M.Tech(with Credits)-Regular-Semester 2012-Heat Power Engineering Sem II MT-1018 - Thermal Engineering - II

P. Pages : 3 Time : Three Hours			rs	GUG/W/16/3966 Max. Marks : 70	
	Notes	5: 1. 2. 3. 4. 5.	All questions carry equal marks. Due credit will be given to neatness and adequate dimensions. Assume suitable data wherever necessary. Use of slide rule, Logarithmic tables, Steam tables, Mollier's chart instruments, Thermodynamic tables for moist air, Psychrometric of Refrigeration charts is permitted. Answer any five questions.	t, Drawing charts and	
1.	a)	Describe with a neat sketch the working of a simple constant pressure open cycle gas turbine. How does actual cycle differ from the theoretical cycle.			
	b)	The pressure ratio of an open cycle constant pressure Gas turbine plant is 06. The temperature range of the plant is 15°C and 800°C. Using the following data: $c_{p_a} = 1 \text{ kJ/kgk}$, $c_{p_g} = 1.075 \text{ kJ/kgk} \& \gamma = 1.4$ for air & gas. c.v. of fuel = 43000 kJ/kg;			
		$\eta_c = 0.85$; $\eta_1 = 0.8$ and $\eta_{comb} = 0.95$ Find			
		i)]	The thermal efficiency of the plant.		
		ii) I	P. of the plant if the circulation of air is 5kg/sec.		
		iii) A	A.F. ratio and		
		iv) S	pecific fuel consumption		
2.	a)	Explain optimum pressure ratio for maximum cycle thermal efficiency for constant pressure closed cycle Gas turbine.		constant pressure 5	
	b)	The for Isentry Isentry Mech Comb Heat I Pressu Maxin Ambi Lowe Take	bllowing data apply to a gas turbine set using Heat exchanges opic efficiency of compressor = 0.83 opic efficiency of turbine = 0.85 anical transmission efficiency = 0.99 ustion efficiency = 0.98 Exchanger effectiveness = 0.80 ure ratio = 4.0 num cycle temperature = 1100 k ent conditions = 1 bar and 288k theating value of fuel = 43100 kJ/kg $c_{p_a} = 1.005 kJ/kgk$; $\gamma = 1.4$ during compression $c_{p_a} = 1.147 kJ/kgk$; $\gamma = 1.3$ during combustion & expansion late the specific work output; specific fuel consumption and cycle effectives	9 ficiency Neglect	

- **3.** a) Why the method of obtaining friction power by computing the difference between indicated **7** power and brake power is mostly used in Research Laboratories.
 - b) The following data were recorded during a trial on a single cylinder 2-stroke diesel engine. 7 Power supplied by electric motor for motion at a rated speed = 1.5kw; Rated speed = 500rpm; Net load on brake = 225N; Diameter of brake wheel = 100cm; Rate of cooling water through engine jacket = 13.65 kg/min; Rise in temperature of cooling water = 10°C; fuel consumption = 2 kg/hr; c.v. of fuel = 43000 kJ/kg; Air fuel ratio = 32:1 $c_{p_g} = 1.0 \text{ kJ/kg k}$; Exhaust gas temperature = 345°C; Ambient temperature = 25°C & Ambient pressure = 1 bar. Take L = D = 30 mm Determine :
 - i) Mechanical efficiency ii) Thermal efficiency
 - iii) Brake specific fuel consumption iv) Brake mean effective pressure

Draw a Heat balance sheet on percentage basis.

4. a) With the help of neat figure; Explain in detail the Exhaust Gas Calorimeter.
b) The following data were obtained from a test on a single cylinder 4-stroke oil engine.
cylinder bore = 15cm; stroke 25 cm; Area of indicator diagram = 450 sq.mm; Length of indicator diagram = 50mm; Indicator spring rating = 1.2mm for a pressure of 9.80 N/m²; Engine speed = 400 rpm. Brake Torque = 225 Nm Fuel consumption = 3 kg/hr; c.v. of fuel =44200 kJ/kg; cooling water flow rate = 4 kg/min; cooling water

Temp. rise = 42° C; specific heat of cooling water = 4.18 kJ/kgkCompute :

- i) Mechanical efficiency
- ii) Brake thermal efficiency
- iii) Specific fuel consumption
- iv) Draw Heat balance sheet in kw
- 5. a) Name the three basic types of Accumulators. Which type of accumulator operates at constant pressure. How can the pressure be changed.
 b) Explain with neat sketch Hydraulic circuit for the planning machine.
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- 6. a) Design a circuit using the standard symbols, showing how to obtain two different pressure 7 in a pneumatic circuit.
 - b) Explain any one Industrial Application of pneumatic system with diagram.

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7. a) Explain 'Economic Analysis of Power Plants''.

b) The Annual load duration curve of a station varies uniformally from 64000kw to zero. The load is supplied by two stations whose cost equations are given as:

 $C_1 = Rs.(840000 + 840 kw + 0.116 kwh)$

 $C_2 = Rs.(50000 + 440 kw + 0.2955 kwh)$



Find the maximum cost of Generation in Rs./kw hr for the system.

- 8. a) What are the effects of variable load on the power plants design and operation.
 - b) Determine the load factor at which the cost of supplieng a unit of electricity is same in 7 Diesel station as in a steam station its the respective annual fixed and running charges are given below: Diesel Rs. (300/kw + 0.5/kwh) Steam Rs. (1200/kw + 0.125/kwh)

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