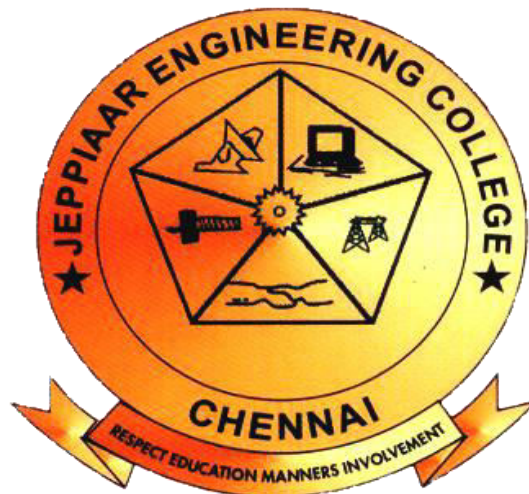


JEPPIAAR ENGINEERING COLLEGE

Jeppiaar Nagar, Rajiv Gandhi Salai – 600 119

DEPARTMENT OF MECHANICAL ENGINEERING

QUESTION BANK



VIII SEMESTER

ME 2041 – ADVANCED IC ENGINES

Regulation – 2018(Batch: 2012 -2016)

Academic Year 2015– 16

Prepared by

Mr.T.Arunkumar, Assistant Professor/Mech

JEPPIAAR ENGINEERING COLLEGE

Vision of Institution

To build Jeppiaar Engineering College as an institution of academic excellence in technological and management education to become a world class university.

Mission of Institution

- To excel in teaching and learning, research and innovation by promoting the principles of scientific analysis and creative thinking.
- To participate in the production, development and dissemination of knowledge and interact with national and international communities.
- To equip students with values, ethics and life skills needed to enrich their lives and enable them to meaningfully contribute to the progress of society.
- To prepare students for higher studies and lifelong learning, enrich them with the practical and entrepreneurial skills necessary to excel as future professionals and contribute to Nation's economy.

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	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.
PO3	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
PO4	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.
PO5	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.
PO6	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.
PO7	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.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	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.
PO11	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.
PO12	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.

JEPPIAAR ENGINEERING COLLEGE
DEPARTMENT OF MECHANICAL ENGINEERING

Vision of the Department

To create excellent professionals in the field of Mechanical Engineering and to uplift the quality of technical education on par with the International Standards.

Department Mission

1. **To reinforce** the fundamentals of Science and Mathematics to **Mechanical Engineering and critically and relatively investigate** complex **mechanical systems and processes**.
2. To engage in the **production, expansion and practice** of **advanced engineering applications** through knowledge sharing activities by interacting with global communities and industries.
3. To **equip** students with **engineering ethics, professional roles, corporate social responsibility** and life skills and **apply** them for the betterment of society.
4. **To promote** higher studies and lifelong learning and entrepreneurial skills and **develop** excellent professionals for empowering nation's economy.

PEO's

1. To **enrich** the technical knowledge of **design, manufacturing and management of mechanical systems** and **develop creative and analytical thinking** in research.
2. To **relate, strengthen and develop** the **theoretical knowledge of the Mechanical Engineering** by exhibiting various concepts applied through diverse industrial exposures and experts' guidance.
3. **Facilitate** the students to communicate effectively on complex social, professional and engineering activities with strict adherence to ethical principles.
4. **Create awareness for independent and lifelong learning and develop the ability to keep abreast of modern trends and adopt them for personal technological growth of the nation.**

PSO's

1. To understand the basic concept of various mechanical engineering field such as design, manufacturing, thermal and industrial engineering.
2. To apply the knowledge in advanced mechanical system and processes by using design and analysis techniques.
3. To develop student's professional skills to meet the industry requirements and entrepreneurial skills for improving nation's economy stronger.

ME2041 ADVANCED I.C ENGINES

COURSE OUTCOMES

C801.1	Evaluate the various emission problems and its solutions in SI Engine.
C801.2	Evaluate the various emission problems and its solutions in CI Engine.
C801.3	Develop the Knowledge in various toxic exhaust gases like CO,H,NO and its effects.
C801.4	Ability to classify the basic emission characteristics of various alternate fuels.
C801.5	Illustrate the knowledge in recent trends of advanced combustion chambers and fuel injection system.

OBJECTIVES:

To understand the underlying principles of operation of different IC Engines and components.
To provide knowledge on pollutant formation, control, alternate fuel etc.

UNIT I **SPARK IGNITION ENGINE** **9**
Mixture requirements – Fuel injection systems – Mono point, Multipoint & Direct injection - Stages of combustion – Normal and Abnormal combustion – Knock - Factors affecting knock – Combustion chambers.

UNIT II **COMPRESSION IGNITION ENGINES** **9**
Diesel Fuel Injection Systems - Stages of combustion – Knocking – Factors affecting knock – Direct and Indirect injection systems – Combustion chambers – Fuel Spray behaviour – Spray structure and spray penetration – Air motion - Introduction to Turbo charging.

UNIT III **POLLUTANT FORMATION AND CONTROL** **9**
Pollutant – Sources – Formation of Carbon Monoxide, Un burnt hydrocarbon, Oxides of Nitrogen, Smoke and Particulate matter – Methods of controlling Emissions – Catalytic converters, Selective Catalytic Reduction and Particulate Traps – Methods of measurement – Emission norms and Driving cycles.

UNIT IV **ALTERNATIVE FUELS** **9**
Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel - Properties, Suitability, Merits and Demerits - Engine Modifications.

UNIT V **RECENT TRENDS** **9**
Air assisted Combustion, Homogeneous charge compression ignition engines – Variable Geometry turbochargers – Common Rail Direct Injection Systems - Hybrid Electric Vehicles – NOx Adsorbers - Onboard Diagnostics.

TOTAL : 45 PERIODS

OUTCOME:

Upon completion of this course, the students can able to compare the operations of different IC Engine and components and can evaluate the pollutant formation, control, alternate fuel

TEXT BOOKS:

1. Ramalingam. K.K., "Internal Combustion Engine Fundamentals", Scitech Publications, 2002.
2. Ganesan, "Internal Combustion Engines", II Edition, TMH, 2002.

REFERENCES:

1. Mathur. R.B. and R.P. Sharma, "Internal Combustion Engines".,DhanpatRai& Sons 2007.
2. Duffy Smith, "Auto Fuel Systems", The Good Heart Willcox Company, Inc., 1987.
3. Eric Chowenitz, "Automobile Electronics", SAE Publications, 1995



JEPPIAAR ENGINEERING COLLEGE

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DEPARTMENT OF MECHANICAL ENGINEERING

QUESTION BANK

Subject : ME2041-ADVANCED I.C ENGINES

Year / Sem : IV / VIII

UNIT I- SPARK IGNITION ENGINE

Mixture requirements – Fuel injection systems – Mono point, Multipoint & Direct injection - Stages of combustion – Normal and Abnormal combustion – Knock - Factors affecting knock – Combustion chambers.

