SEMBODAI RUKMANI VARATHARAJAN ENGINEERING COLLEGE.

SEMBODAI, NAGAPATTINAM.

**DEPARTMENT OF MECHANICAL ENGINEERING**

**QUESTION BANK**

# V SEMESTER

**CME 394 – ADVANCED IC ENGINEERING**

# Regulation – 2021(Batch: 2021 -2025)

**Academic Year 2023– 2024**

*Prepared by*

# Mr.VEERAPANDIAN.K, Assistant Professor/Mech

SEMBODAI RUKMANI VARATHARAJAN 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.

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| **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. |

### SEMBODAI RUKMANI VARATHARAJAN 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 co**mplex 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.

**CME 394 – ADVANCED IC ENGINEERING**

### COURSE OUTCOMES

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| **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. |

**CME 394 – ADVANCED IC ENGINEERING**

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**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, 1

**DEPARTMENT OF MECHANICAL ENGINEERING**

## QUESTION BANK

Subject : **CME 394– ADVANCED IC ENGINEERING**

Year / Sem : III / V

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| **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** |

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|  | engine? | | | | |  |  |  |  |
| 13 | List the parameters in time factors that reduce the | | | | | **BTL-1** | Remembering | **PO3** |
| knocking? | | | | |
| 14 | List the composition factors in the knocking? | | | | | **BTL-1** | Remembering | **PO5** |
| 15 | What are the objectives to be kept in mind during | | | | | **BTL-1** | Remembering | **PO5** |
| design of combustion chamber? | | | | |
| 16 | What are the factors to be considered to obtain high | | | | | **BTL-1** | Remembering | **PO5** |
| thermal efficiency? | | | | |
| 17 | Write the different types of combustion chambering | | | | | **BTL-1** | Remembering | **PO6** |
| SI engine? | | | | |
| 18 | What are the components | required | in | the | fuel | **BTL-1** | Remembering | **PO6** |
| injection system? |  |  |  |  |  |  |
| 19 | What are the advantages of fuel–injection in an SI | | | | | **BTL-1** | Remembering | **PO10** |
| engine? | | | | |
| 20 | List the draw backs of the carburetion? | | | | | **BTL-1** | Remembering | **PO1** |
| 21 | What is the functional requirement so fan injection | | | | | **BTL-1** | Remembering | **PO5** |
| system? | | | | |
| 22 | List some of the important requirements of an | | | | | **BTL-1** | Remembering | **PO5** |
| automobile carburetor? | | | | |
| 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** | | | | | | | | |  |
|  | Discuses why a modern carburetor is being replaced | | | | |  |  |  |  |
| 1 | by an injection | | | | | **BTL-6** | Creating | **PO1** |
|  | system in SI engine? | | | | |  |  |  |
| 2 | Explain the factors that affect the process of | | | | | **BTL-2** | Understanding | **PO5** |
| carburetion? | | | | |
| 3 | What are different air–fuel mixtures on which an | | | | | **BTL-1** | Remembering | **PO5** |
| engine can be operated? | | | | |
| 4 | Explain the following; 1.Richmixture, | | | | | **BTL-6** | Creating | **PO1** |
| 2.Stoichiometric mixture3. Lean mixture. | | | | |
| 5 | How the power and efficiency of the SI engine vary | | | | | **BTL-2,** | Understanding | **PO1** |

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|  | with air- fuel ratio for different load and speed  conditions? | **BTL-5** |  |  |
| 6 | Explain why a rich mixture is required for the following1.Idling2.Maximumpower and sudden acceleration. | **BTL-2, BTL-5** | Understanding | **PO5** |

