Code No: 07A42202 **R07** **Set No. 2**

II B.Tech II Semester Examinations,December 2010
PRIME MOVERS AND MECHANICAL COMPONENTS
Instrumentation And Control Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. Compare steam and gas power plants. Why the 'steam power plants' are more popular than 'gas power plants'? Explain the reasons. [16]

2. (a) How are the turbines classified based on the specific speed?
   (b) What is non-dimensional specific speed? What are its advantages over the conventional specific speed?
   (c) A 1/10 scale model of a turbine is tested under a head of 16m.The proto type turbine is required to work under a head of 25m while running at 100 rpm. The model turbine develops a power of 150kW and the corresponding discharge required is $1.2m^3/s$. What should be the speed of the model turbine? [3+5+8]

3. (a) Describe the working principle of a rotary actuator. What are the different types rotational elements of used in 'hydraulic rotary actuators'
   (b) What are the advantages of rotary actuators? [10+6]

4. (a) Distinguish between structure and machine.
   (b) Explain with neat sketches different types of constrain motions. [8+8]

5. (a) What are the applications of a closed cycle gas turbine plant? Explain briefly
   (b) A gas turbine unit has a pressure ratio of 6:1 and a maximum cycle temperature of 623^0C. The isentropic efficiencies of the compressor and turbine are 80 per cent and 82 per cent respectively. Calculate the power output of a turbine, when the air enters the compressor at 15^0C, at the rate of 16 kg/s. [6+10]

6. (a) What is a steam generator? On what factors does the choice of steam conditions depend?
   (b) Explain industrial applications of steam generators and the type of boilers used. [8+8]

7. (a) Does steam condenser an integral part of a boiler-explain.
   (b) What are various accessories used in Benson boiler-describe them in brief. [8+8]

8. (a) Give reasons for the low efficiency of centrifugal pumps compared to turbines.

(b) A single acting reciprocating pump has plunger of 7.5cm diameter and a stroke of 12cm. It draws water from a sump 3m below the pump through a suction pipe 3.5cm diameter and 5m long. It delivers water to a tank 12m above the pump through a delivery pipe 2.5cm diameter and 15m long. If separation occurs at a pressure of 76.5kN/m^2 below atmospheric pressure, find the maximum speed at which the pump may be operated without separation. Assume that the plunger moves with a simple harmonic motion. [8+8]

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Code No: 07A42202 **R07** **Set No. 4**

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PRIME MOVERS AND MECHANICAL COMPONENTS
Instrumentation And Control Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What is meant by steam quality and explain the importance of super heated steam?
   (b) What are supercharged boilers describe its important features? [8+8]
2. (a) Describe the basic processes of an ideal Joule cycle? Draw 'p-v' and 'T-s' diagrams.
   (b) An air-standard Brayton's cycle operates with a pressure of 7. Air enters the compressor at 95 kPa and 290 K and leaves the combustion chamber at 1100 K. The compressor and the turbine efficiencies are 80% and 85% respectively. Determine the compressor work input, the turbine work output, and the thermal efficiency of the cycle. Assume the constant specific heats for air: Cp = 1.005 kJ/kg-K and Cv = 0.718 kJ/kg-K. [6+10]
3. (a) What is meant by specific speed of turbine? Derive an expression for specific speed of a turbine.
   (b) Find the type of turbine and the diameter from the following data:
   Speed, N=30rpm, discharge, Q=25m^3/s, head, H=1.8m, Power, P=350kW. [8+8]
4. (a) Discuss the pressure variation due to acceleration of piston in reciprocating pump.
   (b) A single acting reciprocating pump has a cylinder 200mm in diameter and stroke of 400mm.The delivery pipe is 75mm in diameter and 40m long. If a large air vessel is fitted on the delivery pipe at a distance of 2m from the pump cylinder, determine the power saved when the pump is running at 60rpm. Assume coefficient of friction as 0.02. [8+8]
5. (a) Compare the 'single-vane' and 'double-vane' rotary actuators.
   (b) What are the applications of rotary actuators? [10+6]
6. (a) What is a steam separator? Explain the working of any one type of steam separator.
   (b) Differentiate between the working of steam separator and superheater. [8+8]
7. List various five adjustment and clamping mechanisms. Explain with neat sketch the working of
   (a) The differential screw and

(b) toggle press. [16]

8. (a) With the help of 'p-v' diagram, explain Carnot cycle of an vapour power plant.

