Model Template for Scheme of Course Work

to be submitted by the Faculty of B.Tech/M.Tech/MCA I semester on or before 11.10.2013 to bhanucvk@gvpce.ac.in and yadavalliraghu@yahoo.com

SCHEME OF COURSE WORK

Course Details:

Course Title	: **Design of Thermal Equipment**		
Course Code	**:** 15ME2313	**L T P C**	**:3 0 0 3**
Program:	**: M.Tech.**		
Specialization:	**: THERMAL ENGINEERING**		
Semester	**:I**		
Prerequisites	**:Thermodynamics, Heat Transfer**		
Courses to which it is a prerequisite	**:NO**		

Course Outcomes (COs):

1	Classify and design heat exchangers.
2	Estimate convective heat transfer in ducts, concentric annuli, circular pipes.
3	Determine pressure drop and effect of fouling in heat exchangers.
4	Design double pipe heat exchangers and compact heat exchangers by considering fin effects.
5	Design condensers and evaporators for application in refrigeration and air-conditioning

Program Outcomes (POs)

At the end of the programme, the students in THERMAL ENGINEERING will be able to

PO Code	Program Outcome (PO)
PO 1	exhibit in-depth knowledge in thermal engineering specialization
PO 2	think critically and analyze complex engineering problems to make creative advances in theory and practice
PO 3	solve problem, think originally and arrive at feasible and optimal solutions with due consideration to public health and safety of environment
PO 4	use research methodologies, techniques and tools, and will contribute to the development of technological knowledge
PO 5	apply appropriate techniques, modern engineering tools to perform modeling of complex engineering problems with knowing the limitations
PO 6	understand group dynamics, contribute to collaborative multidisciplinary scientific research
PO 7	demonstrate knowledge and understanding of engineering and management principles and apply the same with due consideration to economical and financial factors
PO 8	communicate complex engineering problems with the engineering community and society, write and present technical reports effectively
PO 9	engage in life-long learning with a high level of enthusiasm and commitment to improve knowledge and competence continuously
PO 10	exhibit professional and intellectual integrity, ethics of research and scholarship and will realize the responsibility towards the community
PO 11	examine critically the outcomes of actions and make corrective measures

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Course Outcome Versus **Program Outcomes:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M		M	S			M					
CO2	M	S		S		S	M					
CO3	M	S	S	M			M					
CO4		S	S	M			M					
CO5		S	S	S			M					

S - Strongly correlated, *M - Moderately* correlated, *Blank - No correlation*

Assessment Methods:	Assignment / Quiz / Seminar / Case Study / Mid-Test / End Exam

Teaching-Learning and Evaluation

Week	TOPIC / CONTENTS	Course Outcomes	Sample questions	TEACHING-LEARNING STRATEGY	Assessment Method & Schedule
1	Classification of heat exchangers: Tubular heat exchangers, plate heat exchangers, extended surface heat exchangers.	CO1	1. Why are baffles used in shell and tube heat exchangers. 2. what are the types of fins that are used in heat exchangers.	Lecture	Mid-Test 1 (Week 9)
2	flow arrangements – applications Basic design methods of heat exchangers: Overall heat transfer coefficient	CO1	Determine the overall heat transfer coefficient U for liquid-to-liquid heat transfer through a 0.003-m thick steel plates(k= 50 W/mK) for the following het transfer coefficients and fouling factor on one side.	Lecture / Discussion Problem solving	Assignment (Week 4 - 6) Mid-Test 1 (Week 9)
3	multi pass and cross flow heat exchangers - log mean temperature difference method	CO1	Air flowing at a rate of 5 kg/s is to be heated in a shell-and- tube heat exchanger from 20 to 50^0 C with hot water entering at 90^0 C and exiting at 60^0 C. The overall heat transfer coefficient is 400 W/m^2 K. The length of the heat exchanger is 2m. Determine the surface area of the heat exchanger and the number of tubes required by using 1. 1 to 2 shell-and-tube type 2. 2 to 4 shell-and-tube type	Lecture / Discussion Problem solving	Assignment (Week 4 - 6) Mid-Test 1 (Week 9)
4	effectiveness-NTU method for heat exchanger analysis	CO1		▫ Lecture / Discussion ▫ Problem solving	Assignment (Week 4 - 6) Mid-Test 1 (Week 9)
5	heat exchanger design calculation– heat exchanger design methodology.	CO1	1. An arrangement of refrigeration system to take multiloads is shown in fig. F-12 is used as refrigerant in the system .Find Kw and C.O.P of the system. 2. Compound compression with inter cooling is effective method of operation Discuss.	▫ Lecture ▫ Problem solving	Assignment (Week 4 - 6) Mid-Test 1 (Week 9)

