

SYED AMMAL ENGINEERING COLLEGE

(Approved by the AICTE, New Delhi, Govt. of Tamilnadu and Affiliated to Anna University, Chennai)

Established in 1998 - An ISO 9001:2000 Certified Institution

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VIII Semester ME 6016 – ADVANCED IC ENGINES Question Bank

PART – A - UNIT – I - SPARK IGNITION ENGINES

1. What are the different air-fuel mixtures on which an engine can be operated? (Dec. 2016)
2. What are the factors that influence the flame speed? (Dec. 2016)
3. What are the various factors affecting knock in spark ignition engine? (May 2016)
4. List the types of combustion chambers found in spark ignition engine? (May 2016)
5. List the different air fuel ratios required for different operating conditions of a gasoline engine. (Dec. 2015)
6. State any 4 important types of (shapes) combustion chambers common in SI Engine. (Dec. 2015)
7. Why a SI Engine requires a rich mixture during idling and at full load? (May 2015)
8. What is principle of a carburetor? How are jet and venturi sizes decided? (May 2015)
9. List the different operating conditions of an automobile SI Engine and indicate the relevant air fuel ratios needed. (Nov. 2014)
10. What is preignition? Explain. (Nov. 2014)
11. What are different air fuel mixtures on which an Engine can be operated? (May 2014)

PART – B

UNIT – I - SPARK IGNITION ENGINES

1. Explain in detail how the fuel jet size and venturi size of the carburetor are decided for an automotive engine. (Dec. 2016)
2. Using pressure crank angle diagram($p-\theta$) explain the different stages of normal (desirable) combustion in a SI engine. Also explain how abnormal combustion takes place using the same $p-\theta$ diagram. (Dec. 2016)
3. Explain in detail about normal and abnormal combustion in SI Engines. (May 2016)
4. With a neat sketch explain in detail about the different types of fuel injection system used in SI engines. (May 2016)
5. Explain how the jet size and venturi size are determined for a carburetor used in SI Engine. (Dec. 2015)
6. Give the function of boost venturi, emulsion tube, acceleration pump and altitude compensation mechanism present in actual carburetors. (Dec. 2015)
7. Using pressure – crank angle diagram explain the desirable combustion for an SI Engine and effect of auto ignition leading to abnormal combustion. Also explain the undesirable effect of auto ignition on Engine. (Dec. 2015)
8. Discuss the air-fuel ratio requirements of a SI Engine. (May 2015)
9. Describe the various stages of combustion in a SI Engine with a $p-\theta$ diagram. (May 2015)
10. Explain the various factors that effect of knock in a SI Engine. (May 2015)
11. Discuss the different types of combustion chambers employed in a SI Engines. (May 2015)

12. Explain in detail how the fuel jet size and venturi size of the carburetor are designed for an automotive engine. (Nov. 2014)
13. Using pressure crank angle diagram ($p-\theta$) explain the different stages of normal (desirable) combustion in SI Engine. Also explain how abnormal combustion takes place using the same $p-\theta$ diagram. (Nov. 2014)
14. Briefly explain the stages of combustion in SI Engines with suitable flame propagation curve. (May 2014)

PART – A - UNIT – II - COMPRESSION IGNITION ENGINES

2. What are the advantages of turbo charging? (Dec. 2016)
3. State briefly about air motion in CI engines using diagrams. (May 2016)
4. Define Turbocharging. (May 2016)
5. What are the factors that influence the flame speed? (May 2014)
6. What is the effect of delay period on knock in CI Engine. (Dec. 2015)
7. List any 4 assumptions made in the thermodynamic analysis of CI Engine combustion process. (Dec. 2015)
8. Define physical delay and chemical delay. (May 2015)
9. What is the effect of increasing the temperature and pressure on knocking in a CI Engine? (May 2015)
10. What is significance of cetane number in the combustion process observed in CI Engines? (Nov. 2014)
11. List any 4 types of Turbochargers used in CI Engines. (Nov. 2014)
12. State the purpose of Turbo charger in an automotive engine. (May 2014)
13. What do you understand by indirect injection system? (May 2014)

PART – B - UNIT – II - COMPRESSION IGNITION ENGINES

1. With the aid of a schematic diagram, explain the combustion process in a CI engine. (Dec. 2016)
2. Explain the factors affecting the delay period in CI engines and summarize them. (Dec. 2016)
3. Discuss in detail about the various stages of combustion in a CI Engine. (May 2016)
4. What are the various factors that influence spray penetration in CI engines? Explain in detail. (May 2016)
5. Using pressure – crank angle diagram explain the different stages of combustion observed in a typical CI Engine. Why is it undesirable to have the fourth phase of combustion (combustion during late expansion stroke)? (Dec. 2015)
6. Explain from first principles how the thermodynamic model to simulate the CI Engine combustion heat release is developed. What are the assumptions made in the model? (Dec. 2015)
7. Using neat sketches explain any two types of Turbocharger arrangements commonly used in Multi cylinder CI Engine. (Dec. 2015)
8. What is delay period? And what are the factors that affect the delay period? (May 2014)
9. What is meant by Abnormal combustion? Explain the phenomenon of knock in SI Engines. (May 2014)
10. Explain with figures various types of combustion chambers used in CI Engines. (May 2014)
11. Explain the phenomenon of spray evaporation and combustion in CI Engines. (May 2014)
12. List the factors which effect knock in a CI Engine and explain their influence in detail. (Nov. 2014)
13. Give any four difference between direct and indirect injection engines. (Nov. 2014)

