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B. TECH.

THEORY EXAMINATION (SEM–IV) 2016-17

APPLIED THERMODYNAMICS

Time : 3 Hours *Max. Marks : 100*

Note : Be precise in your answer. In case of numerical problem assume data wherever not provided.

SECTION – A

1. **Attempt all parts of the following questions: 10 x 2 = 20**

(a) Define adiabatic flame temperature.

(b) what do you mean by thrust augmentation.

(c) What are the sources of air leakage in condenser?

(d) How Equivalent evaporation is used for comparison of boilers?

(e) Explain about cogeneration.

(f) How regeneration in gas turbine increases thermal efficiency of the plant?

(g) Give the classification of condensers.

(h) What is saturation curve and missing quantity?

(i) Discuss type of compounding in turbines.

(j) What is ramjet?

SECTION – B

2. **Attempt any five of the following questions: 5 x 10 = 50**

(a) Describe gas turbine cycle with (i) intercooling, (ii) with reheat and regeneration, (iii) with reheat and intercooling

(b) What do you mean by choked flow? Explain and write effect of friction on nozzle.

(c) (i) Draw the Hypothetical and actual indicator diagram for steam engine, write about diagram factor.

(ii) Explain saturation curve and missing quantity.

(d) A steam power plant running on Rankine cycle has steam entering HP turbine at 20 MPa, 500^0C and leaving LP turbine at 90% dryness. Considering condenser pressure of 0.005 MPa and reheating occurring up to the temperature of 500^oC determine, (a) the pressure at which steam leaves HP turbine (b) the thermal efficiency

(e) With the help of a neat sketch explain Babcock & Wilcox Boiler.

(f) Boiler may have waste gases leaving the installation when artificial draught is used at 150^oC.The natural draught chimney is of 60 m height. The hot gases within chimney are at temperature of 300 ^{o}C and air requirement is 19 kg per kg of fuel burnt. The atmospheric air is at 17 ^{o}C temperature and mean specific heat of hot gases is 1.0032 kJ/kg ^{o} K. The calorific value of fuel burnt is 32604 kJ/kg. Determine

(i) The draught produced in mm of water

(ii) The efficiency of chimney

(iii) The extra heat carried away by flue gases per kg of fuel.

(g) One kg C8H18 fuel is supplied to an engine with 13 kg of air. Determine the percentage by Volume of CO2 in dry exhaust gas considering exhaust gas to consist of CO2, CO and N2.

(h) In a steam nozzle steam expands from 16 bar to 5 bar with initial temperature of 300^0C and mass flow of 1 kg/s. Determine the throat and exit areas considering

(i) expansion to be frictionless and,

(ii) friction loss of 10% throughout the nozzle

SECTION – C

Attempt any two of the following questions: **2 x 15 = 30**

3. Steam is the working fluid in an ideal Rankine cycle. Saturated vapor enters the turbine at 8.0 MPa and saturated liquid exits the condenser at a pressure of 0.008 MPa. The net power output of the cycle is 100 MW. Determine for the cycle (i) the thermal efficiency, (ii) the back work ratio, (iii) the mass flow rate of the steam, in kg/h

4. **(a)** Write principle of

(i) Jet Propulsion (ii) Turbojet Engine

(iii) Turboprop Engine (iv) Rocket Propulsion

(b) In a single stage simple impulse turbine the steam flows at rate of 5 kg/s. It has rotor of 1.2 m 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 blade angles and power developed.

5. In a single stage impulse turbine the isentropic enthalpy drop of 200 kJ/kg occurs in the nozzle having efficiency of 96% and nozzle angle of 15°. The blade velocity coefficient is 0.96 and ratio of blade speed to steam velocity is 0.5. The steam mass flow rate is 20 kg/s and velocity of steam entering is 50 m/s. Determine

(i) The blade angles at inlet and outlet if the steam enters blades smoothly and leaves axially.

(ii) The blade efficiency

(iii) The power developed in kW

(iv) The axial thrust.

Solve using velocity diagram.

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