13/01/22

Program Code: 01PG041

O P JINDAL UNIVERSITY

M.Tech-II Semester Regular Examinations Backlog

Energy Management and Audit

(Offered to Mechanical Engineering)

Time: 3 Hrs. **Max. Marks: 100**

Answer any one question from each unit

All questions carry equal marks

			M	CO	KL
Unit-I (20 marks)					
1	a.	What is energy management? Write their objectives and explain it.	10	1	1
	b.	Discuss the method of pumped hydro energy storage system (PHES) with a neat sketch?	10	1	2
OR					
2	a.	How does a Compressed Air Energy Storage (CAES) system operate? Show the main components in a neat sketch of the system.	10	1	2,3
	b.	What is the Bureau of Energy Efficiency (BEE)? Define the important point of BEE and its features.	10	1	1
Unit-II (20 marks)					
3	a.	Prepare an energy audit report of an energy intensive firm.	10	2	3
	b.	What are the various steps in the implementation of energy management in an organization?	10	2	1,2
OR					
4	a.	Write down the steps involved in 'Energy management Strategy'?	10	2	2
	b.	What are the various levels of mass and energy balances? Explain it.	10	2	2,3
Unit-III (20 marks)					
5	a.	Write the various steps of energy action planning in detail.	10	3	1,2
	b.	What are the roles and responsibilities of an energy manager? Explain it in detail.	10	3	3
OR					
6	a.	What is force field analysis? Prepare a force field analysis for Indian energy management programme.	10	3	1,2
	b.	Why are managerial skills as important as technical skills in energy management?	10	3	2
Unit-IV(20 marks)					
7	a.	List down the various guidelines required for material and energy balance.	10	4	3
	b.	What is energy management information system (EMIS)? Explain the various phases of EMIS.	10	4	1,2
OR					

8	a.	Draw a typical input output diagram for a process and indicate the various energy inputs	10	4	3
	b.	I. What is a simple Payback period? II. List out four non-contact type measuring instruments.	10	4	1,2
UNIT-V (20 marks)					
9	a.	Define the following terms: a. Heat balance b. First law of efficiency c. Heat exchanger d. Cogeneration	10	5	1
	b.	Write shorts notes on- I. Heat recovery system II. Sources of waste heat	10	5	1
OR					
10	a.	Write shorts notes on- I. Guidelines to identify waste heat II. Grading of waste heat	10	5	1
	b.	How to design heat exchangers by L.M.T.D. methods.	10	5	3

12/01/23
07

Course Code: SOE-M-PPE204

O P JINDAL UNIVERSITY

M. Tech. II Semester Backlog Examinations

COMPUTATIONAL FLUID DYNAMICS

(Offered to Mechanical Engineering)

Time: 3 Hrs. **Max. Marks: 100**

Answer any one question from each unit

All questions carry equal marks

			M	CO	KL
Section-A					
1	a.	What is CFD? State its objective.	2	CO1	1
	b.	How is CFD being used as a research tool, a design tool, and an educational tool in academic fields, such as Thermal-Fluids?	2	CO1	1
	c.	Explain the features of TDMA method.	2	CO2	1
	d.	What are the key iterative methods available to solve the system of nonlinear equations?	2	CO2	1
	e.	Define the following term: truncation error and order of accuracy.	2	CO3	1
	f.	What are the differences between explicit and implicit methods?	2	CO3	1
	g.	Define the term: stability and convergence.	2	CO4	1
	h.	What are the advantages of FVM over FDM? Mention the key steps involved in FVM.	2	CO4	1
	i.	What are the advantages and disadvantages of FEM?	2	CO5	1
	j.	What is the importance of using weighted residual in FEM?	2	CO5	1
Section-B: **Unit-I**					
2	a.	Explain the significance of Reynolds Transport theorem; using the same derive the Continuity equation.	6	CO1	2
	b.	Write a short note on commercial CFD packages.	10	CO1	3
OR					
3	a.	What are the key advantages and disadvantages of CFD technique?	6	CO1	2
	b.	Derive the Navier-Stokes equation.	10	CO1	3
Unit-II					
4	a.	State the condition for the convergence of Gauss Seidel iteration method for solving a system of linear equation.	6	CO2	2
	b.	With the help of a block diagram explain the complete computational solution procedure using CFD technique.	10	CO2	3
OR					
5	a.	Explain the features of TDMA method.	6	CO2	2
	b.	Use the Gauss-Jordan technique to solve the following system:	10	CO2	3