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| **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**  **Leve l** | Competence | **PO** |
| 1 | Mention any two advantages of induction swirl | **BTL-1** | Rememberin  g | **PO5** |
| 2 | What is ignition delay period? | **BTL-1** | Rememberin  g | **PO5** |
| 3 | What are two delay occur in ignition delay period? | **BTL-1** | Rememberin  g | **PO3** |
| 4 | List the factors affecting the delay period? | **BTL-1** | Rememberin  g | **PO5** |
| 5 | Explain the effect of quality of fuel factor on the delay period? | **BTL-4** | Analyzing | **PO1** |
| 6 | Giveacomparativestatementvariouscharacteristicsthatreducesknock  ingin S.I and C.I engine (any four)? | **BTL-1** | Rememberin  g | **PO1** |
| 7 | Write the classification of combustion chamber in C.I engine? | **BTL-1** | Rememberin  g | **PO4** |
| 8 | What is called direct injection type of combustion chamber? | **BTL-2** | Understandin  g | **PO1** |
| 9 | What are the types of open combustion chamber? | **BTL-2** | Understandin  g | **PO5** |
| 10 | What are the advantages and disadvantages of open combustion chamber type? | **BTL-1** | Rememberin g | **PO1** |
| 11 | What is indirect injection type of combustion? | **BTL-1** | Rememberin  g | **PO5** |
| 12 | Write the classification of indirect injection chamber(divided combustion chamber) | **BTL-1** | Rememberin g | **PO5** |
| 13 | What are the applications of swirl chamber? | **BTL-1** | Rememberin  g | **PO3** |

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| 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** | |

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| 5 | What are the main factors affecting the penetration of the fuel  spray in CI engines? | **BTL-6** | Creating | | **PO4** |
| **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**  **Leve l** | | **Competen ce** | **PO5** |
| 1 | Why smoke is formed in a CI engine? | **BTL-1** | | Rememberin  g | **PO3** |
| 2 | State the significance of stoichio metric air-fuel mixture? | **BTL-1** | | Rememberin  g | **PO5** |
| 3 | What are the major exhaust emissions? | **BTL-1** | | Rememberin  g | **PO5** |
| 4 | What are the causes for hydro carbon emission from S.I engine? | **BTL-1** | | Rememberin g | **PO5** |
| 5 | What are the reasons for incomplete combustion in SI engine? | **BTL-1** | | Rememberin  g | **PO6** |
| 6 | What are the reasons for flame quenching? | **BTL-1** | | Rememberin  g | **PO6** |
| 7 | How the oil consumption increases in IC engines and what are the | **BTL-1** | | Rememberin  g | **PO1**  **0** |
| 8 | Write a short | **BTL-1** | | Rememberin  g | **PO1** |
| 9 | What is photo chemical smog? | **BTL-2** | | Understandin  g | **PO5** |
| 10 | What are soot particles? | **BTL-1** | | Rememberin  g | **PO5** |
| 11 | What is the most effective after treatment for reducing engine | **BTL-1** | | Rememberin  g | **PO5** |
| 12 | List the materials used as catalyst | **BTL-1** | | Rememberin  g | **PO5** |
| 13 | Whycatalytic converter called as three way converters?( | **BTL-1** | | Rememberin  g | **PO5** |
| 14 | Whatare the types of ceramic structure used in catalytic convertor? | **BTL-1** | | Rememberin  g | **PO1** |
| 15 | What is a catalyst? | **BTL-1** | | Rememberin  g | **PO1** |
| 16 | Listout the draw backs of catalytic converters | **BTL-1** | | Rememberin  g | **PO5** |
| 17 | Whatare the methods of catalytic converter superheating? | **BTL-1** | | Rememberin  g | **PO6** |
| 18 | List the invisible and visible emission | **BTL-1** | | Rememberin  g | **PO4** |

