Code No: RR312405 **Set No.1**

III B.Tech. I Semester Regular Examinations, November -2006
THERMAL ENGINEERING-II
(Automobile Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What are the methods employed to increase the efficiency of Rankine cycle. [8]
   (b) Describe the construction and working principle of the Junkers gas calorimeter. [8]
2. (a) Explain 'Balanced Draught System' with the help of a neat sketch. [8]
   (b) Explain with the help of a neat sketch the working of a steam locomotive boiler. [8]
3. (a) Explain various types of nozzles and their distinguishing features. [8]
   (b) A steam nozzle supplied at 7 bar and 275^0C discharges steam at 1 bar. if the diverging portion of the nozzle 50mm long and the throat diameter is 5mm, determine the cone angle of the diverging portion. Assume 10% of the total available enthalpy drop to be lost in friction in the diverging part. Also determine the velocity and temperature of steam at the throat. [8]
4. (a) What are various methods of governing steam turbines? Explain any one of them giving its merits and demerits. [8]
   (b) The outlet angle of the blade of a Parsons turbine is 20^0 and the axial velocity of flow of steam is 0.5 times the mean blade velocity. If the diameter of the ring is 1.25m and the rotational speed is 3000rpm, determine the inlet angles of the blades. Determine also the power developed if dry saturated steam at 5 bar passes through the blades where height may be assumed as 6 cm. Neglect the effect of the blade thickness. [8]
5. (a) Discuss the methods of compounding steam turbines giving merits and demerits of each method. [10]
   (b) What do you mean by governing of a steam turbine? Explain any one method of governing. [6]
6. (a) Discuss the functions of incorporating a condenser in engine plant. [4]
   (b) Explain the need for separate pumps for extraction of air and water. [4]
   (c) With the help of neat sketch explain the working of barometric jet condenser. [8]
7. (a) Explain with the help of a neat sketch closed cycle gas turbine plant. [8]

(b) A gas turbine plant works between the fixed adiabatic temperature limits 3000^0K and 900^0 K., the absolute pressure limits being 1 bar and 4 bar. The isentropic efficiency of the blower is 0.8 and that of the turbine is 0.85. Estimate the actual thermal efficiency of the plant and the power available for driving external load, if the fuel consumption is 1 bar/s. Calorific value is 40,000 KJ/Kg. [8]

8. (a) What are different methods of thrust augmentation? Discuss. [6]

(b) Draw a typical layout of a solid propellant rocket and explain its working. Give its applications. [10]

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Code No: RR312405 **Set No.2**

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. (a) What do you mean by reheating of steam? [2]
   (b) Sketch the Rankine cycle on p-v and T-s diagram and state in what respects it differs from the carnot cycle working between the same tempertures limits. [6]
   (c) Describe the construction and working principle of the Bomb Calorimeter. [8]
2. (a) What is the function of chimney in natural draught and artificial draught system? [2]
   (b) Explain with the help of a neat sketch a feed check valve for a steam boiler. [6]
   (c) Explain the Cochran Boiler, with the help of an neat sketch. What are its special features. [8]
3. (a) Derive an expression giving relationship between change of cross section area of flow with pressure and velocity for a convergent- divergent nozzle. [8]
   (b) Dry and saturated steam enters a nozzle at 10 bar with a velocity of 100m/s. If the back pressure is 6 bar and exit velocity 1100 m/s, determine the dryness fraction of steam at the exit. it may be assumed that heat loss due to radiation from the nozzle is 1.5KJ/Kg of steam flow. [8]
4. (a) Explain the difference between impulse turbine and reaction turbine. [4]
   (b) Discuss the methods of compounding steam turbines giving merits and demerits of each method. [6]
   (c) In a reaction turbine the fixed and moving blades are of same shape but reversed in direction. The angles of the receiving tips are 35^0 and of the discharging tips 20^0. Find the power developed in KW per pair of blades for a steam consumption of 2Kg/S, when the blade speed is 52m/s. If the enthalpy drop in the pair is 10kJ/kg, find the efficiency of the pair. [6]
5. Explain degree of reaction. Explain the working of single stage reaction turbine. Also explain pressure and velocity variations along the axis of the turbine. [16]
6. (a) Discuss the merits and demerits of surface condenser and jet condenser. Which type is recommended for large plants and why? [10]
   (b) The temperature in a surface condenser is 39^0C and the Vacuum is 70cm of Hg, while barometer standing at 76cm of Hg. Determine the partial pressure of steam and air and the quantity of air present per kg of steam. [6]

7. (a) Discuss the methods of improving the work ratio, specific output and cycle thermal efficiency by employing multistage system gas turbine with intercooling and reheating. [10]

   (b) A gas turbine plant works between the temperature limits of 1152^0K and 288^0K, isentropic efficiency for compressor and turbine are 0.85 and 0.80 respectively. Determine the optimum ratio for maximum work output and also for maximum cycle thermal efficiency. [6]

8. (a) What is the basic difference between jet propulsion and rocket propulsion? Can rocket work in vacuum? [6]

   (b) Explain the principle of operation of 'Turboprop Engine' with the help of a schemetic diagram and T-s diagram. [10]

