.5 Delay period and Ignition Lag	CO1	06/08/2020	06/08/2020	PPT Chalk and Talk	T1 Page 42 -48 R1 Page 39-45
10.		4.1.6 Turbulence and Swirl 4.1.7 Effects of engine variables on combustion parameters	CO2	09/08/2020	09/08/2020	PPT Chalk and Talk	T1 Page 68 -76 R1 Page 48-52
11.		Abnormal combustion in CI & SI engines 4.2.1 Introduction 4.2.2 Abnormal combustion in CI & SI	CO2	16/08/2020	16/08/2020	PPT Chalk and Talk	T1 Page 81 -85 R2 Page 92-98
12.		4.3.1 Theories of detonation 4.3.2 Control of abnormal combustion	CO3	20/08/2020	20/08/2020	PPT	T1 Page 98 -102 R1 Page 78-82
13		4.4.1 Design principles 4.4.2 Types of combustion chamber	CO3	27/08/2020	27/08/2020	PPT	T1 Page 110 -112 R1 Page 80-92
14	5	5.1.1 Methanol 5.2.2 Ethanol 5.3.3 Comparison with gasoline 5.4.4 Manufacturing of fuels	CO2	29/08/2020	29/08/2020	PPT	T1 Page 115 -118 R2 Page 102-112
15		5.5.5 Engine performance with pure Methanol 5.6.6 Ethanol & blends	CO2	06/09/2020	06/09/2020	PPT	T1 Page 120 -132 R1 Page 112-118

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		5.7.7 Alcohols with diesel engine 5.8.8 Vegetable oils 5.9.9 Bio gas.					
16	6	6.1.1 Introduction 6.1.2 Combustion & Injection 6.1.3 process & parameters properties of A/F mixture	CO1	12/09/2020	12/09/2020	PPT	T1 Page 140 -148
17		6.1.4 Requirements of A/F per different operating conditions. 6.1.5 Carburetion & Carburetors, types	CO2	16/09/2020	16/09/2020	PPT Chalk and Talk	
18		6.1.6 Aircraft carburetor 6.1.7 comparison of carburetion & injection 6.1.8 F/A ratio calculations	CO2	19/09/2020	19/09/2020	PPT Chalk and Talk Video	
19		6.1.9 Numerical problems.	CO3	10/10/2020	10/10/2020	PPT Chalk and Talk	T1 Page 158 -162 R1 Page 130-142
20		Revision	CO1-3	11/10/2020	11/10/2020	PPT Chalk and Talk	T1 Page 168 -172 R2 Page 120-132
21		Revision	CO1-3	14/10/2020	15/10/2020	PPT Chalk and Talk	T1 Page 130 -172
22	7	CI engine : Mixture requirements & constraints 7.1.1 Mixture requirements & constraints 7.1.2 Method of injection 7.1.3 Injection systems	CO1	16/10/2020	16/10/2020	PPT Chalk and Talk	T1 Page 190 -194
23		7.1.4 system components 7.1.5 pumps injectors.	CO1	18/10/2020	18/10/2020	PPT Chalk and Talk	T1 Page 200 -212

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24	8	8.1.1 Conventional & Modern ignition systems Magneto v/s Battery, 8.1.2 CB point v/s Electronic ignition 8.1.3 Fuel Ignition Energy requirements.	CO1	21/10/2020	21/10/2020	PPT Chalk and Talk	T1 Page 246 -249
25		8.1.4 Spark galvanic 8.1.5 centrifugal 8.1.6 vacuum Firing order 8.1.7 spark plugs.	CO2	23/10/2020	23/10/2020	PPT Chalk and Talk	T1 Page 254-276
26	9	9.1.1 Introduction 9.1.2 Determination of friction 9.1.3 Lubrication principles 9.1.4 Types of lubrication 9.1.5 Places of lubrication Bearings and piston rings etc.,	CO2	24/10/2020	24/10/2020	PPT Chalk and Talk	R1 Page 170-182
27		9.1.6 Functions of Lubrication 9.1.7 Properties 9.1.8 Rating and Classification of lubricating oil, Additives 9.1.9 Lubrication systems.	CO1	1/11/2020	1/11/2020	PPT Chalk and Talk	T1 Page 280 -294
28		9.2.1 Requirements of cooling 9.2.2 Areas of heat flow 9.2.3 High temperature regions of combustion chamber.	CO2	2/11/2020	2/11/2020	PPT Chalk and Talk	T1 Page 301 -312
29		9.2.4 Heat Balance 9.2.5 Cooling Systems 9.2.5.1 Air cooling 9.2.5.2 Water Cooling, 9.2.6 Cooling system components.	CO3	4/11/2020	4/11/2020	PPT Chalk and Talk	T1 Page 315 -320
30	10	10.1.1 performance of super charged SI & CI engines	CO3	6/11/2020	6/11/2020	PPT Chalk and Talk	T1 Page 350 -361
31		10.1.2Methods of super charging,	CO3	7/11/2020	7/11/2020	PPT	T1 Page 361 -372

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		Limitations				Chalk and Talk	
32		10.2.1 Comparison of 4s & 2s engines construction & valve lining	CO1	9/11/2020	9/11/2020	PPT Chalk and Talk	R2 Page 162-172
33		10.2.2 Scavenging. Process parameters, systems, supercharging of 2 stroke engines	CO1	11/11/2020	11/11/2020	PPT Chalk and Talk	T1 Page 389 -392
34	11	11.1.1 Introduction 11.1.2 Principle, fuels, Combustion, performance Advantages,	CO1	13/11/2020	14/11/2020	PPT Chalk and Talk	T1 Page 401 -412
35		11.1.3 Modification in fuel system.	CO1	15/11/2020	15/11/2020	PPT Chalk and Talk	T1 Page 412 -4222
36	12	12.1.1 Working principles of . Rotary, Stratified charge, 12.1.2.Free piston	CO3	18/11/2020	18/11/2020	PPT Chalk and Talk	R2 Page 242-254
37		12.1.3Variable compression ratio engines.	CO3	19/11/2020	19/11/2020	PPT Chalk and Talk	R2 Page 260-272
38		Revision	CO1-3	20/11/2020	20/11/2020	PPT Chalk and Talk	

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7E1747

Roll No. _____ Total No. of Pages: 2

7E1747

B. Tech. VII - Sem. (Main) Exam., Feb.- March - 2021
PEC Mechanical Engineering
7ME5 – 11 I. C. Engines

Time: 2 Hours **[To be converted as per scheme]**

Max. Marks: 82

Min. Marks: 29

Instructions to Candidates:

Attempt all ten questions from Part A, four questions out of seven questions from Part B and two questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

PART – A

(Answer should be given up to 25 words only) **[10×2=20]**

All questions are compulsory

Q.1 What is objectives of I. C. Engine? [2]

Q.2 What is Thermal efficiency? [2]

Q.3 Draw the figure of combustion chamber. [2]

Q.4 What is Knocking? [2]

Q.5 What is the compression of 4 – stroke diesel engine? [2]

Q.6 What is Turbulence? [2]

Q.7 Write the name of all parts of 4 – stroke petrol engine. [2]

Q.8 What is delay period? [2]

Q.9 Draw the figure of cooling system of I. C. Engine with all components. [2]

Q.10 What is electronic ignition system? [2]

PART – B

(Analytical/Problem solving questions) **[4×8=32]**

Attempt any four questions

Q.1 Explain the lubrication system in I. C. engine. *[8]*

Q.2 Explain Indicated Horse Power (IHP) and also derive formula of IHP. *[8]*

Q.3 Explain the types of Combustion Chamber. [8]

Q.4 Explain fuel –air cycle with diagram. [8]

Q.5 Describe the different method of super charging with diagram and also describe the Thermodynamics cycle of supercharging. [8]

Q.6 Explain the effect of engine variables an ignition lag in S. I. engine. [8]

Q.7 Explain firing order in the engine. [8]

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) **[2×15=30]**

Attempt any two questions

Q.1 What is the function of carburetor and also explain all the parts of carburetor with diagram. [15]

Q.2 Explain the injection system in C. I. engine also explain the types of injection system. [15]

Q.3 A two stroke C. I. engine delivers 500 kW while using 1000 kW to overcome frictional losses. It consume 2300 kg of fuel per hour at an air fuel ratio of 20 to 1. The heating value of fuel is 42000 kJ/kg. Find the – [15]

(a) Indicated Power

(b) Mechanical Efficiency

(c) Indicated Thermal Efficiency

(d) Brake Thermal Efficiency

Q.4 Explain water cooling system with suitable diagram. What is the function of fins? [15]

Q.5 Explain why rich or lean mixtures are supplied during idling normal running and maximum power range in a spark ignition engine. Give the value of A/F ratio. [15]

6E 6012

Roll No. _____ [Total No. of Pages : 2

6E 6012

B.Tech. VI - Semester (Main&Back) Examination, April.2019
Automobile Engineering
6AE2A Advanced IC Engine

Time : 3 Hours **Maximum Marks : 80**
Min. Passing Marks : 26

Instructions to Candidates:

*Attempt any **Five questions**, selecting **One question** from **each unit.** All Questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.) Units of quantities used/calculated must be stated clearly.*

Unit - I

1. a) Explain how to obtain velocities data which characterize the flow within Engine Cylinder. **(8)**

   b) Explain swirl measurement by steady flow impulse torque meter with the help of neat sketch. **(8)**

(OR)

1. a) Explain how blow in piston and wedge shaped S.I. Engine generates squish with the help of diagram. **(8)**

   b) Explain vortex flow generates during compression and exhaust in piston - cylinder wall interaction. **(8)**

Unit - II

2. a) Explain schematic of flame in the engine cylinder during combustion of unburned gas. **(8)**

   b) *The following results refer to a test on a petrol engine:*

   Indicated power = 30k W; break power = 26k W; engine speed = 1000 r.p.m.; fuel per Break Power = 0.35kg; calorific value of fuel used 43900 kj/kg

   Calculate:

   i) The indicated thermal efficiency

   ii) The break thermal efficiency

   iii) The mechanical efficiency

   (8)

(OR)

2. a) Explain analysis of open system boundary for combustion chamber for heat release with the help of necessary equation. **(8)**

   b) Explain the effects of laminar flow during unburned gas moves into flame front in detail in S.I. Engine. **(8)**

Unit - III

3. a) Explain swirl prechamber and turbulent prechamber used in small indirect injection diesel engine combustion system with the help of neat sketch. **(8)**

   b) A large four stroke cycle diesel engine runs at 2000 r.p.m. The engine has a displacement of 25 litres and a break mean effective pressure of 0.6 MN/m^2 it consumes 0.018 kg/s of fuel (calorific value =42000 kj/kg). Determine the break power and break thermal efficiency. **(8)**

(OR)

3. a) Explain schematic of diesel fuel Spray injected radially outward from the chamber axis into swirling air slow. **(8)**

   b) Explain droplet size distribution in diesel fuel spray injected through throttling nozzle in detail. **(8)**

Unit - IV

4. a) Describe the modeling activities can make major contributions to engine engineering. **(8)**

   b) Explain unsteady one dimensional flow analysis for control volume with necessary equations. **(8)**

(OR)

4. a) Elaborate schematic of turbulent premixed spark ignition engine flame illustrating on the physical basis. **(8)**

   b) Describe structure of thermodynamic based direct ignition (DI) diesel engine for predicting engine performance and emission. **(8)**

Unit - V

5. a) Explain the working of multiple injection system in diesel engine. **(8)**

   b) Describe the working of Homogeneous Charge Compression Ignition (HCCI). **(8)**

(OR)

5. a) Explain the effect of SAC volume on injector performance. **(8)**

   b) Write short note on following:-

   i) Electronic fuel injection system
   ii) Variable Valve Timing (VVT)
   iii) Distributer system
   iv) Common Rail Direct Ignition (CRDI). **(8)**

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4E 4145

Roll No. _____ [Total No. of Pages : 2

4E 4145

B.Tech. IV Semester (Main/Back) Examination, May -2018
Mechanical Engg.
4ME6A I.C. Engines
AE,ME

Time : 3 Hours **Maximum Marks : 80**
Min. Passing Marks : 26

*Attempt any **five questions**, selecting **one question** from **each unit**. All Questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.) Units of quantities used/calculated must be stated clearly.*

Unit - I

1. a) Explain the working of 2-stroke Engine with suitable Diagram. **(6)**

   b) Following observations were recorded during a test on a single cylinder oil Engine.
   Bore = 300mm, Stroke = 450mm
   Speed = 300rpm, i.m.e.p = 6bar
   Net brake load = 1.5KN, brake drum diameter = 1.8 meter brake rope diameter = 2c.m.
   Calculate:- (i) Indicated power
   (ii) Brake power
   (iii) Mechanical efficiency **(10)**

(OR)

1. a) Explain the working of 4-Stroke petrol Engine and Also Explain classification of I.C. Engine. **(8)**

   b) A 4-Stroke C.I. Engine delivers 5000kw while using 1000 kw to overcome friction loses. It consumes 2300 Kg of fuel per hour at Air-fuel ratio of 20:1. the heating value is 42000 KJ/Kg. Find the following terms -
   (i) Indicated power
   (ii) Mechanical Efficiency
   (iii) Air consumption per hour
   (iv) Indicated thermal efficiency
   (v) Brake thermal efficiency **(8)**

UNIT - II

2. a) What is meant by abnormal combustion? Explain the phenomenon of knocking in S.I engine. **(8)**

   b) Explain Manufacturing of Methanol from Municipal Solid Wastes. **(8)**

OR

2. a) Explain alcohols as alternate fuels for IC Engines bringing out their merits and demerits. **(8)**

   b) Explain the petroleum refining process. **(8)**

Unit - III

3. a) What do you mean by carburetion? Describe the essential parts of a Modern Carburetor. **(2+8=10)**

   b) What are the functional requirement of an Injection system? Classified the Injection System and why the air Injection System is not used now a days. **(2+2+2=6)**

OR

3. a) Draw a Schematic diagram of Jerk pump type Injection System. **(8)**

   b) Explain the battery Ignition System. Mention the various important qualities of a good Ignition System. **(8)**

UNIT - IV

4. a) Explain Mechanical friction and the various factors affecting them. **(8)**

   b) What is meant by Crankcase ventilation? Explain the details **(8)**

(OR)

4. Explain the following.

   a) Forced Circulation Cooling System.

   b) Evaporative Cooling System. **(2×8)**

UNIT - V

5. a) What are the factors those affect the combustion in dual fuel Engine? Also explain the process of combustion in dual fuel engines. **(8)**

   b) With a neat sketch Explain the working principle of free piston engine. **(8)**

(OR)

5 Explain the following -

   a) Variable compression Ratio engines

   b) Rotary Engine. **(2×8)**

4E4145

Roll No. 15EEBM009

Total No. of Pages : 3

4E4145

B. Tech. IV-Sem. (Main & Back) Exam; April-May 2017

Mechanical Engineering

4ME6A I. C. Engines

Time : 3 Hours

Maximum Marks : 80
Min. Passing Marks : 26

Instructions to Candidates :-

*Attempt any **five questions**, selecting **one question** from **each unit**. All Questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*
Units of quantities used / calculated must be stated clearly.
Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)

1. NIL 2. NIL

UNIT - I

1 (a) What are the fundamental differences between SI and CI engines ? **8**

(b) Discuss the differences between ideal and actual valve timing diagrams of a petrol. **8**

OR

1 A two stroke C.I. Engine delivers 5000 kW while using 1000 kW to overcome frictional losses. It consumes 2300 kg of fuel per hour at an air-fuel ratio of 20 to 1. The heating value of fuel is 42000 kJ/kg. Find the
(a) indicated power
(b) mechanical efficiency

(c) indicated thermal efficiency,
(d) brake thermal efficiency.

4×4=16

UNIT - II

2 (a) Explain briefly the process of combustion in S.I. engine and also explain the stages of combustion with the help of P-Q diagram. 8

(b) Describe the phenomenon of detonation in C.I. Engine. 8

OR

2 (a) Write a short note on alternative fuel for I.C. engines. 8

(b) What are the desirable properties of good I.C. engine fuels, 8

UNIT - III

3 Describe with suitable diagram the following systems of a carburettor :
(a) Main metering system.
(b) Idling system.
(c) Power enrichment or economizer system.
(d) Acceleration pump system.

4×4=16

OR

3 (a) State the advantages of electronic ignition system over convectional ignition system. 8

(b) Describe with the help of suitable diagram common rail direct injection system. 8

UNIT - IV

4 (a) Discuss the functions of lubricant in an engine: 8

(b) Describe the mist lubrication system used for a two stroke engine. 8

OR

4 (a) Explain water cooling system with suitable diagram. What is the function of fins ? 8

(b) Explain the methods of supercharging in four stroke engines. 8

UNIT - V

5 (a) What is a dual fuel engine ? How mixing of fuel takes place. 8

(b) What is the effect of variable compression ratio on thermal efficiency of the engine ? 8

OR

5 (a) Explain the working of stratified engine. 8

(b) What are the requirements of a dual fuel engine ? 8

6E3050

Roll No. _____ Total No of Pages: 3

6E3050

B. Tech. VI-Sem. (Old Back) Exam., April/May-2016
Mechanical Engineering
6ME2 I.C (O) Engines & Diesel Power Plant

Time: 3 Hours **Maximum Marks: 80**

Min. Passing Marks (Old Back): 24

Instructions to Candidates:-

*Attempt any **five questions**, selecting **one question** from **each unit**. All Questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly.*

Units of quantities used/ calculated must be stated clearly.

Use of following supporting material is permitted during examination.

1. NIL 2. NIL

UNIT-I

Q.1 (a) Write short note on automotive pollution control system. [8]

(b) The air flow to a four cylinder four stroke petrol engine is measured by means of 7.5 cm diameter sharp-edged orifice, cd=0.6. During a test on the engine the following data were recorded -

Bore =11cm, stroke =13cm

Engine speed = 2250 rev/min

Brake power = 36 kW

Fuel consumption =10.6 kg/hr

C.V. of fuel = 42000 KJ/kg

Pressure drop across the orifice = 4.1cm of water, atmospheric temperature and pressure =15°C and 1.013bar. Calculate: [8]

(i) Break thermal efficiency

(ii) Break means effective pressure

(iii) Volumetric efficiency based on free air conditions.

OR

Q.1 (a) Explain briefly - [4×2=8]

(i) Mean effective pressure

(ii) Specific fuel consumption

(iii) Indicated thermal efficiency

(iv) Volumetric efficiency

(b) Find out the speed at which a four cylinder engine using natural gas can develop a brake-power of 50kW working under following conditions – [8]

Air-gas ratio - 9 : 1,

Calorific Value of the fuel – 34 MJ/M^3

Compression Ratio – 10 : 1

Volumetric efficiency = 70%,

Indicated thermal efficiency = 35%,

mechanical efficiency = 80%, and

the total volume of the engine = 2liters.

UNIT-II

Q.2 (a) Describe the phenomenon of detonation and discuss different factors affecting detonation in SI engines. [8]

(b) Explain briefly the stages of combustion in CI engines. [8]

OR

Q.2 (a) What is meant by 'delay period'? Discuss the variables affecting the delay period. [8]

(b) Describe the stages of combustion in SI engine. [8]

UNIT-III

Q.3 (a) Briefly describe different types of injection systems. [8]

(b) Write short note on fixing order in engines. [8]

OR

Q.3 (a) Write short note on - [8]

(i) Fuel transfer pump

(ii) Injunction pump of a CI engine

(b) Write short note on 'MPFI system'. [8]

UNIT-IV

Q.4 (a) Why cooling of I.C. engines is essential? What are the effects of under-cooling and over cooling of an engine? [8]

(b) What is the importance of lubrication in I.C. engines? [8]

OR

Q.4 (a) "Super charging is more preferred in C.I. engine than SI engines". Discuss. [8]

(b) What is super charging? How is it achieved? What is the effect of super charging on the following parameters: [8]

(i) Power output

(ii) Mechanical efficiency

(iii) Fuel consumption.

UNIT-V

Q.5 What constitutes a 'Free-piston engine'? Why is it called 'Free-piston"? Describe with a sketch the working of a free piston engine. [16]

OR

Q.5 (a) Write short note on the Duel fuel engine. [8]

(b) Draw a neat line diagram of a diesel power plant showing all the systems. [8]

4E4145

Roll No. _____ [Total No. of Pages : 3

4E4145

B.Tech. IV Semester (Main/Back) Examination, June/July - 2015

Mechanical Engg.

4ME6A I.C. Engines

Common with Automobile

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 26

Instructions to Candidates:

*Attempt any **five** questions, selecting **one question** from **each unit**. All questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Unit - I

1. Describe with a suitable neat sketch the two stroke cycle spark ignition engine. How its indicator diagram differ from that of four stroke cycle spark ignition engine? **(16)**

OR

1. A single cylinder 4-stroke diesel engine gave the following results while running on full load:

Area of indicator card = 300mm^2

Length of diagram = 40 mm

Spring constant = 1 bar/mm

Speed of the engine = 400 r.p.m.

Load on the brake = 370 N

Spring balance reading = 50 N

Diameter of brake drum = 1.2 m

Fuel consumption = 2.8 kg/h

Calorific value of fuel = 41800 KJ/kg

Diameter of the cylinder = 160 mm

Stroke of the piston = 200 mm

Calculate :

i) Indicated mean effective pressure

ii) Brake power and brake mean effective pressure

iii) Brake specific fuel consumption

iv) Brake Thermal efficiency

v) Indicated thermal efficiency (16)

Unit - II

2. a) Explain the effect of engine variables on ignition lag in S.I. Engine (8)

b) Explain in briefly the stages of combustion in CI engine. What is the basic difference in the combustion processes of SI and CI engine? (8)

OR

2. a) What are the desirable properties of good I.C. engines fuels? (8)

b) State the advantages and disadvantages of hydrogen as I.C. engine fuel. (8)

Unit - III

3. a) What are the basic requirements of a SI system? Describe working of SI system used in 4-cylinder petrol engines. (8)

b) What are the requirements of a DI system? Compare air and solid injection. (8)

OR

3. a) What do you understand by 'ignition timing'? Enumerate the various factors which affect ignition timings. (8)

b) Write the short note on 'firing order'. (8)

Unit - IV

4. a) Enumerate lubrication system and explain wet sump lubrication system with the help of a neat sketch. (8)

b) Describe with neat sketch the cooling system of a 4-stroke SI engine used in car-What are the components used in cooling system? (8)

OR

4. a) Describe with neat sketch the different methods of supercharging. Explain thermodynamics cycle of supercharging. (8)

b) Explain the scavenging processes in 2-stroke engine. What is mean by 'blow down'? (8)

Unit - V

5. a) Describe the stages of combustion in a dual fuel engine when gaseous fuel is injected in small quantity near the top dead centre. **(8)**

   b) What is the effect of variable compression ratio on power output, thermal load, specific fuel consumption and engine noise? **(8)**

OR

5. a) What is a multi-fuel engine? What are the requirements of a multi-fuel engine? **(8)**

   b) What constitutes a 'free piston engine'.? Why is it called 'free piston'? Describe with a neat sketch the working of a 'free piston engine'. **(8)**

6E3050

Roll No. _____ Total No of Pages: 4

6E3050

B. Tech. VI Sem. (Main & Back) Exam. May/June-2014

Mechanical Engineering

6ME2 I.C. Engines & Diesel Power Plant

Time: 3 Hours **Maximum Marks: 80**

Min. Passing Marks: 24

Instructions to Candidates:-

*Attempt any **five questions**, selecting **one question** from **each unit**. All Questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly.*

Units of quantities used/ calculated must be stated clearly.

Use of following supporting material is permitted during examination.

1._____ 2._____

UNIT-I

Q.1 (a) Discuss various elements in Energy Balance of a typical diesel engine. [5]

(b) Give a historical view of different emission standards applicable in India. [6]

(c) Describe with the help of a sketch any one method for measurement of air consumption of a single cylinder gasoline engine. [5]

OR

(a) Discuss first law analyses for an I.C. Engine. [4]

(b) Calculate (i) BHP (ii) Torque (iii) bsfc and (iv) volumetric efficiency for the six cylinder four stroke engine for which BHP is measured by a water brake

(law WN/20000 where W is in Newton and speed N is in rpm). The air consumption is measured by an orifice system. [12]

Bore = 100mm

Stroke = 120mm

Brake loot = 560N

Orifice diameter = 30mm

C_d of orifice = 0.6

Pressure drop across orifice = 14.5 Cms of Hg

Fuel density = 831 Kg/m^3

Time taken to consume 100 cc fuel = 20 sec

Ambient pressure = 1 bar

Ambient Temperature = 27^0c

UNIT-II

Q.2 (a) Discuss the effect of various engine design and operating variables on different combustion parameters for a diesel engine. [8]

(b) Define engine knock. How it differs from detonation? [2+6]

Discuss in detail various factors affecting knocking in an S.I. Engine

OR

(a) Discuss in detail types of abnormal combustion in SI and CI engines. Also suggest methods for controlling these abnormal combustions in an actual engine.[8]

(b) Compare important characteristics of methanol and ethanol fuels with gasoline fuel and explain their effect on important engine performance parameters. [8]

UNIT-III

Q.3 (a) Explain in detail working of a common rail fuel injection system for a diesel engine and enumerate main advantages of CRDI over a conventional fuel injection system. [8]

(b) Discuss the effect of air-fuel ratio on various performance parameters of diesel and gasoline engines. [8]

OR

(a) Discuss in detail any one type of Electronic Ignition system for a SI engine and explain its benefits over conventional ignition system. [7]

(b) Write short notes on –

(i) Firing order of a multi-cylinder engine [3]

(ii) Aircraft carburetor [3]

(iii) Spark advance and its effects [3]

UNIT-IV

Q.4 (a) Discuss different lubrication regimes and explain which of them is applicable for bearings, piston rings and tappets of an engine. [6]

(b) Find IHP, BHP and draw neat balance sheet for a single cylinder four stroke engine with following data: [10]

Bore = 20cm Stroke = 40cm mep = 6bar

Torque = 407N_m Speed = 250rpm Fuel construction = 4kg/h

C.V of fuel = 43mJ/kg Air used/kg of fuel = 30kg

Cooling water flow = 4.5kg/min

Rise in cooling water temp = 45^0c

Exhaust gas temp = 420^0c

Room Temperature = 20^0c

Specific heat of exhaust gas = 1 kJ / kgK

Specific heat of water = 4.18 kJ / kgK

OR

(a) Explain in detail different ratings and classification of engine oils. [8]

(b) Describe different methods of super charging CI and SI engines and explain their limiting factors. [8]

UNIT-V

Q.5 Explain working principles of - [4×4]

(a) Variable compression ratio engine

(b) Rotary combustion engine

(c) Stratified charge engine

(d) Free piston engine

OR

(a) Explain how a dual fuel engine works? How combustion in a dual fuel engine is different from a conventional diesel engine. What modifications are needed to convert a conventional diesel engine to a duel fuel engine? [4×3]

(b) Explain how the speed of an engine generator is controlled. [4]

6E3050

6E3050

B.Tech. (Sem.VI) (Main/Back) Examination, May -2013
Mechanical Engineering
I. C. Engine

[Time : 3 Hours] **[Total Marks : 80]**
[Min. Passing Marks : 24]

Instructions to Candidates :

*Attempt any **five questions,** selecting **one question** from **each unit**. All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/ calculated must be stated clearly.*

UNIT -I

1. **(a)** Explain the first law analysis of an internal combustion engine and also show by means of diagram the energy flow in internal combustion engine. **[8]**

   (b) A four stroke, four-cylinder diesel engine running at 2000 rpm develops 60KW. Brake thermal efficiency is 30% and calorific value of fuel is 42 MJ/kg. Engine has a bore of 120mm and stroke of 100mm. Take $e_a = 1.15 kg/m^3$, air-fuel ratio = 15% and $\eta_m = 0.8$. Calculate (i) fuel consumption (ii) air consumption (m^3/sec) (iii) indicated thermal efficiency (iv) brake mean effective pressure. **[8]**

OR

1. **(a)** What are the emission standards in India as well as in world? Explain in details. **[8]**

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(b) Explain followings:
(i) Mean effective pressure
(ii) Specific fuel consumption
(iii) Air-fuel ratio
(iv) Heating value of fuel [4×2=8]

UNIT – II

2. **(a)** Explain the knocking phenomenon in a C.I. engine and compare it with S.I. engines. Discuss the effects of operating variables on delay period and diesel knock. Is it true that the condition which encourages knocking in SI engine reduces knocking in C.I. engines? [8]

(b) What are the requirements of combustion chamber for C.I. engines? Describe the various types of combustion chambers. [8]

OR

2. **(a)** What are the important qualities of S.I. and C.I. fuel? Also explain in detail the knock rating of S.I. and C.I. engine fuels. [8]

(b) Explain alcohol as an alternative fuel for I.C. engine and also state its merits and demerits. [8]

UNIT – III

3. **(a)** Develop an expression for air-fuel ratio neglecting compressibility for a simple carburetor. [8]

(b) What are the requirements of fuel injection system for C.I. engines? Also explain the various methods of injection system. [8]

OR

3. **(a)** What are the various types of Ignition systems which are commonly used? Explain. [8]

(b) Explain the following :
(i) Firing order
(ii) CRDI
(iii) MPFI
(iv) Spark plug [4×2=8]

UNIT – IV

4. **(a)** What are the various desired properties of a lubricant? Explain how do additives help to achieve the desired properties. [8]

(b) Why is cooling of an I.C. engine required? Explain the various methods of cooling. [8]

OR

4. **(a)** What is meant by supercharging? What is its effect on engine performance? Also state the various methods of supercharging and explain any one? [8]

(b) Define the following:
(i) Delivery ratio
(ii) Trapping efficiency
(iii) Relative efficiency
(iv) Scavenging efficiency
(v) Charging efficiency
(vi) Pressure loss coefficient
(vii) Excess air factor
(viii) Index of compression. [8]

UNIT – V

5. **(a)** Describe the followings:
(i) Free Piston Engine
(ii) Rotary Engine
(iii) Stratified Charge Engine
(iv) Variable Compression Ratio Engine. [4×2=8]

(b) Explain the construction and working of dual fuel engine cycle? Also state its merits and demerits. [8]

OR

5. **(a)** What are requirements of diesel power plant? Give the layout of a diesel power plant. [8]

(b) What are the applications of diesel power plant? Also states the factors which are considered while selecting the site for a diesel power plant. [8]

POORNIMA
COLLEGE OF ENGINEERING

Session: 2020 -21 (VII Sem.)