		$3x_1 - 0.1x_2 - 0.2x_3 = 7.85$ $0.1x_1 + 7x_2 - 0.3x_3 = -19.3$ $0.3x_1 - 0.2x_2 + 10x_3 = 71.4$			
Unit-III					
6	a.	Which of the following: forward difference, backward difference, and central difference is more accurate and why?	6	CO3	2
	b.	Derive a 3-point backward difference formula on uniform grid, using general procedure, for a first order derivative $\left(\frac{\partial f}{\partial x}\right) = \frac{3f_i - 4f_{i-1} + f_{i-2}}{2\Delta x^1} + TE \approx 0(\Delta x^2)$	10	CO3	3
OR					
7	a.	Explain the UPWIND difference scheme used in FDM. Explain why it is important in case of strong convective flows?	6	CO3	2
	b.	Derive the expressions for explicit FTCS, CTCS for a parabolic PDE. Also discuss their stability and consistency. $\frac{\partial T}{\partial t} = \alpha \frac{\partial^2 T}{\partial x^2}$	10	CO3	3
Unit-IV					
8	a.	Write down the Mid-point rule and Trapezoidal rule, schemes used for approximation of surface integrals in Finite volume method.	6	CO4	2
	b.	Explain SIMPLE Algorithm in detail.	10	CO4	3
OR					
9	a.	Explain finite volume method for 2-D unsteady state diffusion problem, with no volumetric heat generation.	6	CO4	2
	b.	Explain the implicit methods - Crank-Nicolson for solving the given parabolic PDE. $\frac{\partial T}{\partial t} = \alpha \frac{\partial^2 T}{\partial x^2}$	10	CO4	3
UNIT-V					
10	a.	Explain the advantages and disadvantages of using FEM over FDM.	6	CO5	2
	b.	Illustrate finite element formulation for heat conduction analysis.	10	CO5	3
OR					
11	a.	Why are polynomial types of interpolation function preferred over trigonometric function?	6	CO5	2
	b.	What is meant by discretization of a flow domain? Discuss the various aspects to be considered while discretizing a flow domain for finite element analysis.	10	CO5	3

OP JINDAL UNIVERSITY, RAIGARH (C.G.)

OPJU
UNIVERSITY OF STEEL TECHNOLOGY AND MANAGEMENT

END SEMESTER EXAMINATION, JAN-2023

Course : **M Tech** Time : **03 Hrs**

Semester:2nd Branch :Mechanical (PPEEM) Max. Marks : **100**

Subject Code: SOE-M-PPE203 Subject: Design of Heat Exchangers

Note: **Section A :** All Questions are compulsory. [10 x 02 marks]
Section B : Answer any 8 questions. [08 x 05 marks]
Section C : Answer any 5 questions [05 x 08 marks]
HMT Data book is allowed

Q. No.	Section [A]	CO
Q1 a)	What is convective boiling	1
Q1 b)	What is film condensation.	2
Q1 c)	What is difference between recuperation and Regeneration in heat exchanger.	2
Q1 d)	What is projected length in plate heat exchanger	1
Q1 e)	Write the general equation of fins	2
Q1 f)	Draw a cooling tower and label the different parts of it.	5
Q1 g)	Write different types of plate heat exchanger	4
Q1 h)	What is a fired process heater	3
Q1 i)	What is DBT & WBT.	1
Q1 j)	What do you mean by the efficiency of cooling tower	4