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| 19 | What are the methods of measuring the following emission? | **BTL-1** | Rememberin  g | **PO5** |
| 20 | Effect of catalytic converters? | **BTL-1** | Rememberin  g | **PO5** |
| 21 | short note on hc and carbon monoxide emissions ? | **BTL-1** | Rememberin  g | **PO3** |
| 22 | Function of turbo charging? | **BTL-1** | Rememberin  g | **PO5** |
| 23 | Methods of controlling emissions? | **BTL-1** | Rememberin  g | **PO1** |
| 24 | Explain EGR? | **BTL-1** | Rememberin  g | **PO1** |
| 25 | What is particulate traps? | **BTL-1** | Rememberin  g | **PO4** |
| 26 | How photochemical smog produce? | **BTL-1** | Rememberin  g | **PO1** |
| 27 | What is SOF? | **BTL-1** | Rememberin  g | **PO5** |
| 28 | What is evaporative emission | **BTL-1** | Rememberin  g | **PO1** |
| 29 | Define crankcase blow by? | **BTL-6** | Creating | **PO5** |
| 30 | What are the method to find performance of engine ? | **BTL-1** | Rememberin  g | **PO5** |
| **PART-B & PART-C** | | | | |
| **Q.**  **No.** | **Questions** | **BT**  **Leve l** | **Competen ce** | **PO** |
| 1 | Describe in detail the causes of hydro carbon emissions from SI engines.. | **BTL-2** | Understandin g | **PO5** |
| 2 | What are catalytic converters? How are they help full in reducing HC,CO and NOx emissions? | **BTL-2** | Understandin g | **PO5** |
| 3 | Give a brief account of emissions from CI engines. | **BTL-6** | Creating | **PO5**  **,PO 1** |
| 4 | Explain the inter nationally accepted method so measuring the following in visible emission | **BTL-2** | Understandin g | **PO5** |
| 5 | i) Oxides of nitrogen (ii) Carbon monoxide (iii) Unburned hydrocarbons | **BTL-2** | Understandin g | **PO5**  **,PO 1** |
| 6 | What is smoke and classify the measurement of smoke? | **BTL-6** | Creating | **PO1**  **,PO**  **5,P** |

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| **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 alcoholasa 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 are 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 dis advantages 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** |

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| 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 fules 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** |

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|  | 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,** |

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|  |  |  |  | **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 learn burn engine? What are the advantages of using learn 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** |

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| **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 termedas abnormal combustion (or) knocking combustion. Consequences are(1). Loss of power (2).Recurring pre ignition(3).Mechanical damage to the engine |
| **4. Whatisequivalence ratio?** |

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| The ratio of the actual fuel-air ratio to the stoichio metric fuel–air ratio. |
| **5. Short note on SI engine equivalence ratio requirements?**  Ina homogeneous mixture with equivalence ratio close to 1.0 the flame speed is normally of the order of 40cm/s. However in a SI engine the maximum flame speed is obtained when φ is between1.1and 1.2(i.e.)when the mixture is slightly richer than stoichio metric. |
| **6. Write the desirable qualities for SI engine fuel? (APRIL/MAY 2010)**  In order to avoid orinhibit detonation, a high auto ignition temperature and along ignition lagare the desirable qualities for SI engine fuel.  . |
| 1. **Explain the type of vibration produced when auto ignition occurs.**   Two different vibrations are produced.   * 1. Inonecase,alargeamount of mixture may auto ignite giving use 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.Inanother case, larger pressure differences may exit 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 transfer this transducer is connected, usually to acathode ray oscilloscope. Thus pressure-time traces can be obtained from the pressure transducer. |
| 1. **Listoutsome of the knock limited parameters?**   The knock limited parameters are:   * 1. Knock limited compression ratio   2. Knock limited into pressure   3. Knock limited Indicated mean effective pressure.(Klimep) |
| **10. Listoutsome 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. |

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| **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. |
| 1. **Whataretheobjectives to be kept in mind during design of combustion chamber?**   General objectives are   * 1. Smooth engine operation (b) Moderate rate of pressure rise(c)Reducing the possibility of knocking (d)High power output and thermal efficiency |
| 1. **Whatare the factors to be considered to obtain high thermal efficiency?**   Following are the factors:   * 1. Ahighvolumetricefficiency. 2.Antiknockcharacteristicmustbe 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. |
| 1. **What are the advantages of fuel–injection in an SI engine?**   Advantages are:   * 1. Increasedvolumetric efficiency. 2.Betterthermalefficiency 3.Lower exhaust emissions 4.Highqualityfueldistribution |
| 1. **List the draw backs of the carburetion?**    1. Non uniform distribution of mixture in multi cylinder engines. 2.Lossofvolumetricefficiencyduetoretractionformixtureflowandpossibility of backfiring. |
| **21. Whatare the functional requirement so fan injection system?** |

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| 1.Accuratemixingofthefuelinjectedpercycle. 2.Timingtheinjectionof the fuel. 3.Proper atomization of fuel into fine droplets 4.Proper spray pattern.  5. No lag during beginning and end of injection. |
| 1. **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–fuelstrainer,floatchamber,mainmeteringandidlingsystem,thechoke &the throttle. Compensating devise- Air–bleed jet, compensating jet, Emulsion tube, auxiliary valve and port, back suction control mechanism.  Additional system–Ant 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. |
| 1. **Whatare 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 |
| 1. **Whatare the different types air–fuel mixtures?**    1. Chemicallycorrect mixture 2.Richmixture3.leanmixture. |
| 1. **Whatare 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 ?** |

