Code No: RT31035 **R13** SET - 1

III B. Tech I Semester Supplementary Examinations, May -2016
THERMAL ENGINEERING – II
(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**
(Use of steam tables and Mollier chart is allowed)
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PART –A

1	a)	Explain the concept of Mean temperature of heat addition.	[4M]
	b)	Define Stoichiometric quantity of air.	[3M]
	c)	What is the need of compounding steam turbine and list out different methods of compounding?	[4M]
	d)	Draw velocity triangle for 50% reaction steam turbine.	[4M]
	e)	Draw the T-s diagram of a reheat gas turbine cycle.	[3M]
	f)	Define propulsive efficiency and thermal efficiency of jet propulsion system.	[4M]

PART -B

2	a)	The steam is supplied to a steam turbine at a pressure of 32 bar and a temperature 410°C. The steam then expands isentropically to a pressure of 0.08bar. Find the dryness fraction of steam at the end of expansion and thermal efficiency of the cycle. If the steam is reheated at 5.5 bar to a temperature of 395° C and then expands isentropically to 0.08 bar, what will be the dryness fraction at the end of final expansion and the thermal efficiency of the cycle?	[10M]
	b)	Why is the actual temperature of real gas combustion process much less than the adiabatic flame temperature.	[6M]
3	a)	With the help of a neat diagram explain the working principle and construction of any water tube boiler.	[8M]
	b)	Calculate the height of chimney required to produce a draught equivalent to 1.7cm of water if the flue gas temperature is 270°C and ambient temperature is 22°C and minimum amount of air per kg of fuel is 17kg.	[8M]
4	a)	Steam enters an impulse wheel having a nozzle angle 20^0 at a velocity of 450 m/sec. The exit angle of moving blade is 20^0 and the relative velocity of steam may be assumed to remain constant over the moving blades. If the blade speed is 180m/sec; Calculate i) Blade angle at inlet, ii) Work done per kg of steam, iii) Power developed if rate of steam flow is 1.6 kg/sec.	[10M]
	b)	Explain the phenomenon of meta stable flow of steam through a nozzle. What is the significance of Wilson's line in it?	[6M]

5 a) Deduce an expression for work done per stage of a reaction turbine [8M]

b) Following particulars refer to a compound turbine: Inlet pressure and temperature to the first stage are: 20 bar and 250^0C, pressure at entrance to next stage is 1.5 bar and exhaust pressure is 0.05 bar. Stage efficiency is 0.77. Determine i) Internal heat drop, ii) If external losses are 4% of total isentropic heat drop, calculate overall efficiency ratio, iii) Reheat factor. [8M]

6 a) With the help of a neat diagram explain the working of a regenerative cycle gas turbine also compare the performance with simple cycle. [8M]

b) Derive an equation for thermal efficiency of a simple gas turbine cycle in terms of pressure ratio and specific heat ratio. [8M]

7 a) State the fundamental difference between the jet propulsion and rocket propulsion [6M]

b) A jet plane having 2 jets works on turbo-jet system. It flies at a speed of 800km/hr at an altitude where density of air is 0.15 kg/m^3. The propulsive efficiency is 55%. The drag on the plane is 6500N. Calculate i) Absolute velocity of jet ii) quantity of compressed air and iii) diameter of jet. [10M]

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