Registration No. : | | | | | | | | | | |

Total number of printed pages – 3

B. Tech

PCME 4302

Fifth Semester Regular Examination – 2014

I. C. ENGINES AND GAS TURBINES

BRANCH : MECH

QUESTION CODE : H 151

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2 ×10

(a) What is valve overlap ?

(b) What do you mean by exhaust blowdown loss in actual cycles ?

(c) For a particular SI engine running at 2000 rpm, it was found that ignition lag takes 0.0015s/12° crank angle and flame propagation takes 0.0010/8° crank angle. When speed of the engine increases to 4000 rpm, what are the values of ignition lag and flame propagation speed. (Mention in time(s) and crank angle (degree) format.

(d) Mention the advantages of alternative fuels with two examples of alternative fuels used.

(e) What is the effects of intercooling and regeneration on the work output and efficiency of gas turbine ?

(f) Write down different types of nozzles used in injectors for CI engine.

(g) What is A/F ratio at a height of 2000m from the sea level when A/F ratio at ground level is 14 : 1 ? The densities at ground and 2000 m above sea level are 1.225 kg/m^3 and 1.006 kg/m^3 respectively.

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(h) What do you mean by surging and stalling on compressor ?

(i) List main constituents of the exhaust gases that cause air pollution. What are their effects ?

(j) What is velocity of diesel through nozzle in the injector when change in pressure between injector and cylinder is 145 bar, density of fuel is 850 kg/m^3 and coefficient of discharge is 0.85 ?

2. (a) Compare the Otto cycle with Diesel cycle. 4

(b) The pressure and temperature at the beginning of compression of a Diesel cycle is 1 bar and 310 K. The pressure at the end of compression is 50 bar and cut-off occurs at 6% of the stroke. Calculate the compression ratio, percentage clearance, heat supplied, work ratio. If the relative efficiency is 0.6 and the calorific value of fuel is 40 MJ/kg, estimate specific fuel consumption. 6

3. (a) Explain the difference between the air standard cycle and fuel-air cycle. 4

(b) What is dissociation ? Explain with suitable graphs the effects of dissociation on power output and maximum temperature. 6

4. Air at 1 bar and 20°C enters the compressor of a gas turbine unit and comes out at 8 bar. The compressor is driven by a high pressure turbine and low pressure turbine drives a generator. The isentropic efficiencies of compressor, H.P. turbine and L.P. turbine are 0.82, 0.85 and 0.85 respectively. Estimate the net power developed, work ratio and the overall efficiency of the unit if the mass flow rate of air is 5 kg/s, air-fuel ratio 60 : 1, the maximum temperature of gases entering the H.P turbine is 700°C. Take C_p of air = 1005 J/kg-K, heating value of fuel = 40 MJ/kg 10

5. (a) Differentiate between normal and abnormal combustion. Discuss four main variables that control knock. 5

(b) Briefly explain with a neat sketch the operation of a simple float type carburetor. 5

6. (a) Explain various stages of combustion in a diesel engine. 5

(b) With sketches, describe the types of injection systems used in CI engines. 5

7. (a) Briefly explain different types of cooling systems used for IC engines. 5

(b) Differentiate and explain Mist lubrication and Wet sump lubrication system in IC engines. 5

8. Write short notes on any **two** : 5×2

(a) Morse test

(b) Turbofan engine

(c) Supercharging

(d) EGR.