www.FirstRanker.com || www.FirstRanker.com || www.FirstRanker.com || www.FirstRanker.com

Thermal Engineering-II (November/December-2012, Set-1) JNTU-Kakinada

Code No.: R31034/R10

Set-1

III B.Tech. I Semester Regular Examinations

November/December - 2012

THERMAL ENGINEERING-II

(Common to Mechanical Engineering and Automobile Engineering)

Time: 3 Hours | Max. Marks: 75

*Answer any **FIVE** Questions*

***All** Questions carry **equal** marks*

- - -

1. (a) What is regeneration? Draw the schematic and T-s diagram for an ideal regenerative cycle.

   (b) An adiabatic steam turbine receives dry saturated steam at 1.0 MN/m^2 and discharges at 0.1 MN/m^2. The steam flow rate is 3 kg/s and the moisture at exit is negligible. If the ambient temperature is 300 K. Find the rate of entropy production and power lost. **[7+8]**

2. (a) Why is there no chimney in the case of a locomotive boiler?

   (b) The following results were obtained from a boiler trail. Feed water temperature = 36°C. Steam pressure = 14.8 bar, with dry saturated steam. Duration of trail = 10 hrs. Total quantity of water utilized = 50,000 kg. Total coal burned = 6000 kg. C_V of coal = 30,000 kJ/kg. Total grate area = 3 m^2. Calculate,

      (i) Amount of coal burned per m^2 grate area per hour

      (ii) Boiler efficiency and

      (iii) Equivalent evaporation. **[5+10]**

3. Discuss the process of supersaturation in steam nozzles with the help of enthalpy-entropy diagram. Define degree of supersaturation and degree of undercooling. Explain in detail the physical significance of abrupt change in Wilson's line. **[15]**

4. (a) Write short notes on De-Laval turbine and about its features.

   (b) Steam leaves the nozzle of a single-stage impulse turbine at 840 m/s. The nozzle angle is 18° and the blade angles are 29° at the inlet and outlet. The friction coefficient is 0.9. Calculate,

      (i) Blade velocity

      (ii) Steam mass flow rate in kg/h to develop 300 kW power. **[7+8]**

5. A stage of steam turbine with Parson blading delivers dry, saturated steam at 2.7 bar from the fixed blades at 90 m/s. The mean blade height is 40 mm and the moving blade's exit angle is 20°. The axial velocity of steam is three quarter of the blade velocity at the mean radius. The steam is supplied to the stage at the rate of 9000 kg/h. The effect of the blade tip thickness on the annulus area can be neglected. Calculate the following,

   (i) Rotational speed of the wheel

   (ii) Diagram power

   (iii) Diagram efficiency

   (iv) Enthalpy drop of the steam at this stage. **[15]**

FirstRanker

www.FirstRanker.com || www.FirstRanker.com

6. (a) What are the principal requirements of a steam condensing plant in power generation unit? Explain.

(b) In a surface condenser the pressure of steam is 12 kPa and the cooling water flow rate is 40 kg/kg of steam condensed. The condensate leaves at 44°C and the rise in temperature of circulating water is 14°C. Determine the dryness fraction of steam entering into the condenser. **[5+10]**

---

7. (a) Differentiate between closed cycle and open cycle gas turbine plant.

(b) Define effectiveness of a regenerator. **[8+7]**

---

8. (a) State the fundamental differences between the jet propulsion and rocket propulsion.

(b) Explain the advantages and disadvantages of bipropellants used in rocket engines over monopropellants. **[7+8]**

FirstRanker

www.FirstRanker.com || www.FirstRanker.com || www.FirstRanker.com || www.FirstRanker.com

Thermal Engineering-II (November/December-2012, Set-2) JNTU-Kakinada

Code No.: R31034/R10

Set-2

III B.Tech. I Semester Regular Examinations

November/December - 2012

THERMAL ENGINEERING-II

(Common to Mechanical Engineering and Automobile Engineering)

Time: 3 Hours | Max. Marks: 75

*Answer any **FIVE** Questions*

***All** Questions carry **equal** marks*

- - -

1. (a) What is reheating? What the advantages of reheat Rankine cycle?

   (b) Superheated steam at 10 bar abs and 300°C admitted into the cylinder of a steam engine expands isentropically to a pressure of 0.7 bar. The pressure then falls at constant volume to a back pressure of 0.28 bar. Determine,

   (i) Modified Rankine cycle efficiency

   (ii) Steam consumption per kWhr

   (iii) Mean effective pressure

   (iv) Heat removed in the condenser per kg of steam

   (v) Loss of work due to incomplete expansion

   (vi) If the cylinder diameter and stokes are 30 cm and 58 cm respectively, what would be the new stroke if the steam is allowed to expand without any restriction upto the condenser pressure. **[5+10]**

---

2. (a) What do you understand by the term "boiler draught"? What are the various types of draughts used in usual practice?