Campus: PCE **Course: B.TECH** **Class/Section: VIIth SEM/**

Name of Faculty: Dr. Narayan Lal Jain

Zero Lecture

1). Name of Subject: I. C. Engines **CODE**: **7ME5-11**

2). Self-Introduction:

a). Name: Dr. Narayan Lal Jain

b). Qualification: B.Tech, M. Tech , PhD

c). Designation: Professor & Head

d). Research Area: Thermal Engineering

e). E-mail Id: narayan.jain@poornima.org

f). Other details:

g) *Subject Taken:* TE, ICE, RAC, DOM, DME, MD, PE, NCM, EM, EME, RET

h) Research Publications

i. Journal: 6

ii. Conference: 10

i) Professional Body Membership: LMISTE

3). Introduction of Students:

a*). Records of students in 12th*

Sr. No.	Average result of 12th	Name of student scored highest marks	Marks 60% above (No. of students)	Marks between 40%-60% (No. of students)	English Medium Students (No.)	Hindi Medium Students (No.)	No. of Hostellers	No. of Day Scholar
1	69.67%	Lekha Tiwari	36	5	25	16	27	14

b*). Name of 05 best students based on previous result*

1. *Lekha Tiwari*
2. *Amit Singh Rawat*
3. *Harshita Bhatia*
4. *Harshit Kumar Meena*
5. *Aditya Singh Rajavat*

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Vision & Mission Statements of the Institute

Vision of Institution

To create knowledge based society with scientific temper, team spirit and dignity of labor to face the global competition challenges.

Mission of Institution

To evolve and develop skill based systems for effective delivery of knowledge so as to equip young professionals with dedication & commitment to excellence in all spheres of life.

Vision of Department

To be recognized for quality education in the field of Mechanical Engineering and identified for its innovation & excellence.

Mission of Department

M1. - To provide education that transforms students through rigorous teaching and thought process to fulfill the needs of the society and industry.

M2. - To collaborate with leading industry partners and other academic & research institutes around the world to strengthen the education and research ecosystem.

M3. - To prepare students with life-long learning for their career by fostering in them the ethical & technical capabilities pertinent to mechanical & allied engineering.

PROGRAM EDUCATIONAL OBJECTIVES (PEO'S)

PE01. Graduates will have good fundamental & multidisciplinary knowledge with an ability to analyze, design, innovate and handle the realistic problems.

PE02. Graduates will possess ethical conduct, sense of responsibility to serve society and protect the environment.

PE03. Graduates will have a strong foundation in academics, leadership qualities and lifelong learning for a prosperous professional career.

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PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

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Programme Specific outcomes (PSOs)

Students will be able to

PSO1:- Design, analyze and innovate solutions to technical issues in Thermal, Production and Design Engineering.

PSO2:- Exhibit the knowledge and skills in the field of Mechanical & Allied engineering concepts

PSO3:- Apply the knowledge of skills in HVAC&R and Automobile engineering

4). Instructional Language: - 100%English

5). Introduction to subject: -

a). Relevance to Branch: IC Engine is related to basic thermodynamics and heat transfer in previous semester. In order to have a better understanding of the subject, it is compulsory for mechanical engineers to revise basics of thermodynamics before studying this course.

b). **Relevance to Society:** The effect of the internal combustion engine on society was immense. Its main advantage over the steam engine was its weight to power ratio. ... The development of the engine also gave oil producing countries a wealth and an influence in world affairs that they had not previously possessed.

c). Relevance to Self: As Every mechanical engineer should know basic knowledge of IC Engine which have application in our day to day life.

d). Connection with previous year and next year: This subject is completely based on the basic concepts Basic Thermodynamics and heat transfer from previous semester.

e) **Relation with laboratory**: it is related with Thermal Engineering lab lab in which different principle of IC Engine is used.

f) Relevance with GATE: About 1 to 2 questions are listed in GATE.

Course Objective

1. To make students familiar with the design and operating characteristics of internal combustion engines
2. To apply analytical techniques to the engineering problems and performance analysis of internal combustion engines
3. To study the thermodynamics, combustion, heat transfer, friction and other factors affecting engine power, efficiency and emissions
4. To introduce students to the environmental and fuel economy challenges facing the internal combustion engine

5. To introduce students to future internal combustion engine technology and market trends

Course Outcome

Semester-VII

Subject Code – 7ME5-11

CO 1: Explain the fundamental concepts and working of I C engine systems and its Components.

CO 2: Identify fuel metering, fuel supply, lubricating and Ignition systems for I C engines.

CO 3: Analyze the performance, emission and combustion characteristics of I C engines

6). Syllabus of university

Sr. No.	Name of Unit
1.	Introduction
2.	History of I C Engine
3	Testing & Performance
4.	Fuel and Combustion
5.	Alternative Fuels
6	Engine System and Component
7	C I Engine Injection System
8	Ignition System
9	Engine Friction and Lubrication
10	Supercharging
11	Duel and Multi Fuel Engine
12	Special Engine

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus

Introduction: Objective, scope and outcome of the course.

2

History of IC engines: Nomenclature, Classification & Comparisons & CI, 4stroke- 2 stroke, First Law analysis, Energy Balance. Fuel- air cycles, Actual cycles.

3

Testing & Performance: Performance parameters, Measurement of operating parameters e.g. speed, fuel & air consumption, Powers, IHP, BHP, FHP, Efficiencies Thermal, Mechanical, Volumetric, Emission Measurement, Indian & International standards of Testing, Emission.

4

Fuel & Combustion: Combustion in CI & SI engines, Ignition Limits, Stages of combustion, Combustion parameters. Delay period and Ignition Lag, Turbulence and Swirl. Effects of engine variables on combustion parameters, abnormal combustion in CI & SI engines, Detonation,

knocking, Theories of detonation, Control of abnormal combustion, Combustion chamber design principles, Types of combustion chamber.

5

Alternative Fuels: Methanol, Ethanol, Comparison with gasoline, Manufacturing, Engine performance with pure Methanol, Ethanol &blends, Alcohols with diesel engine, Vegetable oils, Bio gas.

6

Engine Systems & Components: Fuel System (SI Engine), Carburetion & Injection, process & parameters, properties of A/F mixture, Requirements of A/F ratios as per different operating conditions, Carburetors, types, Aircraft carburetor, comparison of carburetion & injection, F/A ratio calculations.

7

CI engine: Mixture requirements & constraints, Method of injection, Injection systems, CRDI etc. system components, pumps injectors.

8

Ignition system: Conventional & Modern ignition systems Magneto v/s Battery, CB point v/s Electronic ignition, Fuel Ignition Energy requirements. Spark advance, centrifugal, vacuum Firing order, spark plugs.

9

Engine Friction & Lubrication: Determination of friction, Lubrication principles, Types of lubrication, Places of lubrication Bearings and piston rings etc., Functions of Lubrication, Properties, Rating and Classification of lubricating oil, Additives, Lubrication systems. Engine Cooling: Requirements of cooling, Areas of heat flow, High temperature regions of combustion chamber. Heat Balance, Cooling Systems, Air, Water Cooling, Cooling system components.

10

Supercharging: Objectives, Thermodynamic cycle & performance of super charged SI & CI engines, Methods of super charging, Limitations, Two stroke engines: Comparison of 4s & 2s engines construction & valve lining scavenging. Process parameters, systems, supercharging of 2 stroke engines.

11

Dual & Multi fuel engines: Principle, fuels, Combustion, performance Advantages, Modification in fuel system.

12

Special Engines: Working principles of Rotary, Stratified charge, Free piston, Variable compression ratio engines

B) ABC Analysis

Unit No.	Category A (Hard topics)	Category B (Topics with average hardness level)	Category C (Easy to understand topics)
2	First Law analysis, Energy Balance.	Fuel- air cycles, Actual cycles.	History of IC engines: Nomenclature, Classification & Comparisons & CI, 4stroke- 2 stroke
3	Measurement of operating parameters e.g. speed, fuel & air consumption, Powers, IHP, BHP, FHP,	Efficiencies Thermal, Mechanical, Volumetric, Emission Measurement, Indian & International standards of Testing, Emission.	Performance parameters
4	Detonation & knocking, Theories of detonation, Control of abnormal combustion	Combustion in CI & SI engines, Ignition Limits, Stages of combustion, Combustion parameters. Delay period and Ignition Lag, Turbulence and Swirl, Effects of engine variables on combustion parameters, abnormal combustion in CI & SI engines	Combustion chamber design principles, Types of combustion chamber
5	Engine performance with pure Methanol, Ethanol & blends, Alcohols with diesel engine,	Vegetable oils, Bio gas.	Methanol, Ethanol, Comparison with gasoline, Manufacturing.
6	Aircraft carburetor, comparison of carburetion & injection, F/A ratio calculations.	Injection, process & parameters, properties of A/F mixture, Requirements of A/F ratios as per different operating conditions,	Fuel System (SI Engine), Carburetion Type

7	Mixture requirements & constraints	Injection systems, CRDI etc. system components, and pumps injectors.	Method of injection,
8	Magneto v/s Battery, CB point v/s Electronic ignition, Fuel Ignition Energy requirements.	Spark advance, centrifugal, vacuum Firing order, spark plugs.	Conventional & Modern ignition systems
9	Bearings and piston rings Areas of heat flow, High temperature regions of combustion chamber. Heat Balance, Cooling Systems,	Engine Friction & Lubrication: Determination of friction	Lubrication principles, Types of lubrication, Places of lubrication ., Functions of Lubrication, Properties, Rating and Classification of lubricating oil, Additives, Lubrication systems. Air, Water Cooling, Cooling system components. Requirements of cooling
10	Scavenging. Process parameters, systems, supercharging of 2 stroke engines.	Thermodynamic cycle & performance of super charged SI & CI engines	Objectives , Methods of super charging, Limitations, Two stroke engines: Comparison of 4s & 2s engines construction & valve lining
11	Principle, fuels, Combustion,	Performance, Modification in fuel system.	Advantages
12	Variable compression ratio engines	Stratified charge, Free piston	Working principles of Rotary

7). Books/ Website/Journals & Handbooks/ Association & Institution:

a). Recommended Text & Reference Books and Websites:

S. No.	Title of Book	Authors	Publisher	Cost (Rs.)	No. of books in Library
Text Books					
T1	Internal Combustion Engines	Mathur and Sharma,	Dhanpat Rai & Sons	560	20
Reference Books					
R1	Fundamentals of Internal Combustion Engines	Gupta H.N.,	Prentice Hall of India	780	5
R2	Internal Combustion Engines	Edward Obert,	Harper and Raw Publisher	1022	1
R3	Internal Combustion Engines	Ganeshan V	TMH	521	15
R4	I.C. Engines	R. Yadav	Central Publishing House	386	5
Websites related to subject					
1	Ocw.mit.edu				
2	NPTEL				

b). Journals & Handbooks: -

- *Indian Journal of Technology: By Council of Scientific and Industrial Research*
- *Journal of Institute of Engineers (India): By Institute of Engineers*
- *Journal on mechanisms: By S science direct*

c). Associations and Institutions: -

- *ASME- American Society of Mechanical Engineers*
- *Institution of Mechanical Engineers (India)*
- *Bureau of Indian Standards*

8). Syllabus Deployment: -

a). Total weeks available for academics (excluding holidays) as per Poornima Foundation c

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Semester	
No. of Working days available(Approx.)	84
No. of Weeks (Approx.)	12

- Total weeks available for special activities (as mentioned below)- 02 weeks (Approx.)

b). Special Activities (To be approved by HOD & Dean & must be mentioned in deployment):

- Assignment –Twice in a semester
- Open Book Test- Once in a semester

c). Lecture schedule per week

i). University scheme (L+T+P) = 03+00+00

Sr. No.	Name of Unit	No. of lectures	Broad Area	Degree of difficulty	Text/ Reference
1.	Introduction: Objective, scope and outcome of the course.	01	Basic Details	Low	
2.	History of IC engines	03	About Brief Details	Low	Dhanpat Rai & Sons
3.	Testing & Performance	05	Performance parameters, Measurement of operating parameters	Hard	TMH
4.	Fuel & Combustion	05	Combustion in CI & SI engines,	Medium	CBS
5.	Alternative Fuels	02	Methanol, Ethanol, Comparison with gasoline	Medium	TMH
6	Engine Systems & Components	4	Fuel System (SI Engine), Carburetion & Injection, process & parameters	Medium	Dhanpat Rai & Sons
7	CI engine	4	Mixture requirements & constraints	Low	CBS
8	Ignition system	4	Conventional & Modern ignition systems	Low	TMH
9	Engine Friction & Lubrication	5	Determination of friction, Lubrication principles, Types of lubrication	Low	Dhanpat Rai & Son

10	Supercharging	2	Thermodynamic cycle & performance of super charged SI & CI engines	Medium	Dhanpat Rai & Sons
11	Dual & Multi fuel engines	3	Principle, fuels, Combustion, performance Advantages, Modification in fuel system.	Medium	TMH
12	Special Engines	3	Working principles of Rotary, Stratified charge, Free piston, and Variable compression ratio engines.	Hard	Prentice Hall of India

d). Introduction & Conclusion: Each subject, unit and topic shall start with introduction & close with conclusion. In case of the subject, it is Zero lecture.

e). Time Distribution in lecture class: - Time allotted: 60 min.

i. First 5 min. should be utilized for paying attention towards students who were absent for last lecture or continuously absent for many days + taking attendance by calling the names of the students and also sharing any new/relevant information.
ii. Actual lecture delivery should be of 50 min.
iii. Last 5 min. should be utilized by recapping/ conclusion of the topic. Providing brief introduction of the coming up lecture and suggesting portion to read.
iv. After completion of any Unit/Chapter a short quiz should be organized.
v. During lecture student should be encouraged to ask questions**.**

Note: Pl. ensure that each student is having Lecture Note Book. Also, write on the black board day and date, name of the teacher, name of subject with code, unit and lecture no. and topics to be covered at the beginning of each lecture and ensure that students write in lecture note book. Ask students to leave 4/5 pages blank for copying the note from fellow students in case of their absenteeism.

9). Assignment : - An essential component of Teaching- Learning process in Professional Education.

Home assignment shall comprise of two parts:

Part (i) Minimum essential questions, which are to be solved and submitted by all in the specified due date.

Part (ii) Other important questions, which may also be solved and submitted for examining and guidance by teacher.

10). Examination Systems:

Sr. No.	Name of the Exam	Weightage	Max. Marks	% of passing marks	Nature of paper Theory + Numerical	Syllabus coverage (in %)	Conducted by
1.	1st Mid Term (IA)	20%	60	60 (24 marks)	T+N	60 (3 units)	College
2.	2nd Mid Term (IA)		60	60 (24 marks)	T+N	40 (Remaining 2 units)	College
3.	University Exam	80%	120	120 (48 Marks)	T+N	100	RTU, Kota

11). CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3													2	1
CO2		2											3	2	2
CO3		3											2	3	

Target and Attainment of the subject during the session

Target and Attainme

nt of the subject during the session (2020-21)

Target and Attainment of the subject during the session (2019-20): New Subject introduced in this semester

Place & Date:

PCE, 5/07/2020

Dr. Narayan Lal jain

Professor & Head

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PCE | DETAILED LECTURE NOTES | SUB/ I.C Engine

(PLAIN SHEET) | TOPIC L-4

Testing and Performance

✡ The basic task of the development engineer is to reduce the loss and improve power output and reliability of the engine.

Performance parameter :—

— Degree of Success with its assigned job

↳ chemical energy —(Convert / (Thermal energy))→ useful mechanical ~~energy~~ work

① SFC

② Brake mean effective pressure (MEP) = $\frac{Ai*K}{Li*} = \frac{BP*h}{LAN}$

③ Specific Power output (P) = $\frac{BP}{A}$

④ Specific weight (W) = Pg

⑤ Exhaust smoke and other emission

Basic parameters are to be studies for evaluation of performance and effect of various operating condition, design concepts and modification

Basic Performance Parameters :—

① Power and mechanical efficiency :—

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Force – dynamometer
Speed – Tachometer

$$P = F \times V = T \times \omega$$

* **Brake power** – Power developed by an engine at the output shaft

$$B.P. = 2\pi N T$$

– Dynamometer

N = No of revolution (RPM)

$$T = W \times R$$

$$N = \frac{N}{60}$$

* **IP** – Power developed by combustion of fuel in combustion chamber.

$$IP > BP$$

– basis of evaluation of Combustion efficiency

Heat release in the cylinder

$$\eta_m = \frac{BP}{IP}$$

$$F.P. = IP - BP$$

(2) Mean effective pressure and Torque

(mep) – Pressure from Piston during power stroke in CC

Hypothetical pressure which is ~~to be~~ acting on the piston throughout the power stroke.

$$P_{IM} = \frac{IP \times 60 \times 2}{LANK}$$

$$P_m = \frac{\text{Area of indicator diagram} \times \text{Spring constant}}{\text{Length of indicator dia} \times \text{Spring constant}}$$

$$IP = \frac{P_{IM} \times LAN}{n} \text{ watts}$$

n = no of revolutions required for one engine cycle.

for hit and miss governor

IP/cylinder = Pim · L A X No of working stroke/sec.

$$fmep = imep - bmep$$

$$BP = \frac{P_{BM} LANK}{60,000}$$

$$RP = \frac{P_{bm} \cdot X\, CAN}{n}$$

$$P_{BM} = \frac{B.P. * 60000}{LANK}$$

$$BP = 2\pi NT$$

$$T = \frac{1}{2\pi} \frac{P_{bm} X L A}{n}$$

Numerical problems

mean Piston speed $\bar{S_p} = 2LN$

$\simeq$ 8 to 15 m/s

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PCE DETAILED LECTURE NOTES SUB/ IC Engine

(PLAIN SHEET) TOPIC Power L-5

③ Specific output (Power) = Brake output / Piston displacement

Power output per unit stroke volume

$P_s = \frac{B.P}{A \times L} = \frac{(P_m)(L)(A)(N)(K)}{60 \times A}$

$P_s = \frac{P_{out}}{V_s}$

$P_s = P_M \times N$

$= \text{Constant} \times P_{mb} \times N$

$= \text{Constant} \times P_M \times 2LN$

$P_s = (P_m) \times (S_p) \times \text{Constant}$

P_m = force available to work; S_p = Speed with which it is working.

④ Volumetric eff^n :- measure of degree to which the Engine fill its swept Volume.

$\eta_v =$ Mass of air inducted into the engine cylinder during suction stroke / Mass of air corresponding to the swept volume at Patm & Tatm

$\eta_v = \frac{V}{V_s}$ $\frac{V_{act}}{V_{th}}$

$\eta_v =$ mass of charge (fuel) actually inducted / Mass of charge corresponding to the cylinder volume at intake pr & T

For Supercharged Engine $\Rightarrow \eta_v =$

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⑤ f/A Ratio →

$$f/A = \frac{M_f}{M_a}$$

⑥ Specific fuel Consumption — $\propto \frac{1}{\eta_{th}}$

$$BSFC = \frac{\dot{M}_f}{BP} \times 3600 \quad \frac{kg}{kW\,hr}$$

$$ISFC = \frac{\dot{M}_f}{IP} \times 3600 \quad kg/kW\,hr$$

Inlet valve mach index :—

V_{max} is limited by local sonic velocity

$$\eta = \left(\frac{A_p}{A_i}\right)\left(\frac{V_p}{C_i}\right)$$

V_p = Piston speed
C_i = Flow coefficient of inlet
A_p = Piston Area
A_i = intake valve opening area

If a = Sonic velocity (Inlet)

$$\frac{\eta}{a} = \left(\frac{A_p}{A_i}\right)\left(\frac{V_p}{C_i a}\right)$$

$$(\eta_{vol})_{max} = 0.5\,M$$

$M = ?$

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PCE | DETAILED LECTURE NOTES | SUB/ IC Engine.

(PLAIN SHEET) | TOPIC 1-9 Combustion Phenomenon

Combustion in CI Engine

- The importance of CI Engine due to

① $\eta_{th} > (\eta_{th})_{otto\ (SI)}$

② Diesel oil being less expensive than the SI Engine fuel (Petrols)

③ Since $\rho_D > \rho_P$

and fuel is sold on the volume basis (litres) & Not on the mass basis (Kg)

More kg of the fuel per litre are obtained in purchasing CI Engine fuel

* CI Engines have some drawbacks also in Comparision to SI Engine -

Drawback of CI Engine

(i) Heavy weight :- $\gamma \uparrow$ also Heterogeneous mixture

(ii) Noise and vibration

(iii) Smoke and Adour — Incomplete Combustion of diesel fuel.

Range :- 50 to 900 mm bore

100 to 4500 RPM

2 to 10,000 B.P.

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Combustion in CI Engine :-

Ignition temp of Diesel = 400°C

In CI Engine Air alone is compressed through a large C.R. (12:1) to (22:1) during the compression stroke rising its Pr and Temperature. (Temp = 2000 - 2500°C — at the end of compression — after combustion)

On this highly compressed & heated air (well above the ignition Temp^r (400°C) of fuel) one or more jet of fuel are injected in the liquid state, Compressed to high Pr^r of 100 to 150 bar (injection Pr^r) by fuel pump:

- Each minute droplet enters the [hot air (440 to 550°C) and Pr^r (30 to 40) (MEP)] is quickly surrounded by its own vapour envelope. &

  this is then after an appreciable interval is inflamed at the surface of envelope.

- To evaporate the liquid, Latent heat is abstracted from the surrounding air which reduces the Temp^r of thin layer of air, surrounding the droplet and some time must elapse before this Temp^r can be rised again by conducting heat from the Bulk of air

As soon as the vapour and air in Contact with it reach a certain temp^r & local air-fuel ratio is within the Combustible range, ignition takes place (though the core is still liquid and relatively cold.

Once ignition has taken place & the flame established, the heat required for further evaporation will be supplied from heat released by the Combustion.

- There is a delay period before the ignition takes place. (first time 4 injection for 0.002 sec)

⇒ So the higher the air temp (Ta ↑) & lower the self ignition temp^r the starter would be the delay.

⇒ Pr Ratio ↑ - shorter the delay since it increase the rate of heat transfer & more intimate Contact between the hot air & cold fuel.

- In CI Engine since fuel is not injected at once., But is spread over a definite period of time corresponding to (20-40)° θ. So the initial fuel droplet meet air, whose temp is only little above their self ignition temp & ignite after the ignition delay. (0.002 sec)

- The subsequent fuel drops find air already heated to a much higher temp by the burning of initial droplets. & therefore burn more quickly, almost as they issue from the injector nozzle. But their subsequent progress is handicapped. because of less quantity of O_2 available.

- The fuel air mixture in CI Engine is heterogeneous under these condition (a) if air within the cylinder were motionless (b) only a small proportion of fuel would find sufficient O_2 & (c) even burning of these fuel would be slow or (d) even blocked as it is surrounded by its own products of combustions. (burnt gases)

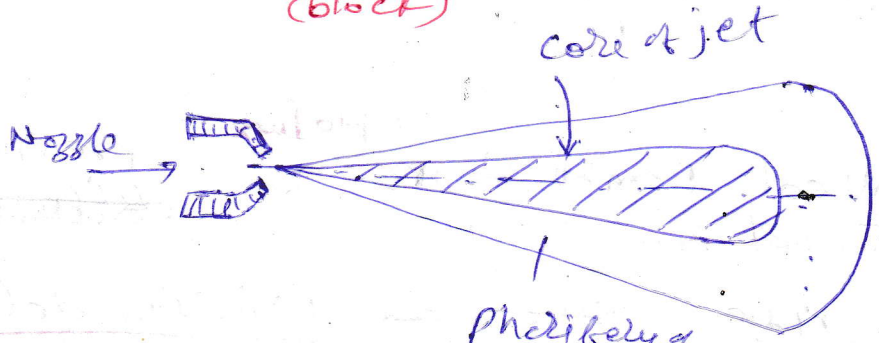
- It is therefore essential to impart an orderly & controlled movement of air & fuel so that the continuous supply of fresh air is brought to each burning drop.

Air swirl & scavenging

& product of Combustion are swept away the effect of this air motion is called "AIR SWIRL" (Turbulence)

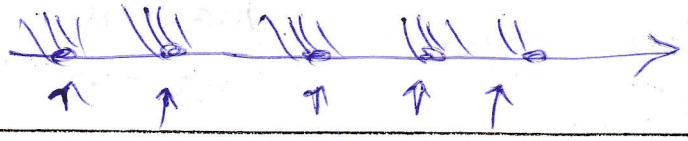
- Turbulence in SI Engine implies the disordered air motion with no general direction of flow. → No required in SI Engine

- Swirl which is required in CI Engine implies an orderly movement ~~of whole body~~ of air with a particular direction of flow to bring a continuous supply of fresh air to each burning droplet Air swirl & sweep away (exhaust) the product of Combustion (burnt gases) which otherwise it would suffocate it (block) - scavenging



Air swirl is Required for CI Engine

No swirl.



Swirl.