Q. No.	Section [B]	CO
Q2 a)	Write a short note on temperature distribution on a triangular profile fins.	1
Q2 b)	What do you mean by plate heat exchangers	1
Q2 c)	What do you mean by the condition of long and short fin.	3
Q2 d)	Write any two performance parameters of cooling towers.	4
Q2 e)	Give a suitable classification for the heat exchanger.	3
Q2 f)	Write any 5 steps to be followed for the design of reheater furnace	1
Q2 g)	What are different types of cooling towers	5
Q2 h)	Give a suitable classification of fins	4
Q2 i)	Write a short note on any one type of fouling.	3
Q2 j)	Write the different inputs for the design of the furnace and write any two steps.	2

Q. No.	Section [C]	CO
Q3 a)	Write a short note on parallel and counter flow HX.	2
Q3 b)	Longitudinal fins of triangular profiles are exposed to ambient temperature at 20°C with a heat transfer coefficient 40 W/m²K. The base temperature is 90°C and the thermal conductivity of fin is 30 W/mK. The fin length is 10 cm and thickness at the base is 0.8 cm. Determine the temperature at the tip of the fin and heat transfer from the fin	4
Q3 c)	A cylindrical furnace whose height and diameter are 5 m contains combustion gases at 1200 K and total pressure of 1 atm. The composition of the combustion gases is determined by volumetric analysis to be 80% N_2, 8% H_2O, 7% O2 and 5% of CO_2. Determine the effective emissivity of combustion	3

<table>
<tr><td></td><td>gases.</td><td></td></tr>
<tr><td>Q3 d)</td><td>Write a short note on Rotary Regenerator</td><td>2</td></tr>
<tr><td>Q3 e)</td><td>Derive a general expression for temperature distribution for a parallel flow heat exchanger.</td><td>4</td></tr>
<tr><td>Q3 f)</td><td>Cold water will be heated by a waste water stream. The cold water with a flow rate of 140 kg/s enters the gasketed- plate heat exchanger at 22°C and it will be heated to 42°C. The wate water has the same flow rate entering at 65°C and leaving at 45°C. The process specifications are as follows:
<table>
<tr><th>Items</th><th>Hot Fluid</th><th>Cold Fluid</th></tr>
<tr><td>Fluids</td><td>Wastewater</td><td>Cooling water</td></tr>
<tr><td>Total fouling resistance</td><td>0.00005</td><td>0</td></tr>
<tr><td>Specific heat (J/kgK)</td><td>4183</td><td>4178</td></tr>
<tr><td>Dynamic Viscosity</td><td>5.09×10^{-4}</td><td>7.66×10^{-4}</td></tr>
<tr><td>Thermal Conductivity</td><td>0.645</td><td>0.617</td></tr>
<tr><td>Density</td><td>985</td><td>995</td></tr>
<tr><td>Prandlt Number</td><td>3.31</td><td>5.19</td></tr>
</table>
The constructional data for the proposed plate heat exchanger are
<table>
<tr><td>Plate Material</td><td>SS304</td></tr>
<tr><td>Plate thickness (mm)</td><td>0.6</td></tr>
<tr><td>Chevron angle</td><td>45</td></tr>
<tr><td>Total number of plates</td><td>105</td></tr>
<tr><td>Number of Passes</td><td>0ne pass</td></tr>
<tr><td>Overall heat transfer coefficient (Clean/fouled)</td><td>8000/4500</td></tr>
<tr><td>Total effective area (m2)</td><td>110</td></tr>
<tr><td>Port Diameter (mm)</td><td>200</td></tr>
<tr><td>Compressed pack lemgth</td><td>0.38</td></tr>
<tr><td>Vertical Port distance</td><td>1.55</td></tr>
<tr><td>Horizontal port distance</td><td>0.43</td></tr>
<tr><td>Effective channel width</td><td>0.63</td></tr>
<tr><td>Thermal conductivity of plate material</td><td>17.5</td></tr>
</table>
a) Determine the total amount of heat transfer</td><td>5</td></tr>
<tr><td>Q3 g)</td><td>With reference to above question - Obtain enlargement factor & number of channels per pass</td><td>5</td></tr>
</table>