(b) A Steam turbine plant operates on the Rankine cycle. Steam is delivered from the boiler to the turbine at a pressure of 3.5 MN/m^2 and with a temperature of 350 ^0C. Steam from the turbine exhausts into a condenser at a pressure of 10 kN/m^2. Neglecting the losses, determine

i. the energy supplied to the boiler per kg of steam generated,

ii. The dryness fraction of the steam entering the condenser, and

iii. the Rankine cycle efficiency. [6+10]

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Code No: 07A42202 **R07** **Set No. 1**

II B.Tech II Semester Examinations,December 2010
PRIME MOVERS AND MECHANICAL COMPONENTS
Instrumentation And Control Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. Draw the neat sketches of a cylindrical, spherical and flat pair, and mention the 'degree-of freedom' of each pair. [16]

2. (a) Make a note on characteristics curves of hydraulic turbines under constant head.
   (b) A turbine is operate under a head of 25m at 200rpm.The discharge is $9m^3/s$. If the efficiency is 90%. Determine the performance of the turbine under a head of 20m. [8+8]

3. (a) Write a short notes on the classification of gas turbines.
   (b) Draw 'pressure-specific volume', 'pressure-temperature' and 'temperature-entropy' diagrams for a gas turbine engine cycle. Mark all the events in the diagrams. [6+10]

4. (a) The centrifugal pump should be installed above the water level in the sump. Justify the statement
   (b) Describe the working of a single acting reciprocating pump without a air vessel with a neat discharge diagram. [8+8]

5. (a) Explain the Reaction staging and draw the variation of pressure, velocity and specific volume across 'two' stages?
   (b) In an ideal Rankine cycle, the steam at inlet to turbine is saturated at a pressure of 30 bar and the pressure at turbine exit is 0.25 bar. Determine
      i. the pump work,
      ii. output power of the turbine, and
      iii. the cycle efficiency. [8+8]

6. (a) What are the essential features of supercharged boilers? Differentiate between unsupercharged and supercharged boilers.
   (b) Describe the importance of steam drum of high pressure boiler, with an example. [8+8]

7. (a) Draw a neat sketch of a hydraulic control-vlave assembly and describe the working pinciple.
   (b) What are the advantages ball check valves? [10+6]

8. (a) Explain the reason for inefficiency in surface condensers.

(b) Explain the effects of air leakage in a condenser. [8+8]

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Code No: 07A42202 **R07** **Set No. 3**

II B.Tech II Semester Examinations,December 2010
PRIME MOVERS AND MECHANICAL COMPONENTS
Instrumentation And Control Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) How reciprocating pumps are classified? Explain them in brief.
   (b) A centrifugal pump rotates at 1000rpm and delivers 300liters/sec of water. The impeller has diameter of 35cm and a width of 5cm at the periphery. The blades tip angles are inclined backward 60% from the radius (the blade angle=30^o). Determine the velocity and direction of water as it leaves the impeller. [8+8]

2. (a) Draw a neat sketch of Cochran boiler and describe its working.
   (b) Differentiate between Cochran boiler and Cornish boiler. [8+8]

3. (a) Why the isentropic turbine expansion is preferred for an ideal Brayton cycle? Explain.
   (b) A gas turbine operates between pressure limits of 1 bar and 5 bar. The inlet air temperature to the compressor is 15 ^{0}C and the air entering the turbine is at a temperature of 537 ^{0}C. If the volume rate of air entering the compressor is 1400 m^3/min, compute net the power output and efficiency of the cycle. Assume that the cycle operates under ideal conditions. [6+10]

4. (a) What is a check valve? What are the applications of check valves?
   (b) Draw the sketch of a ball check valve and describe working principle. [8+8]

5. (a) How the mountings of Simple vertical boilers different from high pressure boiler types? Explain
   (b) What precautions are to be taken in maintaining safety valves of boilers? [8+8]

6. Explain an intermittent motion mechanism and explain its practical applications. [16]

7. (a) What is cavitation? Explain Thoma's cavitation index.
   (b) The following data relates to a reaction turbine. Guide vane angle=22^o Wheel vane angle at inlet=94^o, Diameter of wheel at inlet=3.2m. Diameter of wheel at outlet =2.28m. Axial depth of the wheel at inlet=0.5m, speed=170rpm. Assuming maximum efficiency, calculate
      i. discharge
      ii. power developed and
      iii. Wheel vane angle at outlet. [8+8]

8. (a) Compare the 'Impulse' and 'Impulse-Reaction' turbines, with respect to its construction and working principle.

   (b) Steam enters a turbine at 10 MPa and leaves at 20 kPa. If the quality of the steam has to be 90 per cent, what should be the temperature at the turbine inlet for an adiabatic turbine efficiency of 100 per cent? [8+8]

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