PART-A

CO Mapping : C801.1

Q.No.	Questions	BT Level	Competence	PO
1	What is a heterogeneous air-fuel mixture? In which engine is it used?	BTL-1	Remembering	PO5
2	What is the principle of carburetor?	BTL-1	Remembering	PO5
3	Define abnormal combustion and its consequences?	BTL-1	Remembering	PO3
4	What is equivalence ratio?	BTL-1	Remembering	PO5
5	Short note on SI engine equivalence ratio requirements?	BTL-4	Analyzing	PO1
6	Write the desirable qualities for SI engine fuel?	BTL-1	Remembering	PO1
7	Explain the type of vibration produced when auto ignition occurs.	BTL-4	Analyzing	PO4
8	What is the method to detect the phenomenon of knocking?	BTL-1	Remembering	PO1
9	List out some of the knock limited parameters?	BTL-1	Remembering	PO5
10	List out some of the knock limited parameters?	BTL-5	Evaluating	PO1
11	List the factors that are involved in either producing(or)preventing knock	BTL-2	Understanding	PO5
12	List the parameters which are affecting knock in SI	BTL-1	Remembering	PO5

	engine?			
13	List the parameters in time factors that reduce the knocking?	BTL-1	Remembering	PO3
14	List the composition factors in the knocking?	BTL-1	Remembering	PO5
15	What are the objectives to be kept in mind during design of combustion chamber?	BTL-1	Remembering	PO5
16	What are the factors to be considered to obtain high thermal efficiency?	BTL-1	Remembering	PO5
17	Write the different types of combustion chambering SI engine?	BTL-1	Remembering	PO6
18	What are the components required in the fuel injection system?	BTL-1	Remembering	PO6
19	What are the advantages of fuel-injection in an SI engine?	BTL-1	Remembering	PO10
20	List the draw backs of the carburetion?	BTL-1	Remembering	PO1
21	What is the functional requirement so fan injection system?	BTL-1	Remembering	PO5
22	List some of the important requirements of an automobile carburetor?	BTL-1	Remembering	PO5
23	What are the general types of carburetors?	BTL-1	Remembering	PO5
24	What are the essential parts, compensating device and additional system (Modern) carburetors?	BTL-1	Remembering	PO5
25	Define carburetion?	BTL-1	Remembering	PO5
26	What are the factors effecting carburetion?	BTL-1	Remembering	PO1
27	What are the different types air-fuel mixtures?	BTL-2	Understanding	PO1
28	What are the different range of throttle operation	BTL-1	Remembering	PO5
29	Function of carburetor?	BTL-1	Remembering	PO6
30	Define Heat Engine?	BTL-1	Remembering	PO4

PART-B&PART-C

1	Discusses why a modern carburetor is being replaced by an injection system in SI engine?	BTL-6	Creating	PO1
2	Explain the factors that affect the process of carburetion?	BTL-2	Understanding	PO5
3	What are different air-fuel mixtures on which an engine can be operated?	BTL-1	Remembering	PO5
4	Explain the following; 1.Richmixture, 2.Stoichiometric mixture3. Lean mixture.	BTL-6	Creating	PO1
5	How the power and efficiency of the SI engine vary	BTL-2,	Understanding	PO1

	with air- fuel ratio for different load and speed conditions?	BTL-5		
6	Explain why a rich mixture is required for the following 1.Idling 2.Maximum power and sudden acceleration.	BTL-2, BTL-5	Understanding	PO5

UNIT II COMPRESSION IGNITION ENGINES

Diesel Fuel Injection Systems - Stages of combustion – Knocking – Factors affecting knock – Direct and Indirect injection systems – Combustion chambers – Fuel Spray behaviour – Spray structure and spray penetration – Air motion - Introduction to Turbo charging.

PART-A

CO Mapping : C801.2

Q. No.	Questions	BT Level	Competence	PO
1	Mention any two advantages of induction swirl	BTL-1	Remembering	PO5
2	What is ignition delay period?	BTL-1	Remembering	PO5
3	What are two delay occur in ignition delay period?	BTL-1	Remembering	PO3
4	List the factors affecting the delay period?	BTL-1	Remembering	PO5
5	Explain the effect of quality of fuel factor on the delay period?	BTL-4	Analyzing	PO1
6	Give a comparative statement various characteristics that reduces knock in S.I and C.I engine (any four)?	BTL-1	Remembering	PO1
7	Write the classification of combustion chamber in C.I engine?	BTL-1	Remembering	PO4
8	What is called direct injection type of combustion chamber?	BTL-2	Understanding	PO1
9	What are the types of open combustion chamber?	BTL-2	Understanding	PO5
10	What are the advantages and disadvantages of open combustion chamber type?	BTL-1	Remembering	PO1
11	What is indirect injection type of combustion?	BTL-1	Remembering	PO5
12	Write the classification of indirect injection chamber (divided combustion chamber)	BTL-1	Remembering	PO5
13	What are the applications of swirl chamber?	BTL-1	Remembering	PO3

14	List the advantages and draw backs of indirect	BTL-2	Understandin g	PO5
15	Why specific fuel consumption is high in indirect injection type combustion	BTL-1	Rememberin g	PO5
16	What is turbo charging?	BTL-1	Rememberin g	PO5
17	What are the major parts of a turbocharger?	BTL-1	Rememberin g	PO6
18	Explain the term turbo lag.	BTL-1	Rememberin g	PO6
19	Explain the function of waste gate.	BTL-1	Rememberin g	PO1 0
20	Why there is a large pressure differences a cross the injector nozzle are required:	BTL-1	Rememberin g	PO1
21	What is called breakup length?	BTL-1	Rememberin g	PO5
22	What are the different designs of nozzle used?	BTL-1	Rememberin g	PO5
23	What are the two types of photographic technique used?	BTL-1	Rememberin g	PO5
24	Explain photographic techniques method:	BTL-1	Rememberin g	PO5
25	List the droplet size depends on various factors:	BTL-1	Rememberin g	PO5
26	Define flame development angle:	BTL-1	Rememberin g	PO1
27	Define rapid burning angle:	BTL-1	Rememberin g	PO1
28	List the factors that are involved in either producing (or) preventing knock.	BTL-1	Rememberin g	PO5
29	List types of nozzle?	BTL-1	Rememberin g	PO6
30	What are consideration should doing assemble of fuel injections?	BTL-1	Rememberin g	PO4
Q. No.	Questions	BT Leve l	Competen ce	PO5
PART-B&PART-C				
1	Bring out clearly the process of combustion in CI engines and also explain the various stages of combustion. What is delay period and what are the factors that affect the delay period?	BTL-2	Understandin g	PO3
2	Explain Turbo charging in CI engines	BTL-2	Understandin g	PO5
3	Explain with heat sketch about the air ventilation.	BTL-2	Understandin g	PO1
4	What are the effects of trubo charging on CI engines?.	BTL-2 BTL-5	Understandin g Evaluating	PO1

5	What are the main factors affecting the penetration of the fuel spray in CI engines?	BTL-6	Creating	PO4
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UNIT III CELLULAR MANUFACTURING

Pollutant – Sources – Formation of Carbon Monoxide, Un burnt hydrocarbon, Oxides of Nitrogen, Smoke and Particulate matter – Methods of controlling Emissions – Catalytic converters, Selective Catalytic Reduction and Particulate Traps – Methods of measurement – Emission norms and Driving cycles

PART-A

CO Mapping : C801.3

Q. No.	Questions	BT Level	Competence	PO5
1	Why smoke is formed in a CI engine?	BTL-1	Remembering	PO3
2	State the significance of stoichiometric air-fuel mixture?	BTL-1	Remembering	PO5
3	What are the major exhaust emissions?	BTL-1	Remembering	PO5
4	What are the causes for hydro carbon emission from S.I engine?	BTL-1	Remembering	PO5
5	What are the reasons for incomplete combustion in SI engine?	BTL-1	Remembering	PO6
6	What are the reasons for flame quenching?	BTL-1	Remembering	PO6
7	How the oil consumption increases in IC engines and what are the effects□	BTL-1	Remembering	PO10
8	Write a short note on carbon monoxide emissions□	BTL-1	Remembering	PO1
9	What is photo chemical smog?	BTL-2	Understanding	PO5
10	What are soot particles?	BTL-1	Remembering	PO5
11	What is the most effective after treatment for reducing engine emissions□	BTL-1	Remembering	PO5
12	List the materials used as catalyst	BTL-1	Remembering	PO5
13	Whycatalytic converter called as three way converters?()	BTL-1	Remembering	PO5
14	Whatare the types of ceramic structure used in catalytic convertor?	BTL-1	Remembering	PO1
15	What is a catalyst?	BTL-1	Remembering	PO1
16	Listout the draw backs of catalytic converters	BTL-1	Remembering	PO5
17	Whatare the methods of catalytic converter superheating?	BTL-1	Remembering	PO6
18	List the invisible and visible emission	BTL-1	Remembering	PO4