14. Explain the advantages of Turbo charging in CI Engine. Also sketch any 4 types of Turbochargers used and explain the arrangement. (Nov. 2014)
15. Briefly explain the thermodynamic analysis of CI engine combustion process. Explain clearly the assumptions made. (Nov. 2014)
16. Explain with p- θ diagram the various stages of combustion in a CI Engine. (May 2015)
17. Discuss the characteristics of DI and IDI Diesel Engines. (May 2015)
18. What do you understand by Turbocharging? Why SI Engines are not usually Turbocharged? Give the boost pressure range for SI and CI Engines. (May 2015)
19. What do you understand by thermodynamic analysis of CI Engine combustion process? Explain in detail giving the governing equations. (May 2015)

PART – A - UNIT – III - ENGINE EXHAUST EMISSION CONTROL

1. What is the difference between smoke and particulate emissions? (Dec. 2016)
2. How does a three way catalytic converter differ in operation compared with two way converter? (Dec. 2016)
3. What are the various pollutants present in combustion products? (May 2016)
4. Briefly discuss about the working of three way catalytic converter. (May 2016)
5. List the factors responsible for formation of NO_x during combustion. (Dec. 2015)
6. Indicate any 4 locations within the SI Engine cylinder where un burnt HC form. (Dec. 2015)
7. What is a three way catalytic convertor? Give the catalysts used in it. (May 2015)
8. What are emission norms? Give the major pollutants that are to be controlled. (May 2015)
9. What is the difference between smoke and particulate emissions? (Nov. 2014)
10. How does the 3 way catalytic convertor differ in operation compared with 2 way convertor? (Nov. 2014)
11. Give a brief account of other emissions from engines. (May 2014)
12. State usage of Ringlemann chart. (May 2014)

PART – B - UNIT – III - ENGINE EXHAUST EMISSION CONTROL

1. Discuss briefly the HC, CO and NO pollutant formation mechanisms in a SI engine. (Dec. 2016)
2. With a simple sketch, explain briefly the working principle of a particulate trap. (Dec. 2016)
3. What are the various types of instruments used for the measurement of emissions from IC engines? With a schematic diagram, describe in detail the chemiluminescence method of measuring oxides of nitrogen. (Dec. 2016)
4. Write short notes on the formation of particulate and smoke emission in IC Engines. (May 2016)
5. Explain in detail about the different methods used for the measurement of exhaust emission in petrol engines. (May 2016)
6. Explain in detail the how the unburnt hydrocarbon emissions occur inside the cylinder during the compression and power stroke of the SI Engine. (Dec. 2015)
7. Explain with neat sketches the construction of pellet type and honey comb type catalytic converters. Also explain how the catalytic surfaces are fabricated and discuss in detail how they perform the catalytic conversion. (Dec. 2015)
8. Give a table describing in detail the comparison between alcohol, hydrogen, natural gas, LPG, and vegetable oils for their suitability as IC Engine fuel. Consider all important factors pertinent to engine combustion. (Dec. 2015)
9. What are the major engine modifications needed when unconventional fuels or their blends are used in conventional diesel powered CI Engine? Explain in detail. (Dec. 2015)

10. Explain in detail the formation NO_x in both SI and CI Engines. Sketch the variation of NO_x concentration with equivalence ratio and explain the reason for the same. (Nov. 2014)
11. With suitable sketches explain the working principle of NDIR analyzer, chemiluminescent analyzer and flame ionization detector (FID). (Nov. 2014)
12. Explain the mechanism of formation of CO, UBHC and NO_x emissions. (May 2015)
13. Why three way catalytic converters are employed in the modern day SI Engine drive vehicles? Show the plot of pollutants versus air fuel ratio and conversion efficiency versus air fuel ratio for all the major pollutants from SI Engines. (May 2015)
14. With help of neat sketch describe the principle of operation of FID Analyzer. (May 2015)
15. Draw the Indian driving cycle and explain the various stages. (May 2015)
16. What is smoke and explain the principle used in the measurement of smoke? (May 2014)
17. Explain the internationally accepted method of measuring the following invisible emissions
(i) Oxides of Nitrogen (ii) CO (iii) aldehydes (May 2014)