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| 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* |
| 1. **Explain about the following types of transformations with example. (Nov/dec2012)**    1. **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* |

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| **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 |

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| **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. |
| 1. **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)?**  (i) |
| 1. **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** |

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| **S.NO** | **CHARCTERISTICS** | **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 |

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| 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 a. Shallow depth chamber b.Hemi sherical chamber c. Cylindrical chamber  d. Toroidal chamber   |
| 1. **Whataretheadvantagesanddisadvantagesofopencombustionchamber 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.Highfuelinjectionpressurerequiredandhencecomplexdesignoffuelinjection pump 2.Necessityofaccuratemeteringoffuelbytheinjectionsystem,particularlyfor small engines |
| **11. Whatisindirectinjection type of combustion? APR/MAY 2013**  Indirect injection type of combustion chamber in which the combustion space is divided in to two or more distinct compartment connected by restricts passages. This creates considerable pressure difference between them during the combustion process. |
| **12. Writethe classification of indirect injection chamber(divided combustion chamber)**  Classification of divided combustion chamber is   1. Swirl chamber –in which compression swirl is generation. 2. Pre combustion chamber– in which combustion swirl is induced. 3. Air cell chamber – in which both compression and combustion swirl are induced. |
| **13. Whatare the applications of swirl chamber?**  Swirl chamber type finds application   1. Where fuel quality is difficult to control 2. Where reliability under adverse condition is more important than fuel economy 3. Use of single hole of larger diameter for the fuels pray nozzle is often important consideration for the choice of fluid chamber engine. |

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| 1. **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 in let fluid density prior to entry to each engine cylinder. This is called turbo charging. |
| **17. Whatare 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 boostor 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 diaphragram operated value that can by pass 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 a cross the injector nozzle are required:**  The fuel is introduced in to the cylinder of a diesel engine through a nozzle with a  large pressure differences across the nozzle jet will enter the chamber a thigh velocity to   1. Atomize into small sized drop lets to enables rapid evaporation and 2. Traverse the combustion chamber in the time available and fully utilize the air charge. |
| **21. Whatiscalled breakup length?**  The liquid column bearing the nozzled is integrates with in the cylinder over a finite Length called the break up length in to drops of different sizes. |
| **22. Whatare the different designs of nozzle used?**  The different design of nozzle use dissingle orifice ,multi orifice ,throttle or pint lndepending on the needs of the combustion system employed. |

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| **23. Whatare 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 ligamentsor drops) is present to attenuate the light.  The shadow graph technique responds to density gradients in the test section soit identifies regions where fuel vapor exists. |
| 1. **List the droplet size depends on various factors:**   The droplet sizes depends on various factors are   * 1. Mean drop let size decreases with increases in a. Injection pressure b.air density 2.Mean drop let size increases with increases in fuel viscosity.   3.Size of drop lets 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. |
| 1. **List types of nozzle ?**    1. the pintle nozzle (ii) the single hole nozzle(iii) the multi hole nozzle (iv) pintaux nozzle   plan in the factory. |
| 1. **What are consideration should doing assemble of fuel injections**?    1. a needle valve    2. a compression spring    3. a nozzle |

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| (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* |

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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** |
| **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(coandco2)  c. Oxides of nitrogen(NOandNO2 d. Oxides of sulphur (SO2 andSO3) |

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| 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.Valveoverlap. 5.Deposits on walls. 6.Oil on combustion chamber walls. |
| 1. **What are the reasons for incomplete combustion in SI engine?**   Incomplete combustion is due to   * 1. 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.   2. 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 as on 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 with in 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)Astheflamegoesveryclosetothewallsitgetsquenchedatthewallsleavinga small volume of un reacted air-fuel mixture. |
| 1. **How the oil consumption increases in IC engines and what are the effects**   Often as engine sages, due to wear, clearance between the pistons and cylinder wall increases.This increases oil consumption contributes to increases in the emissions in three ways.   * 1. There is an added crevices volume.   2. There is added absorption–desorption of fuel in the thicker oil film on cylinder walls   3. There is oil burned in the combustion process |
| **8. Write a short note on carbon monoxide emissions**  Carbon monoxide is a colourless and odour less but a poisonous gas. It is generated in an engine when it is operated with a fuel rich equivalance ratio. Poormixing,localrichregions,andincompletecombustionwillalsobethesourcefor co emissions. |
| **9. What is photo chemical smog?**  NOx is the primary causes of photochemical smog, Smog is formed by the photochemicalreactionofautomobilesexhaustandatmoshericairinthepresenceof |