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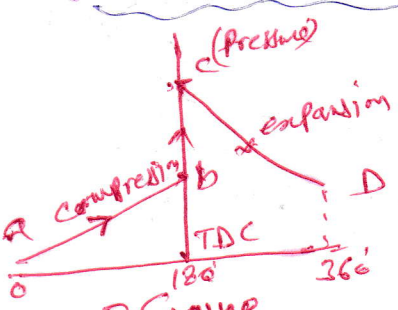
STAGES of Combustion



(I) – Starting of fuel injection to rise of pr^{v}
(II) up to Pmax
(III) up to Tmax
(IV) After burning / Late burning

(I) Ignition delay Period (0.002 sec)

during which some fuel has been admitted but has not yet been ignited

(Initial fuel droplet meet air of temp little above own self ignition temp (4 to 5))

(Start of injection to separation from Motoring curve)

— the ignition delay is a sort of preparatory phase.

II Un controlled Combustion (Abnormal combustion)

upto Pmax

— Premixed (~~diffusion~~ Flame)

beg of Rapid pr^{v} rise & ignition delay fuel droplet have time to spread themselves over a wide area and having air around them.

{ end of delay period . to Max pr^{v} in the cycle }

(Abnormal Combustion)

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PCE DETAILED LECTURE NOTES SUB/ I.C. Engine

(PLAIN SHEET) TOPIC.....

II Controlled Combustion :- (Diffusion flame) Pmax – Tmax

Since Temp^r and Pr^r are so high that the fuel droplet injected during the stage burns almost as they enter (quickly)

* Further pr^r rise can be controlled by injection rate.

{ Max pr^r in the cycle } to { Max temp in the cycle }

· Heat evolved = 70 to 80% Total heat of fuel supply

IV After burning / Late burning —

Theoritically it is expected that the combustion ends after the II stage

– Due to poor distribution of fuel particles, combustion continuous during part of ~~the reminder of~~ the expansion stroke.

θ = 70 to 80° from TDC

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Air – Fuel Ratio in CI Engine :–

* In CI Engine

Air supply = Constant
fuel supply = vary / load
↳ less fuel consumption

Air supply will be constant irrespective of Load.

$$\dot{m}_a = \text{constant}$$

$\dot{M}_a = C$

∴ So CI Engine can be termed as Constant Air Supply Engine

→ So as Load changes (Fuel Supply) → $\dot{m}_a$ changes (Fuel Pump + Fuel injector)

↳ (A/F) vary ⇒ (100:1) to (20:1)

---

* In SI Engine

$A/F = C$

$\left(\frac{A}{F}\right)$ = constant for all load
↳ more fuel consumption

A/F Ratio remains Practically constant for all the Load.

– Since we know that Inflamable limit of A/F Ratio Ranging from

Too rich ← SI | 8:1 to 30:1 | → Too Lean CI

Can Burn

– How does the combustion occur in CI Engine when mixture is more Leaner than (30:1) ?

Whatever may be the overall (A/F) ratio in CI Engine, due to injection it is fixed. there is a Heterogenous mixture

PCE DETAILED LECTURE NOTES SUB/ I.C Engine –
(PLAIN SHEET) TOPIC

∴ (A/F) mixture varies widely in different areas within the chamber.

Like (i) only fuel (A/F = 0)
(ii) very lean
(iii) very Rich
(iv) only air (A/F) = ∞

A/F = 8:1
A/F = 8/1
A = 8 kg
F = 1 kg
or A = 5 kg
F = 1 kg
Rich

However there would be some areas where local (A/F) Ratio is within the Combustion Range.

– So Ignition may occur in many places simultaneously.

– Like SI Engine there is no definite flame front in CI Engine

* (A/F) use at Full Load condition

SI	CI
13:1	20:1
Slightly Richer	Leaner

Since η_{th} ↑ as Leaner mixture → higher ($r = V/V_c$)
mep ↓ —— " ——
Power ↓ —— " ——
} CI Engine

which results in Larger size engine for same Power o/p.

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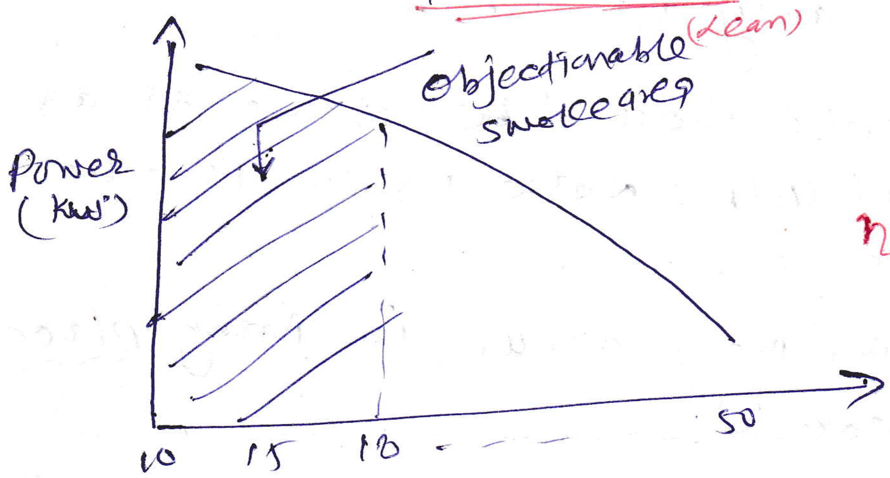
* Since the poor distribution of fuel and its limited intermixing with air (Less O_2) results in the objectionable SMOKE (∵ incomplete combustion) (I) if operated near the chemically correct A/F (stoichiometric) Ratio. (15:1) → power more

Hence the CI Engine must always operates with excess air.

i.e. $A/F = 23:1$ (Lean) or 30% excess air

→ Power less, η_t more
→ Less Fuel Consumption

$\eta_t \uparrow$ CR $\uparrow$



∵ Power (↑) as A/F is → Stoichoimetric

but if it is operated near the stoichoimetric condition, the (A/F) ratio in certain region within the chamber is likely to be so rich that some of fuel molecules will not be able to find the necessary (O_2) of combustion & thus produce the noticeably BLACK SMOKE.

Thus power of deisel engine is limited by SMOKE.

For the same power, Diesel engine is larger

* Because of incomplete utilization of air, power of diesel engine per unit volume is less than that of

P/Vs

Assignment Sheet-1

Campus: PCE Course: B.Tech. **Class/Section: IV A** **Date: 02/09/2020**
Name of Faculty: Dr. Narayan Lal Jain **Name of Subject:** I C Engine **Code:** 7ME5-11
Date of Preparation-01/09/2020 **Scheduled Date of Submission:09/09/2020**

Q. No.	Questions	COs	POs	PSOs
Q.1	Explain the following: Mean effective pressure, Specific fuel consumption, Air-fuel ratio, heating value of fuel.	1	1	2
Q.2	Compare the SI and CI engine on the basis of following characteristics: Thermodynamic cycle and properties of fuel used, Method of governing, compression ratio range, supercharging, power output per unit weight, initial cost and maintenance cost	1	1	2
Q.3	Write a brief note on historical development of Internal Combustion Engines	2	2	1
Q.4	Compare by way of tabulation the difference between the four stroke and two stroke engines	2	2	2
Q.5	A four stroke cycle petrol engine has six single acting cylinders of 7.5 cm bore and 9 cm stroke. The engine is coupled to a brake having a torque arm radius of 38 cm. At 3300 rev/min, with all cylinders operating the net brake load is 324 N. When each cylinder in turn is rendered inoperative, the average net brake load produced at the same speed by the remaining five cylinders is 245 N. Estimate the indicated mean effective pressure of engine. With all cylinders operating the fuel consumption is 0.3 kg/min, fuel calorific value 42000 kJ/kg, the jacket water flow rate and temperature rise are 65 kg/min and 12 C. On test, the engine is enclosed in a thermally and acoustically insulated box, through which the output drive, water, fuel, air and exhaust connections pass. Ventilating air blown up through the box at the rate of 14 kg/min enters at 10 C and leave 55 C. Draw heat balance sheet..	2	2	2

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POORNIMA COLLEGE OF ENGINEERING,JAIPUR																		
Assignment-1, 2020-21				B. TECH. IV YEAR (VII SEM.)														
FORMAT OF Q. WISE MARKS STATEMENT			Name of Faculty	Dr. Narayan Lal Jain														
SUB CODE:	7ME5-11		SUBJECT NAME:	I C Engine														
BRANCH:	MECHANICAL ENGG.			SECTION:									A					
S. No.	Roll No.	Name of Students	Q. No.	Q. 1	Q. 2	Q. 3	Q. 4	Q. 5	Q. 6	Q. 7	Q. 8	Q. 9	Q. 10	Q. 11	Q. 12	Q. 13	Q. 14	Q. 15	Total
			CO No.	1	2	1	3	3											25
			PO No.	1	2	1	1	1											
			Max. Marks:	5	5	5	5	5											
1	2	ADITYA SINGH .	PCE17ME002	3	2	4	4												13
2	3	ADITYA SINGH RAJAWAT	PCE17ME003	3	5	5	5	2											20
3	6	AKSHAY PAREEK .	PCE17ME006	5	5	5	3	3											21
4	8	AMIT KUMAR	PCE17ME008	5	3	2	4												14
5	9	AMIT SINGH RAWAT .	PCE17ME009	2	5	5	4	5											21
6	14	ARMESH SAINI .	PCE17ME016	2	5	3	3	5											18
7	15	ASHEER UL HAMEED	PCE17ME017	5	3	5	4												17
8	17	AYUSH KHANDELWAL .	PCE17ME019	5	3	3	4	4											19
9	20	CHIRAG LODWAL .	PCE17ME024	3		4	4	3											14
10	23	DEVENDRA SINGH	PCE17ME027	5	4	3	3	3											18
11	25	DUSHYANT SAINI .	PCE17ME030	2	3	4	3	4											16
12	26	GAGAN DEEP KARDAM .	PCE17ME031	4	3		4	2											13
13	27	GANESH SHARMA .	PCE17ME032	5	4	5													14
14	28	GAURAV JOSHI .	PCE17ME033	3	4	5	3												15
15	31	GOVINDPATEL M .	PCE17ME039	5	3	2	3	4											17
16	32	HARISH GUPTA .	PCE17ME040	2	3	5	5	3											18
17	33	HARSH RAJ	PCE17ME041	3	2	5	5	4											19
18	34	HARSHIT KUMAR MEENA .	PCE17ME042	4	4	5	5	3											21
19	35	HARSHIT LOHAR .	PCE17ME043	5	1	4	4	3											17
20	37	HARSHITA BHATIA .	PCE17ME045	5	4	4	3	4											20
21	38	ISHAN SEN	PCE17ME046	4	2	4	3	4											17
22	39	KANHAIYA KUMAR	PCE17ME048	3	4	2	5	3											17
23	40	KARAN SUTHAR .	PCE17ME049	4	3	4	5	2											18

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24	42	KARTIK SHARMA	PCE17ME051	4	2	5	2	4												17
25	43	KUSHAGRA VASHISHTHA .	PCE17ME052	5	4	4	3	2												18
26	44	LAKSHYA SAPRA .	PCE17ME053	4	2	2	5	3												16
27	45	LALIT SINGH	PCE17ME054	3	4	5	4	2												18
28	46	LEKHA TIWARI .	PCE17ME055	3	5	4	4	5												21
29	47	LOKESH YADAV .	PCE17ME057	3	4	4	1	4												16
30	48	MAYANK GUPTA .	PCE17ME060	5	4	3	3	2												17
31	49	MITUL SHARMA .	PCE17ME061	3	4	4	2	4												17
32	52	NISHANT KUMAR	PCE17ME065	2	3	5	2	5												17
33	53	PARASRAM MALI	PCE17ME069	2	1	4	2	4												13
34	54	PIYUSH SHARMA .	PCE17ME072	3	3	5	2	5												18
35	55	PRAKHAR TOLAMBIA .	PCE17ME075	5	3	3	3	2												16
36	56	SOM AGRAWAL	PCE17ME092	4	2	3	2	3												14
37	57	YASH AVASTHI .	PCE17ME103	5	5	4	3	5												22
38	59	DINESH KUMAR ARYA	PCE18ME702	3	3	3	4	3												16
39	60	MANISH SINGH CHOUHAN	PCE18ME703	2	3	4	3	3												15
40	61	RAHUL KUMAR BOHRA	PCE18ME704	3	5	3	2	4												17
41	62	SAJID GOURI	PCE18ME705	4	3	3	4	3												17
42	65	RAHUL KUMAR	PCE18ME708	3	5	4	2	3												17
43	66	VINESH SONI	PCE18ME709	4	4	3	2	2												15

Total Students=		**43**
Absent / Debarred Students=		**0**
Eligible to Appear=		**43**
Students Passed=		**43**
Students Failed=		**0**
Pass % =		**100.00**
Above 80% Marks=		**5**
80%- 70% Marks=		**11**
70%- 60% Marks=		**20**
60%- 50% Marks=		**7**
50%- 40% Marks=		**0**
40%- 30% Marks=		**0**
Below 30% Marks=		**0**

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POORNIMA COLLEGE OF ENGINEERING,JAIPUR

Department of Mechanical Engineering

NBA Process Implementation

CO-PO Attainment Sheet Session 2020-2021

Batch	**2017-2021**	**Name of Activity**	**Assignment-1**
Name of Course	**I C Engine**	**Name of Faculty**	**Dr. Narayan Lal Jain**
Course Code	**7ME5-11**	**Semester / Section**	**VII Elective**

Roll No.	Name of Students	University Roll No	TOTAL	CO1	CO2	Overall CO AverageLevel	PO1	PO2	PSO1	PSO2	PSO3
			25	level	Level	Overall CO AverageLevel	Level	Level	Level	Level	Level
1	ADITYA SINGH.	PCE17ME002	13	2	3	3	2	2	3	2	1
2	ADITYA SINGH RAJAWAT	PCE17ME003	20	3	3	3	3	2	3	2	2
3	AKSHAY PAREEK .	PCE17ME006	21	3	3	3	3	2	3	2	2
4	AMIT KUMAR	PCE17ME008	14	3	2	3	3	2	2	2	1
5	AMIT SINGH RAWAT .	PCE17ME009	21	3	3	3	3	2	3	2	2
6	ARMESH SAINI .	PCE17ME016	18	3	3	3	3	2	3	2	1
7	ASHEER UL HAMEED	PCE17ME017	17	3	3	3	3	2	3	2	2
8	AYUSH KHANDELWAL .	PCE17ME019	19	3	3	3	3	2	3	2	1
9	CHIRAG LODWAL .	PCE17ME024	14	2	3	3	2	2	3	2	1
10	DEVENDRA SINGH	PCE17ME027	18	3	2	3	3	2	2	2	1
11	DUSHYANT SAINI .	PCE17ME030	16	2	3	2	2	2	3	2	1
12	GAGAN DEEP KARDAM .	PCE17ME031	13	3	2	3	3	2	2	2	1

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13	GANESH SHARMA .	PCE17ME032	**14**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**
14	GAURAV JOSHI .	PCE17ME033	**15**	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**1**
15	GOVINDPATEL M .	PCE17ME039	**17**	**3**	**2**	**3**	**3**	**2**	**2**	**2**	**1**
16	HARISH GUPTA .	PCE17ME040	**18**	**2**	**3**	**3**	**2**	**2**	**3**	**2**	**1**
17	HARSH RAJ	PCE17ME041	**19**	**2**	**3**	**3**	**2**	**2**	**3**	**2**	**1**
18	HARSHIT KUMAR MEENA .	PCE17ME042	**21**	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**2**
19	HARSHIT LOHAR .	PCE17ME043	**17**	**2**	**3**	**3**	**2**	**2**	**3**	**2**	**1**
20	HARSHITA BHATIA .	PCE17ME045	**20**	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**1**
21	ISHAN SEN	PCE17ME046	**17**	**2**	**3**	**3**	**2**	**2**	**3**	**2**	**1**
22	KANHAIYA KUMAR	PCE17ME048	**17**	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**1**
23	KARAN SUTHAR .	PCE17ME049	**18**	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**1**
24	KARTIK SHARMA	PCE17ME051	**17**	**2**	**3**	**3**	**2**	**2**	**3**	**2**	**1**
25	KUSHAGRA VASHISHTHA .	PCE17ME052	**18**	**3**	**2**	**3**	**3**	**2**	**2**	**2**	**1**
26	LAKSHYA SAPRA .	PCE17ME053	**16**	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**1**
27	LALIT SINGH	PCE17ME054	**18**	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**1**
28	LEKHA TIWARI .	PCE17ME055	**21**	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**2**
29	LOKESH YADAV .	PCE17ME057	**16**	**3**	**2**	**3**	**3**	**2**	**2**	**2**	**1**
30	MAYANK GUPTA .	PCE17ME060	**17**	**3**	**2**	**3**	**3**	**1**	**2**	**2**	**1**
31	MITUL SHARMA .	PCE17ME061	**17**	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**1**
32	NISHANT KUMAR	PCE17ME065	**17**	**2**	**3**	**3**	**2**	**2**	**3**	**2**	**1**
33	PARASRAM MALI	PCE17ME069	**13**	**1**	**3**	**2**	**1**	**2**	**3**	**1**	**1**
34	PIYUSH SHARMA .	PCE17ME072	**18**	**2**	**3**	**3**	**2**	**2**	**3**	**2**	**1**
35	PRAKHAR TOLAMBIA .	PCE17ME075	**16**	**3**	**2**	**3**	**3**	**1**	**2**	**2**	**1**

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36	SOM AGRAWAL	PCE17ME092	14	2	2	2	2	1	2	1	1
37	YASH AVASTHI .	PCE17ME103	22	3	3	3	3	2	3	2	2
38	DINESH KUMAR ARYA	PCE18ME702	16	2	3	2	2	2	3	2	1
39	MANISH SINGH CHOUHAN	PCE18ME703	15	2	3	2	2	2	3	1	1
40	RAHUL KUMAR BOHRA	PCE18ME704	17	3	2	3	3	2	2	2	1
41	SAJID GOURI	PCE18ME705	17	3	3	3	3	2	3	2	1
42	RAHUL KUMAR	PCE18ME708	17	3	2	3	3	2	1	1	1
43	VINESH SONI	PCE18ME709	15	3	2	2	3	1	1	1	1

	CO				PO				
Overall CO Attainments for PO		CO1	CO2	CO	PO1	PO2	PSO1	PSO2	PSO3
Targets		3.00	2.00	2.75	3.00	2.50	2.50	2.33	1.50
Attainments		2.63	1.81	2.60	2.63	1.61	2.23	1.47	0.59
Gap		0.37	0.19	0.15	0.37	0.89	0.27	0.87	0.91

Average	2.84
Student Attainment Level 3 Count	36
Student Attainment Level 3 - %	84
Student Attainment Level 2 Count	7
Student Attainment Level - 2%	16
Student Attainment Level 1 Count	0
Student Attainment Level - 1 %	0
Course Attainment (%Students getting level 3)	0.84
Target Achieved	YES

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POORNIMA COLLEGE OF ENGINEERING,JAIPUR

Department of Mechanical Engineering

NBA Process Implementation

CO-PO Attainment Sheet Session 2020-2021

Batch	**2017-2021**	**Name of Activity**	**Assignment-1**
Name of Course	**I C Engine**	**Name of Faculty**	**Dr. Narayan Lal Jain**
Course Code	**7ME5-11**	**Semester / Section**	**VII Elective**

CO				PO				
Overall CO Attainments for PO	**CO1**	**CO2**	**CO**	**PO1**	**PO2**	**PSO1**	**PSO2**	**PSO3**
Targets	3.00	2.00	2.75	3.00	2.50	2.50	2.33	1.50
Attainments	2.63	1.81	2.60	2.63	1.61	2.23	1.47	0.59
Gap	0.37	0.19	0.15	0.37	0.89	0.27	0.87	0.91

Average	**2.84**
Student Attainment Level 3 Count	**36**
Student Attainment Level 3 - %	**84**
Student Attainment Level 2 Count	**7**
Student Attainment Level - 2%	**16**
Student Attainment Level 1 Count	**0**
Student Attainment Level - 1 %	**0**
Course Attainment (%Students getting level 3)	**0.84**
Target Achieved	**YES**

Even if target is achieved but little gap is there and reasons of gaps are as follows:

1. Thirteen students could not attempt questions related to CO1 in assignment 1 properly due to less understanding of the topic. They were not regular in the class.

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2. Eleven Students could not attempt CO2 related questions in assignment 1 properly due to less understanding of the topic. They were not regular in the class.

Activities Decided to bridge the gap after Assignment 1

- NPTEL online Videos were played for important topics and these videos were also given to all the students.
- Revision classes on the topic of Combustion of SI and CI engines for better understanding.

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POORNIMA COLLEGE OF ENGINEERING, JAIPUR

IV B.TECH. (VII Sem.) **SET- 1**

FIRST MID TERM ONLINE EXAMINATION 2020-21
Code: 7ME5-11: Category: PCC Subject Name– I. C. Engines
(BRANCH – MECHANICAL ENGINEERING)

Max. Time: 90 Minutes + 15 Min for Uploading **Max. Marks: 50**

NOTE:- All questions are compulsory.

Q.1	(a)	CO1	PO1	How 2-Stroke IC Engine is Different from 4-Stroke IC Engine?	**(5)**
	(b)	CO1	PO1	Enumerate Important Performance Parameters of I.C. Engines.	**(5)**
Q.2	(a)	CO2	PO2	Analyze the First law for IC Engine.	**(5)**
	(b)	CO2	PO1	Explain the assumptions for Air standard cycle. Explain phases of OTTO cycle.	**(5)**
Q.3	(a)	CO1	PO1	List out procedure of measuring Indicate Power. Explain Any One.	**(5)**
	(b)	CO1	PO1	Explain the combustion process of SI Engines with help of P-Ɵ Diagram.	**(5)**
Q.4	(a)	CO3	PO1	How auto ignition theory justify the detonation in SI engine.	**(5)**
	(b)	CO3	PO1	Why F-head type combustion chamber is better than others.	**(5)**
Q.5	(a)	CO3	PO1	Biodiesel is recognized as a clean alternative fuel. Why?	**(5)**
	(b)	CO3	PO1	What is different alternative fuel option available for IC engine?	**(5)**

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POORNIMA COLLEGE OF ENGINEERING, JAIPUR

IV B.TECH. (VII Sem.) **SET- 2**

FIRST MID TERM ONLINE EXAMINATION 2020-21
Code: 7ME5-11: Category: PCC Subject Name– I. C. Engines
(BRANCH – MECHANICAL ENGINEERING)

Max. Time: 90 Minutes + 15 Min for Uploading **Max. Marks: 50**

NOTE:- All questions are compulsory.

Q.1	(a)	CO1	PO1	How SI Engine is Different from CI Engine?	**(5)**
	(b)	CO1	PO1	Compare SI Engine Actual cycle with Air Standard Cycle.	**(5)**
Q.2	(a)	CO2	PO2	How the Friction power is evaluated by Willan's line methods ?	**(5)**
	(b)	CO2	PO1	Why Rotameter is most suitable for fuel consumption measurement?	**(5)**
Q.3		CO2	PO2	Explain the combustion process of CI Engines with help of P-Θ Diagram.	**(10)**
Q.4	(a)	CO3	PO1	Explain the effect of engine variable on engine combustion parameters.	**(5)**
	(b)	CO3	PO1	Explain the ignition lag and ignition delay for I C Engine.	**(5)**
Q.5	(a)	CO3	PO1	Why alternative fuels are better than conventional fuels?	**(5)**
	(b)	CO3	PO1	Justify suitability of ethanol as a partial substitute of gasoline in SI engine.	**(5)**

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POORNIMA COLLEGE OF ENGINEERING,JAIPUR																		
I MID TERM THEORY EXAM, 2020-21				B. TECH. IV YEAR (VII SEM.)														
FORMAT OF Q. WISE MARKS STATEMENT			Name of Faculty	Dr. Narayan Lal Jain														
SUB CODE:	7ME5-11		SUBJECT NAME:	I C Engine														
BRANCH:	MECHANICAL ENGG.			SECTION:									A					
S. No.	Roll No.	Name of Students	Q. No.	Q. 1	Q. 2	Q. 3	Q. 4	Q. 5	Q. 6	Q. 7	Q. 8	Q. 9	Q. 10	Q. 11	Q. 12	Q. 13	Q. 14	Q. 15	Total
			CO No.	1	2	1	3	3											50
			PO No.	1	2	1	1	1											
			Max. Marks:	10	10	10	10	10											
1	2	ADITYA SINGH .	PCE17ME002	7	6	5	5	6											29
2	3	ADITYA SINGH RAJAWAT	PCE17ME003	9	7	8	9	8											41
3	6	AKSHAY PAREEK .	PCE17ME006	8	9	9	7	8											41
4	8	AMIT KUMAR	PCE17ME008	6	6	7	6	0											25
5	9	AMIT SINGH RAWAT .	PCE17ME009	9	8	8	8	8											41
6	14	ARMESH SAINI .	PCE17ME016	8	7	7	8	6											36
7	15	ASHEER UL HAMEED	PCE17ME017	7	8	8	6	7											36
8	17	AYUSH KHANDELWAL .	PCE17ME019	8	7	8	7	6											36
9	20	CHIRAG LODWAL .	PCE17ME024	6	6	5	5	3											25
10	23	DEVENDRA SINGH	PCE17ME027	8	7	8	8	6											37
11	25	DUSHYANT SAINI .	PCE17ME030	8	7	7	6	5											33
12	26	GAGAN DEEP KARDAM .	PCE17ME031	4	6	6	5	4											25
13	27	GANESH SHARMA .	PCE17ME032	6	5	5	4	5											25
14	28	GAURAV JOSHI .	PCE17ME033	8	5	5	6	4											28
15	31	GOVINDPATEL M .	PCE17ME039	8	7	7	6	5											33
16	32	HARISH GUPTA .	PCE17ME040	8	8	8	6	6											36
17	33	HARSH RAJ	PCE17ME041	8	8	7	7	6											36
18	34	HARSHIT KUMAR MEENA .	PCE17ME042	8	9	8	8	7											40
19	35	HARSHIT LOHAR .	PCE17ME043	9	7	6	6	7											35
20	37	HARSHITA BHATIA .	PCE17ME045	8	8	9	8	8											41
21	38	ISHAN SEN	PCE17ME046	8	7	7	8	6											36
22	39	KANHAIYA KUMAR	PCE17ME048	7	7	5	7	6											32
23	40	KARAN SUTHAR .	PCE17ME049	8	7	7	5	7											34

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24	42	KARTIK SHARMA	PCE17ME051	8	7	7	6	6											34
25	43	KUSHAGRA VASHISHTHA .	PCE17ME052	8	7	7	5	6											33
26	44	LAKSHYA SAPRA .	PCE17ME053	6	6	7	7	6											32
27	45	LALIT SINGH	PCE17ME054	7	8	7	8	8											38
28	46	LEKHA TIWARI .	PCE17ME055	8	9	9	8	8											42
29	47	LOKESH YADAV .	PCE17ME057	6	4	7	7	6											30
30	48	MAYANK GUPTA .	PCE17ME060	7	6	6	5	5											29
31	49	MITUL SHARMA .	PCE17ME061	6	6	6	4	6											28
32	52	NISHANT KUMAR	PCE17ME065	5	5	5	4	6											25
33	53	PARASRAM MALI	PCE17ME069	5	6	7	7	0											25
34	54	PIYUSH SHARMA .	PCE17ME072	8	8	6	0	7											29
35	55	PRAKHAR TOLAMBIA .	PCE17ME075	7	7	7	4	6											31
36	56	SOM AGRAWAL	PCE17ME092	6	5	5	5	5											26
37	57	YASH AVASTHI .	PCE17ME103	7	8	8	7	6											36
38	59	DINESH KUMAR ARYA	PCE18ME702	7	7	5	5	5											29
39	60	MANISH SINGH CHOUHAN	PCE18ME703	5	6	6	6	5											28
40	61	RAHUL KUMAR BOHRA	PCE18ME704	7	8	7	6	6											34
41	62	SAJID GOURI	PCE18ME705	8	7	6	4	5											30
42	65	RAHUL KUMAR	PCE18ME708	7	7	8	6	6											34
43	66	VINESH SONI	PCE18ME709	8	6	6	4	5											29

