SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY :: PUTTUR
(AUTONOMOUS)
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Siddharth Nagar, Narayanavanam Road, PUTTUR-517 583

QUESTION BANK

Subject with Code: Advanced IC Engines(16ME8811) **Course & Branch: M. Tech(TE)**
Sem : II-Sem **Regulation: R16**

UNIT-I

1 (a) List five important differences between the design and operating characteristics of spark ignition and Compression ignition engines.

(b) What are the different air standard cycles that are used in IC engines? Explain.

2 (a) What factors influence in computer modeling of engine cycle analysis?

(b) Briefly explain the following: (i) Time loss factor. (ii) Heat loss factor. (iii) Exhaust blow down factor.

3. (a)How are heat engines classified? Explain the basic deference in their working principle.

(b) How does the composition of exhaust gases vary for various fuel-air ratios in a gasoline engine?

4. (a) List the three principal factors that influence engine performance.

(b) Discuss the optimum opening position of exhaust valve to reduce the exhaust blow down loss.

5. (a) Discuss the air-fuel ratio mixture requirements of an automotive petrol engine.

(b) Explain why the bmep is lower at the maximum rated power for a given engine than the bmep at the maximum torque.

6. A four cylinder four stroke automotive spark ignition engine is being designed to provide a maximum brake torque of 150 Nm in the speed range (3000 rpm). Estimate the required engine displacement, bore, stroke and the maximum brake power that the engine will deliver. Assume suitable bore to stroke ratio, mean piston speed and bmep.

7. It is desired to increase the output of a spark ignition engine by either (1) raising the compression ratio (RC) from 8 to 10 or (2) increasing the inlet pressure from 1 atm to 1.5 atm. Using the constant volume

cycle as a model for engine operation, which procedure will give: (i) The highest pressure of the cycle. (ii) The highest efficiency. (iii) The highest mean effective pressure.

Assume and (mf LHV) / mCVT1) = 9.3(RC-1)/RC.

8. (a) Draw the typical performance curves of SI and CI engines and discuss them in detail.

(b) The Fiat Padmini car has a four stroke petrol engine of 1089 cc capacity. It develops maximum power 32 kW at 5000 rpm. The volumetric efficiency at this speed is 75% and the air- fuel ratio 13:1. At peak power the air speed at the choke is 120 m/s. The coefficient of discharge for the venturi is 0.85 and that of the main petrol jet is 0.66. The petrol surface is 6 mm below the choke at this engine condition. Calculate the sizes of a suitable choke and main jet. The specific gravity of petrol is 0.75 and the atmospheric pressure 1.013 bar and temperature 27 ºC.

9. Combustion in a diesel engine is assumed to begin at inner to dead centre and to be at constant pressure. The air-fuel ratio is 27:1, the calorific value of the fuel is 43000 KJ/kg, 0.71 + 20x 10-5 T; R for the products = 0.287 kJ/kg K. If the compression ratio is 15:1, and the temperature at the end of compression 870 K, find at what percentage of the stroke combustion is completed.

10. (a) List five important differences between the design and operating characteristics of SI and CI engines.

(b) What are the important engine characteristics? Explain.

UNIT-II

1 (a) Define the volumetric efficiency and discuss the effect of various factors affecting the volumetric efficiency.

(b) What is meant by supercharging? What are the effects on engine performance?

2 (a) Draw and describe the spray pattern when fuel is injected in to swirling air. Show a plot of equivalence ratio on the spray pattern.

(b) What do you mean by "Mean Velocity". Explain the turbulent characteristics of charge motion.

3. Briefly explain the working of the following: (i) Centrifugal supercharger. (ii) Roots supercharger.

4. (a) Describe with the help of diagrams the air-swirl and squish in the C.I engine combustion chamber.

(b) Describe the mechanism of combustion of a fuel spray injected in swirling air.

5. An air compressor is being run by the engine output of a supercharged 4-stroke cycle oil engine. Air enters the compressors at 25 and is passed on to a cooler where 1210 kJ/min are rejected. The air leaves the cooler at 65 and 1.75 bar. Part of this air flow is used to supercharge the engine which has a volumetric efficiency of 72% based on induction manifold condition of 65 and 1.75 bar. The engine which has six cylinders of 100 mm bore and 110 mm stroke runs at 2000 rpm and delivers an output torque of 150 Nm. The mechanical efficiency of engine is 80%. Determine: (i) The indicated mean effective pressure of the engine. (ii) The air consumption rate of the engine. (iii) The air flow into compressor in kg/min.

6. (a) Explain the various methods of generating swirl in CI engines with neat sketches.

(b) Briefly explain the following: (i) Squish motion. (ii) Tumble motion.

7. Explain the working of turbo charging with neat sketch.

8. Explicate the various types of indirect injection combustion chambers with neat sketch.

9. (a) What are the various factors governs in selecting of a combustion chamber? Explain different types of combustion chambers.

