Code No:**R31034** **R10** **Set No. 1**

III B.Tech I Semester Supplementary Examinations, May/June - 2015

THERMAL ENGINEERING-II

(Com. to ME and AME)

Time: 3 hours **Max. Marks:75**

Answer any FIVE Questions

All Questions carry equal marks

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1 a) Discuss the effect of the variables given below on the efficiency and power output of a Rankine cycle; (i) inlet pressure and temperature (ii) condenser pressure. [8]

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 300K find the rate of entropy production and power lost. [7]

2 a) Explain the construction and working of a simple vertical boiler with a neat sketch. [8]

b) A boiler evaporates 8 kg of water per kg of coal into dry saturated steam at 10 bar pressure. The feed water temperature is 46^0C. Find the equivalent evaporation from and at 100^0C. Also calculate the factor of evaporation. [7]

3 a) What is the function of a nozzle? Explain about various types of nozzles. [7]

b) Derive an expression for velocity of flow through a nozzle. [8]

4 What do you mean by compounding of steam turbines? Discuss various methods of compounding steam turbines. [15]

5 a) What are the important considerations for selection of blade material for a steam turbine? [7]

b) Derive the equation for maximum efficiency of reaction turbine. [8]

6 a) The following data relate to a two-pass surface condenser: [15]
Steam condensed = 1540 kg/h
Temperature of cooling water when it enters the condenser = 15 ºC
Temperature of cooling water when it leaves the condenser = 30 ºC
Vacuum in the condenser = 675 mm of Hg
Barometer reading = 750 mm of Hg
Temperature of the condensate = 32 ºC
Quality of exhaust steam = 0.92
Water velocity in the tubes = 2.6 m/s
Outside diameter of tubes = 2.8 cm
Thickness of tubes = 0.03 cm
Heat transfer coefficient = 3.35 kJ/h/cm^2/ ºC
Determine (i) area of the tube surface required (ii) no. of tubes
(iii) length of tubes

7 a) What are the deviations in actual gas turbine cycle as compared with air standard cycle? [8]

b) Define isentropic efficiency of a compressor and turbine. [7]

8 a) Explain using a neat sketch, the principle of operation of pulse jet engine. [8]

b) What are the propulsive devices in aircrafts and missiles? [7]

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Code No:**R31034** **R10** **Set No. 2**

III B.Tech I Semester Supplementary Examinations, May/June - 2015

THERMAL ENGINEERING-II

(Com. to ME and AME)

Time: 3 hours **Max. Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

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1 a) A simple Rankine cycle works between pressure of 30 bar and 0.04 bar, the initial condition of steam being dry saturated, calculate the cycle efficiency, work ratio and specific steam consumption. [8]

b) What are the methods which can lead to increase in thermal efficiency of Rankine cycle? [7]

2 a) Sketch and describe a Cochran boiler? What are its special features? [8]

b) What are the essential features of a good boiler? [7]

3 A convergent-divergent nozzle receives steam at 8 bar and temperature 200ºC and expands it to 2.9 bar. Neglecting inlet velocity. Calculate the exit area for a discharge of 0.125 kg/s. Assume supersaturated flow with $pv^{1.3}$=C. Also find the degree of undercooling, degree of supersaturation, loss of heat due to irreversibility, increase in entropy and ratio of mass flow rate with supersturation expansion to that if expansion in thermal equilibrium. [15]

4 a) Write short notes on De-Lavel Turbine and about its features. [8]

b) What is the disadvantage of having very small exit angles for nozzles and moving blades of an impulse turbine? [7]

5 Draw the velocity triangle for a 50% reaction turbine and derive the expression for work done and blade efficiency. [15]

6 a) Compare various features of jet and surface condensers. [7]

b) How will you calculate the mass of steam circulated in a condenser? [8]

7 a) Enumerate various uses of gas turbines. [7]

b) Explain the working of reheat gas turbine plant with the help of a T-*S* diagram. [8]

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

b) Define specific fuel consumption as applicable to jet engines. [7]

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Code No:**R31034** **R10** **Set No. 3**

III B.Tech I Semester Supplementary Examinations, May/June - 2015

THERMAL ENGINEERING-II

(Com. to ME and AME)