Total Students=		**43**
Absent / Debarred Students=		**0**
Eligible to Appear=		**43**
Students Passed=		**43**
Students Failed=		**0**
Pass % =		**100.00**
Above 80% Marks=		**5**
80%- 70% Marks=		**11**
70%- 60% Marks=		**12**
60%- 50% Marks=		**15**
50%- 40% Marks=		**0**
40%- 30% Marks=		**0**
Below 30% Marks=		**0**

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Department of Mechanical Engineering

NBA Process Implementation

CO-PO Attainment Sheet Session 2020-2021

Batch	**2017-2021**	**Name of Activity**	**Mid-1**
Name of Course	**I C Engine**	**Name of Faculty**	**Dr. Narayan Lal Jain**
Course Code	**7ME5-11**	**Semester / Section**	**VII Elective**

S. No.	Name of Students	Q. No.	Total Marks	PRE. CO 1	CUR. CO 1	OVER CO1	PRE. CO 2	CUR. CO 2	OVER CO2	PRE. CO 3	CUR. CO 3	OVER CO3	PRE. OVERALL CO	CUR. OVERALL CO	OVER CO
		University Roll No		level	level	Avg. Level	Level	level	Avg. Level	Level	level	Avg. Level	Level	level	Avg. Level
1	ADITYA SINGH .	PCE17ME002	29	2	2	2	3	2	3		2	2	3	2	3
2	ADITYA SINGH RAJAWAT	PCE17ME003	41	3	3	3	3	3	3		3	3	3	3	3
3	AKSHAY PAREEK .	PCE17ME006	41	3	3	3	3	3	3		3	3	3	3	3
4	AMIT KUMAR	PCE17ME008	25	3	3	3	2	2	2		1	1	3	2	3
5	AMIT SINGH RAWAT .	PCE17ME009	41	3	3	3	3	3	3		3	3	3	3	3
6	ARMESH SAINI .	PCE17ME016	36	3	3	3	3	3	3		3	3	3	3	3
7	ASHEER UL HAMEED	PCE17ME017	36	3	3	3	3	3	3		3	3	3	3	3
8	AYUSH KHANDELWAL .	PCE17ME019	36	3	3	3	3	3	3		3	3	3	3	3
9	CHIRAG LODWAL .	PCE17M	25	2	2	2	3	2	3		2	2	3	2	3

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		E024													
10	DEVENDRA SINGH	PCE17ME027	37	3	3	3	2	3	3		3	3	3	3	3
11	DUSHYANT SAINI .	PCE17ME030	33	2	3	3	3	3	3		2	2	2	3	3
12	GAGAN DEEP KARDAM .	PCE17ME031	25	3	2	3	2	2	2		2	2	3	2	3
13	GANESH SHARMA .	PCE17ME032	25	3	2	3	3	2	3		2	2	3	2	3
14	GAURAV JOSHI .	PCE17ME033	28	3	3	3	3	2	3		2	2	3	2	3
15	GOVINDPATEL M .	PCE17ME039	33	3	3	3	2	3	3		2	2	3	3	3
16	HARISH GUPTA .	PCE17ME040	36	2	3	3	3	3	3		2	2	3	3	3
17	HARSH RAJ	PCE17ME041	36	2	3	3	3	3	3		3	3	3	3	3
18	HARSHIT KUMAR MEENA .	PCE17ME042	40	3	3	3	3	3	3		3	3	3	3	3
19	HARSHIT LOHAR .	PCE17ME043	35	2	3	3	3	3	3		3	3	3	3	3
20	HARSHITA BHATIA .	PCE17ME045	41	3	3	3	3	3	3		3	3	3	3	3
21	ISHAN SEN	PCE17ME046	36	2	3	3	3	3	3		3	3	3	3	3
22	KANHAIYA KUMAR	PCE17ME048	32	3	2	3	3	3	3		3	3	3	3	3
23	KARAN SUTHAR .	PCE17ME049	34	3	3	3	3	3	3		2	2	3	3	3
24	KARTIK SHARMA	PCE17ME051	34	2	3	3	3	3	3		2	2	3	3	3
25	KUSHAGRA VASHISHTHA .	PCE17ME052	33	3	3	3	2	3	3		2	2	3	3	3
26	LAKSHYA SAPRA .	PCE17ME053	32	2	3	3	3	2	3		3	3	2	2	2
27	LALIT SINGH	PCE17ME054	38	3	3	3	3	3	3		3	3	3	3	3
28	LEKHA TIWARI .	PCE17ME055	42	3	3	3	3	3	3		3	3	3	3	3
29	LOKESH YADAV .	PCE17ME057	30	3	3	3	2	2	2		3	3	3	2	3
30	MAYANK GUPTA .	PCE17ME060	29	3	3	3	2	2	2		2	2	3	2	3

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31	MITUL SHARMA .	PCE17ME061	28	3	2	3	3	2	3		2	2	3	2	3
32	NISHANT KUMAR	PCE17ME065	25	2	2	2	3	2	3		2	2	3	2	3
33	PARASRAM MALI	PCE17ME069	25	1	2	2	3	2	3		1	1	2	2	2
34	PIYUSH SHARMA .	PCE17ME072	29	2	3	3	3	3	3		1	1	3	2	3
35	PRAKHAR TOLAMBIA .	PCE17ME075	31	3	3	3	2	3	3		2	2	3	2	3
36	SOM AGRAWAL	PCE17ME092	26	2	2	2	2	2	2		2	2	2	2	2
37	YASH AVASTHI .	PCE17ME103	36	3	3	3	3	3	3		3	3	3	3	3
38	DINESH KUMAR ARYA	PCE18ME702	29	2	2	2	3	3	3		2	2	2	2	2
39	MANISH SINGH CHOUHAN	PCE18ME703	28	2	2	2	3	2	3		2	2	2	2	2
40	RAHUL KUMAR BOHRA	PCE18ME704	34	3	3	3	2	3	3		2	2	3	3	3
41	SAJID GOURI	PCE18ME705	30	3	3	3	3	3	3		2	2	3	2	3
81	RAHUL KUMAR	PCE18ME708	34	3	3	3	2	3	3		2	2	3	3	3
82	VINESH SONI	PCE18ME709	29	3	3	3	2	2	2		2	2	2	2	2
32															
84															

		CO			
Overall CO Attainments for PO		**CO1**	**CO2**	**CO3**	**CO**
Targets		**3.00**	**2.00**	**3.00**	**2.75**
prev Act Attainments		**2.63**	**1.81**		**2.60**
Attainments curr ActI		**2.74**	**1.77**	**2.35**	**2.34**

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Attainments Cumulative		2.69	1.79	2.35	2.47
Gap		0.31	0.21	0.65	0.28

Student Attainment Level 3 Count	23
Student Attainment Level 3 %	53
Student Attainment Level 2 Count	20
Student Attainment Level 2%	47
Student Attainment Level 1 Count	0
Student Attainment Level 1 %	0
Course Attainment (%Students getting level 3)	53.00%

S. No.	Name of Students	Q. No. / University Roll No	Total Marks	PRE. PO1 Level	CUR. PO1 level	OVER PO1 Avg. Level	PRE. PO2 Level	CUR. PO2 level	OVER PO2 Avg. Level	PRE. PSO1 Level	CUR. PSO1 level	OVER PSO1 Avg. Level	PRE. PSO2 Level	CUR. PSO2 level	OVER PSO2 Avg. Level	PRE. PSO3 Level	CUR. PSO3 level	OVER PSO3 Avg. Level
1	ADITYA SINGH .	PCE17ME002	29	2	2	2	2	2	2	3	2	3	2	2	2	1	1	1
2	ADITYA SINGH RAJAWAT	PCE17ME003	41	3	3	3	2	3	3	3	2	3	2	2	2	2	1	2
3	AKSHAY PAREEK .	PCE17ME006	41	3	3	3	2	3	3	3	3	3	2	2	2	2	2	2
4	AMIT KUMAR	PCE17ME008	25	3	3	3	2	1	2	2	2	2	2	1	2	1	1	1
5	AMIT SINGH RAWAT .	PCE17ME009	41	3	3	3	2	3	3	3	3	3	2	2	2	2	2	2
6	ARMESH SAINI .	PCE17ME016	36	3	3	3	2	2	2	3	2	3	2	2	2	1	1	1
7	ASHEER UL HAMEED	PCE17ME017	36	3	3	3	2	2	2	3	2	3	2	2	2	2	1	2
8	AYUSH KHANDELWAL .	PCE17ME019	36	3	3	3	2	2	2	3	2	3	2	2	2	1	1	1

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9	CHIRAG LODWAL .	PCE17ME024	25	2	2	2	2	2	2	3	2	3	2	1	2	1	1	1
10	DEVENDRA SINGH	PCE17ME027	37	3	3	3	2	2	2	2	2	2	2	2	2	1	1	1
11	DUSHYANT SAINI .	PCE17ME030	33	2	3	3	2	2	2	3	2	3	2	2	2	1	1	1
12	GAGAN DEEP KARDAM .	PCE17ME031	25	3	2	3	2	2	2	2	2	2	2	1	2	1	1	1
13	GANESH SHARMA .	PCE17ME032	25	3	2	3	3	1	2	3	2	3	2	1	2	2	1	2
14	GAURAV JOSHI .	PCE17ME033	28	3	3	3	2	2	2	3	2	3	2	2	2	1	1	1
15	GOVINDPATEL M .	PCE17ME039	33	3	3	3	2	2	2	2	2	2	2	2	2	1	1	1
16	HARISH GUPTA .	PCE17ME040	36	2	3	3	2	2	2	3	2	3	2	2	2	1	2	2
17	HARSH RAJ	PCE17ME041	36	2	3	3	2	2	2	3	2	3	2	2	2	1	1	1
18	HARSHIT KUMAR MEENA .	PCE17ME042	40	3	3	3	2	3	3	3	3	3	2	2	2	2	2	2
19	HARSHIT LOHAR .	PCE17ME043	35	2	3	3	2	2	2	3	2	3	2	2	2	1	1	1
20	HARSHITA BHATIA .	PCE17ME045	41	3	3	3	2	3	3	3	3	3	2	2	2	1	2	2
21	ISHAN SEN	PCE17ME046	36	2	3	3	2	2	2	3	2	3	2	2	2	1	1	1
22	KANHAIYA KUMAR	PCE17ME048	32	3	2	3	2	2	2	3	2	3	2	2	2	1	1	1
23	KARAN SUTHAR .	PCE17ME049	34	3	3	3	2	2	2	3	2	3	2	2	2	1	1	1
24	KARTIK SHARMA	PCE17ME051	34	2	3	3	2	2	2	3	2	3	2	2	2	1	1	1
25	KUSHAGRA VASHISHTHA .	PCE17ME052	33	3	3	3	2	2	2	2	2	2	2	2	2	1	1	1
26	LAKSHYA SAPRA .	PCE17ME053	32	2	3	3	2	2	2	3	2	3	2	2	2	1	1	1
27	LALIT SINGH	PCE17ME054	38	3	3	3	2	3	3	3	3	3	2	2	2	1	1	1
28	LEKHA TIWARI .	PCE17ME055	42	3	3	3	2	3	3	3	3	3	2	3	3	2	2	2
29	LOKESH YADAV .	PCE17ME057	30	3	3	3	2	2	2	2	2	2	2	2	2	1	1	1
30	MAYANK GUPTA .	PCE17ME060	29	3	3	3	1	2	2	2	2	2	2	2	2	1	1	1
31	MITUL SHARMA .	PCE17ME061	28	3	2	3	2	2	2	3	2	3	2	2	2	1	1	1
32	NISHANT KUMAR	PCE17ME065	25	2	2	2	2	2	2	3	2	3	2	1	2	1	1	1
33	PARASRAM MALI	PCE17ME069	25	1	2	2	2	1	2	3	2	3	1	1	1	1	1	1
34	PIYUSH SHARMA .	PCE17ME072	29	2	3	3	2	2	2	3	2	3	2	2	2	1	1	1
35	PRAKHAR TOLAMBIA .	PCE17ME075	31	3	3	3	1	2	2	2	2	2	2	2	2	1	1	1
36	SOM AGRAWAL	PCE17ME092	26	2	2	2	1	2	2	2	2	2	1	2	2	1	1	1
37	YASH AVASTHI .	PCE17ME103	36	3	3	3	2	2	2	3	2	3	2	2	2	2	1	2
38	DINESH KUMAR ARYA	PCE18ME702	29	2	2	2	2	2	2	3	2	3	2	2	2	1	1	1
39	MANISH SINGH CHOUHAN	PCE18ME703	28	2	2	2	2	2	2	3	2	3	1	2	2	1	1	1
40	RAHUL KUMAR BOHRA	PCE18ME704	34	3	3	3	2	2	2	2	2	2	2	2	2	1	1	1
41	SAJID GOURI	PCE18ME705	30	3	3	3	2	2	2	3	2	3	2	2	2	1	1	1
81	RAHUL KUMAR	PCE18ME708	34	3	3	3	2	2	2	1		1	1		1	1		1
82	VINESH SONI	PCE18ME709	29	3	3	3	1	2	2	1		1	1		1	1		1
32																		
84																		

		PO

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Overall CO Attainments for PO		PO1	PO2	PSO1	PSO2	PSO3
Targets		3.00	2.50	2.50	2.33	1.50
prev Act Attainments		2.63	1.61	2.23	1.47	0.59
Attainments curr ActI		2.74	1.74	1.79	1.46	0.57
Attainments Cumulative		2.69	1.68	2.01	1.46	0.58
Gap		0.31	0.82	0.49	0.87	0.92

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Assignment Sheet-2

Campus: PCE Course: B.Tech. **Class/Section: IV A** **Date: 04/11/20**
Name of Faculty: Dr. Narayan Lal Jain **Name of Subject:** I C Engine **Code:** 7ME5-11
Date of Preparation15/07/19 **Scheduled Date of Submission:11/11/20**

Q. No.	Questions	COs	POs	PSOs
Q.1	Describe with neat sketch cooling system of a four stroke S.I. Engine used in car	2	2	1
Q.2	Describe with neat sketch different methods of supercharging. Explain thermodynamic cycle of supercharging.	3	2	2
Q.3	How Efficiency is increased with supercharging?	2	2	1
Q.4	Explain lubrication system with the help of a neat sketch	2	2	2
Q.5	Give the average temperature range of Exhaust Valve and spark plug. How these specific parts are classified.	1	1	2

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POORNIMA COLLEGE OF ENGINEERING,JAIPUR																		
Assignment-2, 2020-21			B. TECH. IV YEAR (VII SEM.)															
FORMAT OF Q. WISE MARKS STATEMENT			Name of Faculty	Dr. Narayan Lal Jain														
SUB CODE:	7ME5-11		SUBJECT NAME:	I C Engine														
BRANCH:	MECHANICAL ENGG.		SECTION:										A					
S. No.	Roll No.	Name of Students	Q. No.	Q. 1	Q. 2	Q. 3	Q. 4	Q. 5	Q. 6	Q. 7	Q. 8	Q. 9	Q. 10	Q. 11	Q. 12	Q. 13	Q. 14	Q. 15	Total
			CO No.	1	2	1	3	3											25
			PO No.	1	2	1	1	1											
			Max. Marks:	5	5	5	5	5											
1	2	ADITYA SINGH .	PCE17ME002	4	5	3		2											14
2	3	ADITYA SINGH RAJAWAT	PCE17ME003	5	4	4	3	3											19
3	6	AKSHAY PAREEK .	PCE17ME006	4	5	3	4	5											21
4	8	AMIT KUMAR	PCE17ME008	3	5	3		4											15
5	9	AMIT SINGH RAWAT .	PCE17ME009	5	5	3	5	5											23
6	14	ARMESH SAINI .	PCE17ME016	5	4	4	2	3											18
7	15	ASHEER UL HAMEED	PCE17ME017	2	2	5	3	4											16
8	17	AYUSH KHANDELWAL .	PCE17ME019	5	2	4	4	4											19
9	20	CHIRAG LODWAL .	PCE17ME024	5	3	4		3											15
10	23	DEVENDRA SINGH	PCE17ME027	5	4	4	2	4											19
11	25	DUSHYANT SAINI .	PCE17ME030	3	3	5	1	5											17
12	26	GAGAN DEEP KARDAM .	PCE17ME031	3	3	5		4											15
13	27	GANESH SHARMA .	PCE17ME032	5	4	5		2											16
14	28	GAURAV JOSHI .	PCE17ME033	5	3	3		4											15
15	31	GOVINDPATEL M .	PCE17ME039	3	2	3	4	4											16
16	32	HARISH GUPTA .	PCE17ME040	5	2	4	3	3											17
17	33	HARSH RAJ	PCE17ME041	5	3	4	2	5											19
18	34	HARSHIT KUMAR MEENA .	PCE17ME042	4	5	4	2	5											20
19	35	HARSHIT LOHAR .	PCE17ME043	5	2	3	2	5											17
20	37	HARSHITA BHATIA .	PCE17ME045	2	4	5	3	4											18
21	38	ISHAN SEN	PCE17ME046	3	5	5		3											16
22	39	KANHAIYA KUMAR	PCE17ME048	4	4	3	2	4											17
23	40	KARAN SUTHAR .	PCE17ME049	3	2	4	3	5											17

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24	42	KARTIK SHARMA	PCE17ME051	5	3	4		5												17
25	43	KUSHAGRA VASHISHTHA .	PCE17ME052	3	5	3	5	2												18
26	44	LAKSHYA SAPRA .	PCE17ME053	4	5	4		4												17
27	45	LALIT SINGH	PCE17ME054	2	4	5	3	3												17
28	46	LEKHA TIWARI .	PCE17ME055	3	5	4	3	5												20
29	47	LOKESH YADAV .	PCE17ME057	2	2	3	4	4												15
30	48	MAYANK GUPTA .	PCE17ME060	3	2	5	2	3												15
31	49	MITUL SHARMA .	PCE17ME061	3	5	5		5												18
32	52	NISHANT KUMAR	PCE17ME065	5	3	5		5												18
33	53	PARASRAM MALI	PCE17ME069	4	4	3		3												14
34	54	PIYUSH SHARMA .	PCE17ME072	5	5	4	2	2												18
35	55	PRAKHAR TOLAMBIA .	PCE17ME075	3	4	3	4	2												16
36	56	SOM AGRAWAL	PCE17ME092	5	3	5		4												17
37	57	YASH AVASTHI .	PCE17ME103	4	5	2	4	5												20
38	59	DINESH KUMAR ARYA	PCE18ME702	2	4	5	3	2												16
39	60	MANISH SINGH CHOUHAN	PCE18ME703	5	3	2	3	4												17
40	61	RAHUL KUMAR BOHRA	PCE18ME704	5	2	4	4	4												19
41	62	SAJID GOURI	PCE18ME705	4	5	2	2	4												17
42	65	RAHUL KUMAR	PCE18ME708	4	2	3	3	4												16
43	66	VINESH SONI	PCE18ME709	2	5	3	1	5												16

Total Students=		**43**
Absent / Debarred Students=		**0**
Eligible to Appear=		**43**
Students Passed=		**43**
Students Failed=		**0**
Pass % =		**100.00**
Above 80% Marks=		**2**
80%- 70% Marks=		**14**
70%- 60% Marks=		**25**
60%- 50% Marks=		**2**
50%- 40% Marks=		**0**
40%- 30% Marks=		**0**
Below 30% Marks=		**0**

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POORNIMA COLLEGE OF ENGINEERING,JAIPUR

Department of Mechanical Engineering

NBA Process Implementation

CO-PO Attainment Sheet Session 2020-2021

Batch	**2017-2021**	**Name of Activity**	**Assignment-2**
Name of Course	**I C Engine**	**Name of Faculty**	**Dr. Narayan Lal Jain**
Course Code	**7ME5-11**	**Semester / Section**	**VII Elective**

S. No.	Name of Students	Q. No.	Total Marks	PRE. CO1	CUR. CO1	OVER CO1	PRE. CO2	CUR. CO2	OVER CO2	PRE. CO3	CUR. CO3	OVER CO3	PRE. OVERALL CO	CUR. OVERALL CO	OVER CO
		University Roll No		level	level	Avg. Level	Level	level	Avg. Level	Level	level	Avg. Level	Level	level	Avg. Level
1	ADITYA SINGH .	PCE17ME002	14	2	2	2	3	3	3	2	3	3	3	3	3
2	ADITYA SINGH RAJAWAT	PCE17ME003	19	3	2	3	3	3	3	3	3	3	3	3	3
3	AKSHAY PAREEK .	PCE17ME006	21	3	3	3	3	3	3	3	3	3	3	3	3
4	AMIT KUMAR	PCE17ME008	15	3	3	3	2	2	2	1	3	2	3	3	3
5	AMIT SINGH RAWAT .	PCE17ME009	23	3	3	3	3	3	3	3	3	3	3	3	3
6	ARMESH SAINI .	PCE17ME016	18	3	2	3	3	3	3	3	3	3	3	3	3
7	ASHEER UL HAMEED	PCE17ME017	16	3	3	3	3	3	3	3	2	3	3	2	3
8	AYUSH KHANDELWAL .	PCE17ME019	19	3	3	3	3	3	3	3	2	3	3	3	3
9	CHIRAG LODWAL .	PCE17ME024	15	2	2	2	3	3	3	2	2	2	3	3	3
10	DEVENDRA SINGH	PCE17ME027	19	3	3	3	3	3	3	3	3	3	3	3	3

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11	DUSHYANT SAINI .	PCE17ME030	17	3	3	3	3	2	3	2	2	2	3	3	3
12	GAGAN DEEP KARDAM .	PCE17ME031	15	3	3	3	2	3	3	2	2	2	3	3	3
13	GANESH SHARMA .	PCE17ME032	16	3	2	3	3	3	3	2	3	3	3	3	3
14	GAURAV JOSHI .	PCE17ME033	15	3	3	3	3	3	3	2	2	2	3	3	3
15	GOVINDPATEL M .	PCE17ME039	16	3	3	3	3	3	3	2	2	2	3	2	3
16	HARISH GUPTA .	PCE17ME040	17	3	2	3	3	3	3	2	2	2	3	2	3
17	HARSH RAJ	PCE17ME041	19	3	3	3	3	3	3	3	2	3	3	3	3
18	HARSHIT KUMAR MEENA .	PCE17ME042	20	3	3	3	3	3	3	3	3	3	3	3	3
19	HARSHIT LOHAR .	PCE17ME043	17	3	3	3	3	3	3	3	2	3	3	3	3
20	HARSHITA BHATIA .	PCE17ME045	18	3	3	3	3	3	3	3	3	3	3	3	3
21	ISHAN SEN	PCE17ME046	16	3	2	3	3	3	3	3	3	3	3	3	3
22	KANHAIYA KUMAR	PCE17ME048	17	3	3	3	3	2	3	3	3	3	3	3	3
23	KARAN SUTHAR .	PCE17ME049	17	3	3	3	3	3	3	2	2	2	3	3	3
24	KARTIK SHARMA	PCE17ME051	17	3	3	3	3	3	3	2	2	2	3	3	3
25	KUSHAGRA VASHISHTHA .	PCE17ME052	18	3	2	3	3	3	3	2	3	3	3	3	3
26	LAKSHYA SAPRA .	PCE17ME053	17	3	3	3	3	3	3	3	3	3	2	3	3
27	LALIT SINGH	PCE17ME054	17	3	2	3	3	3	3	3	3	3	3	3	3
28	LEKHA TIWARI .	PCE17ME055	20	3	3	3	3	3	3	3	3	3	3	3	3
29	LOKESH YADAV .	PCE17ME057	15	3	3	3	2	2	2	3	2	3	3	2	3
30	MAYANK GUPTA .	PCE17ME060	15	3	2	3	2	3	3	2	2	2	3	2	3
31	MITUL SHARMA .	PCE17ME061	18	3	3	3	3	3	3	2	3	3	3	3	3
32	NISHANT KUMAR	PCE17ME065	18	2	3	3	3	3	3	2	2	2	3	3	3

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33	PARASRAM MALI	PCE17ME069	14	2	2	2	3	3	3	1	3	2	2	3	3
34	PIYUSH SHARMA .	PCE17ME072	18	3	2	3	3	3	3	1	3	2	3	3	3
35	PRAKHAR TOLAMBIA .	PCE17ME075	16	3	2	3	3	3	3	2	3	3	3	2	3
36	SOM AGRAWAL	PCE17ME092	17	2	3	3	2	3	3	2	2	2	2	3	3
37	YASH AVASTHI .	PCE17ME103	20	3	3	3	3	3	3	3	3	3	3	3	3
38	DINESH KUMAR ARYA	PCE18ME702	16	2	2	2	3	3	3	2	3	3	2	2	2
39	MANISH SINGH CHOUHAN	PCE18ME703	17	2	3	3	3	3	3	2	2	2	2	3	3
40	RAHUL KUMAR BOHRA	PCE18ME704	19	3	3	3	3	3	3	2	2	2	3	3	3
41	SAJID GOURI	PCE18ME705	17	3	3	3	3	2	3	2	3	3	3	3	3
81	RAHUL KUMAR	PCE18ME708	16	3	3	3	3	3	3	2	2	2	3	2	3
82	VINESH SONI	PCE18ME709	16	3	3	3	2	2	2	2	3	3	2	3	3
32															
84															

		CO			
Overall CO Attainments for PO		**CO1**	**CO2**	**CO3**	**CO**
Targets		**3.00**	**2.00**	**3.00**	**2.75**
prev Act Attainments		**2.69**	**1.79**	**2.35**	**2.47**
Attainments curr ActI		**2.67**	**1.91**	**2.56**	**2.58**
Attainments Cumulative		**2.68**	**1.85**	**2.45**	**2.53**
Gap		**0.32**	**0.15**	**0.55**	**0.22**

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Student Attainment Level 3 Count	**32**
Student Attainment Level 3 %	**74**
Student Attainment Level 2 Count	**11**
Student Attainment Level 2%	**26**
Student Attainment Level 1 Count	**0**
Student Attainment Level 1 %	**0**
Course Attainment (%Students getting level 3)	**74.00%**

