(3 Hours) **[Total Marks: 80**

N. B. : (1) Question No. **1** is **compulsory**.
(2) Solve any **three** out of the remaining **five** questions.
(3) Assume suitable data if required and state it clearly.
(4) Use of Steam Table and Mollier diagram is permitted

1		Attempt any **four** out of the following	20
	(a)	What is the difference between a closed and an open system	
	(b)	Define isothermal. efficiency in case of reciprocating air compressor and state the methods used to improve isothermal efficiency?	
	(c)	Define: Kelvin Planck and Clausius Statements.	
	(d)	Draw a simple schematic diagram of a thermal power plant with one reheater. Also represent this on T-S diagram	
	(e)	Write the applications of the compressed air.	
2	(a)	1 kg of nitrogen undergoes the following sequence of quasi-static processes in a piston cylinder arrangement: (i) An adiabatic expansion from 5 bar and 150˚C in which volume is doubled. (ii) A constant pressure process in which volume is reduced to its initial value. (iii) A constant volume process back to its initial state. Calculate the work done and heat transferred during each process	12
	(b)	Derive the first and second Tds equations.	8
3	(a)	Write down general steady flow energy equation. Derive it for 1) steam turbine 2) steam nozzle	10
	(b)	What are Maxwell relations and why they are important in thermodynamics?	10
4	(a)	Show that entropy is a property of the system	10
	(b)	Three reversible engines of Carnot type are operating in series as shown between the limiting temperatures of 1100 K and 300 K. Determine the intermediate temperatures if the work output from engines is in proportion of 3 : 2 : 1.	10
5	(a)	In an air standard Diesel engine cycle with a compression ratio of 14, the condition of air at the start of the compression stroke are 1 bar and 300 K. After addition of the heat at constant pressure the temperature rises to 2775 K. Determine the thermal efficiency of the cycle, net work done per kg of air and the mean effective pressure.	10
	(b)	Derive an equation of air standard efficiency of otto cycle	10
6	(a)	In a Rankine cycle the stream at the inlet to the turbine is at 100 bar and 500^0C. If the exhaust pressure is 0.5 bar, determine the pump work, turbine work, condenser heat flow and Rankine efficiency.	10
	(b)	What is meant by complete and perfect intercooling in case of multistage air compressor? What is the effect of multi staging over the volumetric efficiency of reciprocating air compressor?	10

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