PART – A - UNIT – IV - ALTERNATE FUELS

1. What is trans-esterification? List down any two vegetable oils. (Dec. 2016)
2. Give the composition of LPG and CNG. (Dec. 2016)
3. Write about the different types of alternate fuels available. (May 2016)
4. Which are the different types of on board hydrogen storage methods that can be used? (May 2016)
5. State any 2 reasons for using ethyl alcohol as a SI Engine fuel. (Dec. 2015)
6. Indicate any 2 limitations of vegetable oils as a CI Engine fuel. (Dec. 2015)
7. What are the problems of using methanol in an Engine? (May 2015)
8. List down 4 properties that are important in the selection of fuels for an Engine. (May 2015)
9. List any 4 advantages of Bio diesel over petroleum based fuels. (Nov. 2014)
10. Why engine modifications needed while using Bio diesel in CI Engine as a fuel? (Nov. 2014)
11. Can one use solid fuels for IC Engines? If so how? . (May 2014)
12. Can alcohol be used for CI Engines? Explain. . (May 2014)

PART – B - UNIT – IV - ALTERNATE FUELS

1. Explain the fuel characteristics of Alcohols, CNG, LPG and Hydrogen. (Dec. 2016)
2. Explain the Performance Combustion and Emission characteristics of CI engine using Bio-diesel as a fuel. (Dec. 2016)
3. What are the modifications to be made in CI engine running on biodiesel? Explain in detail about the use of biodiesel as fuel in CI engines and the various merits and demerits of its use. (May 2016)
4. Explain in detail about the effects of using biogas as fuel on engine performance and emission characteristics. (May 2016)
5. Explain fuel characteristics of alcohols, CNG, LPG and Hydrogen. (May 2014)

6. Explain the performance combustion and emission characteristics of CI Engine using bio diesel as a fuel. (May 2014)
7. Give a detail comparison between alcohols, vegetable oils, vegetable oil based Biodiesel as their suitability for using SI and CI Engines. (Nov. 2014)
8. Explain in detail the engine modifications needed in CI Engines when bio diesels are used as fuel. Also explain briefly the performance of these engines while bio diesel are used as fuel. (Nov. 2014)
9. Discuss the salient properties of Hydrogen as a fuel. (May 2015)
10. List down the advantages and disadvantages of using Bio diesel in CI Engine. (May 2015)
11. What modifications are required in CI Engine to use gaseous fuels? Explain. (May 2015)
12. Explain the combustion and emission characteristics of using Hydrogen in a CI Engine. (May 2015)

PART – A - UNIT – V - RECENT TRENDS

- What is the working principle of prechamber stratified charge engine? (Dec. 2016)
- Mention the advantages of plasma ignition system. (Dec. 2016)
- Give a brief introduction to lean burn engines. (May 2016)
- What is common rail direct injection diesel engine? (May 2016)
5. How does a lean burn engine differ conventional engine. (Dec. 2015)
 6. List the components present in the measurement chain for pressure measurement in Engine research. (Dec. 2015)
 7. What is a multi valve engine? Indicate its advantages. (May 2015)
 8. What do you understand by CRDI systems? Give its salient features. (May 2015)
 9. What is principle of operation of stratified charge engine? (Nov. 2014)
 10. Why do we require charge amplifier in the measurement of engine pressure? (Nov. 2014)
 11. Write short note on pressure pickup used in engine measurement. (May 2014)
 12. What are the advantages of gasoline direct injection? (May 2014)

PART – B - UNIT – V - RECENT TRENDS

1. What is a surface ignition engine? Explain its advantages and disadvantages. (Dec. 2016)
 2. With a neat sketch explain the operation of a stratified charge engine. (Dec. 2016)
 3. Explain the characteristics of a common rail direct injection diesel engine. (Dec. 2016)
 4. Discuss the method of obtaining pressure crank angle diagram. List down the parameters that can be studied from the pressure crank angle diagram. (Dec. 2016)
 5. With a neat sketch explain in detail about gasoline direct engine. (May 2016)
 6. Discuss in about the heat release analysis in engines. (May 2016)
 7. What is the Lean burn Engines? Explain the advantages and disadvantages. (May 2015)
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8. With a neat sketch explain the operation of an Electronic fuel Injection system used in a SI Engine. (May 2015)
9. Explain the operation of CRDI Engine with neat sketch. (May 2015)
10. Discuss the method of obtaining the rate of heat release from Engine. (May 2015)
11. Give a detail comparison between homogeneous charge compression ignition engine, lean burn engine and stratified charge engine. (Nov. 2014)
12. Explain in detail the pressure transducer, charge amplifier, data acquisition system used in the combustion and heat release analysis of IC Engine. How the data is collected and thermodynamic analysis carried out in detail. (Nov. 2014)
13. Discuss about the HCCI Engine. (May 2014)
14. Briefly describe the performance of surface ignition engine. (May 2014)
15. With a layout diagram explain the working features of CRDI diesel engine. (May 2014)
16. Write short notes on data acquisition system. (May 2014)
17. Using a neat layout diagram explain any one type of multipoint port fuel injection (MPFI) system employed in modern petrol cars. Explain the type of sensors used for measurement of air mass flow, temperature, speed and pressure. (Dec. 2015)
18. Explain the procedure adopted to arrive at the specification of piezo electric sensor charge amplifier crank angle encoder and AD converter with data storage for heat release analysis of a given IC Engine. (Dec. 2015)