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6	Correlations for forced convection heat transfer coefficients: Laminar forced convection in ducts and concentric annuli	CO2	In an absorption refrigeration system heating cooling refrigeration take place at the temperatures of 150 ^{0} C,30 ^{0} C and -20 ^{0} C. Find C.O.P of the system.	▫ Lecture ▫ Problem solving	Mid-Test 1 (Week 9)
7	turbulent forced convection in circular pipes – heat transfer in helical coils and spirals – heat transfer in bends.	CO2	1. What is equilibrium concentration. Find out the expression for the same. 2. Dry and saturated steam at 2.8 bar is available for an ejector refrigeration unit. Estimate steam consumption in kg/hr/ton of refrigeration if condenser pressure is 0.07 bar, recirculated water temp = 20 ^{0}C, Chilled water temp =10^0 C, Nozzle efficiency = 0.94, entrainment efficiency = 0.65, diffuser efficiency = 0.75, Quality of flashed vapour= 0.97	▫ Lecture ▫ Problem solving	Mid-Test 1 (Week 9)
8	Heat exchanger pressure drop and pumping power: Tube side pressure drop in laminar and turbulent flows	CO3	1. Explain the working principle of thermo electric refrigeration system. 2. What are advantages of vortex tube over other refrigeration systems	▫ Lecture	Mid-Test 1 (Week 9)
9	**Mid-Test 1**	CO1, CO2, CO3			
10	pressure drop in helical and spiral coils – pressure drop in bends and fittings.	CO3	1. What is the reason of frost formation? What effect does frost have on cooling coil? 2. Explain hot gas method of defrosting system having two evaporators. 3. What is automatic periodic defrosting? Explain the working of such system. 4. Explain working of electric defrost system with neat diagram.	▫ Lecture ▫ Discussion	Seminar (Week 10) Mid-Test 2 (Week 18)
11	Fouling of heat exchangers: Basic considerations – effect of fouling and heat transfer and pressure drop – aspects of fouling – design of heat exchangers subject to fouling.	CO4	1. Draw a neat diagram o air conditioning system required in winter season. Explain the working of components in the circuit. 2. A sling psychrometric reads 44^0 C DBT and 30^0 C WBT, calculate specific humidity, relative humidity, dew point temperature, enthalpy of mixture	▫ Lecture ▫ Discussion Problem solving	Mid-Test 2 (Week 18)
12	Double pipe heat exchangers: Pressure drop – hydraulic diameter – hairpin heat exchanger – parallel and series arrangements of hairpins – total pressure drop.	CO4	1. Define term Effective Temperature and explain its importance in air- conditioning system. 2. Define the human comfort and explain factors which effect human comfort.	▫ Lecture ▫ Discussion	Assignment (Week 14 - 16) (Mid-Test 2 (Week 18)
13	Compact heat exchangers: Plate-fin heat exchangers – tube-fin heat exchangers	CO4	1. differentiate between Central, District, Unitary air- conditioning systems. 2. Draw a diagram of constant volume variable temperature air conditioning system and explain its working.	▫ Lecture ▫ Discussion	Seminar (Week 13) (Mid-Test 2 (Week 18)
14	pressure drop for finned-tube heat exchangers – pressure drop for plate-fin heat exchangers.	CO4	An air conditioned room is maintained at 26 ^{0} C DBT and 50% R.H. The sensible and latent heat loads in the room are 1,20,000 kg/hr and 30,000 kJ/hr resp. The characteristics of the cooling coil used is such that the chilled air leaves the coil at 80% R.H. 30% of the total chilled air supplied to the room as fresh air taken in and mixed with the return air	▫ Lecture	Assignment (Week 14 - 16) (Mid-Test 2 (Week 18)

			ahead of the cooling coil if the outdoor conditions are 33^0 C DBT and 26^0 C WBT, find (i) DBT of chilled air. (ii) Quantity of chilled air passing per minute. (iii) Capacity of refrigerating machine in tons of refrigeration.		
15	Condensers and evaporators: Horizontal shell-and-tube condensers	CO5	What are the different factors which must be considered evaluating cooling load? What are different means by which this load can be reduced?	▫ Lecture Problem solving	Assignment (Week 14 - 16) (Mid-Test 2 (Week 18)
16	horizontal in-tube condensers – plate condensers – air-cooled condensers,	CO5	The bypass factor of a single depth coil is 0.75. Find the bypass factor for 3 depth and 5 depth coil. If the required bypass factor is 0.15, then find the depth of coil required.	▫ Lecture Problem solving	Assignment (Week 14 - 16) (Mid-Test 2 (Week 18)
17	thermal design of shell-and-tube condensers – design and operational considerations.	CO5	Explain ESHF, RSHF, GSHF. Short notes on Cooling coils, dehumidifying air washers	▫ Lecture Problem solving	Assignment (Week 14 - 16) (Mid-Test 2 (Week 18)
18	**Mid-Test 2**	**C03,CO4,CO5**			
19/20	**END EXAM**				