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1. (a) In a Rankine cycle steam is supplied at 15 bar and exhausts at a pressure of 0.2 bar. Find the heat supplied, pump work and turbine work per kg of steam. Calculate also the cycle efficiency. [8]
   (b) Discuss the method for finding the volumetric analysis of flue gases. [8]
2. (a) Explain with the help of neat sketch, stirling steam generator. Enumerate its advantages and disadvantages of using bent tubes over straight tubes. [10]
   (b) What is the function of a water level indicator? Explain with the help of a line diagram. [6]
3. (a) Explain the effect of friction on the performance of a steam nozzle. Explain the same on temperature-Entropy and Enthalpy-Entropy diagram. [8]
   (b) Steam expands from 40 bar and specific volume of 0.0749 m^3/kg to a pressure of 20 bar in a nozzle. Steam remains superheated throughout. Determine the exit area of cross section. [8]
4. (a) Derive the expressions for maximum blade efficiency in a single stage impulse turbine. [8]
   (b) One stage of an impulse turbine consists of a converging nozzle and one ring of moving blades. The nozzles are inclined at 22^0 to the blades whose tip angles are both 35^0.
      i. If the velocity of the steam at exit from the nozzle is 660m/s, find the blade speed so that the steam shall pass on without shock, and find the diagram efficiency, neglecting losses, if the blades run at this speed.
      ii. If the relative velocity of steam to the blade is reduced by 15% in passing through the blade ring, find the efficiency and the end thrust on the shaft when blade ring develops 2000kW. [8]
5. (a) Explain Reheat factor. Why its magnitude is always greater than unity? [4]
   (b) In a Parson's reaction turbine, the fixed and the moving blades are of same shape. The moving blade angles at entry and exit are 35^0 and 20^0 respectively. Determine the power developed for a steam flow rate of 1.5kg/s and the blade speed of 75m/s. Determine also the stage efficiency, if enthalpy drops over the stage is 5 kJ/kg. [12]
6. (a) Explain the working of barometric jet condenser with the help of a neat sketch. [8]

(b) A surface condenser gets 40kg/min of steam. At 35^0C and 85% dry. The rise in temperature of the cooling water to the condenser is observed to be 11^0C. Determine the quantity of cooling water in Kg/min. [8]

7. (a) Discuss with the help of graphs, the variation of cycle thermal efficiency with pressure ratio at various maximum cycle temperature for gas turbine plant. [6]

(b) In a gas turbine plant, the air enters the compressor at 1 bar and leaves at 4 bar and 500^0 K. Calorific value of the fuel is 44000kJ/kg is burnt in the combustion chamber. 50Kg of air being supplied for 1Kg of fuel. The material of the turbine blades allows for gases, at a maximum temperature of 1000^0K. Determine the area of the nozzles at throat and exit for a mass flow rate of 8Kg/s. [10]

8. (a) Explain with the help of a schematic diagram the working of the turbojet engine. [10]

(b) Discuss the relative merits of gas-pressurization rocket power plant and the pump pressurization system. [6]

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Code No: RR312405 **Set No.4**

III B.Tech. I Semester Regular Examinations, November -2006
THERMAL ENGINEERING-II
(Automobile Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. (a) Derive an expression for thermal efficiency of a Rankine cycle. [8]
   (b) What do you mean by stiochiometric equation. [2]
   (c) What do you mean by Calorific value of fuel: lower and higher calorific value of fuel. [6]

2. (a) What is the function of a fusible plug? Explain its working with the help of a diagram. [10]
   (b) With the help of neat sketch, explain Lancashire Boiler. What are its special features? [6]

3. (a) Derive an expression for maximum mass flow per unit area of flow through a convergent divergent nozzle when steam expands isentropically from rest. [10]
   (b) Steam expands through a nozzle adiabatically and reversibly from 8 bar and 220^0C to a final pressure of 3 bar. Determine the final conditions of steam and the exit velocity. [6]

4. (a) Explain with the help of neat sketch a single stage impulse turbine. Also explain the pressure and velocity along the axial direction. [8]
   (b) Derive an expression for force, work done, diagram efficiency, stage efficiency of an impulse turbine. [8]

5. (a) Explain the working of single stage reaction turbine. Explain the variation of pressure and velocity along with the axis of turbine. [8]
   (b) Absolute velocity of steam from the nozzles of a DeLaval turbine is 1100m/s at an angle of 20^0 to the tangent to the wheel. Blade speed ratio is 0.45. if the entry and exit angle of the blades are equal and the steam flow rate is 1800 kg/hr, Calculate
      i. The blade angles
      ii. Tangential force on the rotor
      iii. Power developed
      iv. axial thrust on each bearing. Assume no friction. [8]

6. (a) What are the sources of air leakage into the condenser. How its pressure is detrimental. [6]
   (b) With the help of neat sketch, explain the working of low level jet condenser. [10]

7. (a) Explain with a neat sketch the working of open cycle gas turbine plant. [6]
   (b) Derive an equation for the optimum pressure ratio for the maximum specific output for a gas turbine plant. [10]

8. (a) Discuss the relative applications of the solid and liquid propellant rocket engines. [6]
   (b) Explain with the help of a schematic diagram the working of 'Ramjet Engines'. [10]

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