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| sunlight.  NO2+ energy fromsunlight NO+O+smog |
| **10. What are soot particles?**  Soot particles are clusters solid carbons here s. These spheres have diameter from 9nm to90nm (1nm=10-9).But most of the mare within the range of 15–30nm.The spheres are solid carbon with HC and traces of other components absorbed 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. Cocanbe oxidizedto CO2 and H2O inexhaust system and thermalconverters if the  temperature is held at 600-700 C.If certain catalysts are present, the temperature needed to sustain these oxidation processes is reducedto250- 300 C, making for a much more attractive system. |
| ***12.*** *What is a catalyst? MAY/JUNE 2014*  Acatalyst is a substance that accelerates chemical reaction by lowering the energy needed for it to proceed.The catalyst is not consumed in there action and so functions indefinitely unless degraded by heat age contaminants or other factors. |
| **13. List the materials used as catalyst**  The catalyst materials most commonly used are **a**. platinum **b.** palladium **c.**  rhodium. |
| **14. Whycatalytic converter called as three way converters**?(*APRIL/MAY 2015)*  Catalytic converters are called as three way converters because they are used to reduce the concentration of CO, HC and NOx in the exhaust. |
| **15. Whatare the types of ceramic structure used in catalytic convertor?**  Inside the container is a process ceramic structure through which the exhaust gas flows.   1. The ceramic is a single honey comb structure with many flow passages. 2. Some converters use loose granular ceramic with the gas passing between the packed spheres. |
| **16. Listout the draw backs of catalytic converters**  **a.** Sulphur offers unique problems for catalytic converters some catalyst promote the conversion of SO2 to SO3 which eventually converted to sulphuric acid.This degreds the catalytic convertor and contributes to |



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| acidrain.  **b.**Catalytic converter sarenot very efficient when they are cold. When an engine is started after not being operated for several hours it takes several minute for the converter to reach an efficient operating temperature called as cold start up problem |
| **17. Whatare 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, un burnthy drocarbons,carbon monoxide ,aldehyes.  **Visible emission:** Smoke,particulate. |
| **19. Whatare the methods of measuring the following emission? a.**Oxides of nitrogen =CHEMILUMINESCENCEANALYZER **b.**Carbon monoxide =NONDISPERSIVEINFRAREDANALYZER **c.**Unburned hydrocarbons = FLAMEIONIZATIONDETECTOR (FID) |
| **20. Effect of catalytic converters**?  catalytic converters some catalyst promote the conversion of SO2 to SO3 which eventually converted to sulphuricacid.This degreds the catalytic convertor and contributes to acidrain. |
| **21. short note on hc and carbon monoxide emissions** ?  Carbon monoxide is a colour less and odourless but a poisonous gas. It is generated in an engine when it is operated with a fuel rich equi valance ratio.  Poormixing,localrichregions,andincompletecombustionwillalsobethesourcefor co emissions. |
| **22. Function of turbo charging?**  Energy available in the engines 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. |
| 1. **Explain EGR?**   Exhaust Gas Recirculation is the most effective way of reduction NOx emissions is to hold combustion chamber temperatures down.   * + To have a good management control. |

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| **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 NOx 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 ?**   1. Willan's line method 2. Morse test 3. Motoring test 4. 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* |

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| **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: 3. Alcohols have poor ignition characteristics in general. 4. 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.Thiscausestheengineto run erratically due to the large air-fuelratiodifferencebetweenthe 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) |
| 1. **What arethe techniquesof usingalcoholin dieselengine fuel?**   The techniquesofusingalcoholindiesel engine are:   * 1. Alcoholdieselemulsions. 2. Dualfuelinjection.   3. Alcoholfumigation. 4.Surface ignitionofalcohols |