19	What are the methods of measuring the following emission?	BTL-1	Remembering	PO5
20	Effect of catalytic converters?	BTL-1	Remembering	PO5
21	short note on hc and carbon monoxide emissions ?	BTL-1	Remembering	PO3
22	Function of turbo charging?	BTL-1	Remembering	PO5
23	Methods of controlling emissions?	BTL-1	Remembering	PO1
24	Explain EGR?	BTL-1	Remembering	PO1
25	What is particulate traps?	BTL-1	Remembering	PO4
26	How photochemical smog produce?	BTL-1	Remembering	PO1
27	What is SOF?	BTL-1	Remembering	PO5
28	What is evaporative emission	BTL-1	Remembering	PO1
29	Define crankcase blow by?	BTL-6	Creating	PO5
30	What are the method to find performance of engine ?	BTL-1	Remembering	PO5

PART-B & PART-C

Q. No.	Questions	BT Level	Competence	PO
1	Describe in detail the causes of hydro carbon emissions from SI engines..	BTL-2	Understanding	PO5
2	What are catalytic converters? How are they help full in reducing HC,CO and NOx emissions?	BTL-2	Understanding	PO5
3	Give a brief account of emissions from CI engines.	BTL-6	Creating	PO5 ,PO1
4	Explain the inter nationally accepted method so measuring the following in visible emission	BTL-2	Understanding	PO5
5	i) Oxides of nitrogen (ii) Carbon monoxide (iii) Unburned hydrocarbons	BTL-2	Understanding	PO5 ,PO1
6	What is smoke and classify the measurement of smoke?	BTL-6	Creating	PO1 ,PO5,P

UNIT IV ALTERNATIVE FUELS

Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel - Properties, Suitability, Merits and Demerits - Engine Modifications.

PART-A

CO Mapping : C801.4

Q.No.	Questions	BT Level	Competence	PO
1	Write the advantage and disadvantage of alcohol as a fuel?	BTL-1	Remembering	PO5
2	What is the problem with gasoline-alcohol mixture as a fuel?	BTL-1	Remembering	PO5
3	Write the sources for methanol?	BTL-2	Understanding	PO3
4	Write the source for ethanol?	BTL-1	Remembering	PO5
5	What are the techniques of using alcohol in diesel engine fuel?	BTL-5	Evaluating	PO1
6	What are the methods adopted for induction of alcohol into intake manifold?	BTL-1	Remembering	PO1
7	List the advantages of hydrogen as an IC engine?	BTL-5	Evaluating	PO4
8	List the disadvantages of using hydrogen as a fuel?	BTL-1	Remembering	PO1
9	Write the methods for hydrogen can be used in SI engines?	BTL-1	Remembering	PO5
10	List the advantages and disadvantages of natural gas?	BTL-1	Remembering	PO1
11	Write the two types of LPG used in automobiles engine?	BTL-1	Remembering	PO5
12	What are the advantages of LPG?	BTL-2	Understanding	PO5
13	Write the disadvantages of LPG?	BTL-1	Remembering	PO3
14	Write the improvements required for the LPG vehicle in future?	BTL-2	Understanding	PO5
15	Compare the petrol and LPG?	BTL-1	Remembering	PO5
16	Write any two Advantages of alcohol.	BTL-2	Understanding	PO5
17	Disadvantages of alcohol.	BTL-1	Remembering	PO6
18	Techniques of using alcohol in diesel engine?	BTL-1	Remembering	PO6
19	Advantages of hydrogen.	BTL-1	Remembering	PO10

20	Disadvantage of hydrogens.	BTL-2	Understanding	PO1
21	What are all the methods can be used hydrogen as S.I engine fuels?	BTL-1	Remembering	PO5
22	List the benefits of natural gas?	BTL-1	Remembering	PO5
23	Write down three phases of shop floor control	BTL-1	Remembering	PO5
24	What are all the methods can be used hydrogen as S.I engine fuels?	BTL-1	Remembering	PO5
25	List the benefits of natural gas?	BTL-1	Remembering	PO5
26	Demerits of LPG?	BTL-1	Remembering	PO1
27	What is dual fuel operation?	BTL-1	Remembering	PO1
28	Define Indicator diagram?	BTL-1	Remembering	PO5
29	Willan's line Method?	BTL-1	Remembering	PO6
30	What is Morse test?	BTL-1	Remembering	PO4

PART-B& PART-C

1	Explain the reasons for looking for alternate fuels for IC engines.	BTL-2	Understanding	PO9, PO5, PO1
2	Explain alcohols as alternate fuels for IC engines bringing out their merits and demerits.	BTL-1	Remembering	PO5
3	Explain the possibility of using reformulated gasoline and water gasoline mixture as alternate fuel.	BTL-2	Understanding	PO1,P O5
4	Can alcohol be used for CI engines? Explain	BTL-2	Understanding	PO5, PO1
5	Explain with a neat sketch the surface-ignition alcohol engine	BTL-6	Creating	PO5
6	What are the advantages and disadvantages of using hydrogen in SI engine.	BTL-2	Understanding	PO1,P O5

UNIT V RECENT TRENDS

Air assisted Combustion, Homogeneous charge compression ignition engines – Variable Geometry turbochargers – Common Rail Direct Injection Systems - Hybrid Electric Vehicles – NOx Adsorbers - Onboard Diagnostics.

PART-A

CO Mapping : C801.5

Q.No.	Questions	BT Level	Competence	PO
1	What is lean burn engine?	BTL-1	Remembering	PO5
2	Why lean mixture is preferred in SI engine?	BTL-1	Remembering	PO5
3	What are the modifications to be made to convert	BTL-1	Remembering	PO3

	an existing engine as a lean burn engine?			
4	How the stratified charge engine can be characterised?	BTL-1	Remembering	PO5
5	List the advantages of the stratified charge engine.	BTL-1	Remembering	PO1
6	What are the main disadvantages of the stratified charge engine?	BTL-1	Remembering	PO1
7	Write short notes on plasma jet ignition system.	BTL-1	Remembering	PO4
8	What are the factors that influence the operation of the plasma jet plug?	BTL-1	Remembering	PO1
9	What are there a sons for automotive engines equipped with gasoline injection system?	BTL-1	Remembering	PO5
10	What are the types of injection system?	BTL-1	Remembering	PO1
11	What are the objective of the fuel injection system?	BTL-1	Remembering	PO5
12	What are the components of injection system?	BTL-1	Remembering	PO5
13	Write notes on continuous injection system.	BTL-1	Remembering	PO3
14	Explain the functions of the following components. (a) Pumping element, (b) Metering element, (c) Timing control, (d) Ambient control.	BTL-1	Remembering	PO5
15	Write the advantages of homogeneous charge compression ignition engine?	BTL-1	Remembering	PO5
16	What are the fuel s used in HC CI engines?	BTL-1	Remembering	PO5
17	List the disadvantages of homogeneous charge compression ignition engine?	BTL-1	Remembering	PO6
18	What is the chemical formula for diesel, ethanol, methanol and LPG	BTL-6	Creating	PO6
19	define charge stratification?	BTL-1	Remembering	PO10
20	Mention the advantages of plasma ignition system	BTL-1	Remembering	PO1
21	Mention the advantages of plasma ignition system	BTL-1	Remembering	PO5
22	What is the working principle of pre chamber stratified charge engine?	BTL-1	Remembering	PO5
23	What is multi valve engine?	BTL-1	Remembering	PO5
24	Explain data acquisition system.	BTL-1	Remembering	PO5
25	Explain gasoline direct injection engine	BTL-1	Remembering	PO5
26	Explain briefly plasma–jet ignition system.	BTL-1	Remembering	PO1
27	Classification of ignition systems.	BTL-1	Remembering	PO1
28	what is direct ignition chamber type	BTL-1	Remembering	PO5
29	indirect ignition chamber	BTL-1	Remembering	PO6
30	what is direct frictional losses	BTL-1	Remembering	PO4
PART-B& PART-C				
1	What is the necessity for gasoline injection? Explain with suitable sketch.	BTL-2	Understanding	PO5, PO6,

				PO7
2	With neat sketch, explain the exhaust emissions with different air-fuel ratio lean burn spark ignition engines.	BTL-2	Understanding	PO5, PO6, PO7
3	What do you understand by charge stratification? Explain the method of achieving the same with suitable sketches. Discuss the advantages and disadvantages of charge stratification.	BTL-2	Understanding	PO5, PO6, PO7
4	Explain briefly plasma-jet ignition system	BTL-2	Understanding	PO5, PO6, PO7
5	What is a lean burn engine? What are the advantages of using lean mixture in SI engine?	BTL-2	Understanding	PO5, PO6, PO7
6	Explain the characteristics of Homogeneous charge compression ignition engine	BTL-2	Understanding	PO5, PO6, PO7

UNIT I- SPARK IGNITION ENGINE

Mixture requirements – Fuel injection systems – Mono point, Multipoint & Direct injection - Stages of combustion – Normal and Abnormal combustion – Knock - Factors affecting knock – Combustion chambers.