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S. No.	Name of Students	Q. No.	Total Marks	PRE. PO 1	CUR. PO 1	OVER PO1	PRE. PO 2	CUR. PO 2	OVER PO2	PRE. PSO1	CUR. PSO1	OVER PSO 1	PRE. PSO2	CUR. PSO2	OVER PSO 2	PRE. PSO3	CUR. PSO3	OVER PSO 3
		University Roll No		Level	level	Avg. Level	Level	level	Avg. Level	Level	level	Avg. Level	Level	level	Avg. Level	Level	level	Avg. Level
1	ADITYA SINGH .	PCE17ME002	14	2	2	2	2	3	3	3	3	3	2	2	2	1	1	1
2	ADITYA SINGH RAJAWAT	PCE17ME003	19	3	2	3	3	3	3	3	3	3	2	2	2	2	1	2
3	AKSHAY PAREEK .	PCE17ME006	21	3	3	3	3	3	3	3	3	3	2	3	3	2	2	2
4	AMIT KUMAR	PCE17ME008	15	3	3	3	2	3	3	2	2	2	2	2	2	1	1	1
5	AMIT SINGH RAWAT .	PCE17ME009	23	3	3	3	3	3	3	3	3	3	2	3	3	2	2	2
6	ARMESH SAINI .	PCE17ME016	18	3	2	3	2	2	2	3	2	3	2	2	2	1	1	1
7	ASHEER UL HAMEED	PCE17ME017	16	3	3	3	2	2	2	3	2	3	2	2	2	2	1	2
8	AYUSH KHANDELWAL .	PCE17ME019	19	3	3	3	2	2	2	3	2	3	2	2	2	1	2	2
9	CHIRAG LODWAL .	PCE17ME024	15	2	2	2	2	2	2	3	3	3	2	2	2	1	2	2
10	DEVENDRA SINGH	PCE17ME027	19	3	3	3	2	2	2	2	2	2	2	2	2	1	1	1
11	DUSHYANT SAINI .	PCE17ME030	17	3	3	3	2	2	2	3	2	3	2	2	2	1	1	1
12	GAGAN DEEP KARDAM .	PCE17ME031	15	3	3	3	2	2	2	2	2	2	2	2	2	1	2	2
13	GANESH SHARMA .	PCE17ME032	16	3	2	3	2	3	3	3	3	3	2	2	2	2	2	2
14	GAURAV JOSHI .	PCE17ME033	15	3	3	3	2	2	2	3	2	3	2	2	2	1	2	2
15	GOVINDPATEL M .	PCE17ME039	16	3	3	3	2	2	2	2	2	2	2	2	2	1	1	1
16	HARISH GUPTA .	PCE17ME040	17	3	2	3	2	2	2	3	2	3	2	2	2	2	1	2
17	HARSH RAJ	PCE17ME041	19	3	3	3	2	2	2	3	2	3	2	2	2	1	2	2
18	HARSHIT KUMAR MEENA .	PCE17ME042	20	3	3	3	3	3	3	3	3	3	2	3	3	2	1	2
19	HARSHIT LOHAR .	PCE17ME043	17	3	3	3	2	2	2	3	2	3	2	2	2	1	1	1
20	HARSHITA	PCE17ME045	18	3	3	3	3	2	3	3	2	3	2	2	2	2	1	2

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	BHATIA .																	
21	ISHAN SEN	PCE17ME046	16	3	2	3	2	3	3	3	3	3	2	2	2	1	1	1
22	KANHAIYA KUMAR	PCE17ME048	17	3	3	3	2	2	2	3	2	3	2	2	2	1	1	1
23	KARAN SUTHAR .	PCE17ME049	17	3	3	3	2	2	2	3	2	3	2	2	2	1	1	1
24	KARTIK SHARMA	PCE17ME051	17	3	3	3	2	2	2	3	3	3	2	2	2	1	2	2
25	KUSHAGRA VASHISHTHA .	PCE17ME052	18	3	2	3	2	3	3	2	3	3	2	2	2	1	1	1
26	LAKSHYA SAPRA .	PCE17ME053	17	3	3	3	2	3	3	3	3	3	2	3	3	1	2	2
27	LALIT SINGH	PCE17ME054	17	3	2	3	3	2	3	3	2	3	2	2	2	1	1	1
28	LEKHA TIWARI .	PCE17ME055	20	3	3	3	3	3	3	3	3	3	3	3	3	2	1	2
29	LOKESH YADAV .	PCE17ME057	15	3	3	3	2	2	2	2	2	2	2	2	2	1	1	1
30	MAYANK GUPTA .	PCE17ME060	15	3	2	3	2	2	2	2	2	2	2	2	2	1	1	1
31	MITUL SHARMA .	PCE17ME061	18	3	3	3	2	3	3	3	3	3	2	3	3	1	2	2
32	NISHANT KUMAR	PCE17ME065	18	2	3	3	2	2	2	3	3	3	2	2	2	1	2	2
33	PARASRAM MALI	PCE17ME069	14	2	2	2	2	2	2	3	2	3	1	2	2	1	1	1
34	PIYUSH SHARMA .	PCE17ME072	18	3	2	3	2	3	3	3	3	3	2	2	2	1	1	1
35	PRAKHAR TOLAMBIA .	PCE17ME075	16	3	2	3	2	2	2	2	2	2	2	2	2	1	1	1
36	SOM AGRAWAL	PCE17ME092	17	2	3	3	2	2	2	2	3	3	2	2	2	1	2	2
37	YASH AVASTHI .	PCE17ME103	20	3	3	3	2	3	3	3	3	3	2	3	3	2	1	2
38	DINESH KUMAR ARYA	PCE18ME702	16	2	2	2	2	2	2	3	2	3	2	2	2	1	1	1
39	MANISH SINGH CHOUHAN	PCE18ME703	17	2	3	3	2	2	2	3	2	3	2	2	2	1	1	1
40	RAHUL KUMAR BOHRA	PCE18ME704	19	3	3	3	2	2	2	2	2	2	2	2	2	1	2	2
41	SAJID GOURI	PCE18ME705	17	3	3	3	2	3	3	3	2	3	2	2	2	1	1	1
81	RAHUL KUMAR	PCE18ME708	16	3	3	3	2	2	2	1	2	1	1	2	1	1	1	1
82	VINESH SONI	PCE18ME709	16	3	3	3	2	2	2	1	2	1	1	2	1	1	1	1
32																		
84																		

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		PO				
Overall CO Attainments for PO		**PO1**	**PO2**	**PSO1**	**PSO2**	**PSO3**
Targets		**3.00**	**2.50**	**2.50**	**2.33**	**1.50**
prev Act Attainments		**2.69**	**1.68**	**2.01**	**1.46**	**0.58**
Attainments curr ActI		**2.67**	**1.96**	**2.01**	**1.69**	**0.67**
Attainments Cumulative		**2.68**	**1.82**	**2.01**	**1.58**	**0.63**
Gap		**0.32**	**0.68**	**0.49**	**0.76**	**0.87**

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POORNIMA COLLEGE OF ENGINEERING,JAIPUR

Department of Mechanical Engineering

NBA Process Implementation

CO-PO Attainment Sheet Session 2020-2021

Batch	**2017-2021**	**Name of Activity**	**Assignment-2**
Name of Course	**I C Engine**	**Name of Faculty**	**Dr. Narayan Lal Jain**
Course Code	**7ME5-11**	**Semester / Section**	**VII Elective**

		CO			
Overall CO Attainments for PO		**CO1**	**CO2**	**CO3**	**CO**
Targets		**3.00**	**2.00**	**3.00**	**2.75**
prev Act Attainments		**2.69**	**1.79**	**2.35**	**2.47**
Attainments curr ActI		**2.67**	**1.91**	**2.56**	**2.58**
Attainments Cumulative		**2.68**	**1.85**	**2.45**	**2.53**
Gap		**0.32**	**0.15**	**0.55**	**0.22**

Student Attainment Level 3 Count	**32**
Student Attainment Level 3 %	**74**
Student Attainment Level 2 Count	**11**
Student Attainment Level 2%	**26**
Student Attainment Level 1 Count	**0**
Student Attainment Level 1 %	**0**
Course Attainment (%Students getting level 3)	**74.00%**

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Even if target is achieved but little gap is there and reasons of gaps are as follows:

- Students were not able to solve the problems of supercharging and working of various engines.

Activities Decided to bridge the gap after Assignment-2:

- Animated Video about working of various engines and supercharging process were played and send to students to learn more.

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POORNIMA COLLEGE OF ENGINEERING, JAIPUR

IV B.TECH. (VII Sem.) **SET- 1**

SECOND MID TERM ONLINE EXAMINATION 2020-21

Code: 7ME5-11 Category: PCC Subject Name– I C Engine

(BRANCH – MECHANICAL ENGINEERING)

Max. Time: 90 Minutes + 15 Min for Uploading **Max. Marks: 50**

Instruction:

1. All Question are Compulsory.
2. Write your answer on a clean A4 size or any paper and mention your Name, Roll no., Reg. no, Subject name, subject code, Section, Set number. Date and time on the top of the sheet and page no on bottom of the sheet. Write Name, Registration & Page no on other pages.
3. Scan and upload your hand written answer copy to the class room only (do not mail).
4. Make sure that scan documents (PDF) is readable for evaluation purpose and you have additional 15 minutes to upload the PDF.
5. Save documents with your Name, Registration No., and Subject Name.
   (Exp. – Abhishek_PCE18ME310_AEM)
6. The answer-sheet upload after the specified time duration shall be rejected and not be evaluated.
7. Follow the sequence to upload as Classwork -> Assignment -> Your work -> Add or Create -> Select file to upload -> Hand In or Turned in.
8. Keep your hard copy of answer sheet intact as it will be submitted after college resumes.
9. CO- Course Outcome, PO- Program Outcome, BL- Bloom's Taxonomy Levels & PI- Performance Index are mentioned according to the exam reform policy- AICTE.

Q. No.	Question	Marks	CO	PO	BL	PI
Q.1	Describe the simple carburation system with neat sketch.	**(10)**	CO 2	PO1	L-2	1.4. 1
Q.2	Compare the SI Engine injection system with CI Engine injection system.	**(10)**	CO 2	PO1	L-2	1.4. 1
Q.3	How electronic ignition system is better than CB point Ignition system explain with neat sketch?	**(10)**	CO 2	PO2	L-3	2.2. 4
Q.4	How supercharging increase the efficiency of the engine? Explain the various supercharging methods.	**(10)**	CO 3	PO2	L-3	2.2. 4
Q.5	Why VCR engine is called a research engine? How a single cylinder engine can be converted into a VCR engine?	**(10)**	CO 3	PO3	L-3	3.2. 1
	.					

***** ALL THE BEST*****

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POORNIMA COLLEGE OF ENGINEERING, JAIPUR

IV B.TECH. (VII Sem.) **SET- 2**

SECOND MID TERM ONLINE EXAMINATION 2020-21
Code: 7ME5-11 Category: PCC Subject Name– I C Engine
(BRANCH – MECHANICAL ENGINEERING)

Max. Time: 90 Minutes + 15 Min for Uploading **Max. Marks: 50**

Instruction:

1. All Question are Compulsory.
2. Write your answer on a clean A4 size or any paper and mention your Name, Roll no., Reg. no, Subject name, subject code, Section, Set number. Date and time on the top of the sheet and page no on bottom of the sheet. Write Name, Registration & Page no on other pages.
3. Scan and upload your hand written answer copy to the class room only (do not mail).
4. Make sure that scan documents (PDF) is readable for evaluation purpose and you have additional 15 minutes to upload the PDF.
5. Save documents with your Name, Registration No., and Subject Name.
   (Exp. – Govind_PCE18ME310_AEM)
6. The answer-sheet upload after the specified time duration shall be rejected and not be evaluated.
7. Follow the sequence to upload as Classwork -> Assignment -> Your work -> Add or Create -> Select file to upload -> Hand In or Turned in.
8. Keep your hard copy of answer sheet intact as it will be submitted after college resumes.
9. CO- Course Outcome, PO- Program Outcome, BL- Bloom's Taxonomy Levels & PI- Performance Index are mentioned according to the exam reform policy- AICTE.

Q. No.	Question	Marks	CO	PO	BL	PI
Q.1	Enumerate lubrication system and explain wet sump lubrication system with the help of a neat sketch.	**(10)**	CO2	PO1	L-1	
Q.2	Why 'ignition timing' is required? List out the various f-actors which affect ignition timing.	**(10)**	CO2	PO2	L-2	
Q.3	Describe with neat sketch the different thermodynamics cycle of supercharging.	**(10)**	CO2	PO2	L-2	
Q.4	What constitutes a 'free piston engine'.? Why is it called 'free piston'? Describe with a neat sketch the working of a 'free piston engine'.	**(10)**	CO3	PO2	L-3	
Q.5	Explain the suitability of a diesel engine to run a dual fuel. Why the preferred fuel for diesel engine is natural gas?	**(10)**	CO3	PO3	L-3	
	.					

***** ALL THE BEST*****

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POORNIMA COLLEGE OF ENGINEERING,JAIPUR																		
II MID TERM THEORY EXAM, 2020-21				B. TECH. IV YEAR (VII SEM.)														
FORMAT OF Q. WISE MARKS STATEMENT			Name of Faculty	Dr. Narayan Lal Jain														
SUB CODE:	7ME5-11		SUBJECT NAME:	I.C ENIGNE														
BRANCH:	MECHANICAL ENGG.			SECTION:										A				
S. No.	Roll No.	Name of Students	Q. No.	Q. 1	Q. 2	Q. 3	Q. 4	Q. 5	Q. 6	Q. 7	Q. 8	Q. 9	Q. 10	Q. 11	Q. 12	Q. 13	Q. 14	Q. 15	Total
			CO No.																50
			PO No.																
			Max. Marks:																
1	2	ADITYA SINGH .	PCE17ME002	7	4	6	6	5											28
2	3	ADITYA SINGH RAJAWAT	PCE17ME003	9	8	8	8	8											41
3	6	AKSHAY PAREEK .	PCE17ME006	8	6	7	6	6											33
4	8	AMIT KUMAR	PCE17ME008	6	6	5	5	7											29
5	9	AMIT SINGH RAWAT .	PCE17ME009	9	7	7	6	6											35
6	14	ARMESH SAINI .	PCE17ME016	6	5	3	7	7											28
7	15	ASHEER UL HAMEED	PCE17ME017	7	6	6	7	5											31
8	17	AYUSH KHANDELWAL .	PCE17ME019	9	8	8	9	8											42
9	20	CHIRAG LODWAL .	PCE17ME024	7	4	5	6	5											27
10	23	DEVENDRA SINGH	PCE17ME027	8	7	8	8	9											40
11	25	DUSHYANT SAINI .	PCE17ME030	6	8	7	6	4											31
12	26	GAGAN DEEP KARDAM .	PCE17ME031	A	A	A	A	A					covid + Case						A
13	27	GANESH SHARMA .	PCE17ME032	6	8	7	6	4											31
14	28	GAURAV JOSHI .	PCE17ME033	8	9	8	8	7											40
15	31	GOVINDPATEL M .	PCE17ME039	6	7	5	6	6											30
16	32	HARISH GUPTA .	PCE17ME040	7	7	6	5	6											31
17	33	HARSH RAJ	PCE17ME041	0	0	0	0	0											0
18	34	HARSHIT KUMAR MEENA .	PCE17ME042	8	7	7	7	6											35
19	35	HARSHIT LOHAR .	PCE17ME043	4	4	4	4	4											20
20	37	HARSHITA BHATIA .	PCE17ME045	8	9	8	8	8											41
21	38	ISHAN SEN	PCE17ME046	3	5	6	6	6											26
22	39	KANHAIYA KUMAR	PCE17ME048	7	6	7	6	6											32
23	40	KARAN SUTHAR .	PCE17ME049	8	8	7	7	6											36
24	42	KARTIK SHARMA	PCE17ME051	7	5	4	7	5											28
25	43	KUSHAGRA VASHISHTHA .	PCE17ME052	7	5	5	4	4											25
26	44	LAKSHYA SAPRA .	PCE17ME053	8	7	6	7	7											35
27	45	LALIT SINGH	PCE17ME054	7	6	5	6	5											29
28	46	LEKHA TIWARI .	PCE17ME055	8	8	8	9	9											42
29	47	LOKESH YADAV .	PCE17ME057	8	3	6	5	5											27
30	48	MAYANK GUPTA .	PCE17ME060	7	7	7	7	6											34
31	49	MITUL SHARMA .	PCE17ME061	8	7	5	6	4											30

Name of Examiner:_____

Signature of Examiner:_____

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II MID TERM THEORY EXAM, 2020-21				B. TECH. IV YEAR (VII SEM.)														
FORMAT OF Q. WISE MARKS STATEMENT			Name of Faculty	Dr. Narayan Lal Jain														
SUB CODE:	7ME5-11		SUBJECT NAME:	I.C ENIGNE														
BRANCH:	MECHANICAL ENGG.			SECTION:										A				
S. No.	Roll No.	Name of Students	Q. No.	Q. 1	Q. 2	Q. 3	Q. 4	Q. 5	Q. 6	Q. 7	Q. 8	Q. 9	Q. 10	Q. 11	Q. 12	Q. 13	Q. 14	Q. 15	Total
			CO No.																50
			PO No.																
			Max. Marks:																
32	52	NISHANT KUMAR	PCE17ME065	6	5	6	5	6											28
33	53	PARASRAM MALI	PCE17ME069	9	4	6	6	6											31
34	54	PIYUSH SHARMA .	PCE17ME072	8	7	8	8	6											37
35	55	PRAKHAR TOLAMBIA .	PCE17ME075	5	6	4	5	5											25
36	56	SOM AGRAWAL	PCE17ME092	7	6	6	6	6											31
37	57	YASH AVASTHI .	PCE17ME103	8	5	6	5	4											28
38	59	DINESH KUMAR ARYA	PCE18ME702	7	6	7	6	7											33
39	60	MANISH SINGH CHOUHAN	PCE18ME703	7	3	8	5	5											28
40	61	RAHUL KUMAR BOHRA	PCE18ME704	7	8	8	7	7											37
41	62	SAJID GOURI	PCE18ME705	7	3	8	8	3											29
42	65	RAHUL KUMAR	PCE18ME708	8	7	7	8	6											36
43	66	VINESH SONI	PCE18ME709	6	3	4	5	4											22
																		Total Students=	43
																		ABSENT / DEBARRED Students=	1
																		Eligible to Appear=	42
																		Students Passed=	41
																		Students FAILED=	1
																		Pass % =	97.62
																		Above 80% Marks=	4
																		80%- 70% Marks=	9
																		70%- 60% Marks=	12
																		60%- 50% Marks=	14
																		50%- 40% Marks=	2
																		40%- 30% Marks=	0
																		Below 30% Marks=	1

Name of Examiner:_____

Signature of Examiner:_____

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SUB CODE:		7ME5-11	SUBJECT NAME:	I.C ENIGNE													
BRANCH:		MECHANICAL ENGG.		SECTION:								A					
S. No.	Roll No.	Name of Students	Q. No.	Q. 1	Q. 2	Q. 3	Q. 4	Q. 5	Q. 6	Q. 7	Q. 8	Q. 9	Q. 10	Q. 11	Q. 12	Q. 13	Q. 14	Q. 15	Total
			CO No.																50
			PO No.																
			Max. Marks:																
1	2	ADITYA SINGH .	PCE17ME002	7	4	6	6	5											28
2	3	ADITYA SINGH RAJAWAT	PCE17ME003	9	8	8	8	8											41
3	6	AKSHAY PAREEK .	PCE17ME006	8	6	7	6	6											33
4	8	AMIT KUMAR	PCE17ME008	6	6	5	5	7											29
5	9	AMIT SINGH RAWAT .	PCE17ME009	9	7	7	6	6											35
6	14	ARMESH SAINI .	PCE17ME016	6	5	3	7	7											28
7	15	ASHEER UL HAMEED	PCE17ME017	7	6	6	7	5											31
8	17	AYUSH KHANDELWAL .	PCE17ME019	9	8	8	9	8											42
9	20	CHIRAG LODWAL .	PCE17ME024	7	4	5	6	5											27
10	23	DEVENDRA SINGH	PCE17ME027	8	7	8	8	9											40
11	25	DUSHYANT SAINI .	PCE17ME030	6	8	7	6	4											31
12	26	GAGAN DEEP KARDAM .	PCE17ME031	A	A	A	A	A						covid + Case					A
13	27	GANESH SHARMA .	PCE17ME032	6	8	7	6	4											31
14	28	GAURAV JOSHI .	PCE17ME033	8	9	8	8	7											40
15	31	GOVINDPATEL M .	PCE17ME039	6	7	5	6	6											30
16	32	HARISH GUPTA .	PCE17ME040	7	7	6	5	6											31
17	33	HARSH RAJ	PCE17ME041	0	0	0	0	0											0
18	34	HARSHIT KUMAR MEENA .	PCE17ME042	8	7	7	7	6											35
19	35	HARSHIT LOHAR .	PCE17ME043	4	4	4	4	4											20
20	37	HARSHITA BHATIA .	PCE17ME045	8	9	8	8	8											41
21	38	ISHAN SEN	PCE17ME046	3	5	6	6	6											26
22	39	KANHAIYA KUMAR	PCE17ME048	7	6	7	6	6											32

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23	40	KARAN SUTHAR .	PCE17ME049	8	8	7	7	6											36
24	42	KARTIK SHARMA	PCE17ME051	7	5	4	7	5											28
25	43	KUSHAGRA VASHISHTHA .	PCE17ME052	7	5	5	4	4											25
26	44	LAKSHYA SAPRA .	PCE17ME053	8	7	6	7	7											35
27	45	LALIT SINGH	PCE17ME054	7	6	5	6	5											29
28	46	LEKHA TIWARI .	PCE17ME055	8	8	8	9	9											42
29	47	LOKESH YADAV .	PCE17ME057	8	3	6	5	5											27
30	48	MAYANK GUPTA .	PCE17ME060	7	7	7	7	6											34
31	49	MITUL SHARMA .	PCE17ME061	8	7	5	6	4											30
32	52	NISHANT KUMAR	PCE17ME065	6	5	6	5	6											28
33	53	PARASRAM MALI	PCE17ME069	9	4	6	6	6											31
34	54	PIYUSH SHARMA .	PCE17ME072	8	7	8	8	6											37
35	55	PRAKHAR TOLAMBIA .	PCE17ME075	5	6	4	5	5											25
36	56	SOM AGRAWAL	PCE17ME092	7	6	6	6	6											31
37	57	YASH AVASTHI .	PCE17ME103	8	5	6	5	4											28
38	59	DINESH KUMAR ARYA	PCE18ME702	7	6	7	6	7											33
39	60	MANISH SINGH CHOUHAN	PCE18ME703	7	3	8	5	5											28
40	61	RAHUL KUMAR BOHRA	PCE18ME704	7	8	8	7	7											37
41	62	SAJID GOURI	PCE18ME705	7	3	8	8	3											29
42	65	RAHUL KUMAR	PCE18ME708	8	7	7	8	6											36
43	66	VINESH SONI	PCE18ME709	6	3	4	5	4											22

Total Students=		**43**
ABSENT / DEBARRED Students=		**1**
Eligible to Appear=		**42**
Students Passed=		**41**
Students FAILED=		**1**
Pass % =		**97.62**
Above 80% Marks=		**4**
80%- 70% Marks=		**9**
70%- 60% Marks=		**12**
60%- 50% Marks=		**14**
50%- 40% Marks=		**2**
40%- 30% Marks=		**0**
Below 30% Marks=		**1**

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POORNIMA COLLEGE OF ENGINEERING,JAIPUR

Department of Mechanical Engineering

NBA Process Implementation

CO-PO Attainment Sheet Session 2020-2021

Batch	**2017-2021**	**Name of Activity**	**Mid-2**
Name of Course	**I C Engine**	**Name of Faculty**	**Dr. Narayan Lal Jain**
Course Code	**7ME5-11**	**Semester / Section**	**VII Elective**

		CO			
Overall CO Attainments for PO		**CO1**	**CO2**	**CO3**	**CO**
Targets		**3.00**	**2.00**	**3.00**	**2.75**
prev Act Attainments		**2.68**	**1.85**	**2.45**	**2.53**
Attainments curr ActI			**1.67**	**2.37**	**2.19**
Attainments Cumulative		**2.68**	**1.76**	**2.41**	**2.36**
Gap		**0.32**	**0.24**	**0.59**	**0.39**

Student Attainment Level 3 Count	**29**
Student Attainment Level 3 %	**67**
Student Attainment Level 2 Count	**14**
Student Attainment Level 2%	**33**
Student Attainment Level 1 Count	**0**
Student Attainment Level 1 %	**0**
Course Attainment (%Students getting level 3)	**67.00%**

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Even if target is achieved but little gap is there and reasons of gaps are as follows:

- Students were not able to understand basic concept of supercharging (CO-1). Some of the students could not understand how to evaluate the performance of supercharged engine (CO-3). Some of students were not able to explain injection system of petrol engine (CO-2).