(b) Explain the factors which effect the penetration of fuel in the combustion chamber

10 (a) Distinguish between L – MPFI and D – MPFI, explain their applications.

(b) With a neat sketch, explain the working of a common rail fuel injection system

UNIT-III

1. (a) Explain briefly the harmful effects of detonation.
   (b) Describe in brief the effects of NOx and HC on human health.

2. (a) Explain briefly ignition delay period in C.I. Engines.
   (b) Explain how blow by can affect hydrocarbon exhaust emissions. Specifically discuss the influence of engine speed.
3. (a) What is meant by abnormal combustion? Explain the phenomena of knock in S.I engines.
   (b) Describe in brief the effect of particulate matter and CO on human health.

4. (a) Discuss the common rail fuel injection system. What are its merits and demerits?
   (b) Give the classification of different types of combustion chambers of a C.I engine. Explain briefly.

5. (a) Explain the formation of NOx in detail.
   (b) Describe the MPFI system with neat sketch and enumerate its merits and demerits

6. (a) Explain the working principle of selective catalytic reduction (SCR) with neat sketch.
   (b) What do you mean by particulates? Explain the various PM measurement techniques in detail.

7. The following data is taken from a trial on a 4 cylinder 4-stroke petrol engine which is coupled to a hydraulic dynamometer at constant speed with full throttle.
   BP with all cylinder working = 14.7 kW
   BP with cylinder No: 1 cut out = 10.2 kW
   BP with cylinder No: 2 cut out = 10.3 kW
   BP with cylinder No: 3 cut out = 10.4 kW
   BP with cylinder No: 4 cut out = 10.2 kW
   Petrol used = 5.44 kg/h
   Calorific value of the fuel used = 42,000 kJ/kg
   Diameter of the cylinder = 8 cm
   Stroke of the piston = 10 cm
   Clearance volume = 100 cm3
   Find the mechanical efficiency and the relative efficiency.

8.(a) Explain the various factors affecting ignition delay in SI engine.

(b) How will you measure NOx content from IC engine?

9. (a) Explain the combustion behavior in SI and CI engines. What are the factors affecting the combustion?

(b) Explain the influence of ignition delay, spray behavior and flame propagation on the cycle performance.

10. (a) With a neat sketch explain the functioning of MPFI system.

(b) Explain the relation between the efficiency of a SI engine and air-fuel ratio.

UNIT-IV

1.(a) What are the advantages and disadvantages of using CNG in S.I. Engine?

(b) Why is hydrogen termed as the freedom fuel? Explain briefly.

2. (a) Explain with neat sketch, basic principle of HCCI engine.

(b) What are the modifications that are needed in I.C. engine operating on bio-fuels?

3. (a) Give a brief account LPG being used as a alternative fuel in S.I engine.

(b) What are the advantages and disadvantages of using hydrogen in S.I engine?

4. (a) Briefly discuss the working principle of rotary engine with neat sketch.

(b) What is the lean burn engine? Discuss its applications in modern days.

5. (a) Describe the typical LPG fuel supply system with neat sketch.

(b) Discuss the various induction techniques of hydrogen in IC engines with their merits and demerits.

6. How will you develop the HCCI process in an existing IC engine? Briefly list out the challenges?

7. Describe the typical CNG fuel supply system with neat sketch

8. Discuss the suitability of biodiesel for diesel engine.

9. (a) List down various abnormalities in combustion and methods to control them.

(b) Explain the following: (i) Charge stratification. (ii) Exhaust gas treatment.

10. (a) What do you understand by the term C.I engine emissions? Explain in detail.

(b) Explain the effect of A:F ratio on CO, HC and NOx emission from petrol engines.

UNIT-V

1. Compare the properties of alcohol, hydrogen, CNG and LPG in favor of injection, storage, quality of ignition and emissions.

2. (a) Define m.e.p and comment its application in IC engines.
   (b) A 2.7 liter cubic capacity, six cylinders, four stroke Otto engine has a compression ratio of 10, the engine develops 140 kW at 5000 rpm. Calculate rate of heat addition, m.e.p peak temperatures and pressures of the cycle.

3. Explain the differences between: (i) Pre-ignition. (ii) Auto-ignition. (iii) Detonation.

4. Explain the advantages and disadvantages of Hydrogen, gasoline and methanol and how they influence the combustion and emissions.

5. (a) With a neat sketch, explain the functioning of two and three way catalytic converters.
   (b) Describe various methods to contain particulate matter emissions.

6. Discuss the methods of using H2 as a fuel in CI engine and discuss its merits and demerits in terms of storage, performance, combustion and emissions.

7 (a) What are the factors necessitate the supercharging? Explain the various supercharging methods and where they are more effective.
(b) Explain in detail the advantages of turbo-charging in CI engines.

8. What are the various design aspects to be considered in designing and modeling of a multi cylinder CI engine with turbo charging?

9. Explain with the help of diagram in the combustion phenomena in SI engines.

10. Explain with neat sketch, the principle of exhaust turbo charging of a single cylinder engine.