B.E. Eighth Semester (Mechanical Engineering) (C.B.S.)
Elective - III : Advanced Internal Combustion (IC) Engine

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Notes : 1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.

1. a) Explain working of 4 – stroke diesel engine with neat sketch and P.V. diagram. **5**

   b) What are various types of lubrication systems Used in an I.C. engine? With a neat sketch Explain dry Sump lubrication system. **5**

   c) What is the main reason for the development of two – stroke engines and explain working of two – stroke engines? **4**

OR

2. a) What are the important basic components of an IC engine? Explain them briefly. **5**

   b) Sketch P-V diagram for otto cycle and diesel cycle. Derive an expression for air-standard efficiency of otto cycle. **6**

   c) Discuss in detail the application of various types of I.C. engines. **3**

3. a) What are the different parts of fuel injection systems of CI engine? Explain the working of fuel pump used in the system. **6**

   b) A simple jet carburetor is required to supply 5 kg of air and 0.5 kg of fuel per minute. The fuel SP. gravity is 0.75. The air is initially at 1 bar and 300 K. Calculate the throat diameter of the choke for a flow velocity of 100 m/s. Velocity coefficient is 0.8. If the pressure drop across the fuel metering orifice is 0.80 of that of the choke, calculate orifice diameter assuming,
   $C_{df} = 0.60$ and $\gamma = 1.4$. **7**

OR

4. a) Enumerate Various components of a electronic injection system and mention their functions Explain port injection and throttle body injection system. **6**

b) A four- cylinder, four stroke diesel engine develops a power of 180 KW at 1500 rpm. The bsfc is 0.2 kg/KWh. At the beginning of injection pressure is 30 bar and the maximum cylinder pressure is 50 bar. The injection is expected to be at 200 bar and maximum pressure at the injector is to be set to be about 500 bar assuming the following: **7**
C$_d$ for injector = 0.7 S.G. of fuel = 0.875,
Atmospheric pressure = 1 bar,
Effective pressure difference = Avg pressure difference over the injection period
Determine the total orifice area required per injector if the injection takes place over 15º crank angles.

5. a) Explain the stages of combustion in SI engines elaborating the flame front propagation. **5**

   b) Explain with neat sketch Battery Ignition system. Discuss its merits and demerits over magneto ignition system. **5**

   c) Explain with suitable sketches the different scavenging systems. **3**

<div align="center">OR</div>

6. a) Discuss the abnormal combustion in SI engines. **5**

   b) Describe any two combustion chamber used in S.I. engine. **5**

   c) Discuss the supercharging limits for C.I. engine. **3**

7. a) What is delay period? Explain various factors affecting delay period. **5**

   b) Explain the phenomenon of diesel knock. Compare it with the phenomenon of detonation in S.I. engine. **5**

   c) Discuss the effect of fuel properties on combustion in C.I. engines. **3**

<div align="center">OR</div>

8. a) Describe Combustion stages in C.I. engine using $P-\theta$ diagram. **5**

   b) Explain with neat sketch the various types of combustion chambers used in CI engine. **5**

   c) Explain the various factors that influence the flame speed. **3**

9. a) Give a brief account of air pollution due to engines. **5**

   b) What are catalytic converters? How do they help in reducing HC, CO and NOx emissions. **5**

   c) What is crankcase blow by? How itis controlled. **3**

<div align="center">OR</div>

10. a) Explain NOx formation in C.I. engine. **5**

    b) Explain stratified charge engine with neat sketch. **5**

    c) State and discuss Euro norms and Bharat Stage norms. **3**

11. a) Explain orifice chamber method to measure air consumption of I.C. engine. **5**

b) The power output of a six cylinder four-stroke engine is absorbed by a water brake for which the law is WN/20000 where the brake load, w is in newton and the speed, N is in rpm. The air Consumption is Measured by an air box with Sharp edged orifice system. The following readings are obtained **9**

Orifice diameter = 30 mm.

Bore = 100 mm, Stroke = 120 mm, Brake load = 560 N,

C/H ratio by Mass = 83/17, C_d = 0.6,

Ambient pressure = 1 bar, pressure drop across orifice = 14.5 cm of Hg, Time taken for 100 CC of fuel consumption = 205.

Ambient temp = 27° C, fuel density = 831 kg/m^3

Calculate.

i) Brake power ii) the torque iii) bsfe

iv) The percentage of excess air and v) Volumetric efficiency.

OR

12 a) Briefly explain the reason of poor part load thermal efficiency of SI engine compared with CI engine. **4**

b) In a test of oil engine under full load condition the following results were obtained. **10**

IP = 33 KW, BP = 27 KW, Fuel used = 8 kg/h

Rate of flow of water through gas calorimeter = 12 kg/min

Cooling water flow rate = 7kg/min

Calorific value of fuel = 43 MJ/kg

Inlet temp. of cooling water = 15°C

Outlet temp. of cooling water = 75° C

Inlet temp. of water to exhaust gas calorimeter = 15° C

Outlet temp. of water to exhaust gas calorimeter = 55° C

Find temp. of exhaust gases = 80° C, Room temp. = 17° C

Air fuel ratio on Mass basis = 20

Mean Sp. heat of exhaust gas = 1kJ/kg.k

Specific heat of water = 4.18 J/kg.k

Draw Up a heat balance sheet and estimate the thermal and mechanical efficiencies.

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