PART-A

1. What is a heterogeneous air-fuel mixture? In which engine is it used? (MAY/JUNE 2013)

A homogeneous mixture is a type of mixture in which the composition is uniform and every part of the solution has the same properties which is used in SI engine.

2. What is the principle of carburettor? (APRIL/MAY 2015)

The carburettor works on Bernoulli's principle: the faster air moves, the lower its static pressure, and the higher its dynamic pressure. The throttle (accelerator) linkage does not directly control the flow of liquid fuel. Instead, it actuates carburettor mechanisms which meter the flow of air being pulled into the engine. The speed of this flow, and therefore its pressure, determines the amount of fuel drawn into the airstream.

3. Define abnormal combustion and its consequences?

Under certain operating conditions the combustion deviates from its normal Course leading to loss of performance and possible damage to the engine are termed as abnormal combustion (or) knocking combustion. Consequences are (1). Loss of power (2).Recurring pre ignition(3).Mechanical damage to the engine

4. What is equivalence ratio?

The ratio of the actual fuel-air ratio to the stoichiometric fuel-air ratio.

5. Short note on SI engine equivalence ratio requirements?

In a homogeneous mixture with equivalence ratio close to 1.0 the flame speed is normally of the order of 40 cm/s. However in a SI engine the maximum flame speed is obtained when ϕ is between 1.1 and 1.2 (i.e.) when the mixture is slightly richer than stoichiometric.

6. Write the desirable qualities for SI engine fuel? (APRIL/MAY 2010)

In order to avoid or inhibit detonation, a high auto ignition temperature and a long ignition lag are the desirable qualities for SI engine fuel.

7. Explain the type of vibration produced when auto ignition occurs.

Two different vibrations are produced.

1. In one case, a large amount of mixture may auto ignite giving rise to a very rapid increase in pressure throughout the chamber and there will be a direct blow on free vibration of the engine parts
- 2. In another case, larger pressure differences may exist in the combustion chamber and the resulting gas vibration can force the walls of the chamber to vibrate at the same frequency as the gas

8. What is the method to detect the phenomenon of knocking?

The scientific method to detect the phenomenon of knocking is to use a pressure transducer. This transducer is connected, usually to a cathode ray oscilloscope. Thus pressure-time traces can be obtained from the pressure transducer.

9. List out some of the knock limited parameters?

The knock limited parameters are:

1. Knock limited compression ratio
2. Knock limited intake pressure
3. Knock limited Indicated mean effective pressure. (KIMEP)

10. List out some of the knock limited parameters?

Performance number is defined as the ratio of Knock limited Indicated mean effective pressure with the sample fuel to knock limited Indicated mean effective pressure with ISO-OCTANE when the inlet pressure is kept constant.

11. List the factors that are involved in either producing (or) preventing knock.

The factors that are involved in either producing (or) preventing knock are temperature, pressure, density of the unburned charge and the time factor.

12. List the parameters which are affecting knock in SI engine?

The parameters which are directly(or)indirectly connected with knocking are inlettemperatureofmixturecompressionratio, massofinductedcharge, poweroutput of the engine

13. List the parameters in time factors that reduce the knocking?

Parameters are turbulence, engine speed, flame travel distance, combustion chamber shape and location of sparkplug.

14. List the composition factors in the knocking?

Air –fuel ratio and octane value of the fuel are the composition factors.

15. What are the objectives to be kept in mind during design of combustion chamber?

General objectives are

- (a) Smooth engine operation
possibility of knocking
- (b) Moderate rate of pressure rise
(c) Reducing the
- (d) High power output and thermal efficiency

16. What are the factors to be considered to obtain high thermal efficiency?

Following are the factors:

1. A high volumetric efficiency.
2. Anti knock characteristic must be improved.
3. Compact combustion chamber reduces heat loss during combustion increases the thermal efficiency.

17. Write the different types of combustion chambering SI engine? NOV2009

T-Head type, L- Head type, I- Head type, F- Head type.

18. What are the components required in the fuel injection system?

Components are –pumping element, metering element, mixing element, distributing element, Timing control, and ambient control.

19. What are the advantages of fuel–injection in an SI engine?

Advantages are:

1. Increased volumetric efficiency.
2. Better thermal efficiency
3. Lower exhaust emissions
4. High quality fuel distribution

20. List the draw backs of the carburetion?

1. Non uniform distribution of mixture in multi cylinder engines.
2. Loss of volumetric efficiency due to retraction of mixture flow and possibility of backfiring.

21. What are the functional requirements of fuel injection system?

1. Accurate mixing of the fuel injected per cycle.
2. Timing the injection of the fuel.
3. Proper atomization of fuel into fine droplets
4. Proper spray pattern.
5. No lag during beginning and end of injection.

22. List some of the important requirements of an automobile carburetors?

1. Ease of starting the engine, particularly under low ambient conditions.
2. Good and quick acceleration of the engine.
3. Good fuel economy.
4. Ensuring full torque at low speeds.

23. What are the general types of carburetors?

Types are UPDRAUGHT, DOWNDRAUGHT, and CROSS DRAUGHT.

24. What are the essential parts, compensating device and additional system

(modern) carburetors?

Parts—fuel strainer, float chamber, main metering and idling system, the choke & the throttle. Compensating device—Air—bleed jet, compensating jet, Emulsion tube, auxiliary valve and port, back suction control mechanism.

Additional system—Anti-dieseling, richer coasting, acceleration pump and economic (or) power enrichment system

25. Define carburetion?

The process of formation of a combustible fuel–air mixture by mixing the proper amount of fuel with air before admission to engine cylinder is called carburetion.

26. What are the factors effecting carburetion?

1. The engine speed
2. The vaporization characteristics of fuel
3. The temperature of the incoming air
4. The design of the carburetor

27. What are the different types air–fuel mixtures?

1. Chemically correct mixture
2. Rich mixture
3. Lean mixture.

28. What are the different range of throttle operation

1. Idling
2. Cruising
3. High power .

29. Function of carburetor?

The process of formation of a combustible fuel–air mixture by mixing the proper amount of fuel with air before admission to engine cylinder.

30. Define Heat Engine ?

Heat Engine is a device which transforms the chemical energy of a fuel into thermal energy and utilizes this thermal energy to perform useful work.

PART-B

1. Describe the applications of computers for design. (Nov/dec 2011)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

Refer: "Mikell P.Groover, "Automation,Production Systems,and CIM", Prentice- Hall, 1987", Page No from 6 to 7 and from 10 to 11.

2. Explain the drawing features of CAD. (Nov/dec 2011)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

3 .Name the types of modeling of CAD? Explain about any one of them. (Nov/dec 2011)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

4. Describe about operator input devices used at the graphics workstation. (May/june2012)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

5. Explain about the following types of transformations with example. (Nov/dec2012)

(i) Translation (ii) scaling (iii) rotation

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

6. Write the short notes on 3D scaling and 3D shearing geometric transformation. (May/june 2013)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

UNIT II COMPRESSION IGNITION ENGINES

Diesel Fuel Injection Systems - Stages of combustion – Knocking – Factors affecting knock – Direct and Indirect injection systems – Combustion chambers – Fuel Spray behaviour – Spray structure and spray penetration – Air motion - Introduction to Turbo charging.