Activities Decided to bridge the gap after Mid-2:

- Animated Video about working of various engines and supercharging process were played and send to students to learn more.
- Revision classes were taken and notes of these topics were circulated among the students

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POORNIMA COLLEGE OF ENGINEERING,JAIPUR																		
II MID TERM THEORY EXAM, 2020-21				B. TECH. IV YEAR (VII SEM.)														
FORMAT OF Q. WISE MARKS STATEMENT			Name of Faculty	Dr. Narayan Lal Jain														
SUB CODE:	7ME5-11		SUBJECT NAME:	I.C ENIGNE														
BRANCH:	MECHANICAL ENGG.			SECTION:										A				
S. No.	Roll No.	Name of Students	Q. No.	Q. 1	Q. 2	Q. 3	Q. 4	Q. 5	Q. 6	Q. 7	Q. 8	Q. 9	Q. 10	Q. 11	Q. 12	Q. 13	Q. 14	Q. 15	Total
			CO No.																120
			PO No.																
			Max. Marks:																
1	2	ADITYA SINGH .	PCE17ME002	77															77
2	3	ADITYA SINGH RAJAWAT	PCE17ME003	74															74
3	6	AKSHAY PAREEK .	PCE17ME006	44															44
4	8	AMIT KUMAR	PCE17ME008	71															71
5	9	AMIT SINGH RAWAT .	PCE17ME009	55															55
6	14	ARMESH SAINI .	PCE17ME016	72															72
7	15	ASHEER UL HAMEED	PCE17ME017	90															90
8	17	AYUSH KHANDELWAL .	PCE17ME019	71															71
9	20	CHIRAG LODWAL .	PCE17ME024	81															81
10	23	DEVENDRA SINGH	PCE17ME027	85															85
11	25	DUSHYANT SAINI .	PCE17ME030	66															66
12	26	GAGAN DEEP KARDAM .	PCE17ME031	65									covid + Case						65
13	27	GANESH SHARMA .	PCE17ME032	81															81
14	28	GAURAV JOSHI .	PCE17ME033	81															81
15	31	GOVINDPATEL M .	PCE17ME039	78															78
16	32	HARISH GUPTA .	PCE17ME040	65															65
17	33	HARSH RAJ	PCE17ME041	50															50
18	34	HARSHIT KUMAR MEENA .	PCE17ME042	100															100
19	35	HARSHIT LOHAR .	PCE17ME043	74															74
20	37	HARSHITA BHATIA .	PCE17ME045	84															84
21	38	ISHAN SEN	PCE17ME046	81															81
22	39	KANHAIYA KUMAR	PCE17ME048	90															90
23	40	KARAN SUTHAR .	PCE17ME049	74															74
24	42	KARTIK SHARMA	PCE17ME051	44															44
25	43	KUSHAGRA VASHISHTHA .	PCE17ME052	68															68
26	44	LAKSHYA SAPRA .	PCE17ME053	80															80
27	45	LALIT SINGH	PCE17ME054	85															85
28	46	LEKHA TIWARI .	PCE17ME055	88															88
29	47	LOKESH YADAV .	PCE17ME057	84															84
30	48	MAYANK GUPTA .	PCE17ME060	80															80
31	49	MITUL SHARMA .	PCE17ME061	81															81

Name of Examiner:_____

Signature of Examiner:_____

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POORNIMA COLLEGE OF ENGINEERING,JAIPUR																		
II MID TERM THEORY EXAM, 2020-21				B. TECH. IV YEAR (VII SEM.)														
FORMAT OF Q. WISE MARKS STATEMENT			Name of Faculty	Dr. Narayan Lal Jain														
SUB CODE:	7ME5-11		SUBJECT NAME:	I.C ENIGNE														
BRANCH:	MECHANICAL ENGG.			SECTION:										A				
S. No.	Roll No.	Name of Students	Q. No.	Q. 1	Q. 2	Q. 3	Q. 4	Q. 5	Q. 6	Q. 7	Q. 8	Q. 9	Q. 10	Q. 11	Q. 12	Q. 13	Q. 14	Q. 15	Total
			CO No.																120
			PO No.																
			Max. Marks:																
32	52	NISHANT KUMAR	PCE17ME065	81															81
33	53	PARASRAM MALI	PCE17ME069	69															69
34	54	PIYUSH SHARMA .	PCE17ME072	74															74
35	55	PRAKHAR TOLAMBIA .	PCE17ME075	78															78
36	56	SOM AGRAWAL	PCE17ME092	59															59
37	57	YASH AVASTHI .	PCE17ME103	74															74
38	59	DINESH KUMAR ARYA	PCE18ME702	36															36
39	60	MANISH SINGH CHOUHAN	PCE18ME703	49															49
40	61	RAHUL KUMAR BOHRA	PCE18ME704	65															65
41	62	SAJID GOURI	PCE18ME705	71															71
42	65	RAHUL KUMAR	PCE18ME708	60															60
43	66	VINESH SONI	PCE18ME709	44															44
																	Total Students=		43
																	ABSENT / DEBARRED Students=		0
																	Eligible to Appear=		43
																	Students Passed=		43
																	Students FAILED=		0
																	Pass % =		100.00

Name of Examiner:_____

Signature of Examiner:_____

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Department of Mechanical Engineering

NBA Process Implementation

CO-PO Attainment Sheet Session 2020-2021

2017-21 RTU Examination

Name of Course	**I C Engine**	**Name of Faculty**	**Dr. Narayan Lal Jain**
Course Code	**7ME5-11**	**Semester / Section**	**VII Elective**

S. No.	Name of Students	University Roll No.	Marks Obtained	RTU Overall CO Level	PO1 Level	PO2 Level	Overall CO of PO	PSO1 Level	PSO2 Level	PSO3 Level	Overall CO of PSO
1	ADITYA SINGH .	PCE17ME002	77	3	3	3	3	3	2	2	2
2	ADITYA SINGH RAJAWAT	PCE17ME003	74	3	3	3	3	3	2	2	2
3	AKSHAY PAREEK .	PCE17ME006	44	2	2	2	2	2	1	1	1
4	AMIT KUMAR	PCE17ME008	71	3	2	2	2	2	2	2	2
5	AMIT SINGH RAWAT .	PCE17ME009	55	2	2	2	2	2	2	2	2
6	ARMESH SAINI .	PCE17ME016	72	3	3	3	3	3	2	2	2
7	ASHEER UL HAMEED	PCE17ME017	90	3	3	3	3	3	2	2	2
8	AYUSH KHANDELWAL .	PCE17ME019	71	3	2	2	2	2	2	2	2
9	CHIRAG LODWAL .	PCE17ME024	81	3	3	3	3	3	2	2	2
10	DEVENDRA SINGH	PCE17ME027	85	3	3	3	3	3	2	2	2
11	DUSHYANT SAINI .	PCE17ME030	66	3	2	2	2	2	2	2	2
12	GAGAN DEEP KARDAM .	PCE17ME031	65	3	2	2	2	2	2	2	2
13	GANESH SHARMA .	PCE17ME032	81	3	3	3	3	3	2	2	2
14	GAURAV JOSHI .	PCE17ME033	81	3	3	3	3	3	2	2	2
15	GOVINDPATEL M .	PCE17ME039	78	3	3	3	3	3	2	2	2
16	HARISH GUPTA .	PCE17ME040	65	3	2	2	2	2	2	2	2
17	HARSH RAJ	PCE17ME041	50	2	2	2	2	2	1	1	2
18	HARSHIT KUMAR MEENA .	PCE17ME042	100	3	3	3	3	3	2	2	3
19	HARSHIT LOHAR .	PCE17ME043	74	3	3	3	3	3	2	2	2
20	HARSHITA BHATIA .	PCE17ME045	84	3	3	3	3	3	2	2	2
21	ISHAN SEN	PCE17ME046	81	3	3	3	3	3	2	2	2

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22	KANHAIYA KUMAR	PCE17ME048	90	3	3	3	3	3	2	2	2
23	KARAN SUTHAR .	PCE17ME049	74	3	3	3	3	3	2	2	2
24	KARTIK SHARMA	PCE17ME051	44	2	2	2	2	2	1	1	1
25	KUSHAGRA VASHISHTHA .	PCE17ME052	68	3	2	2	2	2	2	2	2
26	LAKSHYA SAPRA .	PCE17ME053	80	3	3	3	3	3	2	2	2
27	LALIT SINGH	PCE17ME054	85	3	3	3	3	3	2	2	2
28	LEKHA TIWARI .	PCE17ME055	88	3	3	3	3	3	2	2	2
29	LOKESH YADAV .	PCE17ME057	84	3	3	3	3	3	2	2	2
30	MAYANK GUPTA .	PCE17ME060	80	3	3	3	3	3	2	2	2
31	MITUL SHARMA .	PCE17ME061	81	3	3	3	3	3	2	2	2
32	NISHANT KUMAR	PCE17ME065	81	3	3	3	3	3	2	2	2
33	PARASRAM MALI	PCE17ME069	69	3	2	2	2	2	2	2	2
34	PIYUSH SHARMA .	PCE17ME072	74	3	3	3	3	3	2	2	2
35	PRAKHAR TOLAMBIA .	PCE17ME075	78	3	3	3	3	3	2	2	2
36	SOM AGRAWAL	PCE17ME092	59	2	2	2	2	2	2	2	2
37	YASH AVASTHI .	PCE17ME103	74	3	3	3	3	3	2	2	2
38	DINESH KUMAR ARYA	PCE18ME702	36	2	2	2	2	2	1	1	1
39	MANISH SINGH CHOUHAN	PCE18ME703	49	2	2	2	2	2	1	1	2
40	RAHUL KUMAR BOHRA	PCE18ME704	65	3	2	2	2	2	2	2	2
41	SAJID GOURI	PCE18ME705	71	3	2	2	2	2	2	2	2

CO Attainments	Overall CO	PO1	PO2	Overall for PO	PSO1	PSO2	PSO3	Overall for PSO
Target	3.00	3.00	2.50	2.67	2.50	2.33	1.50	2.11
RTU Component Attainments	2.81	2.58	2.15	2.29	2.15	1.45	0.93	1.36
Gap	0.19	0.42	0.35	0.37	0.35	0.89	0.57	0.75

Student Attainment Level 3 Count	35
Student Attainment Level 3 %	81
Student Attainment Level 2 Count	8
Student Attainment Level 2%	19
Student Attainment Level 1 Count	0
Student Attainment Level 1 %	0
Course Attainment (%Students getting level 3)	81

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POORNIMA

COLLEGE OF ENGINEERING

Name of Faculty	**Dr. Narayan Lal Jain**
Course/Class	**B. Tech.**
Branch	**Mechanical Engineering**
Course Code	**7ME 5-11**
Course Name	**I C Engine**
Session	**(2020-2021)**

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COURSE OUTCOMES

After completion of course students will be able to
CO-1 Explain the fundamental concepts and working of I C engine systems and its Components.
CO-2 Identify fuel metering, fuel supply, lubricating and Ignition systems for I C engines.
CO-3 Analyze the performance, emission and combustion characteristics of I C engines

CO-PO/PSO MAPPING AND TARGETS

CO-PO-PSO Mapping: Mapping Levels: 1- Low, 2- Moderate, 3-Strong

CO	PO												Avg.	PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	CO Targets	PSO1	PSO2	PSO3
CO1	3												3		2	1
CO2		2											2	3	2	2
CO3		3											3	2	3	

Level of Course Attainment as per Subject Categories

S. No	Tool	Attainment	
1	Mid Term Examinations	B	Attainment Level 1: 40-50-% students scoring more than target 65% of marks Attainment Level 2: 50–60 % students scoring more than target 65% of marks Attainment Level 3: 60 % students scoring more than target 65% of marks
2	RTU Examinations	B	Attainment Level 1: 35-45--% students scoring more than target 60 % of marks Attainment Level 2: 45–55 % students scoring more than target 60% of marks Attainment Level 3: 55 % students scoring more than target 60% of marks
3	Assignment	B	Attainment Level 1: 40-50-% students scoring more than target 65% of marks Attainment Level 2: 50–60 % students scoring more than target 65% of marks Attainment Level 3: 60 % students scoring more than target 65% of marks
5	Survey and Feedback	B	Attainment Level 1: 40-50-% students scoring more than target 70% of marks Attainment Level 2: 50–60 % students scoring more than target 70% of marks Attainment Level 3: 60 % students scoring more than target 70% of marks

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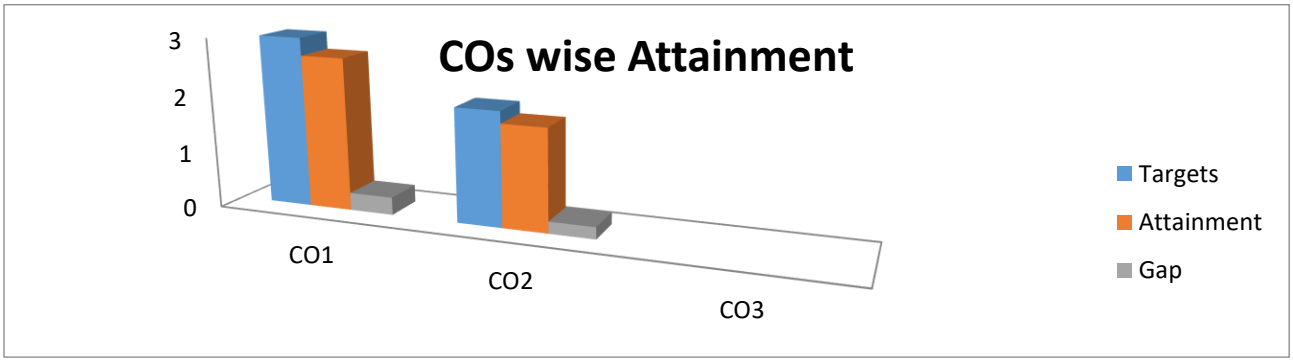
Activity wise Assessment Tools:

Sr. No.	Activity	Assessment Method	Tools	Weightage Marks	Recommendation
1.	Assignment 1	Direct	Marks	5	For CO1 &2
2.	Mid Term 1	Direct	Marks	10	For CO1-3
3.	Assignment 2	Direct	Marks	5	For CO1-3
4.	Mid Term 2	Direct	Marks	10	For CO1-3
5	University Exam.	Direct	Marks	60	For CO1-3
6	Survey	Direct	Marks	10	For CO1-3
Note that for every rubrics you need to decide assessment criteria, range of marks or weightage – above values are indicative					

CO-GAP IDENTIFICATIONS

FOR ASSIGNMENT -1

COs	CO1	CO2
Target	3.00	2.00
Achieved	2.63	1.81
Gap	0.37	0.19



Gaps Identified:
Describe what the reasons for gaps are

1. Thirteen students could not attempt questions related to CO1 in assignment 1 properly due to less understanding of the topic. They were not regular in the class.

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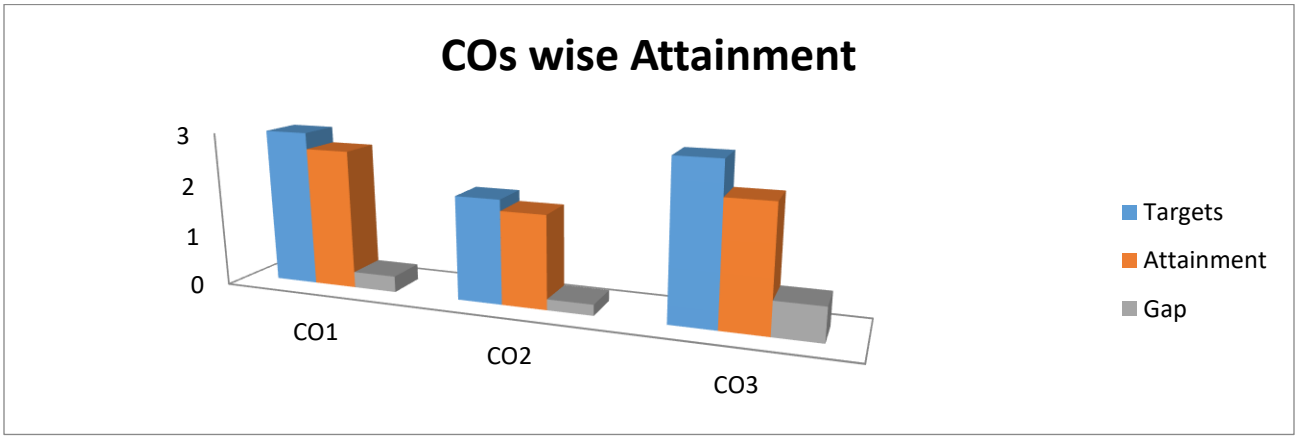
2. Eleven Students could not attempt CO2 related questions in assignment 1 properly due to less understanding of the topic. They were not regular in the class.

Activities decided to bridge the gap

1. NPTEL online Videos were played for important topics and these videos were also given to all the students.
2. Revision classes on the topic of Combustion of SI and CI engines for better understanding.

Up to Mid -1

COs	CO1	CO2	CO3
Target	3	2	3
Achieved	2.69	1.79	2.35
Gap	0.31	0.21	0.65



Gaps Identified:

Describe what the reasons for gaps are

1. Ten students have joined the I C Engine classes after completion of First law concept.

2. Therefore, could not understand the concept of combustion phenomenon (CO-1), first law analysis of IC engine (CO2) and performance and emission characteristics of petrol and diesel engine (CO-3).

Activities decided to bridge the gap

1. Revision classes were conducted for these topics
2. NPTEL Videos were played and given to students
3. You tube videos related these topics were also given to students for better understanding

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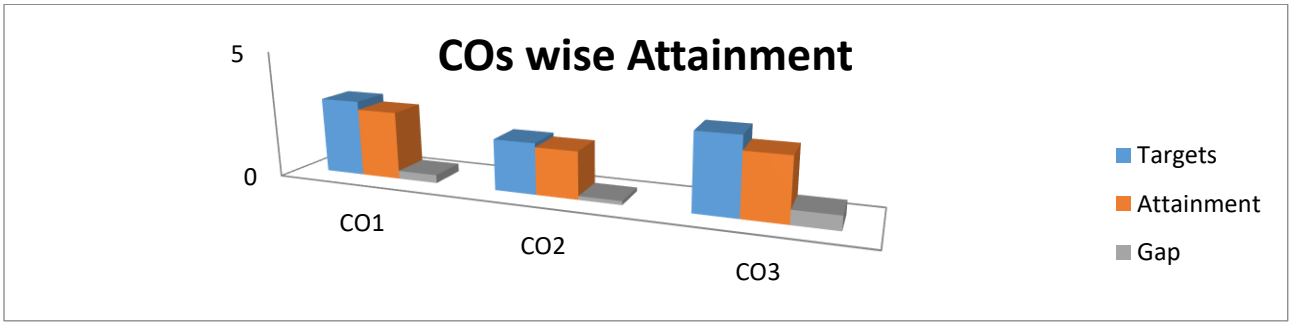
Up to Assignment -2

COs	CO1	CO2	CO3
Target	3	2	3
Achieved	2.68	1.85	2.45
Gap	0.32	0.15	0.55



Gaps Identified:

Describe what the reasons for gaps are

1. Students were not able to solve the problems of supercharging and working of various engines.
2. Some of the students could not understand concept of Multi Fuel Engines.

<u>Activities decided to bridge the gap</u>

1. Animated Video about working of various engines and supercharging process were played and send to students to learn more.
2. NPTEL video and some research papers were provided to students related to Multi Fuel Engines.

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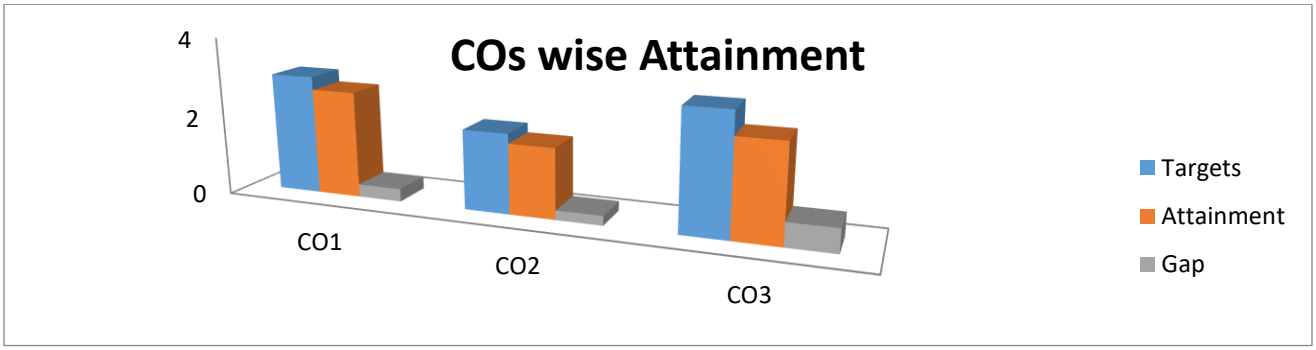
Up to MID-2

COs	CO1	CO2	CO3
Target	3	2	3
Achieved	2.68	1.76	2.41
Gap	0.32	0.24	0.59



Gaps Identified:

Describe what the reasons for gaps are

1. Students were not able to understand basic concept of supercharging (CO-1).
2. Some of the students could not understand how to evaluate the performance of supercharged engine (CO-3). Some of students were not able to explain injection system of petrol engine (CO-2).

<u>Activities decided to bridge the gap</u>

1. Animated Video about working of various engines and supercharging process were played and send to students to learn more.
2. Revision classes were taken and notes of these topics were circulated among the students

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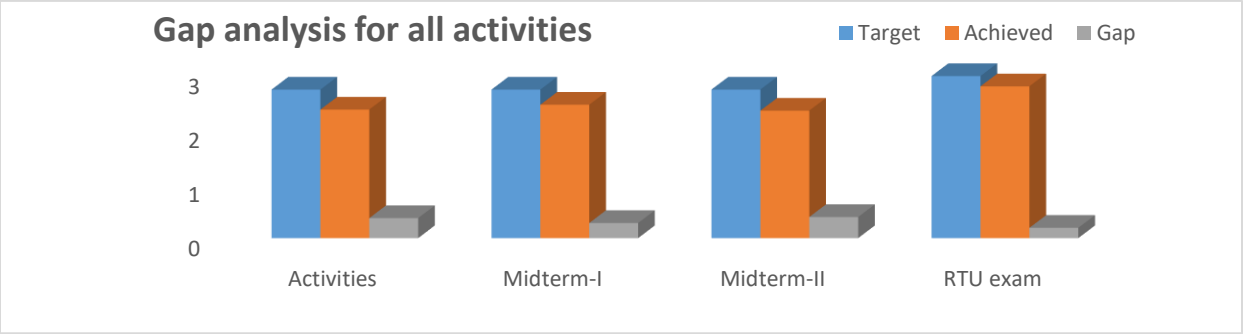
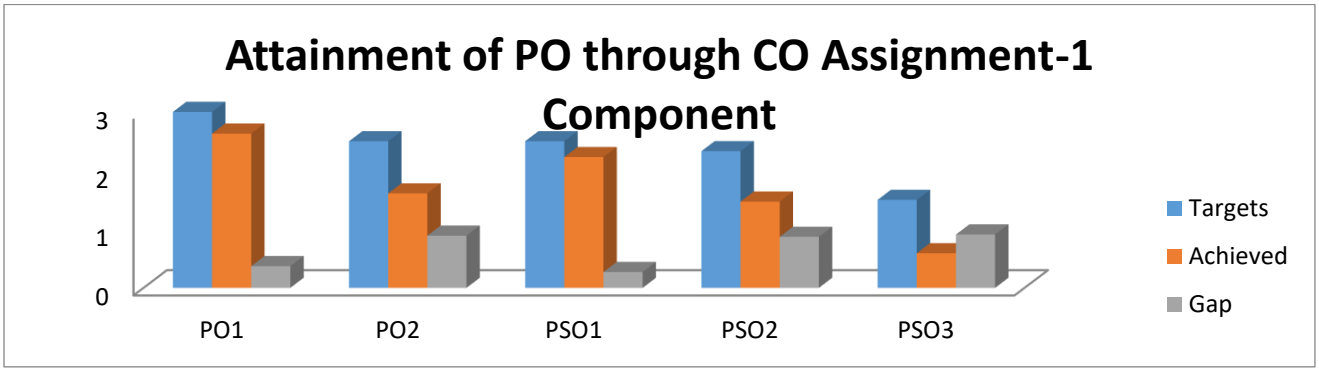
Gap analysis for all activities				
	Activities	**Midterm-I**	**Midterm-II**	**RTU exam**
Target	**2.75**	**2.75**	**2.75**	**3**
Achieved	2.38	2.47	2.36	2.81
Gap	0.37	0.28	0.39	0.19



POs and PSOs GAP IDENTIFICATION

Attainment of PO through CO Assignment-1 Component															
7ME5-11	**PO**												**PSO**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
Targets	**3.00**	**2.50**				-	-	-	-	-	-	-	**2.50**	**2.33**	**1.50**
Achieved	**2.63**	**1.61**				-	-	-	-	-	-	-	**2.23**	**1.47**	**0.59**
Gap	**0.37**	**0.89**				-	-	-	-	-	-	-	**0.27**	**0.87**	**0.91**



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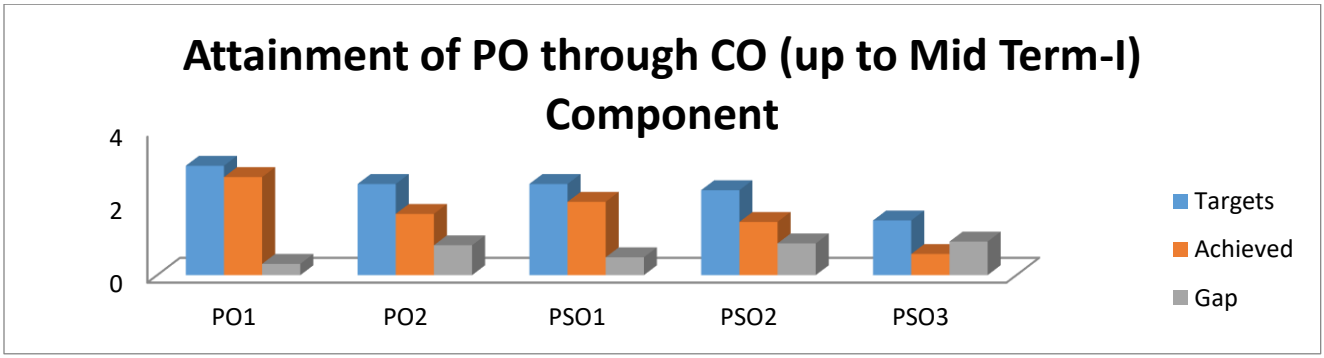
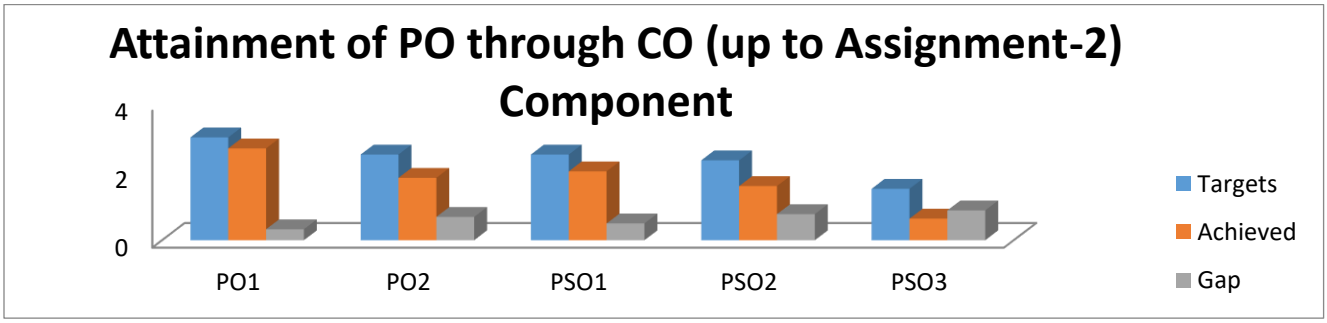
Attainment of PO through CO (up to Mid Term-I) Component															
7ME5-11	**PO**												**PSO**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
Targets	**3**	**2.5**											**2.5**	**2.33**	**1.5**
Achieved	**2.69**	**1.68**											**2.01**	**1.46**	**0.58**
Gap	**0.31**	**0.82**											**0.49**	**0.87**	**0.92**



Attainment of PO through CO (up to Assignment-2) Component															
7ME 5-11	**PO**												**PSO**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
Targets	**3**	**2.5**											**2.5**	**2.33**	**1.5**
Achieved	**2.68**	**1.82**											**2.01**	**1.58**	**0.63**
Gap	**0.32**	**0.68**											**0.49**	**0.76**	**0.87**



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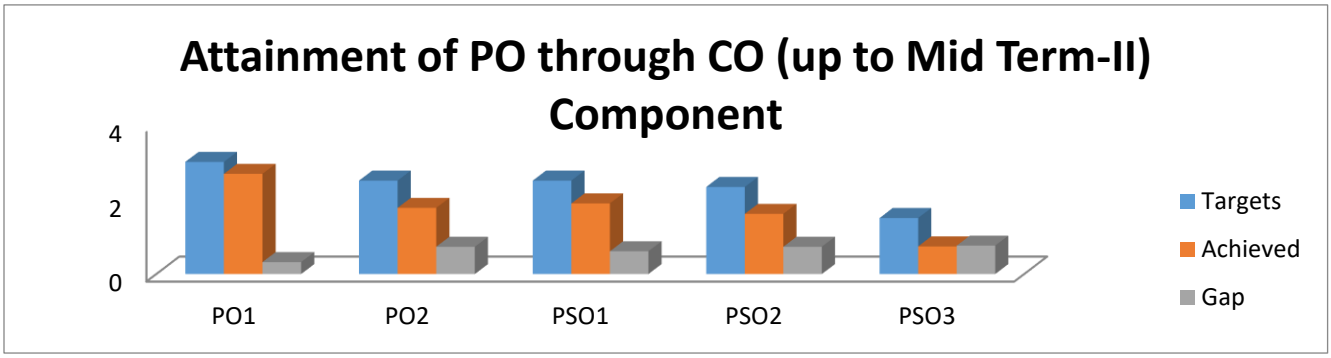
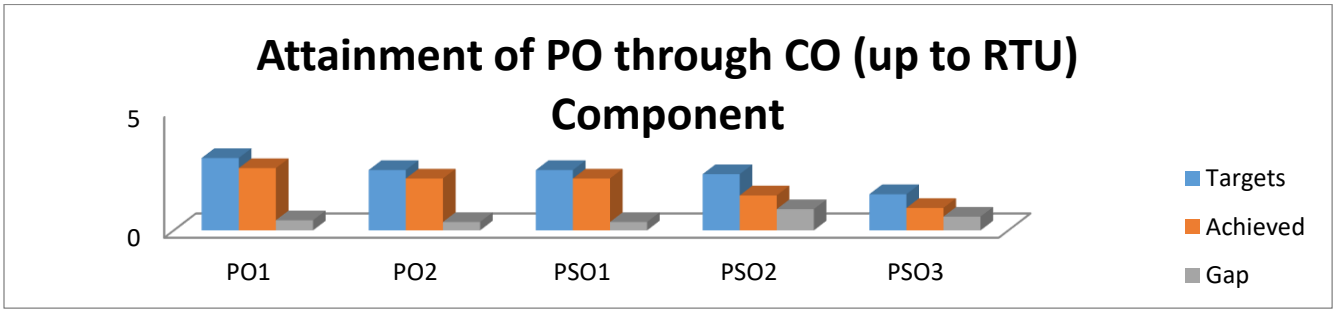
Attainment of PO through CO (up to Mid Term-II) Component															
7ME5-11	**POOOO**												**PSO**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
Targets	**3**	**2.5**											**2.5**	**2.33**	**1.5**
Achieved	**2.68**	**1.77**											**1.89**	**1.61**	**0.74**
Gap	**0.32**	**0.73**											**0.61**	**0.73**	**0.76**



Attainment of PO through CO (up to RTU) Component															
7ME5-11	**PO**												**PSO**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
Targets	**3**	**2.5**											**2.5**	**2.33**	**1.5**
Achieved	**2.58**	**2.15**											**2.15**	**1.45**	**0.93**
Gap	**0.42**	**0.35**											**0.35**	**0.88**	**0.57**



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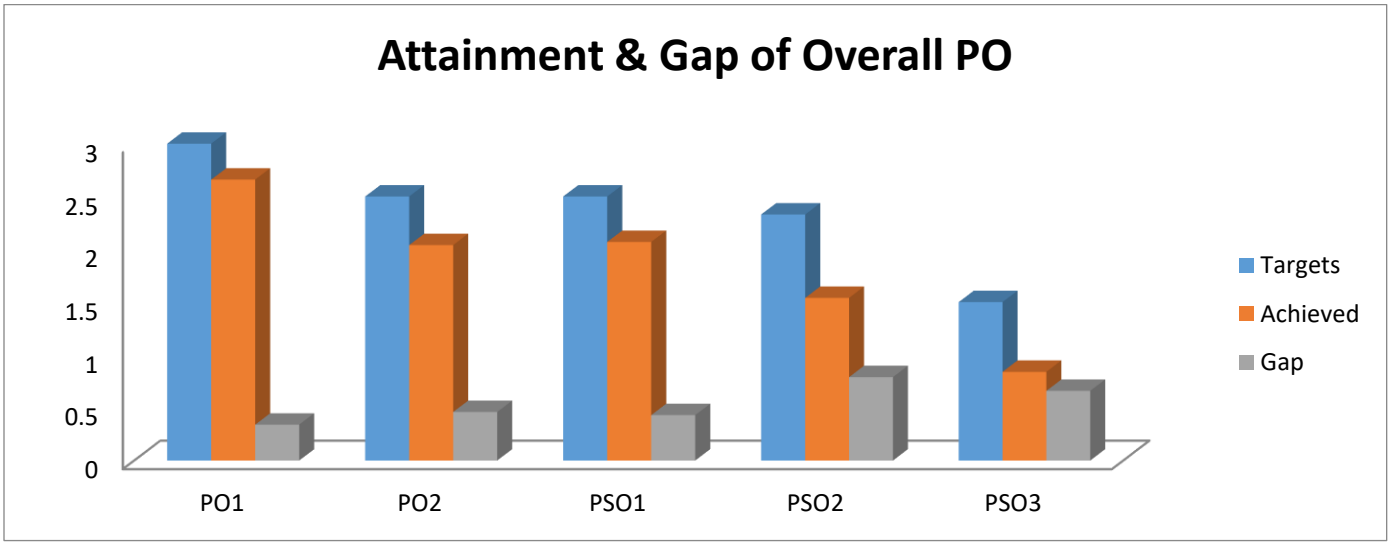
Attainment & Gap of Overall PO														
7ME5-11	**PO**											**PSO**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
Targets	3	2.5											2.5	2.33	1.5
Achieved	2.66	2.04											2.07	1.54	0.84
Gap	0.34	0.46											0.43	0.79	0.66



Overall Comment

CO gaps were observed but RTU result was 100%.