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| **6. What are the methods are adopted for induction of alcohol into intake manifold?** Themethodsareadoptedforinductionofalcoholintointakemanifoldmicrofogunit, pneumatic spraynozzle,vaporizer,carburetor andfuelinjector.   |
| 1. **List theadvantagesof hydrogen asanICengine?**   Advantages   * 1. Lowemissions.   2. Fuelavailability.   3. Fuelleakagetoenvironmentisnota pollutant   4. Highenergycontinentpervolume whenstoredas aliquid.    |
| **8. List thedisadvantagesof usinghydrogen asafuel?**  Disadvantages  Difficulttore fuel. Fuelcostwouldbehighatpresentday’stechnologyandavailability. Poor enginevolumetric efficiency.  HighNOxemissionbecauseof highflame.   |
| **9. Write the methodsfor hydrogen canbe usedin SIengines?**  HydrogencanbeusedinSIenginesbythree methods Bymanifoldinduction Bydirectintroductionofhydrogenintothe cylinder.  Bysupplementinggasoline.  (i) |
| **10. List the advantages and disadvantagesof naturalgas?**  Advantages:  Octane number isaround120, whichmakesitaverygoodSIenginesfuel. Lowengine emissions  Fulelisfairlyabundantworldwide. Disadvantages: Lowenergydensityresultinginlowengine performance. Lowengine volumetric efficiencybecauseitisagaseousfuel.  Refuelingisa slowprocess.  (i) |
| **11. Write the twotypesof LPGusedinautomobilesengine?**  Twotype of LPGusedinautomobile engines: Oneispropaneandtheotherisbutane,sometimesinmixtureofpropaneand butane |



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| isusedasLPGinautomobile engine. |
| **12. Whatare theadvantagesof LPG?**  LPG mixeswithair atalltemperatures.  LPGhashighantiknockcharacteristics.  Thereisnocrackcase dilution, becausethe fuelisinthe formof vapor. |
| **13. Write the disadvantagesof LPG?** Aspecialfuelfeedsystemisrequiredfor liquidpetroleumgas. Agoodcoolingsystemisquite necessary.  Thevehicleweightisincreasedduetotheuseofheavypressurecylinderfor storingLPG. |
| **14. Write the improvements required for the LPG vehicle in future?**  EffortmustbemadetohavemoreLPGfillingstationsatconvenientlocations, so that LPG tank can be filled up easily.  Safetydevicesaretobeintroducedtopreventaccidentsduetoexplosionofgas cylinders(or) Leakage in the gas pipes.  . |
| 15. **Compare the petro land LPG?** |
| **16. Write any two Advantages of alcohol.** APR/MAY 2015 It produce less emission compare to gasoline.  Alcohol have low sulphur content in the fuel. |
| **17. Disadvantages of alcohol**.  Alcohol have poor ignition characteristics in general  There is a possibilities of vapour lock in fuel delivery system. |
| **18. Techniques of using alcohol in diesel engine?**  Alcohol diesel emulsion  Alcohol fumigation Real fuel injection |



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| **PETROL** | **LIQUIEDPETROLEMGAS** |
| Octane rating of petrol is81 | Octane rating of LPGis110. |
| Petrol has odours | LPG is odourless. |
| In order to increase octane number | LPG is lead free with high Octane  number. |

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| 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. |
| 1. **List different types of production monitoring system.**   Three types production/ process monitoring systems are:   * + Data acquisition systems   + Data logging system   + Multilevel scanning |
| 1. **What are the inputs to MRP system? (May/June 2012)**    * Master production schedule    * Bill of material file    * Inventory record file |
| 1. **Write down three phases of shop floor control.( Nov/Dec 2012)**    1. Order release,    2. Order scheduling    3. 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. |

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| **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. |
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| **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.* |

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| **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. |

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| **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 refused to as ale an 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 cooing medium are reduced because of lower peak temperatures. Since lean mixture are less prove 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 comments 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.  Stratificationofthechargemixtureintodistinctlydifferentrichandleanairfuel 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?** |



