

End Semester Examination, May 2018

Program: B Tech ET+IPR
Subject (Course): Thermal Power Generation
Course Code : PSEG336
No. of page/s: 2

Semester – IV
Max. Marks : 100
Duration : 3 Hrs

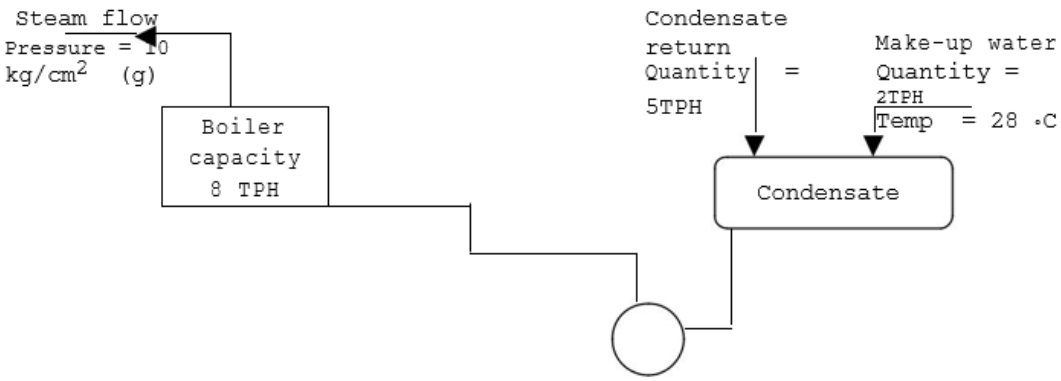
SECTION A			
S. No.		Marks	CO
Q 1	Elaborate on the importance of “Energy Storage” in the context of off-peak hours and peak hours.	4	CO5
Q 2	Enumerate the various challenges of Furnace Design and how these be achieved without having any adverse effect on the environment.	4	CO2
Q 3	Explain “Draft.” Compare and contrast Natural and Artificial draft.	4	CO3
Q 4	Explain the significance of Organic Rankine Cycle; also discuss the various working fluids used in such processes.	4	CO3
Q 5	With the help of examples, discuss organic and inorganic Insulating materials.	4	CO3
SECTION B			
Q 6	<p>Elaborate on the various assumptions considered for Gas, Power & Propulsion cycles.</p> <p>In the above context, with the help of a process flow diagram explain the working of a Combined Cycle Thermal Power Plant where heat discharged from one heat engine serves as the source for the next engine.</p>	10	CO3
Q 7	<p>Elaborate on the five basic components of Compressed Air Energy Storage (CAER)? Contrast and compare Battery Storage with Compressed Air Energy Storage.</p> <p>The Alabama Electric Corporation has a 100 MW CAER plant, present a conceptual flowsheet with explanations for how the system works.</p>	10	CO5
Q 8	<p>The production capacity of a paper drying machine is 500 TPD and is currently operating at an output of 480 TPD. To find out the steam requirement for drying, the Energy Manager measures the dryness of the paper both at inlet and outlet of the paper drying machine, and are found to be 60% and 95% respectively. The steam is supplied at 3.5 kg/cm², having a latent heat of 513 kCal/kg. The evaporated moisture temperature is around 100 °C having enthalpy of 640 kCal/kg.</p> <p>a. Estimate the quantity of moisture to be evaporated/hr. b. Input steam quantity required for evaporation per hour.</p>	10	CO1
Q 9	<p>Elaborate on the various furnace classification methodologies and the various drivers for improved furnace efficiency.</p> <p>In the above context, explain the five objectives of furnace design and further explain the consequences of incomplete combustion inside a Furnace, and how the same can be avoided.</p>	10	CO2