PART-A

1. Mention any two advantages of induction swirl.MAY/JUNE 2013

- 1.Easier starting
- 2.Indicated thermal efficiency is high
- 3.production of swirl require no additional work
- 4.Used with low speed

2. What is ignition delay period?

The fuel does not ignite immediately up on injection in to the combustion chamber. There is a definite period of in activity between the time when the first droplet of fuel hits the hot air in the combustion chamber and the time it starts through the actual burning phase. This period is known as ignition delay period

3. What are two delay occur in ignition delay period? APR/MAY 2015

The two delays occurring ignition delay period are the physically delay and chemically delay. Physical delay is the time between the beginning of injection and the attainment of chemical reaction conditions. Chemical delay is the reaction starts slowly and then accelerates until the inflammation or ignition takes place.

4. List the factors affecting the delay period? APR/ MAY 2011

The factors affecting the delay period are:

- 1.Compressionratio.
- 2. Atomization of the fuel.
- 3. Quality of the fuel.
- 4. Intake temperature and pressure.

5. Explain the effect of quality of fuel factor on the delay period?

Self-ignition temperature is the most important property of the fuel which affects the delay period .A lower self-ignition temperature and fuel with higher cetane number givelowerdelayperiodandsmoothengineoperation.Otherpropertiesofthefuel which affects the delay period are latent heat, viscosity and surface tension.

6. Giveacomparativestatementvariouscharacteristicsthatreducesknockingin

S.I and C.I engine (any four)?

S.NO	CHARACTERISTICS	S.I ENGINE	C.I ENGINE
1	Ignition temperature of fuel	High	low
2	Ignition delay	long	short
3	Compression ratio	Low	high
4	Inlet temperature and pressure	Low	HIGH

(i)

7. Write the classification of combustion chamber in C.I engine?

Combustion chamber in C.I engine is classified in to two categories:

- 1. Direct-injection type
- 2.Indirect-injectiontype.

8. What is called direct injection type of combustion chamber? MAY/JUNE 2013

Direct injection type of combustion chamber is also called an open combustion. In this type the entire volume of the combustion chamber is located in the main cylinder and the fuel is injected into this volume.

•

9. What are the types of open combustion chamber?

In open combustion chamber there are many designs some are

- Shallow depth chamber
- Hemispherical chamber
- Cylindrical chamber
- Toroidal chamber

•

10. What are the advantages and disadvantages of open combustion chamber type?

Advantages:

1. Minimum heat loss during compression because of lower surface area to volume ratio
2. No cold starting problems
3. Fine atomization because of multi hole nozzle

Disadvantages:

1. High fuel injection pressure required and hence complex design of fuel injection pump
2. Necessity of accurate metering of fuel by the injection system, particularly for small engines

11. What is indirect injection type of combustion? APR/MAY 2013

Indirect injection type of combustion chamber in which the combustion space is divided into two or more distinct compartments connected by restricted passages. This creates considerable pressure difference between them during the combustion process.

12. Write the classification of indirect injection chamber (divided combustion chamber)

Classification of divided combustion chamber is

- Swirl chamber – in which compression swirl is generated.
- Pre combustion chamber – in which combustion swirl is induced.
- Air cell chamber – in which both compression and combustion swirl are induced.

13. What are the applications of swirl chamber?

Swirl chamber type finds application

- Where fuel quality is difficult to control
- Where reliability under adverse conditions is more important than fuel economy
- Use of single hole of larger diameter for the fuel spray nozzle is often an important consideration for the choice of fuel chamber engine.

14. List the advantages and draw backs of indirect injection chamber: Advantages:

1. Injection pressure required is low 2. Direction of spraying is not very important

Disadvantages: 1. Poor cold starting performance required heater plugs 2. Specific fuel consumption is high

15. Why specific fuel consumption is high in indirect injection type combustion chamber:

Specific fuel consumption is high because there is a loss of pressure due to air motion through the duct and heat loss due to large heat transfer area.

16. What is turbo charging?

Energy available in the engines exhaust gas is used to drive the turbocharger compressor, which raises the inlet fluid density prior to entry to each engine cylinder. This is called turbo charging.

17. What are the major parts of a turbocharger?

The major parts of a turbo charger are turbine wheel, turbine housing, turbo shaft, compressor wheel, compressor housing and bearing housing

18. Explain the term turbo lag.

In case of turbo charging there is a phenomenon called turbo lag, which refers to the short delay period before the booster manifold pressure, increase. This is due to the time the turbo charger assembly takes the exhaust gases to accelerate the turbine and compressor wheel to speed up.

19. Explain the function of waste gate.

In the turbo charger assembly there is a control unit called waste gate. It is a diaphragm operated valve that can bypass part of the gases around the turbine wheel when manifold pressure is quite high this unit limits the maximum boost pressure to prevent detonation in S.I engines and engine damage

20. Why there is a large pressure differences across the injector nozzle are required:

The fuel is introduced into the cylinder of a diesel engine through a nozzle with a large pressure difference across the nozzle jet will enter the chamber at a high velocity to

1. Atomize into small sized drop lets to enable rapid evaporation and
2. Traverse the combustion chamber in the time available and fully utilize the air charge.

21. What is called breakup length?

The liquid column bearing the nozzle is integrated with in the cylinder over a finite length called the break up length into drops of different sizes.

22. What are the different designs of nozzle used?

The different design of nozzle use single orifice, multi orifice, throttle or pint depending on the needs of the combustion system employed.

23. What are the two types of photographic technique used? To distinguish the liquid-containing core of the jet and the extracts of the fuel vapor region of the spray, which surrounds the liquid core, two types of photographic technique used are back lighting and shadow graph.

24. Explain photographic techniques method:

Back lighting identifies region where sufficient liquid fuel (as ligaments or drops) is present to attenuate the light.

The shadow graph technique responds to density gradients in the test section so it identifies regions where fuel vapor exists.

25. List the droplet size depends on various factors:

The droplet sizes depend on various factors are

1. Mean droplet size decreases with increases in a. Injection pressure b. air density
2. Mean droplet size increases with increases in fuel viscosity.
3. Size of droplets increases with increases in the size of the orifice.

26. Define flame development angle:

The crank angle interval between the spark discharge and the time when a small but significant fraction of the cylinder mass has burned or fuel chemical energy has been released

27. Define rapid burning angle:

The crank angle interval required to burn the bulk of the charge is defined as the interval between the end of the flame development stage and the end of the flame propagation process.

28. List the factors that are involved in either producing (or) preventing knock.
(APR/MAY 2015)

The factors that are involved in either producing (or) preventing knock are temperature, pressure, density of the unburned charge and the time factor.

29. List types of nozzle ?

- (i) the pintle nozzle (ii) the single hole nozzle (iii) the multi hole nozzle (iv) pintaux nozzle
plan in the factory.

30. What are considerations should be done in the assembly of fuel injections?

- (i) a needle valve
- (ii) a compression spring
- (iii) a nozzle

(iv) an injector body

PART-B& PART-C

1. Explain the open system interconnection architecture (OSI) formulated by ISO. (Nov/dec2013)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

Refer: "Mikell P.Groover, "Automation,Production Systems,and CIM", Prentice- Hall, 1987", Page No from 6 to 7 and from 10 to 11.

2. What are the different network topologies available? Discuss them in detail. (Nov/dec2013)

Refer: "Mikell P.Groover, "Automation,Production Systems,and CIM", Prentice- Hall, 1987", Page No from 6 to 7 and from 10 to 11..

3. Explain the important of CIM. Also write the reasons for implementing CIM. (May/June 2013)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

4. Explain and compare the different types of network topologies. (Nov/dec2012)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

5. Brief the significance the MAP in CIM environment. (Nov/dec2013)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

6. Explain the open system interconnection with CAPP. (May/June 2013)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

UNIT III CELLULAR MANUFACTURING

Pollutant – Sources – Formation of Carbon Monoxide, Un burnt hydrocarbon, Oxides of Nitrogen, Smoke and Particulate matter – Methods of controlling Emissions – Catalytic converters, Selective Catalytic Reduction and Particulate Traps – Methods of measurement – Emission norms and Driving cycles

PART-A

1. Why smoke is formed in a CI engine? (APR/MAY 2013)

SMOKE is the most common smoke emitted from diesel engines. It indicates poor and incomplete combustion of the diesel fuel

2. State the significance of stoichio metric air-fuel mixture? (APRIL/MAY2015)

The air fuel ratio contain enough air to complete burning of fuel in the air fuel mixture is called stoichio metric air-fuel mixture.