Time: 3 hours **Max. Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks
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1 a) Why Rankine cycle is preferred for larger power generation? [7]
b) A steam turbine is supplied with dry saturated steam at 25 bar. The exhaust takes place at 0.2 bar. For a flow rate of 8 kg/s, calculate the (i) power required to drive the pump (ii) turbine power (iii) Rankine efficiency and quality of steam at the end of expansion. [8]

2 Derive an expression for maximum discharge rate of gases through the chimney for a given height of the chimney. [15]

3 a) Define the term steam nozzle. Explain various types of steam nozzles. [7]
b) Explain the principle involved in calculation of the velocity with which fluid issues from a nozzle assuming frictionless adiabatic flow. [8]

4 The nozzles of a de-lavel turbine delivers 1.5 kg/s of steam at a speed of 800 m/s to a ring of moving blades having a speed of 200 m/s. The exit angle of the nozzle is 18º. If the blade velocity coefficient is 0.75 and the exit angle of the moving blades is 25º, calculate (i) inlet angle of moving and fixed blades (ii) diagram efficiency (iii) energy lost in blades per second (iv) power developed (v) axial thrust on the turbine rotor. [15]

5 a) Reaction turbine stages are preferred to impulse stages even though the reaction turbine occupies more space and run slower. Comment on the statement. [8]
b) What are the conditions for maximum efficiency of a reaction turbine? [7]

6 Explain briefly the following types of jet condensers: (i) parallel-flow type (ii) counter-flow type (iii) ejector flow type. [15]

7 a) Explain with a neat sketch the working of a constant volume combustion Gas turbine. [8]
b) Differentiate between closed cycle and open cycle gas turbine plant. [7]

8 What is meant by thrust augmentation? When it is necessary? Describe the two main methods of thrust augmentation. [15]

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Code No:**R31034** **R10** **Set No. 4**

III B.Tech I Semester Supplementary Examinations, May/June - 2015

THERMAL ENGINEERING-II

(Com. to ME and AME)

Time: 3 hours **Max. Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

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1 a) Sketch the reheat cycle on Mollier chart. [7]

b) Define the terms: (**i**) ideal efficiency (**ii**) isentropic efficiency (**iii**) overall efficiency (**iv**) work ratio (**v**) specific fuel consumption. [8]

2 a) What do you understand by the term "boiler draught"? What are the various types of draughts used in usual practice? [7]

b) How much air is used/kg of coal burnt in a boiler having chimney of 35 m height to create a draught of 20 mm of water, when the temperature of flue gas in the chimney is 370ºC and the boiler house temperature is 34ºC. Does this chimney satisfy the condition of maximum discharge? [8]

3 a) Discuss the various irreversibilities on nozzle efficiency with the help of a T-S diagram. [8]

b) The dry saturated steam at a pressure of 5 bar is expanded is entropically in a nozzle to a pressure of 0.2 bar. Find the velocity of steam leaving the nozzle. [7]

4 a) In an impulse turbine, the steam issues from the nozzle with a speed of 600 m/s and blade speed is 120 m/s. The velocity is compounded by passing the steam through a ring of moving blades, through a ring of fixed blades and finally through a ring of moving blades. The nozzle angle is 18º and the blade exit angles and relative velocity coefficients are the following: [15]

Blades	Exit angle	Velocity coefficient
First row moving blades	20º	0.8
Fixed-row blades	25º	0.85
Second-row moving blades	30º	0.9

Find the diagram efficiency under these conditions and power output for steam flow rate of 5 kg/s. What would be the maximum possible diagram efficiency for given steam inlet velocity and nozzle angle?

5 a) Give a comparison between impulse turbine and reaction turbine. [10]

b) Write short notes on degree of reaction. [5]

6 a) Describe with neat sketches a modern steam condenser showing how the air is cooled before it enters the air extraction pump. [15]

7 Sketch the diagram of a regenerative gas turbine plant and deduce an expression for its thermal efficiency. [15]

8 a) Define rocket propulsion. Differentiate rocket propulsion and jet propulsion. [8]

b) In which speed range turboprop engine is more suitable than turbojet engine? Why? [7]

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