SECTION-C			
Q 10	<p>With the help of P-V curve show the different processes in an idealized Otto cycle (Internal Combustion Engine) with necessary explanations.</p> <p>Further construct the P-V curve for the actual cycle and derive an expression for determining thermal efficiency of the cycle.</p>	20	CO4
Q 11	<p>“The share of renewable energy from wind, water and sun will increase further but these sources are not suited to cover the electrical base load due to their irregular availability. The combination of these sources, however, to produce hydrogen in co-operation with fuel cells may well be an option for future power generation.”</p> <p>In the above context explain the following in relation to role of Fuel Cells:</p> <ol style="list-style-type: none"> a. Stationary Power. b. Propulsion of vehicles c. Portable applications. 	20	CO4

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Name of Examination <small>(Please tick, symbol is given)</small>	:	MID		END	☐	SUPPLE	
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S. No.		Marks	CO
Q 1	Enumerate some of the advantages of Battery energy storage systems in the context of load levelling capability.	4	CO5
Q 2	With a help of a neat process diagram explain how furnaces work and find an expression for furnace efficiency.	4	CO2
Q 3	A boiler generates steam at the rate of 20 tons/hr consuming 4 ton/hr of coal having a gross calorific value of 4200 kCal/kg. Calculate the evaporation ratio and efficiency of the boiler if the enthalpy of the generated steam is 650 kCal/kg and feed water temperature is 60°C.	4	CO1
Q 4	In the context of analyzing gas cycles used in practical applications for propulsion and power generation, enumerate the various assumptions that are specifically referred to approximate actual cycle behavior.	4	CO4
Q 5	What does Energy Economy mean? Explain the energy utilization trend.	4	CO5
SECTION B			
Q 6	Elaborate on the various energy storage technology concepts that exist today. In the above context explain the basic components of Battery storage systems and how during peak hours the battery system discharges and supplies power to the utility ac power system.	10	CO5
Q 7	A boiler system is to be controlled so the total dissolved solids in the blowdown does not exceed $TDS_{BD} = 2000$ mg/l for a feed water (makeup) that has $TDS_F = 200$ mg/l TDS. Steam consumption, Q_s is 1000 kg/day. Calculate Boiler Blowdown. Elaborate on the role of “Reheater” in the context of steam based Thermal Power Plants.	10	CO1
Q 8	Elaborate on the following properties for Refractory materials: a. Bulk Density b. Melting point c. Porosity d. Cold crushing strength e. Creep.	10	CO3
Q 9	A refractory brick walled furnace with walls of a nominal 9” thickness and an internal wall temperature of 2000°F will lose 145 BTUs per square feet. With a nominal 4” of insulation the heat loss will be reduced to 32 BTUs per square feet and with nominal 8” insulation to 18 BTUs per square feet. In the above context discuss the various issues that a Furnace manufacturer has to consider before selecting insulation and refractory material.	10	CO3
SECTION-C			
Q 10	Analyze the diagram given below and answer the question.	20	CO1

	 <p>Steam flow Pressure = 10 kg/cm² (g)</p> <p>Boiler capacity 8 TPH</p> <p>Condensate return Quantity = 5TPH</p> <p>Make-up water Quantity = 2TPH Temp = 28 °C</p> <p>Condensate</p> <p>Data Given: Enthalpy of steam (dry & saturated) at 10 kg/cm² (g) pressure: 665 kcal/kg Furnace oil consumption: 600 liters Specific gravity of furnace oil: 0.89 Calorific value of FO (GCV): 9650 Kcal/ kg</p> <ol style="list-style-type: none"> Calculate the boiler efficiency by direct method? Calculate the water temperature in the condensate tank? Estimate the fuel loss due to drop in feed water temperature 		
Q 11	<p>“Twenty years ago, mainly universities and research institutions but only a few companies conducted fuel cell research working on the fundamentals of fuel cells. Nowadays due to the commercial interest innumerable research groups and companies have fuel cell activities ranging from the investigation of catalysts to the development of membranes.”</p> <p>In the above context explain the following:</p> <ol style="list-style-type: none"> Efficiency of a Gasoline powered automotive and a Fuel Cell powered e-vehicle. Role of Hydrogen and the Hydrogen Economy. Advantages and disadvantages of Fuel Cells. Future of power generation facilities. 	20	CO4