It has been observed that PO gaps are higher as compared to CO.

Due to COVID-19 we could not plan industrial visits related to subject area and some of the students belong from rural area do not have good internet connectivity so it create the problems to the students to understand the some conceptual topics.

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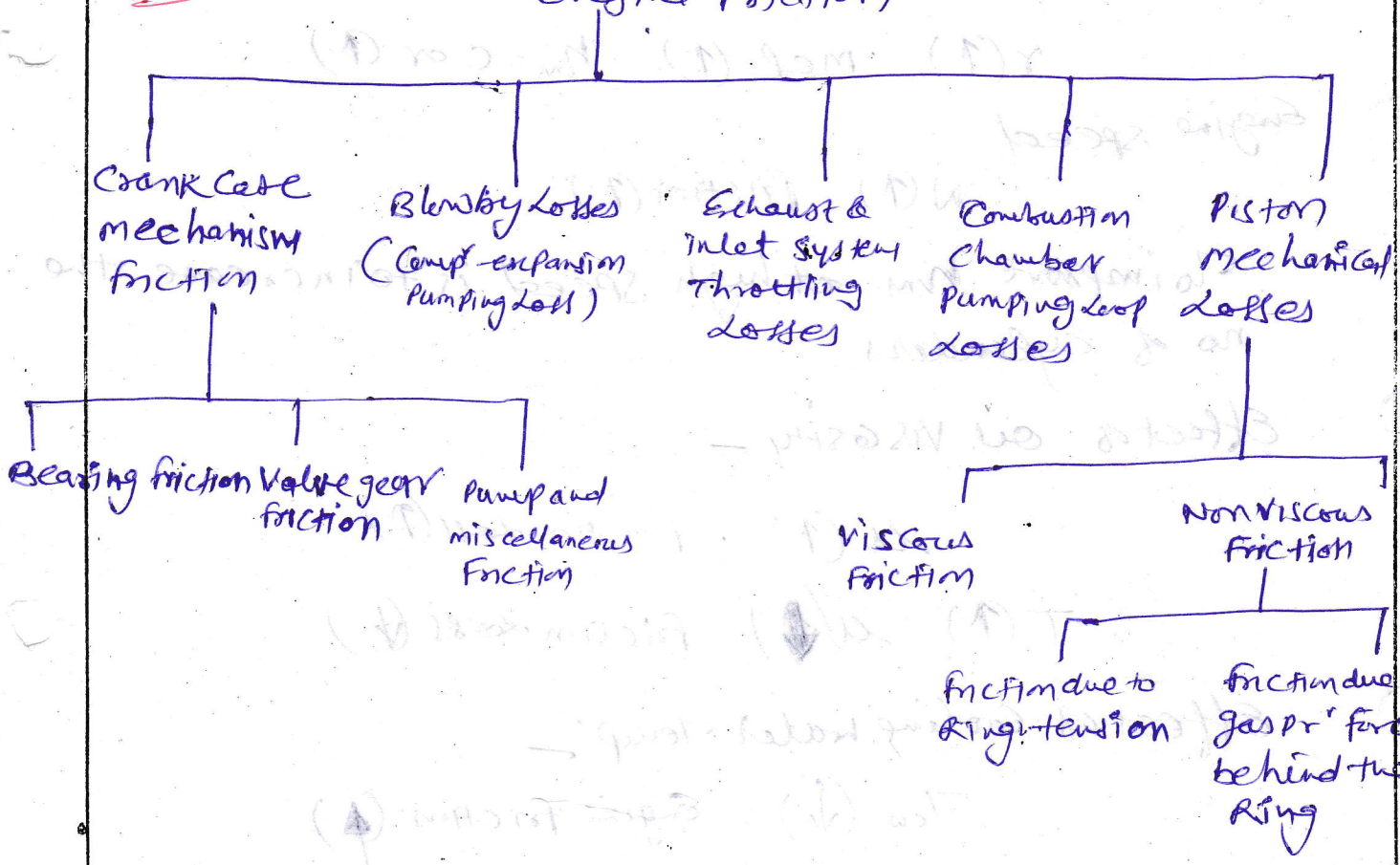
PCE DETAILED LECTURE NOTES SUB/ IC Engine

(PLAIN SHEET) TOPIC L-26

ENGINE FRICTION AND LUBRICATION

(Engine oil)

Total engine friction (FHP) = IHP - BHP — Diff between IHP and BHP. includes ① power required to drive the Comp^r or Scavenging pump and ② Power required to drive engine auxiliaries such as oil pump coolant pump and fan.



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Effect of Engine variables on Engine Friction

① Stroke / Bore Ratio — should small (4D)

② Cylinders size and No of cylinders — ~~(a)~~

Smaller No, Large size Cylinders improve friction and economy.

③ No of Piston Ring — not very critical

No of Ring (↑) Friction (↑) + Economy (↓)

④ Effect of Comp^n Ratio (r) —

r (↑) · mep (↑) η_m = C or (↑)

⑤ Engine speed

N (↑) Friction (↑)

To improve η_m at high speed is to increase the no of cylenders

⑥ Effect of oil viscosity —

μ (↑) · Friction Loss (↑)

T (↑) μ (↓) Friction Loss (↓)

⑦ Effect of Cooling water Temp^r —

T_{cw} (↓) Engine friction (↑)

⑧ Engine Load —

Load (↑) $(P_r)_{max}$ ↑ friction (↑)

for petrol Engine To reduce frictional Losses. Throttle is opened more so that throttle losses reduce.

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PCE DETAILED LECTURE NOTES SUB/ ..... IC Engg.

(PLAIN SHEET) TOPIC .....

Determination of Engine friction (friction power) (FP)

(1) From IP and BP measurement —

IHP — indicator diagram

BHP — dynamometer

FHP = IHP − BHP.

DisAd — very difficult to obtain accurate indicator diagram.

(2) Morse Test — for both petrol and diesel engine

The individual cylinders are successively cut off and the BHP is determined. This gives IP developed by each cylinder.

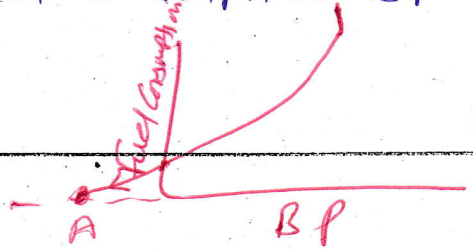
Morse Test is applicable to Multi cylinder engine only.

(3) Willan's line Method (CI) — only for diesel engine

The gross fuel consumption is plotted against BP and the line so obtained is extended backwards to zero fuel consumption.

The negative intercept on the BP axis gives the value of FP.

DisAd - Fuel consumption - bp line is not straight.



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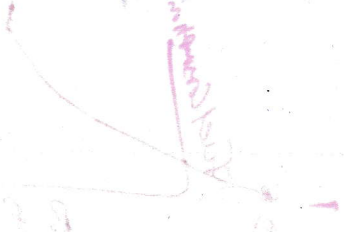
④ Motoring method — Engine is driven with the help of external motor. The power consumed by this motor (if corrected for mechanical and other losses of the motor) gives FP of the engine.

Ans - ① No actual firing takes place the peak Pr, exhaust back Pr, engine temp etc.
② Successive stripping off

⑤ Deceleration method — If a running engine is left free after cutting off the fuel supply it will decelerate due to the effect of the engine friction. If this deceleration is measured and the polar moment of inertia of Engine is known then FP can calculate

Engine friction = $I \times (-a_i)$
= Polar moment × initial deceleration



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PCE DETAILED LECTURE NOTES SUB/ IC Engine -

(PLAIN SHEET) TOPIC L-27

LUBRICATION

Lubrication Principles :-

(a) Hydrodynamic Lubrication —

A Thick oil can support a higher load than that supported by a thin oil.

When a block (which resting on a flat surface covered with a layer of lubricating oil) is moved over the surface a wedge shaped oil film is built up between the moving block and the surface. This wedge shaped film is thicker at the leading edge than at a rear means moving block acts as a pump to force oil into clearance that narrow down progressively as the block moves. This generates appreciable oil film pressure which carries the load.

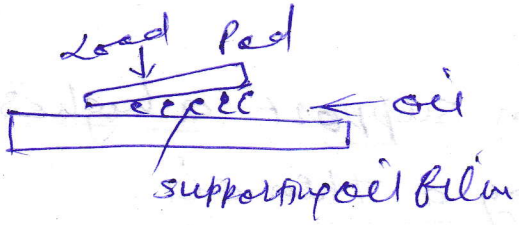
This type of lubrication where a wedge shaped oil film is formed between two moving surfaces is called hydrodynamic lubrication.

Load carrying capacity ↑ with ~~[illegible]~~ / ↑ (thick oil)
of bearing

- The force required to move the block over the surface depends upon the weight of the block, the speed of movement and the thickness or viscosity of the oil

$$\frac{\text{Force}}{\text{Pressure caused by weight of block}} = \text{coefficient of friction}$$

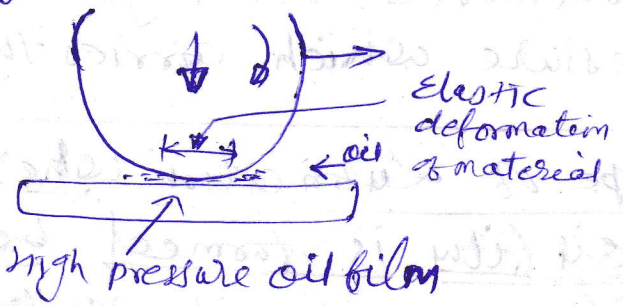
$$\frac{f}{R} = \mu \qquad \boxed{F = \mu R}$$



(b) Elastohydrodynamic Lubrication —

When the load on the bearing is very high the material itself deforms elastically. Called Elastohydrodynamic Lubrication.

Ex. occurs bet' cams and followers, gear teeth, and rolling bearings where the contact pressures are extremely high.



(c) Boundary Lubrication — If the film thickness between the two surface in relative motion becomes so thin that formation of hydrodynamic oil film is not possible and the surface penetrate this film (thin) to make metal to metal contact then such a Lubrication called Boundary Lubrication

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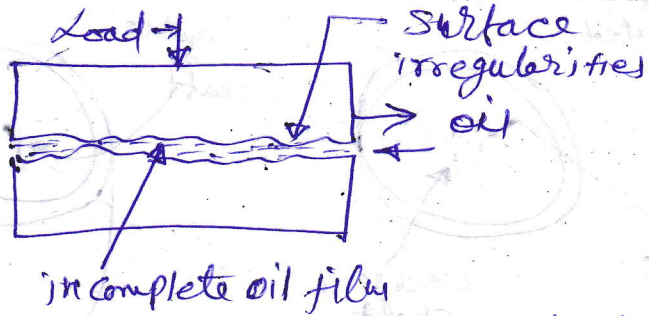
PCE DETAILED LECTURE NOTES SUB/ I.C Engine

(PLAIN SHEET) TOPIC



- The bearing surface are not perfectly smooth - they have "hills" and "valleys" which tear this thin film.
- It occur when the engine is under very high loads or when the oil supply to the bearing is insufficient.

(d) Hydro static Lubrication — In this other oil film resists its instantaneous squeezing out under reversal of loads with relatively slow motion. The oil film acts as a cushion.

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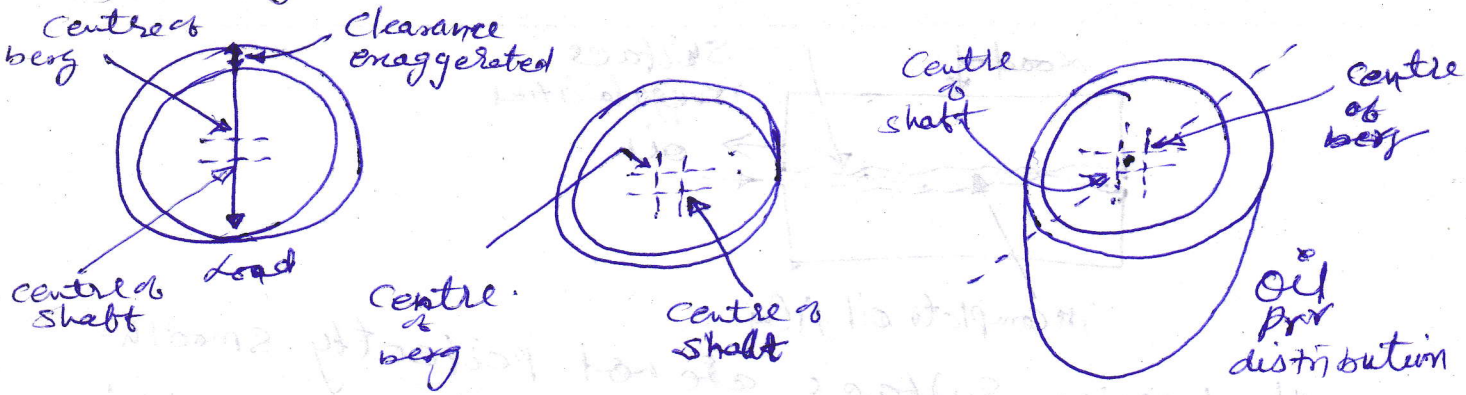
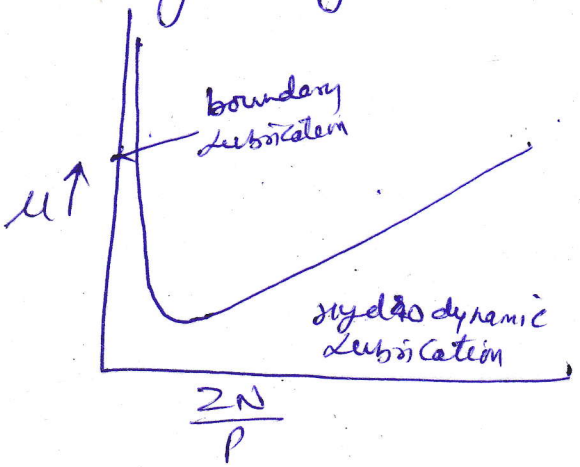
Bearing Lubrication



When the shaft is not running there is metal to metal contact bet^n the shaft and bearing due to squeezing out of oil from under the journal because of shaft weight

As the shaft starts to rotate due to high starting friction, the journal momentarily rolls slightly up the side wall. If some surface oil remains on the bearing the shaft will slide back to the bearing bottom when it hits the oil. This climbing and sliding back continues till sufficient oil is supplied by the pump so that the climbing shaft grabs the oil instead of the bearing wall and a curved wedge shaped oil film is formed. This film now supports the shaft in the bearing.

Phenomenon of shift from boundary Lubrication to Hydrodynamic Lubrication



Z = Viscosity

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PCE DETAILED LECTURE NOTES SUB/ I.C Engine

(PLAIN SHEET) TOPIC L-30

SUPERCHARGING

Power output depends upon 1. $\dot{m}_a$ ← N↑, Pair↑ – supercharging

2. degree of utilization of this air

3. η_{th}

The amount of air inducted per unit time ($\dot{m}$) can be increased by ① increasing speed or by ② increasing the density of air at intake

– The increase in Engine speed calls for rigid and robust engine as the inertia load increase, engine friction and bearing loads also increase and η_o decrease so N↑ → inertia load↑ → friction↑ → η_o↓

– The method of increasing the inlet air density is called "Supercharging"

done by supplying air at high pr by using a Pressure boosting device called "Supercharger"

– η_{th} (↑) ∝ C.R. (r) (↑) ∝ $(P_{max})_{cylinder}$ (↑)

Supercharger → Compressor (Reciprocating, Centrifugal, Lysholm, Vane, Root) blower

– In supercharged engine

The rate of increase of maximum cylinder pressure < Rate of increase of BMEP

$(P_{max})_{cylinder}$ < BMEP

So more power can be obtained by supercharging as compared to that obtain by r(↑)

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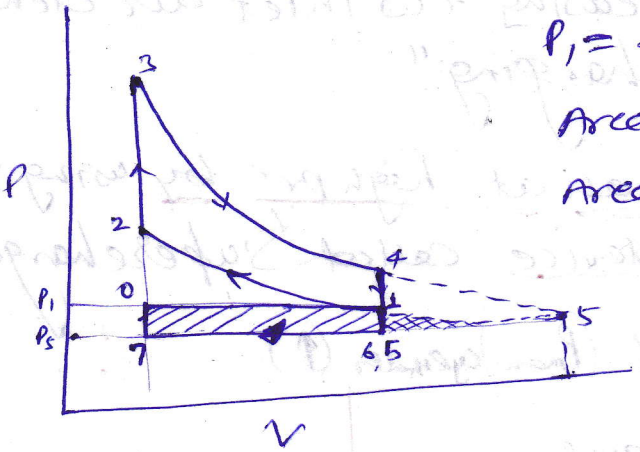
Objective of Supercharging

- To burn a greater amount of fuel (complete combustion) in a given engine and thus increase its power output.
- To increase power output for a given bulk and weight of engine: this is important for aircraft marine engine where space are important
- To compensate for the loss of power due to altitude
  - aircraft engine lose power at rate of 1%, 100 meter altitude
- To obtain more power from an existing engine.
- $\eta_m \uparrow$

THERMODYNAMIC CYCLE

Ottocycle supercharge Engine

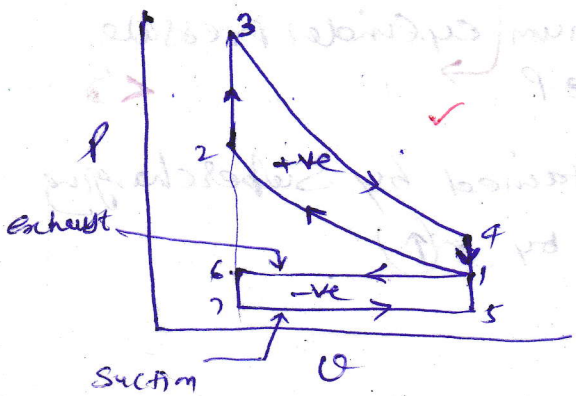


P_1 = supercharge Pr, P_s = exhaust Pr

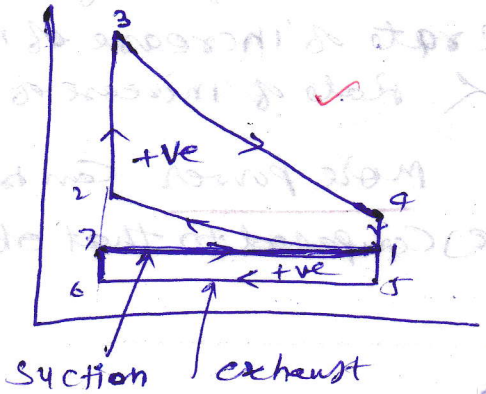
Area 12341 = output of engine

Area 01670 = gain in work during the gas exchange (less due to supercharging

Loss of work → η_m (↓) with P_{super} (↑)



Naturally aspirated Engine



Supercharge engine

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PCE DETAILED LECTURE NOTES SUB/ I.C. Engine

(PLAIN SHEET) TOPIC

Important diff.

① Increase in Pr over the unsupercharged cycle.

② Pumping loop of a supercharged engine is +ve

$$\text{Imep} \uparrow = \frac{(\text{area } 12341 + \text{area } 1567) \times \text{Spring No.}}{\text{Length of indicator diagram.}}$$

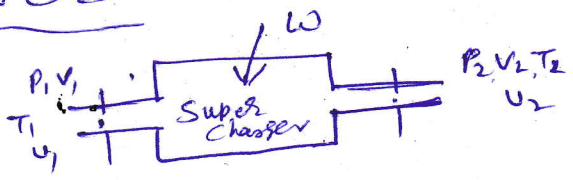
$$= \frac{A_{12341+1567} * K}{L}$$

✓ Increase in $\dot{m}_a$ For the same swept volume.

✓ Increase in η_{mech} by supercharging. & Part = increase

Supercharging Power

Steady flow process



SFEE $(U_1 + P_1V_1) + W = (U_2 + P_2V_2) + \phi$

Let ϕ (heat loss) $= 0$

$$W = (U_2 + P_2V_2) - (U_1 + P_1V_1)$$

$$\boxed{W = h_2 - h_1}$$

$$W = c_p (T_2 - T_1)$$

T_2 = end of compressor Temperature

Now $\frac{T_{2s}}{T_1} = \left(\frac{P_2}{P_1}\right)^{\frac{\gamma-1}{\gamma}}$

$$T_2 - T_1 = T_1 \left\{ \left(\frac{P_2}{P_1}\right)^{\frac{\gamma-1}{\gamma}} - 1 \right\} \times \frac{1}{\eta_s}$$

$\eta_s = \frac{T_{2s} - T_1}{T_2 - T_1}$

η_s = supercharge adiabatic efficiency.

$$W = c_p T_1 \left\{ \left(\frac{P_2}{P_1}\right)^{\frac{\gamma-1}{\gamma}} - 1 \right\} / \eta_s$$

$$\boxed{\text{Power} = \frac{\dot{m}_a \, c_p \, T_1 \left[\left(\frac{P_2}{P_1}\right)^{\frac{\gamma-1}{\gamma}} - 1 \right]}{\eta_s} \text{ KW}}$$

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PCE DETAILED LECTURE NOTES SUB/ I.C. Engine

(PLAIN SHEET) TOPIC 1-3 Knocking

P_i ↓ Knocking ↓

(A) Supercharging of SI Engine :-

Supercharging is employed only in aircraft and Racing Car Engine because increase in P_s - increases the tendency to detonate and pre-ignite

P_s ↑ detonation ↑ Pre ignite ↑

η_v (↑) → T_i (↑) P_i (↑) → Ignition delay (↓) + Flame speed (↑)

→ detonation or pre ignite

∴ Supercharged petrol Engine employs Lower r

r (Lower) → heat loss (↑) → η_{th} (↓) → P_{out} ↑
(ϵ_{proc} ↑)

Thus supercharged petrol engine have a greater fuel consumption than naturally aspirated engine

* Flame speed (↑) → Engine can't run on week mixture without Knock. Knocking + Pre ignition
* Rich mixture are used to control detonation.
→ SFC (↑)
* Knocking can be controlled in highly super Charged Engine by injection of water in the CC (Large amount of liquid required)
* Also Intercooling of the charge befor it is feed to the Engine

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(B) Supercharging of CI Engine

$P_i \uparrow T_i \uparrow$ delay ↓ Knocking ↓

it is good for CI Engine

Supercharging improves combustion, in a diesel engine

T_i or P_i (↑) → ID (↓) → Rate of pr^v (↑) → Smoot Combustion

→ This improvement in combustion allows a poor quality of fuel in diesel Engine.

– It is also not sensitive to type of fuel.

T_i (↑) → η_v or η_{th} (↓) → P (↑) so

→ ✓ Intercooling is not required for highly Supercharged engine.

– Lean mixture
Low f/A and High expansion Ratio Result in lower exhaust temperature. This result in

✓→ Increased life of the exhaust valve.

– Degree of Supercharging is limited by the thermal and mechanical Load on the engine. It depends on the type of Supercharger used and design of the engine.

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PCE DETAILED LECTURE NOTES SUB/ ..... I.C. Engine.

(PLAIN SHEET) TOPIC L-34

DUEL & MULTI FUEL ENGINE

In many engine two fuel 1. gaseous 2. Liquid fuel are used. The two fuels can be taken in widely varying Proportion to run an engine Such Engines are called duel fuel engine.

Working Principle :— works on diesel cycle,

The gaseous fuel (Primary fuel) is added to the air inducted by the engine or supplyied by the supercharger at a Pressure slightly above the Patm.

This mixture of air and gaseous fuel is compressed in the cylinder (as Normal diesel operation)

At some point in the compression stroke, near top dead centre, a small charge of liquid fuel called Pilot fuel (secondary fuel) is injected through a conventional diesel fuel system

This Pilot injection acts as a source of ignition

The gas-air mixture in the vicinity of the injected spray ignites at no of places establishing a no of flame fronts. This Combustion starts smoothly and rapidly.

The power output of the engine is normally controlled by changing the amount of primary gaseous fuel added to inlet manifold. The pilot oil quantity is usually kept constant for a given engine and is about 5 to 7 percent of the total heat of engine at full load. A dual fuel engine is capable of running on either gas or diesel oil or a combination of these two over a wide range of Comp^r ratios.