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10/01/23

Course Code: SOE-M-PPE202

O P JINDAL UNIVERSITY

M.Tech. 2nd Semester Backlog Examinations

Advanced Steam and Gas Turbine Engineering

R 21

(Offered to ME, PPEEM)

Time: 3 Hrs. **Max. Marks: 100**

Answer any one question from each unit

All questions carry equal marks

			M	CO	KL
Section-A					
1	a.	List the name of cycle on which gas and steam turbine power plant operates.	2	1	1
	b.	Classify the steam turbine on the basis of various aspects of steam turbine.	2	1	2
	c.	Compare the impulse and reaction turbine.	2	2	2
	d.	Show the velocity diagram of blade for Parson's turbine.	2	2	2
	e.	What is the purpose of maintenance of steam turbine?	2	3	1
	f.	List the major sequences of steam turbine operation.	2	3	1
	g.	Define the combustion chamber with the classification.	2	4	1
	h.	List the 2 names of materials used for gas turbine blade manufacturing.	2	4	1
	i.	List the name of starters used in gas turbines.	2	5	1
	j.	What is gas turbine controls? Write the name of types of controls.	2	5	1
Section-B: **Unit-I**					
2	a.	Define degree of reaction and demonstrate the mathematical equation.	8	1	1
	b.	In a De-Laval turbine steam issues from the nozzle with a velocity of 1200 m/s. The nozzle angle is 20°, the mean blade velocity is 400 m/s, and the inlet and outlet angles of blades are equal. The mass of steam flowing through the turbine per hour is 1000 kg & the blade velocity coefficient = 0.8. Calculate: (i) Blade angles. (ii) Relative velocity of steam entering the blades. (iii) Tangential force on the blades.	8	1	3
OR					
3	a.	List the name of major components of steam cycle with their functions.	8	1	1
	b.	Explain the principle elements of steam turbine.	8	1	2
Unit-II					
4	a.	Explain Steam Turbine Governing with its different types in detail.	8	2	2
	b.	A certain stage of a Parson's turbine consists of one row of fixed blades and one row of moving blades. The details of the turbine are as below: The mean diameter of the blades = 68 cm R.P.M. of the turbine = 3000. The mass of steam passing per sec = 13.5 kg, Steam velocity at exit from fixed blades = 143.7 m/s. The blade outlet angle = 20o. Calculate the power developed in the stage and gross efficiency, assuming carry over coefficient as 0. 74 and the efficiency of conversion of heat energy into kinetic energy in the blade channel	8	2	3

		is 0.92.			
		OR			
5	a.	Explain Impulse Turbine with velocity pressure variation graph in detail.	8	2	2
	b.	Explain the working of throttle governing with neat sketch.	8	2	2
		Unit-III			
6	a.	Define the steam turbine auxiliary systems and write their names.	8	3	1
	b.	Explain the steam turbine maintenance and write the classification.	8	3	2
		OR			
7	a.	Explain turbine protective devices of steam turbine auxiliary systems.	8	3	2
	b.	Explain in detail about steam turbine operation.	8	3	2
		Unit-IV			
8	a.	Why the gas turbine blades require cooling? List the various cooling schemes.	8	4	1
	b.	Explain the combustion process with chemical reaction involved.	8	4	2
		OR			
9	a.	Classify the combustion chamber and explain the various factors affecting combustion chamber performance.	8	4	2
	b.	Show the velocity diagram for gas Turbine blade and derive the expression for the work done.	8	4	1
		UNIT-V			
10	a.	Define the ignition system. List the types of ignition systems of gas turbine.	8	5	1
	b.	Explain the lubrication systems of gas turbine power plant with neat sketch.	8	5	2
		OR			
11	a.	Explain the gas turbine starting system.	8	5	2
	b.	Explain the operation, maintenance and troubleshooting of gas turbine systems.	8	5	2