•

3. What are the major exhaust emissions?

The major exhaust emissions are

- | | |
|--|--|
| a.Un burn thydro carbons(HC) | b. Oxides of carbon(coandco ₂) |
| c. Oxides of nitrogen(NOandNO ₂ | d. Oxides of sulphur (SO ₂ andSO ₃) |

e. Particulates

f. Soot and smoke

4. What are the causes for hydro carbon emission from S.I engine?

The causes for hydro carbon emission from S.I engine are

1. Incomplete combustion.
2. Crevice volume and flow in crevices.
3. Leakage past the exhaust valve.
4. Valve overlap.
5. Deposits on walls.
6. Oil on combustion chamber walls.

5. What are the reasons for incomplete combustion in SI engine?

Incomplete combustion is due to

- a. Improper mixing due to incomplete mixing of the air and fuel. Some fuel particles do not find the oxygen to react with this cause the emissions.
- b. Flame quenching: As the flame goes very close to the walls it gets quenched at the walls leaving a small volume of un reacted air fuel mixture.

6. What are the reasons for flame quenching?

There are three reasons for flame quenching is the expansion of gases. (i) As the piston moves down from TDC to BDC during power stroke, expansion of the gases lowers both pressure and temperature within the cylinder. This makes combustion slow and finally quenches the flame and causes the emissions. (ii) High exhaust gas contamination causes poor combustion and which in turn causes quenching during expansion. (iii) As the flame goes very close to the walls it gets quenched at the walls leaving a small volume of un reacted air-fuel mixture.

7. How the oil consumption increases in IC engines and what are the effects?

Often as engine ages, due to wear, clearance between the pistons and cylinder wall increases. This increases oil consumption contributes to increases in the emissions in three ways.

- a. There is an added crevices volume.
- b. There is added absorption-desorption of fuel in the thicker oil film on cylinder walls
- c. There is oil burned in the combustion process

8. Write a short note on carbon monoxide emissions?

Carbon monoxide is a colourless and odourless but a poisonous gas. It is generated in an engine when it is operated with a fuel rich equivalence ratio. Poor mixing, local rich regions, and incomplete combustion will also be the source for CO emissions.

9. What is photo chemical smog?

NO_x is the primary cause of photochemical smog, Smog is formed by the photochemical reaction of automobile exhaust and atmospheric air in the presence of

sunlight.

$\text{NO}_2 + \text{energy from sunlight} \rightarrow \text{NO} + \text{O} + \text{smog}$

10. What are soot particles?

Soot particles are clusters of solid carbon spheres. These spheres have diameters from 9 nm to 90 nm ($1 \text{ nm} = 10^{-9} \text{ m}$). But most of them are within the range of 15–30 nm. The spheres are solid carbon with HC and traces of other components adsorbed on the surface. Single soot particles may contain up to 5000 carbon spheres.

11. Which is the most effective after treatment for reducing engine emissions?

The catalytic converter is the most effective after treatment for reducing engine emissions found on most automobiles. Carbon can be oxidized to CO_2 and H_2O in an exhaust system and thermal converters if the temperature is held at 600–700°C. If certain catalysts are present, the temperature needed to sustain these oxidation processes is reduced to 250–300°C, making for a much more attractive system.

12. What is a catalyst? MAY/JUNE 2014

A catalyst is a substance that accelerates a chemical reaction by lowering the energy needed for it to proceed. The catalyst is not consumed in the reaction and so functions indefinitely unless degraded by heat, age, contaminants, or other factors.

13. List the materials used as catalysts.

The catalyst materials most commonly used are **a.** platinum **b.** palladium **c.** rhodium.

14. Why are catalytic converters called three-way converters? (APRIL/MAY 2015)

Catalytic converters are called three-way converters because they are used to reduce the concentration of CO, HC, and NO_x in the exhaust.

15. What are the types of ceramic structures used in catalytic converters?

Inside the container is a porous ceramic structure through which the exhaust gas flows.

- The ceramic is a single honeycomb structure with many flow passages.
- Some converters use loose granular ceramic with the gas passing between the packed spheres.

16. List the drawbacks of catalytic converters.

a. Sulphur offers unique problems for catalytic converters. Some catalysts promote the conversion of SO_2 to SO_3 , which is eventually converted to sulphuric acid. This degrades the catalytic converter and contributes to

acidrain.

b. Catalytic converter are not very efficient when they are cold. When an engine is started after not being operated for several hours it takes several minutes for the converter to reach an efficient operating temperature called as cold start up problem

17. What are the methods of catalytic converter superheating?

The methods of catalytic converters preheating included the following

- a. By locating the converters close to the engine
- b. By having super insulation
- c. By employing electric preheating
- d. By using flame heating
- e. Incorporating thermal batteries.

18. List the invisible and visible emission

Invisible emission: Water vapour, carbon dioxide, oxides of nitrogen, unburnt hydrocarbons, carbon monoxide, aldehydes.

Visible emission: Smoke, particulate.

19. What are the methods of measuring the following emission?

- a. Oxides of nitrogen = CHEMILUMINESCENCE ANALYZER
- b. Carbon monoxide = NONDISPERSIVE INFRARED ANALYZER
- c. Unburned hydrocarbons = FLAME IONIZATION DETECTOR (FID)

20. Effect of catalytic converters?

Catalytic converters some catalyst promote the conversion of SO_2 to SO_3 which eventually converted to sulphuric acid. This degrades the catalytic converter and contributes to acid rain.

21. short note on HC and carbon monoxide emissions ?

Carbon monoxide is a colourless and odourless but a poisonous gas. It is generated in an engine when it is operated with a fuel rich equivalence ratio.

Poor mixing, local rich regions, and incomplete combustion will also be the source for CO emissions.

22. Function of turbo charging?

Energy available in the engine's exhaust gas is used to drive the turbo charger compressor, which raises the inlet fluid density prior to entry to each engine cylinder. This is called turbo charging.

23. Methods of controlling emissions?

Thermal converter, catalytic converters.

24. Explain EGR?

Exhaust Gas Recirculation is the most effective way of reducing NO_x emissions is to hold combustion chamber temperatures down.

- To have a good management control.

25. What is particulate traps?

CI engine system are equipped with particulate traps in their exhaust flow to reduce the amount of particulate released to the atmosphere

26. How photochemical smog produce?

Due to combination of NO_x and HC photochemical smog is produced.

27. What is SOF?

The absorbed portion of the soot particles is called soluble organic fraction.

28. What is evaporative emission ?(APRIL/MAY2012)

Evaporative emissions 15to 25% of total hydro carbon emission from a gasoline is called evaporative emission.

29. Define crankcase blow by?

The blow by is the phenomenon of leakage past the piston and the piston rings from the cylinder to the crank case.

30. what are the method to find performance of engine ?

- (i) Willan's line method
- (ii) Morse test
- (iii) Motoring test
- (iv) Retardation test

PART-B& PART-C

1. Explain about Optiz classification and coding system. (Nov/dec2012)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

2. Explain retrieval and generative CAPP systems. (Nov/dec2013)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

Refer: "Mikell P.Groover, "Automation,Production Systems,and CIM", Prentice- Hall, 1987", Page No from 6 to 7 and from 10 to 11.

3. Briefly discuss the various benefits of implementing a GT in a firm. Also bring out the advantages and limitations of using GT. (Nov/dec2011)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

4.(a) Describe the composite part concept in cellular manufacturing.

(b)Discuss the importance of process planning in product development .(May/June 2012)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

5. Briefly write about i) Composite part concept & ii) Key machine concept. (May/June 2011)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

6. Explain why the GT is important in achieving CAD&CAM integration? (Nov/dec2011)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

UNIT IV ALTERNATIVE FUELS

Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel - Properties, Suitability, Merits and Demerits - Engine Modifications.

