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

Total number of printed pages – 2

B. Tech

PCME 4302

Fifth Semester (Back/Special) Examination – 2013

INTERNAL COMBUSTION ENGINE AND GAS TURBINES

BRANCH : MECH

QUESTION CODE : D265

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which are compulsory and any **five** from the rest.*
The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

   (a) Draw the p-V and T-s diagram for Bryton cycle.

   (b) Write the thermal efficiency expression for Diesel engine, mentioning the nomenclatures in it.

   (c) What are the assumptions made in air standard cycle analysis ?

   (d) What is the difference between air cycle and fuel-air cycle ?

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

   (f) Draw and mention the three stages of combustion phenomenon in SI engine.

   (g) Mention the ill effects of detonation.

   (h) Why cooling of an IC engine is necessary ?

   (i) Differentiate between centrifugal and axial compressors.

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

2. (a) Compare the Otto, Diesel cycle, Dual cycle for the same compression ratio and same maximum pressure. 4

   (b) Derive the formula for the efficiency of an Otto cycle. 6

3. A test on a single cylinder, four stroke oil engine having bore 18 cm and stroke 36 cm yielded the following results, speed 285 rpm, brake torque, 393 Nm, indicated mep, 7.2 bar, fuel consumption, 3.5 kg/hr, cooling water flow 4.5 kg/min, cooling water temperature rise 36°C, air fuel ratio by mass, 25, exhaust gas temperature, 415° C, barometric pressure, 1.013 bar, room temperature,21° C. The fuel has a calorific value of 45200 kJ/kg and contains 15% by mass of hydrogen. Determine 10

(a) the indicated thermal efficiency

(b) the volumetric efficiency based on atmospheric conditions

Draw up a heat balance in terms of kJ/min. Take R=0.287 kJ/kgK, cv for dry exhaust gases = 1.005 kJ/kgK and for superheated steam cp = 2.05 kJ/kgK.

4. In a gas turbine plant, operating on Joule cycle, maximum and minimum temperatures are 825° C. The pressure ratio is 4.5. Calculate the specific work output, cycle efficiency and work ratio. Assume isentropic efficiencies of the compressor and turbine at 85 and 90 percent respectively. What is the heat rate in kJ/Kw-hr ? If the rating of the turbine is 1300 kW, what is the mass flow in kg/sec ? Neglect mass flow. of fuel. Assume cp=1.005 kJ/kgK. 10

5. (a) Explain the phenomenon of diesel knock. Compare it with the phenomenon of detonation in SI engines. 5

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

6. (a) Sketch a typical induction system of a petrol engine. 3

(b) Briefly explain with a neat sketch the operation of a simple float type carburetor ? 7

7. (a) Discuss the basic requirements of petrol and diesel fuel. 5

(b) Describe a battery ignition system with the help of a sketch. 5

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

(a) Turbojet and Turboprop engines

(b) Supercharging in SI and CI engines

(c) Air cooling and Water cooling system in IC engines

(d) Mist lubrication and Wet sump lubrication system in IC engines.