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Course Code: SOE-M-PPE201

O P JINDAL UNIVERSITY

M.Tech. II Semester Backlog Examinations

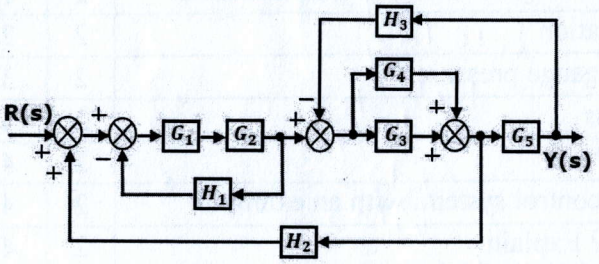
POWER PLANT INSTRUMENTATION & CONTROL ENGINEERING

Time: 3 Hrs. **Max. Marks: 100**

Answer any one question from each unit

All questions carry equal marks

			M	CO	KL
Section-A					
1	a.	What is eddy current damping	2	2	1
	b.	Give the classification of pressure measuring instruments	2	1	1
	c.	What is the environmental factors on the design of measuring instruments?	2	1	1
	d.	What is transducer? Explain its classification	2	3	1
	e.	Differentiate atmospheric, absolute and gauge pressures	2	3	2
	f.	Give the classification of control systems	2	4	2
	g.	What do you mean by transfer function?	2	4	1
	h.	Define poles, zeros, type and order of a control system, with an example	2	4	2
	i.	What do you mean by steady state error? Explain	2	4	2
	j.	What are transient and steady state response of a control system?	2	5	4
Section-B: **Unit-I**					
2	a.	Explain different types of errors of an instrument.	8	1	3
	b.	Define accuracy, precision, threshold and resolution	8	1	1
OR					
3	a.	Differentiate primary, secondary and tertiary types of measurements.	4	1	2
	b.	Explain hysteresis in measurement systems	4	1	2
	c.	Give the steady state errors to a various standard inputs for type 2 system	8	1	3
Unit-II					
4	a.	Explain the construction and working of PMMC type instruments	8	2	2
	b.	Draw the circuit diagram of a Wheatstone bridge and derive the condition for balance	8	2	4
OR					
5	a.	Explain classification of resistances	8	2	2
	b.	Draw the circuit of a Kelvin's double bridge used for measurement of low resistances. Derive the condition for balance	8	2	4
Unit-III					
6	a.	What is thermocouple? What are the different types of thermocouples? Explain the characteristics of thermocouples?	8	3	2
	b.	Explain the construction and working of a Bourden tube pressure gauge with a neat sketch.	8	3	3
OR					

7	a.	Explain the working principle of piezo-electric transducer. What are its advantages and limitations?	8	3	3
	b.	State the working principle of dead weight gauge tester	8	3	3
Unit-IV					
8	a.	Compare open Loop and closed loop control system. Give examples	8	4	4
	b.	Discuss various test signals used for time domain analysis	8	4	4
OR					
9	a.	For a unity feedback control system having open loop transfer function as $\frac{20(s+2)}{s^2(s+1)(s+5)}$, determine static error coefficients and steady state error for input $1+3t+\frac{t^2}{2}$	8	4	5
	b.	Find the overall transfer function for the following block diagram 	8	4	5
UNIT-V					
10	a.	A unity feedback control system is characterized by the following open loop transfer function $G(s)=\frac{4s+1}{s(s+6)}$; Determine its transient response for unit step input and sketch the response. Evaluate the maximum overshoot and the corresponding peak time .	8	5	5
	b.	Determine the stability of the system whose characteristics equation is given by $s^5 + s^4 + 2\,s^3 + 2\,s^2 + 11s + 10 = 0$	8	5	4
OR					
11	a.	Sketch the root locus plot and determine the value of K if damping ratio is 0.707, for the system whose open loop transfer function is given by $G(s)\,H(s) = \frac{K}{s(s+4)}$	8	5	4
	b.	Determine the range of K for stability of unity feedback system using Routh stability criterion whose transfer function $\frac{C(s)}{R(s)} = \frac{K}{s(s^2+s+1)(s+2)+K}$	8	5	4