PART-A

1. Write the advantage and disadvantage of alcohol as a fuel?

The advantages of alcohols a fuel are:

1. itisa high octane fuel with antiknock index number (octane number) of over100.
2. Alcohols have low sulphur content in the fuel.
- 3.Itproduceslessoverallemissionswhencomparedwithgasoline

Disadvantages:

1. Alcohols have poor ignition characteristics in general.
2. There is a possibility of vapour lock in fuel delivery system.
- 3.Ithaspoorcoldweatherstartingcharacteristicsduetolowvaporpressureand evaporation.

(i)

2. What is the problem with gasoline-alcohol mixture as a fuel?

Problems with gasoline-alcohol mixture as a fuel are the tendency for alcohol to combinewithanywaterpresent.Whenthishappensthealcoholseparatestolocally fromthegasoline,resultinginanon-homogenousmixture.Thiscausethengine to run erratically due to the large air-fuelratioidifferencebetweenthe twofuels.

3. Write thesourcesfor methanol?

Methanolcanbeobtainedfrommanysources,bothfossilandrenewable.These include coal, petroleum,naturalgas,biomass, woodlandfillsandeventhe ocean.

4. Write thesource for ethanol?

Ethanolcanbemadefromethylene(or)fromfermentationofgrainsandsugar.Much of itismade fromsugarcane,sugarbeets,andevencellulose (woodandpaper).

(i)

5. What arethe techniquesof usingalcoholin dieselengine fuel?

The techniquesofusingalcoholindiesel engine are:

1. Alcoholdieselemulsions.
2. Dualfuelinjection.
3. Alcoholfumigation.
- 4.Surface ignitionofalcohols

6. What are the methods adopted for induction of alcohol into intake manifold?

The methods adopted for induction of alcohol into intake manifold are microfog unit, pneumatic spray nozzle, vaporizer, carburetor and fuel injector.

•

7. List the advantages of hydrogen as an engine?

Advantages

1. Low emissions.
2. Fuel availability.
3. Fuel leakage to environment is not a pollutant
4. High energy content per volume when stored as a liquid.

•

8. List the disadvantages of using hydrogen as a fuel?

Disadvantages

- ☒ Difficult to store fuel.
- ☒ Fuel cost would be high at present day's technology and availability.
- ☒ Poor engine volumetric efficiency.
- ☒ High NOx emission because of high flame.

•

9. Write the methods for hydrogen can be used in engines?

Hydrogen can be used in engines by three methods

- ☒ By manifold induction
 - ☒ By direct introduction of hydrogen into the cylinder.
 - ☒ By supplementing gasoline.
- (i)

10. List the advantages and disadvantages of natural gas?

Advantages:

- ☒ Octane number is around 120, which makes it a very good engine fuel.
 - ☒ Low engine emissions
 - ☒ Fuel is fairly abundant worldwide.
- Disadvantages:
- ☒ Low energy density resulting in low engine performance.
 - ☒ Low engine volumetric efficiency because it is a gaseous fuel.
 - ☒ Refueling is a slow process.

(i)

11. Write the two types of LPG used in automobile engine?

Two types of LPG used in automobile engines:

One is propane and the other is butane, sometimes in mixture of propane and butane

is used as LPG in automobile engine.

12. What are the advantages of LPG?

- ☐ LPG mixes with air at all temperatures.
- ☐☐☐☐☐☐☐ LPG has high antiknock characteristics.
- ☐ There is no crack case dilution, because the fuel is in the form of vapor.

13. Write the disadvantages of LPG?

- ☐ A special fuel feed system is required for liquid petroleum gas.
- ☐ A good cooling system is quite necessary.
- ☐ The vehicle weight is increased due to the use of heavy pressure cylinder for storing LPG.

14. Write the improvements required for the LPG vehicle in future?

- ☐ Effort must be made to have more LPG filling stations at convenient locations, so that LPG tank can be filled up easily.
- ☐ Safety devices are to be introduced to prevent accidents due to explosion of gas cylinders (or) Leakage in the gas pipes.

15. Compare the petrol and LPG?

PETROL	LIQUID PETROLEUM GAS
Octane rating of petrol is 81	Octane rating of LPG is 110.
Petrol has odours	LPG is odourless.
In order to increase octane number	LPG is lead free with high Octane number.

16. Write any two Advantages of alcohol.

APR/MAY 2015

It produces less emission compared to gasoline.
Alcohol has low sulphur content in the fuel.

17. Disadvantages of alcohol.

Alcohol has poor ignition characteristics in general
There are possibilities of vapour lock in fuel delivery system.

18. Techniques of using alcohol in diesel engine?

- Alcohol diesel emulsion
- Alcohol fumigation
- Real fuel injection

Surface ignition of alcohol.

19. Advantages of hydrogen.

MAY/JUNE 2013

- Low emissions
- Fuel availability
- Fuel leakage to environment is not a pollutant

20 Disadvantage of hydrogens.

- Difficult to refuel
- Possibility of detonation
- High NOx emissions.

21. List different types of production monitoring system.

Three types production/ process monitoring systems are:

- Data acquisition systems
- Data logging system
- Multilevel scanning

22. What are the inputs to MRP system? (May/June 2012)

- Master production schedule
- Bill of material file
- Inventory record file

23. Write down three phases of shop floor control. (Nov/Dec 2012)

- (i) Order release,
- (ii) Order scheduling
- (iii) Order progress

24. What are all the methods can be used hydrogen as S.I engine fuels?

- By manifold induction
- By direct introduction of hydrogen into the cylinder
- By supplementing gasoline.

25. List the benefits of natural gas?

MAY/JUNE 2008

- Low engine emissions
- Less aldehydes than with methanol
- Fuel is fairely abundant world wide.

26. Demerits of LPG?

- LPG mix with air at all temperature
- LPG has anti knocking characteristics
- The engine may have a 50% longer life.

27. What is dual fuel operation?

This dual fuel operation enables the user to change from LPG to petrol or from petrol to LPG at is convenience by merely pressing a button.

28. Define Indicator diagram?

The device which measures the variation of the pressure in the cylinder over a part or full cycle is called an indicator and the plot of such information obtained is called an indicator diagram.

29. Willan's line Method?

This method is also known as fuel rate extrapolation method. The graph connecting fuel consumption and brake power at constant speed is drawn and it is extrapolated on the negative axis of the power.

30. What is Morse test?

The Morse test consists of obtaining indicated power of the engine without any elaborate equipment. The test consists of making in operative in turn each cylinder of the engine and noting the reduction in brake power developed.

PART-B& PART-C**1. Explain various components of FMS? And list out applications, advantages, disadvantages of FMS. (Nov/dec2011, May/June2012)**

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

Refer: "Mikell P.Groover, "Automation,Production Systems,and CIM", Prentice- Hall, 1987", Page No from 6 to 7 and from 10 to 11.

2. What is shop floor control? And what are the functions of SFC? Explain various phases of SFC. (Nov/dec2011)

Refer: "Mikell P.Groover, "Automation,Production Systems,and CIM", Prentice- Hall, 1987", Page No from 6 to 7 and from 10 to 11.

3. Explain the FMS Layout and its application and benefits. (Nov/dec2012, Nov/dec2013)

Refer: "Mikell P.Groover, "Automation,Production Systems,and CIM", Prentice- Hall, 1987", Page No from 6 to 7 and from 10 to 11.

4.Explain about FMS workstation.(May/June2012)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

5. Discuss the technology behind automated data collection system. (Nov/dec2013)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

6. Explain the FMS Layout and SFC flow control. (Nov/dec2011)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9.

UNIT V RECENT TRENDS

Air assisted Combustion, Homogeneous charge compression ignition engines – Variable Geometry turbochargers – Common Rail Direct Injection Systems - Hybrid Electric Vehicles – NOx Adsorbers - Onboard Diagnostics.

PART-A

1. What is lean burn engine?

MAY/JUNE 2013

Lean burn engine is a layout of Otto cycle engine designed to permit the combustion of lean airfuel mixture and to obtain simultaneously low emission values as high fuel economy. It is designed to operate effectively in the air fuel ratio **14:1-16:1 to 20:1-22:1**. When the lean compression ratio, combustion chamber shape, ignition system, the lean limit are successfully optimized, the engine is referred to as a lean burn engine.

