BTS – V(SS) – 06.14 – 0531 Reg. No. | | | | | | | | |

A

B.Tech. Degree V Semester Special Supplementary Examination June 2014

ME 504 THERMAL ENGINEERING

(*2006 Scheme*)

Time : 3 Hours Maximum Marks : 100

PART A

(Answer *ALL* questions)

(8 × 5 = 40)

I. (a) Explain a dual cycle with a neat sketch.

(b) Sketch and explain the valve timing diagram of a four stroke petrol engine.

(c) Briefly explain supercharging and turbocharging in IC engines.

(d) What is cetane number? How it is related to ignition delay time?

(e) Explain supersaturated flow in steam nozzles.

(f) Classify steam turbines and differentiate between steam turbines and steam engines.

(g) Explain a simple open cycle gas turbine with a neat diagram.

(h) Compare the axial flow compressor with centrifugal compressor.

PART B

(4 × 15 = 60)

II. (a) A diesel engine has a compression ratio of 15 and heat addition at constant pressure takes place at 6% of stroke. Find the air standard efficiency of the engine. Take γ for air as 1.4. (8)

(b) Briefly explain scavenging in two stroke cycle engines. (7)

OR

III. An oil engine takes in air at 1.01 bar, 20°C and the maximum cycle pressure is 69 bar. The compression ratio is 18. Calculate the air standard thermal efficiency based on dual combustion cycle. Assume that heat added at constant volume is equal to the heat added at constant pressure. (15)

IV. Explain with the help of sketches ignition system for a spark ignition engine. (15)

OR

V. Explain the knocking phenomenon in C.I. engines and compare it with that of S.I. engines. Discuss the effect of operating variables on delay period and diesel knock. (15)

(P.T.O.)

VI. (a) Determine the mass flow rate of steam through a nozzle having isentropic flow through it. Steam enters nozzle at 10 bar, 500°C and leaves at 6 bar. Cross-section areas at exit of nozzle is $20cm^2$. Velocity of steam entering nozzle may be considered negligible. Show the process on h-s diagram. (9)

(b) Explain the effect of back pressure in a convergent nozzle. (6)

OR

VII. (a) Describe the velocity diagram for single stage impulse turbine. (6)

(b) In a single stage simple impulse turbine the steam flows at the rate of 5kg/s. It has rotor of 1.2m diameter running at 3000 rpm. Nozzle angle is 18°, blade speed ratio is 0.4, velocity coefficient is 0.9, outlet angle of blade is 3° less than inlet angle. Determine the blade angles and power developed. (9)

VIII. A gas turbine unit has a pressure ratio of 10/1 and a maximum cycle temperature of 700°C. The isentropic efficiencies of the compressor and turbine are 0.82 and 0.85 respectively. Calculate the power output of an electric generator geared to the turbine when the air enters the compressor at 15°C at the rate of 15 kg/s. Take C_P = 1.005kJ/kg-K and $\gamma = 1.4$ for the compression process and take C_P =1.11kJ/kg.K and $\gamma = 1.333$ for the expansion process. Also determine the cycle efficiency and work ratio of the plant assuming that C_P for the combustion process is 1.11kJ/kg-K. (15)

OR

IX. (a) Describe the working of a roots blower with neat diagram. (8)

(b) Briefly explain the factors affecting the design of combustion chamber of a gas turbine. (7)

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