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| The maindisadvantagesofthestratifiedcharge enginesare:  Maximumoutput(fromtheairinthecylinder(i.e.)completeutilizationofair)is notachieved. The addedcostoftheinjection/modifiedcombustionsystems.  Addedcomplicationof injectionandsparkignitionsystems. |
| **7. Write short noteson plasmajet ignition system.** MAY/JUNE 2012  Theplasmajetignitionsystem usesaplasmajetsparkplug.Thissystem canbe consideredasaform ofelectricaltorchignition,sincetheignition source is hotjet plasmawhichproject wellaway fromthe spark plug.The plasmajetignitionsourcesis turbulentandelectrodeless, bothdesirablefeaturesforignitingmarginalmixtures. |
| **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?**  Someoftherecentautomotiveenginesareequippedwithgasolineinjectionsystem,  Instead of a carburetion for the reasons:(1)To have uniform distribution of fuel in a multicylinderengine.(2)Toimprovebreathingcapacity(i.e.)volumetricefficiency. (3) To reduce or eliminate detonation. |
| 1. **What are the types of injection system?** MAY/JUNE 2008    1. Gasoline DirectInjection(GDI)intothe cylinder    2. Portinjection(a)timed(b) continuous    3. Manifoldinjection |
| **11. What are the objective of the fuel injection system?** MAY/JUNE 2011  The objectives of the fuel injection system are to meter, atomize and uniformly distributethe fuelthroughoutthe air massinthe cylinder.   |
| 1. **Whatare the componentsofinjection system**? The componentsofinjectionsystemare:    1. Pumpingelement 2. Meteringelement 3. Mixing element   4. Mixture control 5. Timingcontrol |



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| **13. Write noteson continuousinjectionsystem.**  Continuousinjectionsystemusually hasarotary pump.Thepumpmaintainsthefuel linegaugepressureofabout**0.75to1.5bar**.Thesystem injectsthefuelthrougha nozzle locatedinmanifoldimmediatelydownstreamof thethrottle plate. |
| **14. Explain thefunctionsof thefollowingcomponents.**  **(a) Pumping element, (b) Metering element, (c) Timing control, (d) Ambient control. (a)Pumpingelement**-movesthefuelfromthefueltanktotheinjector.Thisinclude necessarypiping,filter etc. **(b)Meteringelement**-measuresandsuppliesthefuelattherate demandedby loadand speedconditionsof the engine.   1. **Timingcontrol**- fixesthe startandstopof the fuel-air mixingprocess. 2. **Ambientcontrol**-compensatesforchargesintemperatureandpressureofeitherair or fuelthatmayaffectthe variouselementsof the system.   • |
| 1. **Writetheadvantagesof homogeneouscharge compression ignition engine?**    1. Lower NOxandparticulateemissions 2. Highthermalefficiency |
| **16. What are the fuels used in HCCI engines?**  Diesel, gasoline , methanol, natural gas and hydrogen   |
| **17. List the disadvantagesof homogeneouscharge compression ignition engine?**  Themajor problemiscontrollingtheignitiontimingover a wide leadandspeed.  Power densityislimitedbycombustionnoise andhighpeakpressure |
| 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 –MAY2007  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](https://en.wikipedia.org/wiki/Automobile), in which the fuel is injected into the [cylinder](https://en.wikipedia.org/wiki/Engine_cylinder) just before [ignition](https://en.wikipedia.org/wiki/Combustion). This allows for higher [compression ratios](https://en.wikipedia.org/wiki/Compression_ratio) without "[knock](https://en.wikipedia.org/wiki/Engine_knocking)," and  leaner [air/fuel ratio](https://en.wikipedia.org/wiki/Air-fuel_ratio) than in conventional internal combustion engines |



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| **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](https://en.wikipedia.org/wiki/Two-stroke_engine) and [four-stroke](https://en.wikipedia.org/wiki/Four-stroke_engine) [gasoline engines](https://en.wikipedia.org/wiki/Petrol_engine). The [gasoline](https://en.wikipedia.org/wiki/Gasoline) is highly pressurized, and injected via a [common rail](https://en.wikipedia.org/wiki/Common_rail) fuel line directly into the [combustion chamber](https://en.wikipedia.org/wiki/Combustion_chamber) of each [cylinder](https://en.wikipedia.org/wiki/Cylinder_%28engine%29) |
| **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. |
| 1. **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. |

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| **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* |