2. Why lean mixture is preferred in SI engine?

MAY/JUNE 2010

Lean mixture is preferred in SI engine because of the following facts:

- Lower pollutants.
- Good fuel economy.
- Heat transfer losses to the cooling medium are reduced because of lower peak temperatures.
- Since lean mixture are less prone to knocking.

3. What are the modifications to be made to convert an existing engine as a lean burn engine?

MAY /JUNE 2009

The modifications to be made to convert an existing engine as a lean burn engine are:

- Increasing the compression ratio of the engine to accurate flame propagation.
- Increasing the swirl and turbulence of the mixture in order to increase flame speed.
- Catalytic activation of the charge in the combustion chamber.

4. How the stratified charge engine can be characterised?

The stratified charge engine can be characterised by the following features:

- Relatively high compression ratio
- Ability of direct cylinder fuel injection variations to run un throttled.
- Stratification of the charge mixture into distinctly different rich and lean airfuel ratios.

5. List the advantages of the stratified charge engine.

MAY/JUNE 2012

The advantages of the stratified charge engines are:

Low octane fuels (cheaper fuels) can be used at higher compression ratios.

- Load control can be achieved without air throttling
- Quiet in operation.
- Multi fuels give more or less equal performance.

6. What are the main disadvantages of the stratified charge engine?

The main disadvantages of the stratified charge engines are:

- ❑ Maximum output (from the air in the cylinder (i.e.) complete utilization of air) is not achieved.
- ❑ The added cost of the injection/modified combustion systems.
- ❑ Added complication of injection and spark ignition systems.

7. Write short notes on plasma jet ignition system.

MAY/JUNE 2012

The plasma jet ignition system uses a plasma jet spark plug. This system can be considered as a form of electrical torch ignition, since the ignition source is hot jet plasma which projects well away from the spark plug. The plasma jet ignition source is turbulent and electrodeless, both desirable features for igniting marginal mixtures.

8. What are the factors that influence the operation of the plasma jet plug?

The factors that can influence the operation of the plasma jet plug are the amount of the applied electrical energy, the rate of energy delivery, the cavity volume, the cavity dimensions, the orifice size, the ambient gas pressure and the quantity of fuel present in the cavity.

9. What are the reasons for automotive engines equipped with gasoline injection system?

Some of the recent automotive engines are equipped with gasoline injection system, instead of a carburetor for the reasons: (1) To have uniform distribution of fuel in a multicylinder engine. (2) To improve breathing capacity (i.e.) volumetric efficiency. (3) To reduce or eliminate detonation.

10. What are the types of injection system?

MAY/JUNE 2008

1. Gasoline Direct Injection (GDI) into the cylinder
2. Port injection (a) timed (b) continuous
3. Manifold injection

11. What are the objectives of the fuel injection system?

MAY/JUNE 2011

The objectives of the fuel injection system are to meter, atomize and uniformly distribute the fuel throughout the air mass in the cylinder.

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12. What are the components of injection system?

The components of injection system are:

1. Pumping element
2. Metering element
3. Mixing element
4. Mixture control
5. Timing control

13. Write notes on continuous injection system.

Continuous injection system usually has a rotary pump. The pump maintains the fuel line gauge pressure of about 0.75 to 1.5 bar. The system injects the fuel through a nozzle located in manifold immediately downstream of the throttle plate.

14. Explain the functions of the following components.

(a) Pumping element, (b) Metering element, (c) Timing control, (d) Ambient control.

(a) Pumping element - moves the fuel from the fuel tank to the injector. This includes necessary piping, filter etc.

(b) Metering element - measures and supplies the fuel at the rate demanded by load and speed conditions of the engine.

(c) Timing control - fixes the start and stop of the fuel-air mixing process.

(d) Ambient control - compensates for changes in temperature and pressure of either air or fuel that may affect the various elements of the system.

15. Write the advantages of homogeneous charge compression ignition engine?

1. Lower NO_x and particulate emissions
2. High thermal efficiency

16. What are the fuels used in HCCI engines?

Diesel, gasoline, methanol, natural gas and hydrogen

17. List the disadvantages of homogeneous charge compression ignition engine?

- ☒ The major problem is controlling the ignition timing over a wide load and speed.
- ☒ Power density is limited by combustion noise and high peak pressure

18. Define charge stratification? MAY/JUNE 2007

A **stratified charge engine** is a type of internal combustion engine, used in automobiles, in which the fuel is injected into the cylinder just before ignition. This allows for higher compression ratios without "knock," and leaner air/fuel ratio than in conventional internal combustion engines.

19. What is the chemical formula for diesel, ethanol, methanol and LPG –MAY 2007

DIESEL C₁₂H₂₃, ETHANOL C₂H₆O, METHANOL CH₃OH, LPG C₃H₈

20. Mention the advantages of plasma ignition system -MAY 2013

It has many advantages including simplicity, low cost, size and weight of the electronic elements, and it produces sufficiently high temperatures to dissociate and partially ionize air-fuel mixture.

21. What is the working principle of pre chamber stratified charge engine? MAY 2013

A **stratified charge engine** is a type of internal combustion engine, used in automobiles, in which the fuel is injected into the cylinder just before ignition. This allows for higher compression ratios without "knock," and leaner air/fuel ratio than in conventional internal combustion engines

22. What is multi valve engine? MAY 2015

In automotive engineering a **multi-valve** or **multivalve engine** is one where each cylinder has more than two **valves**. A **multi-valve engine** has better breathing and may be able to operate at higher revolutions per minute (RPM) than a two-**valve engine**, delivering more power.

23. Explain data acquisition system.

A data acquisition system (DAQ) is an information system that collects, stores and distributes information. It is used in industrial and commercial electronics, and environmental and scientific equipment to capture electrical signals or environmental conditions on a computer device.

24. Explain gasoline direct injection engine

Gasoline Direct Injection (GDI), also known as **Petrol Direct Injection, Direct Petrol Injection, Spark Ignited Direct Injection (SIDI)** and **Fuel Stratified Injection (FSI)**, is a variant of fuel injection employed in modern two-stroke and four-stroke gasoline engines. The gasoline is highly pressurized, and injected via a common rail fuel line directly into the combustion chamber of each cylinder

25. Explain briefly plasma-jet ignition system.

A plasma ignition system for an internal combustion engine, said system comprising: an ignition plug attached to the engine and having a center electrode, a ground electrode, and a discharge space, which is formed between the center electrode and the ground electrode.

26. Classification of ignition systems.

- i).battery ignition systems
- ii).Magneto ignition systems

27. what is direct ignition chamber type

This type of combustion chamber is also called open combustion chamber, the entire volume of the combustion chamber is located at main cylinder. the fuel is injected in this volume.

28. indirect ignition chamber

This type of combustion chamber is separated from cylinder volume. the fuel is separately injected in this volume.

- It all lows sharing of mass central storage and printers.
- It allows file/record locking.

29. what is direct frictional losses

It is the power observed due to the relative motion of different bearing surfaces such as piston rings, main bearings, cam shaft bearing etc.

30. what is coefficient of friction

It is ratio between tangential force to the normal force is known as dynamic coefficient of friction or coefficient of friction

PART-B& PART-C

1. Explain about Robot Anatomy and Related Attributes. . (Nov/dec2013)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

Refer: "Mikell P.Groover, "Automation,Production Systems,and CIM", Prentice- Hall, 1987", Page No from 6 to 7 and from 10 to 11.

2. Explain about Robot Control systems. (Nov/dec2013)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

3. Explain about End Effectors – Sensors in Robotics. (May/June2012)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

4.Explain about Robot Accuracy and Repeatability. (May/June 2012)

Refer: "Stephen P. Robbins & Mary Coulter, "Management", Prentice Hall (India)Pvt. Ltd., 10th Edition, 2009.", Page No from 526 to 530.

5. Explain about Industrial Robot Applications. (Nov/dec 2011)

Refer: "Mikell P.Groover, "Automation,Production Systems,and CIM", Prentice- Hall, 1987", Page No from 6 to 7 and from 10 to 11.

6. Write shortly on Robot Part Programming . (May/June2012)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9