   (b) A Lancashire boiler generates 2400 kg of dry steam per hour at a pressure of 11 bar. The grate area is 3 m^2 and 90 kg of coal is burnt per m^2 of grate area per hour. The calorific value of coal is 33180 kJ/kg and the temperature of feed water is 17.5°C. Determine,

   (i) Actual evaporation per kg of coal

   (ii) Equivalent evaporation from and at 100°C

   (iii) Efficiency of the boiler. **[6+9]**

---

3. For a nozzle, show the area on P-V diagram which represents the conversion of heat energy to kinetic energy. Prove that this area equals the heat drop during expansion. Assume isentropic flow in a nozzle. Further show the expansion for steam on T-s and h-s charts and for air on T-s chart. **[15]**

---

4. Steam issuing from a nozzle at 600 m/s enters the first set of blades of a two row wheel impulse turbine. The tips of both the set of moving blades are inclined at 30° to the plane of motion. Find the speed of the blades, so that the steam is finally discharged axially. Neglect friction. Also find the power developed by the turbine, if the mass of steam supplied to the turbine is 3 kg/s. **[15]**

---

5. (a) Derive an expression for optimum stage efficiency of a reaction turbine.

   (b) What is 50% reaction? What are the characteristics of 50% reaction? **[9+6]**

---

6. (a) How will you calculate the mass of steam circulated in a condenser?

   (b) A 210 MW multistage steam turbine is supplied with steam at 100 bar and 500°C. Vacuum in the condenser is 71 cm of Hg when barometer reads 76 cm of Hg. Assuming stage efficiency of 75% for each stage and reheat factor of 1.04, find the volume rate of cooling water required for the condenser. The rise in cooling water temperature is limited to 10°C and the condensate is undercooled by 2°C. **[7+8]**

FirstRanker

www.FirstRanker.com || www.FirstRanker.com

www.FirstRanker.com || www.FirstRanker.com || www.FirstRanker.com || www.FirstRanker.com

7. (a) Explain with a neat sketch the working of a constant volume combustion turbine.

(b) In an air-standard regenerative gas turbine cycle the pressure ration is 5. Air enters the compressor at 1 bar, 300 K and leaves at 490 K. The maximum temperature in the adiabatic cycle is 1000 K. Calculate the cycle efficiency, given that the efficiency of the regenerator and the adiabatic efficiency of the turbine are each 80%. Assume for air, the ratio of specific heats is 1.4. Also show on T-s diagram. **[7+8]**

---

8. (a) Define rocket propulsion. Differentiate rocket propulsion and jet propulsion.

(b) What is the importance of specific impulse in rocket performance? **[7+8]**

FirstRanker

www.FirstRanker.com || www.FirstRanker.com

www.FirstRanker.com || www.FirstRanker.com || www.FirstRanker.com || www.FirstRanker.com

Code No.: R31034/R10

Set-3

III B.Tech. I Semester Regular Examinations

November/December - 2012

THERMAL ENGINEERING-II

(Common to Mechanical Engineering and Automobile Engineering)

Time: 3 Hours | Max. Marks: 75

*Answer any **FIVE** Questions*

***All** Questions carry **equal** marks*

- - -

1. (a) What are the advantages of using superheated steam in a steam power plant? **(Unit-I, Topic No. 1.1)**

   (b) In a steam power plant operating on an ideal Rankine cycle, the steam enters the turbine at 3 MPa and 400° C and it is exhausted at 10 kPa. Determine,

   (i) Thermal efficiency

   (ii) Thermal efficiency, if the steam is superheated to 500°C at 3 MPa, before it enters the turbine

   (iii) Thermal efficiency, if steam enters in turbine at 10 MPa and 400 °C. **[5+10]**

2. (a) What are the functions of the following in a boiler,

   (i) Superheater

   (ii) Feed check valve

   (iii) Blow-off cock valve.

   (b) Derive an expression for maximum discharge rate of gases through the chimney for a given height of the chimney. **[8+7]**

3. (a) Write short notes about Wilson's line.

   (b) The dry saturated steam is expanded from 10 bar to 6 bar in a nozzle. If the expansion is supersaturated determine the degree of under cooling and degree of supersaturation. **[7+8]**

4. Explain the velocity compounded impulse steam turbine showing pressure and velocity variations along the axis of the turbine.

