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14MTP24

Second Semester M.Tech. Degree Examination, June/July 2015
Theory of IC Engines

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions.***

1 a. Define specific emission. Explain with graph, significance of air-fuel ratio on emissions from I.C. engine. **(04 Marks)**

b. List out the difference between ideal cycle analysis and fuel-air cycle analysis. **(03 Marks)**

c. A four cylinder engine has the following data:
Bore = 15cm, Stroke = 15cm, Piston speed = 510 m/min, BP = 60 kW, η_{mech} = 80%, P_{mep} = 5 bar, calorific value of fuel = 40,000 kJ/kg°K. Calculate whether this is two stroke engine or four stroke engine. Justify your answer. **(06 Marks)**

d. Consider two engine with following details:
Engine I : four-stroke, four cylinder SI engine, indicated power = 40 kW, mean piston speed = 10 m/sec
Engine II : Two stroke, two cylinder SI engine, I.P. = 10kW
Assume that m.e.p. of the both engine to be same. Ratio of bore of engine I:II = 2:1. Show that mean piston of engine II is same as that of engine I. **(07 Marks)**

2 a. What is 'Dieseling' in a carbureted S.I. engine and discuss the effect of dieseling on emission. Also list out the devices used for controlling the dieseling in carbureted engine. **(05 Marks)**

b. A simple carburetor under certain condition delivers 5.45 kg/hr of petrol with an air-fuel ratio of 15:1. The fuel jet area is 2mm^2 with a coefficient of discharge of 0.75. IF the tip of the fuel jet is 0.635cm above the level of petrol in the float chamber and venturi throat coefficient of discharge is 0.80.
Calculate:
i) The venture depression in cm of H_2O necessary to cause air and fuel flow at the desired rate.
ii) The venture throat diameter.
iii) The velocity of air across the venture throat.
Assume density of air is 1.29 kg/m^3 and specific gravity of fuel = 0.72. **(10 Marks)**

c. With suitable sketch, explain closed loop Lambda control system used in I.C. Engine. **(05 Marks)**

3 a. With suitable sketch. Explain the common rail direct injection (CRDI) system used in an automotive vehicle and list out the advantages. **(10 Marks)**

b. What is delay period? Explain the effect of following engine variable on delay period with suitable graph for C.I. engine: i) Compression ratio ; ii) Injection timing ; iii) Self ignition temperature (quality of fuel). **(06 Marks)**

c. Justify with your answer on the following statement "Factors which reduces knock in S.I. engine will increase the knock in C.I. engine". **(04 Marks)**

4 a. What is MBT timing? Explain the effect of spark timing, mixture composition, engine speed, compression ratio on S.I. engines performance with suitable graph. **(10 Marks)**

b. Following data are available for S.I. engine:

Cylinder stroke	= 4
Air-fuel ratio	= 16:1
Mechanical efficiency	= 80%
Speed	= 2500 rpm
Air standard efficiency	= 50%
Brake power	= 75 kW
Relative efficiency	= 70%
L/D ratio	= 1.5
Section condition	= 1 bar at 30°C
Calorific value	= 45000 kJ/kg°K

Calculate: i) Compression ratio; ii) Indicated thermal efficiency; iii) BSFC; iv) Bore and stroke (Assume volumetric efficiency is 80%). **(10 Marks)**

5 a. Explain the requirements of combustion chamber for S.I. engine. **(06 Marks)**

b. Define 'SWIRL'. Briefly explain the types of Swirl used in automotive engines. **(04 Marks)**

c. What is Tumble? Briefly explain the Tumble Swirl control valve used in gasoline direct injection engine. **(04 Marks)**

d. Explain the pre-combustion chamber with suitable sketch and list the advantages. **(06 Marks)**

6 a. Explain with sketch, working principle of NDIR analyzer. **(08 Marks)**

b. Explain with suitable sketch, constant volume sampler. **(08 Marks)**

c. Discuss the advantages and disadvantages of partial flow dilution tunnels for measurement of PM emission. **(04 Marks)**

7 a. Explain with suitable sketch, working principle of EGR (Exhaust Gas Re-circulation system) and list advantages. **(07 Marks)**

b. Explain with suitable sketch, diesel particulate filter with regeneration. **(06 Marks)**

c. With simple sketch, explain selective catalyst reduction (SCR) and list out the advantages of SCR. **(07 Marks)**

8 a. List out any six alternative transport fuels. **(03 Marks)**

b. With suitable sketch, explain the surface ignition for alcohol engine. **(06 Marks)**

c. How can natural gas burn cleaner than diesel? Explain the modification required to convert the diesel engine into a natural gas engine. **(07 Marks)**

d. Why can't we use straight vegetable oil as fuel for I.C. engine? **(04 Marks)**

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