PCE DETAILED LECTURE NOTES SUB/ IC Engine-

(PLAIN SHEET) TOPIC

Combustion in Dual fuel engine

The Combustion depends on the amount of gaseous fuel supplied and ignition of gaseous fuel is effected by introducing a small amount of fuel (in form of spray) near TDC.

(1). Without the gaseous fuel the Pilot fuel burns like that in a diesel operation. However it is not sufficient to maintain the speed of the engine at desired level.

It requires about 15% of fuel Load fuel to run the engine at no Load while the Pilot fuel is only 5 to 7 % of full load value.

(2). As the amount of the gaseous fuel is increased the gas air mixture in the vicinity of the injected fuel spray also gets oxidized and starts burning at a no of places. Flame fronts start travelling from these ignition Points and combustion take place rapidly and almost completely. The Combustion then is exactly similar to Combustion in an SI Engine.

(3) Increased admission of the gaseous fuel results in very fast reaction rates, this followed by ignition with very high rates of pressure rise and Combustion.

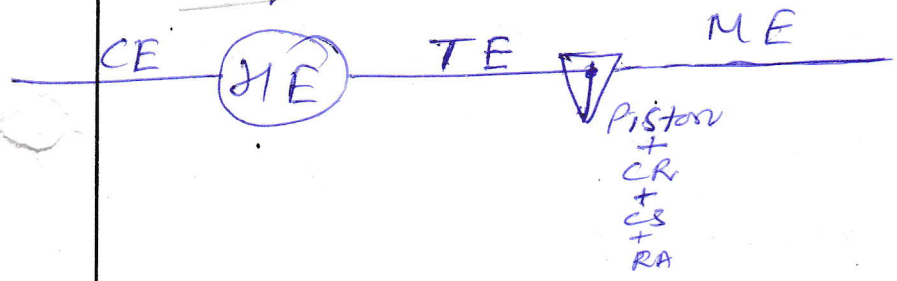
PCE DETAILED LECTURE NOTES SUB/ ..... IC Engine -

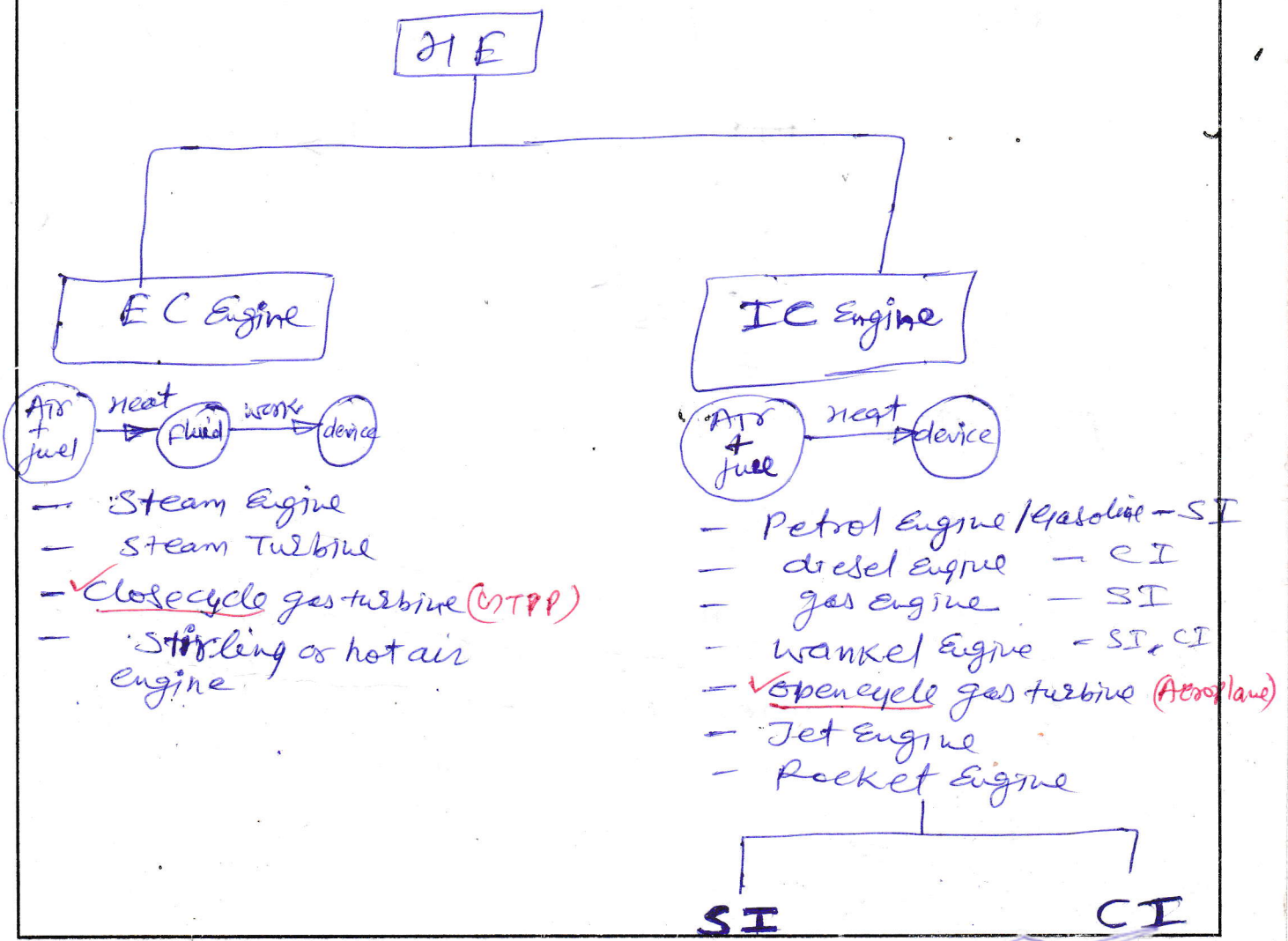
(PLAIN SHEET) TOPIC..... L 1/2

UNIT 1

Historical & Modern development, Nomenclature

Heat Engine:- a device which transforms the chemical energy of a fuel into thermal energy this thermal energy is used for produce mechanical work.





HISTORICAL Development :-

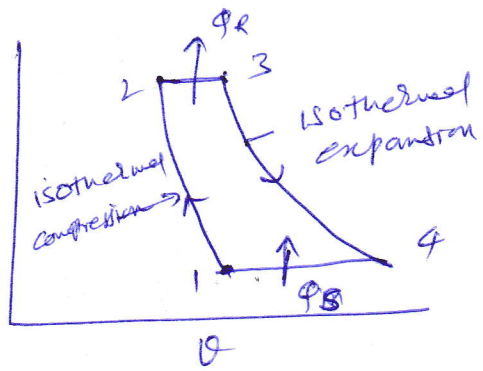
- Huygens Gunpower Engine (1680)
- The Lenoir Engine (1860)
- Free Piston otto : Langen Engine (1866)
- Beau de Rochas : Four Stroke cycle : otto cycle (1862)
- The Brayton Engine (1873)
- Atkinson Engine (1885)
- Diesel Engine (1892)
- Two Stroke Engine (Clerk's Engine) (1881)

Modern Development :-

① Wankel Engine (1957) - chapter - 23

② stirling Engine (Philip Company) (1938, 1965)

o2 isothermal
o2 isobaric



$\eta > 30\%$

③ Free Piston Engine (1944, 1956) —

Combination of reciprocating engine and rotary Turbine

1944 - SIGMA (Society industrielle Generate de Mecanique Appliqué, France) [OS-34]

1956 - General Motor corporation of America - OS-34 (GM 14)

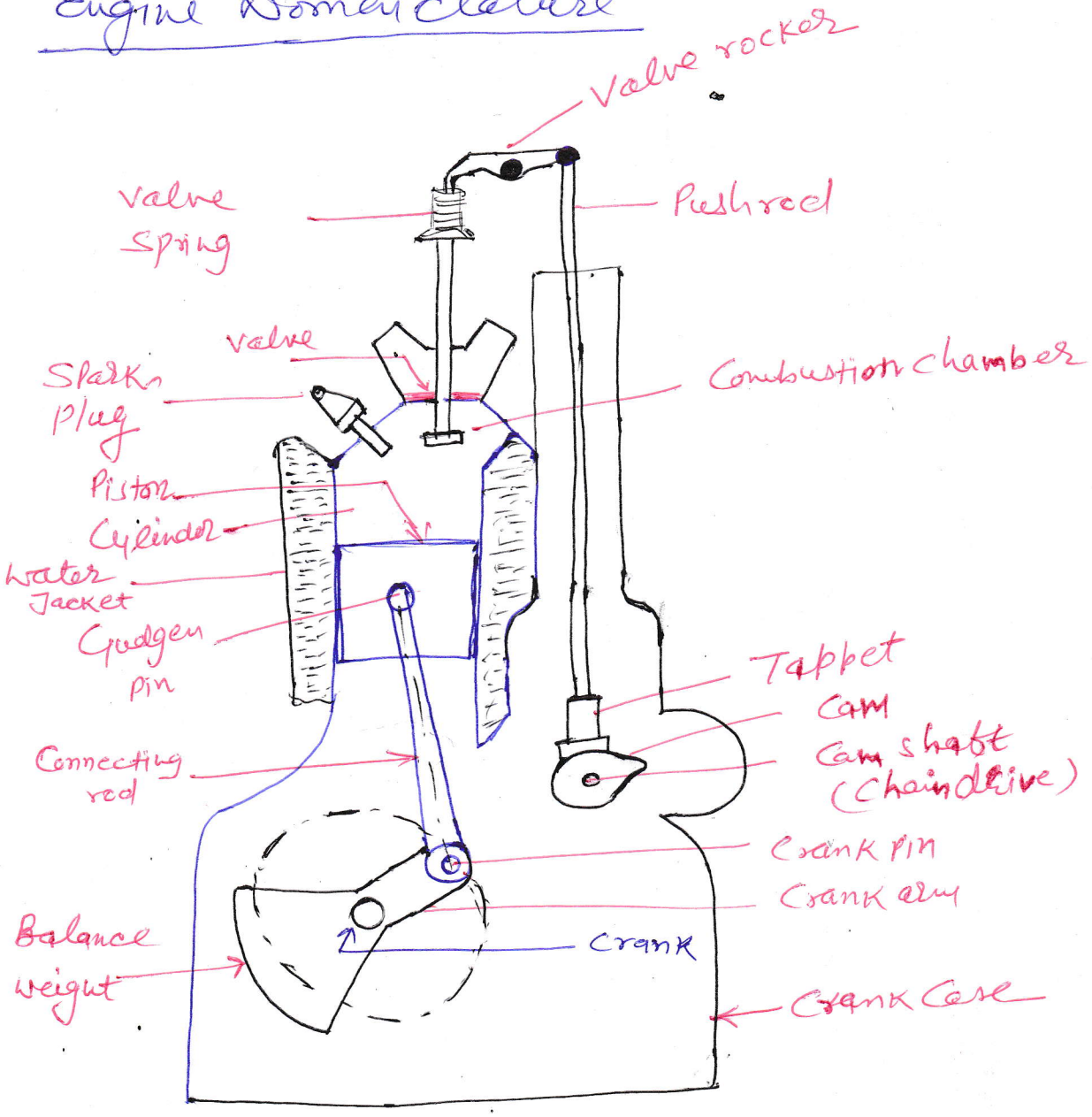
→ Gasifier
Power Turbine

★ Free Piston means in the Gasifier, Piston have variable stroke but in other fixed

PCE DETAILED LECTURE NOTES SUB/ I.C Engine

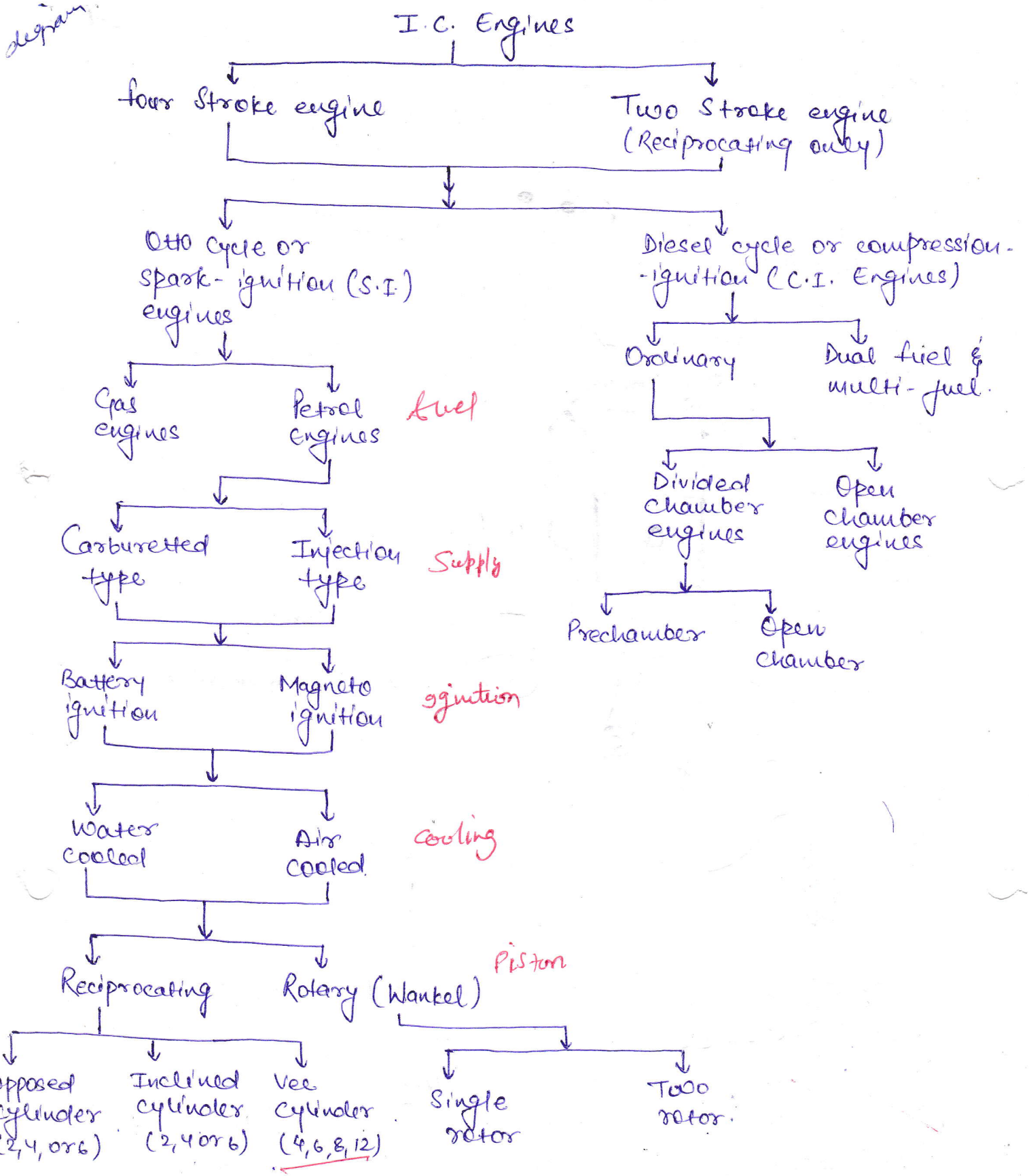
(PLAIN SHEET) TOPIC L-1/2

Engine Nomenclature



1	Cylinder	CI / alloy steel	Casting
2	Cylinder Head	CI / Aluminium alloy	Casting / forming
3	Piston	CI / Al. Alloy	11 —
4	Piston Rings	Silicon Cast iron (Alloy steel)	Casting
5	Gudgeon pin	Steel	Casting
6	Valve	Alloy steel	Forging
7	Connecting Rod	Alloy Steel	Forging
8	Crankshaft	Alloy steel / SG iron	Forging
9	Crank Case	Al alloy / CI / steel	Casting
10	Cylinder liner	CI / Ni alloy steel	11 —
11	Bearing	White metal, Lead	

I C Engine Classification



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Air-Fuel supply system

Fuel Tank – fuel lines – fuel Pump – fuel filter – Air cleaner – CARBURATOR – Intake Manifold → TO CARBURATOR → (A) CARBURATION

(A) SI Engine

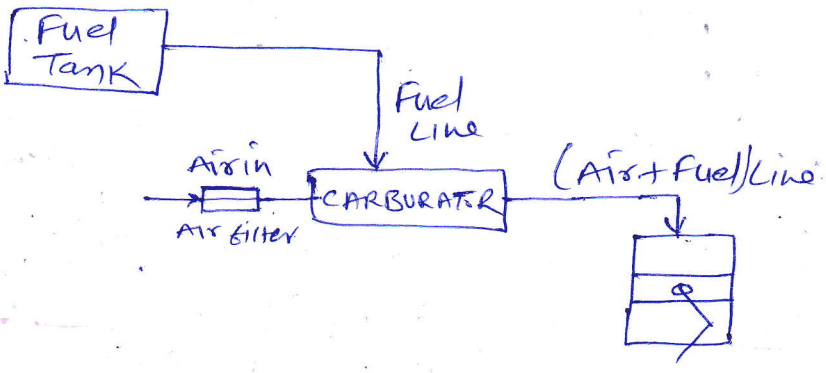
Types of fuel supply system are
- Gravity system
- Air Pressure system
- Vaccum system (Suction & gravity system)
- Pump feed system
- fuel Injection system

① Gravity fuel feed system → the fuel tank is mounted at the highest point of the SI Engine this system is quite simple and cheap as the fuel drops into the float chamber of the carburator under gravity

it is using in a small engine having low fuel consumption as sufficient head is not developed for large engine

Advantage – The system is quite simple and cheap as other fuel feed system

disadvantages – The rigidity of placing the fuel tank necessarily over carburator is its disadvantage



② Air Pressure feed system → an air-tight (sealed) fuel tank is used and is placed under the seat or near the engine. the hand operated a/c mechanically operated pump supplies

to the fuel tank for supply the fuel to the carburetor

Advantage – the fuel tank can be placed at any suitable location

Disadvantage – There are chances of pressure leak within the chamber

③ Vaccum feed system (Suction & gravity system) → (manifolds, carburetor)

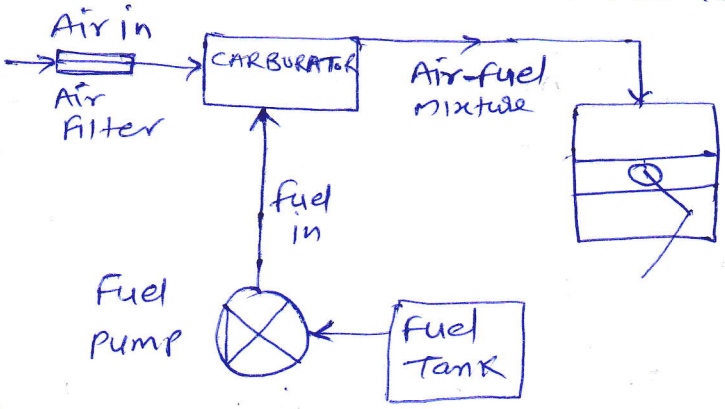
fuel from the fuel tank which is placed near the engine is sucked by means of suction from the induction manifold. by means of gravity, the fuel is supplied to the float of the carburator.

Advantage – The cost of the total system is less

④ Pump feed system – A steel pipe carries petrol to the fuel pump which pumps it into the float chamber of the carburetor through the pipe (fuel line)

Here we use a Mechanical or electrical or a diaphragm pump supplies the fuel from the fuel tank is placed at any suitable location and is vented to the atmosphere.

This system is used in most vehicles in the present days



⑤ fuel injection system → The petrol injection system now comes to modern vehicle. the fuel is automized by means of an fuel injector nozzle then delivered into an air stream. there may be seperate fuel injectors are used for seperate cylinder or one single fuel injector is used (MPFI)

then supply to intake manifolds

Advantage – ① Most accurate fuel supply system

② High power is develop

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③ it has quick starting and warm up

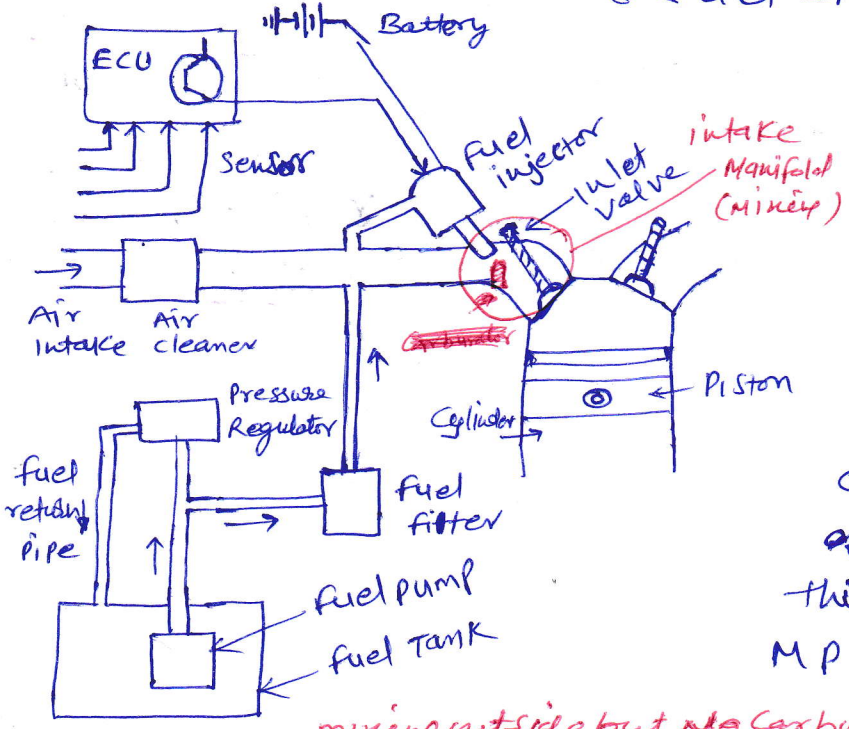
④ Low specific fuel consumption rate

Disadvantage – ① Back flow of petrol may take place

② High initial cost

(A2) MPFI (Multi Point fuel injection) — 3-5 bar SP

An electrically driven fuel pump draws fuel from fuel tank and supplies it to a common header or tube. A pressure regulator fitted at the end maintains a constant pressure of fuel approx "3 bar" in the header"



mixing outside but No Carburator

The header is connected to different branch of inlet manifold through fuel injectors. For each cylinder of engine there is seperate fuel injector which injects fuel in the corrosponding air passage of that cylinder. Due to this the system is called MPFI system

The fuel injectors are precision built "Solenoid Valves" having single or multiple orifices. Due to constant Pressure (3 bar) of fuel maintained in the common header, the quantity of fuel injected depends only on the time period for which the solenoid valve type fuel injectors are kept in open position.

An on board ECU (electronic control unit) i.e. "microprocessor" controls the ① quantity of fuel injected to each cylinder individually and also ② the ignition timing of each cylinder. The data input to the ECU comes from a number of sensors

located all over the engine. These sensors collect the following data continuously.

① Ambient Temperature (T_a) ② inlet manifold vaccum or Air Velocity
③ Exhaust gases Temperature ④ Exhaust O_2 Content
⑤ Throttle Position ⑥ Engine r.P.M.

Based on programmed interpretation or processing of this data, ECU calculates the amount of fuel needed to maintain stoichiometry Air/Fuel Ratio of 14.5 : 1 and converts it into required pulse width i.e. time period for which it keeps the solenoid injector energized. ECU also gives command to ① spark ignition system. In this way ECU ensures overall satisfactory performance of the engine from start to shutdown including ② emission control by sending ③ right quantity (14.5:1) and ④ quality of fuel-air mixture to each cylinder of engine ⑤ at right time based on requirement of engine and also ⑥ ignites it right time.

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Components of the fuel supply system

① **Fuel Tank** → it is made of steel or Aluminum or synthetic rubber compounds and fiber reinforced plastics which are flame resistant and these tanks are coated with lead-tin alloy to protect the tank from the corrosion effect (Pb-Sn)

This tank is placed in any suitable position of a vehicle

⇒ for front engine vehicle, the fuel tank is in the under side of a luggage compartment at the rear end or directly above the rear axle, and for Rear engine,

⇒ the fuel tank is placed in the front behind the compartment.

→ There are couple of baffle plates inside the fuel tanks because of when brakes are applied to the vehicle the fuel surge inside the vehicle or when a car turn around then also fuel surge inside the tank So this baffle plate helps to reduce the surge of fuel inside the tank.

– These plates divide the tank in a no of the compartment which is interconnected through a pipe.

– Petrol is filled by the small opening cap. A filter is placed at the tank end of the fuel line and a small hole is provided for vented to the atmosphere

– A drain plug is fitted at the bottom of the tank to remove sediments and the fuel tank is also provided with a fuel gauge "sensing unit" for checking of fuel level inside the tank → fuel gauge fitted to dash board

use → To store the fuel

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(2) Fuel Pump – To deliver the fuel from the fuel tank to the carburator (High Pr)

(i) A.C. Mechanical Pump – Mechanically operated diaphragm fuel pump. operated by an eccentric mounted on the CAM shaft of the engine. The pump consist of a spring loaded flexible diaphragm actuated by a rocker arm which in turn operated by an eccentric.
inlet and outlet (spring loaded) valves are provided to ensure fuel flow in the proper direction

[Page 15 (AENotes)]

(ii) S.U. Electrical Pump – This pump contains a flexible diaphragm which is operated by electrical means (Electro magnet). The middle of the diaphragm is fixed to an armature. A rod extends from middle of diaphragm and passes through a center hole in the electromagnet (Solenoid). the other end of the rod carries electrical contact points. Return springs are used to keep the diaphragm in position.

[Page 16 (AENotes)]

(3) Fuel Line – These tubes are used for connects the fuel tank with the pump and pump to the carburator. Made of Cu or steel.
The two joints of the tubes are made flexible because of the flexible joints help the fuel tank to moves back or front with the body and also pump is moves according to the body. This joints prevents the loosening of fuel line by front-back movement of the body.

(3) Air cleaner → important for an engine to get fresh air, otherwise, the polluted air causes several damages to the engine chamber. Particularly Piston, piston chamber, Piston Ring and valves.

If the polluted air enters the crank case where we store engine oil that can be damaged the lubricaton parts like bearing. Therefor we need to install an air filter which purifies the air before entering the engine cylinder.

- This can also act as a silencer for the carburation system and also as a flame arrester when the engine has backfired.
- The air filter will clean regularly. If not clean, it can cause much fuel consumption and reduce the engine efficiency

(i) Heavy duty type air cleaner
(ii) Light duty type air cleaner

(4) Fuel filter → (strainer) necessary for a vehicle to clean the fuel. It is screened off the dist or foreign matter from the fuel and prevents entry to the pump (CR)
For this, a very affected device is used and that is "Chamois leather" which only allows to passing the petrol into it and the water is intercepted by this, and also fine particles can not pass through it.

(5) Fuel gauge unit — A fuel gauge is an instrument which is fitted to the dashboard of the vehicle so that driver can know the amount of fuel inside the fuel tank

(6) CARBURATOR → A perfect air-fuel mixture is necessary for a petrol engine to run. It is device which control the air-fuel mixture. There are two chambers in carburator one is (a) Float chamber which is used to maintain the fuel level with the help of needle valve and one is (b) Mixing chamber where the mixture take place

The air fuel ratio in the carburator is 15:1. it means 15 kg of air has sufficient oxygen to burn 1 kg of fuel

Function of Carburator - ① To mix the air and fuel thoroughly ② To Atomise the fuel ③ To regulate the air-fuel ratio at different speeds and loads ④ To supply correct amount of mixture at different speeds and loads.

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