5. (a) Draw the combined velocity triangle of Parson's reaction turbine and explain the salient features.

   (b) In a single stage reaction turbine, both the fixed and moving blades have the same tip angles of 35° and 20° for inlet and outlet respectively. Determine the power required if the isentropic heat drop in both fixed and moving rows is 23.5 kJ/kg. The mean blade speed is 80 m/s and the steam consumption is 22,500 kg/hr.

6. In a surface condenser the vacuum reading is 721 mm of Hg. The barometric reading is 758 mm of Hg. The amount of air leakage in the condenser amounts to 6 kg/hr. The temperature at inlet to the air cooler section is 30°C and at the outlet is 26°C. Calculate,

   (i) Mass of steam condensed in the air cooler section

   (ii) Reduction in the air pump capacity following the cool air. **[15]**

FirstRanker

www.FirstRanker.com || www.FirstRanker.com

www.FirstRanker.com || www.FirstRanker.com || www.FirstRanker.com || www.FirstRanker.com

7. (a) Derive the thermal efficiency of Brayton cycle in terms of pressure ratio and polytropic index.

(b) A constant pressure open cycle gas turbine plant works between temperature range of 15°C and 700°C and pressure ratio of 6. Find the mass of air circulating in the installation, if it develops 1100 kW. Also find the heat supplied by the heating chamber. **[7+8]**

---

8. Explain using a neat sketch the principle of operation of turbo jet engine. **[15]**

FirstRanker

www.FirstRanker.com || www.FirstRanker.com

www.FirstRanker.com || www.FirstRanker.com || www.FirstRanker.com || www.FirstRanker.com

Thermal Engineering-II (November/December-2012, Set-4) JNTU-Kakinada

Code No.: R31034/R10

Set-4

III B.Tech. I Semester Regular Examinations

November/December - 2012

THERMAL ENGINEERING-II

(Common to Mechanical Engineering and Automobile Engineering)

Time: 3 Hours | Max. Marks: 75

*Answer any **FIVE** Questions*

***All** Questions carry **equal** marks*

- - -

1. (a) Draw the schematic for an ideal Rankine cycle. Draw p-v, T-s and h-s diagrams for this cycle.

   (b) In a reheat cycle steam enters the H.P turbine at 100 bar and 500° C. The expansion is continued to a pressure of 8.5 bar with isentropic efficiency of 80%. There is a pressure drop of 1.5 bar in the reheater and then steam enters the L.P turbine at 7 bar and 500° C in which expansion is continued to a back pressure of 0.04 bar with isentropic efficiency of 85%. Determine,

   (i) Thermal efficiency

   (ii) Specific steam consumption. **[5+10]**

2. Explain the working of Babcock and Wilcox boiler with the help of a neat sketch. **[15]**

3. What are the conditions which produce supersaturation of steam? How does the area of the throat of a turbine-nozzle for supersaturated flow compare with the area determined for normal flow? **[15]**

4. (a) Obtain an expression for work in terms of fluid velocities and blade velocities. Explain the meaning of each term.

   (b) The velocity of steam at inlet to simple impulse turbine is 1000 m/s and the nozzle angle is 20°. Mean blade speed is 400 m/s and the blades are symmetrical. The mass flow rate of steam is 0.75 kg/s. Calculate the blade angles, axial thrust and diagram efficiency. **[7+8]**

5. (a) Explain the functions of the blading of a reaction turbine.

   (b) In a Parson reaction turbine, the angles of receiving tips are 35° and of discharging tips, 20°. The blade speed is 100 m/s. Calculate the tangential force, power developed, diagram efficiency and axial thrust of the turbine, if its steam consumption is 1 kg/min. **[5+10]**

6. What are the components of a steam condensing plant? What are the functions of each component working in steam condensing plant? **[15]**

7. (a) What is the effect of pressure ratio during compression on the performance of gas turbine cycle?

   (b) The air enters the compressor of an open cycle constant pressure gas turbine at a pressure of 1 bar and temperature of 20° C. The pressure of the air after compression is 4 bar. The isentropic efficiencies of compressor and turbine are 80% and 85% respectively. The air-fuel ratio used is 90:1. If flow rate of air is 3 kg/s. Find,

   (i) Power developed

   (ii) Thermal efficiency of the cycle. **[6+9]**

8. (a) How a rocket propulsion system works and discuss about various types of rockets.

   (b) What are the propulsive devices used in aircrafts and missiles? **[9+6]**

FirstRanker

www.FirstRanker.com || www.FirstRanker.com