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	**:REFRIGERATION AND AIRCONDITIONING**		
Course Code	**:** 13ME2305	**L T P C**	**:**
Program:	**: M.Tech.**		
Specialization:	**: THERMAL ENGINEERING**		
Semester	**:I**		
Prerequisites	**:Thermodynamics, Heat Transfer**		
Courses to which it is a prerequisite	**:NO**		

Course Outcomes (COs):

1	Explain different refrigeration systems, select refrigerants, and design refrigeration components.
2	Analyze simple vapor compression refrigeration systems, design multi-evaporator systems and vapor absorption refrigeration systems.
3	Design steam jet and non-conventional refrigeration systems, discuss different defrosting methods.
4	Outline psychrometric properties and analyze different air conditioning systems.
5	Calculate capacities at different loads and design air conditioning systems.

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*

AssessmentMethods:	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	Review on refrigeration- Methods of refrigeration-refrigeration by expansion of air-refrigeration by throttling of gas-vapor refrigeration system-steam jet refrigeration system-unit of refrigeration and COP–mechanical refrigeration–types of ideal cycles of refrigeration.Air Refrigeration - Bell-Coleman cycle and Brayton Cycle, open and dense air systems – actual air refrigeration system problems	CO1	A refrigerator working on Bell- Coleman cycle operates between pressure limits of 1.05 bar and 8.5 bar. Air is drawn from the cold chamber at 10^0 C. Air coming out of compressor is cooled to 30^0 C before entering the expansion cylinder. Expansion and compression follow the law $p.v^{1.35}$ = constant. Determine theoretical C.O.P of the system.	▫ Lecture ▫ Problem solving	Assignment (Week 4 - 6) Mid-Test 1 (Week 9)
2	air craft refrigeration -simple, bootstrap, regenerative, and reduced ambient systems – problems based on different systems.	CO1	A simple air cooled system is used for an aeroplane to take the load of 20 tons. Atmospheric temperature and pressure conditions are 23^0 C and 0.9 bar. The pressure of air is increased due to isentropic ramming from 0.9 bar to 1 bar. The pressure of air leaving main compressor is 3.5 bar and itS 60% heat is removed in the air cooled heat exchanger and then it is passed through an evaporator for further cooling. The temperature of air is reduced by $7\ ^0$ C in the evaporator. Lastly the air is passed through cooling turbine and then it is supplied to the cooling cabin where pressure is maintained at 1.03 bar. Assuming compressor and turbine efficiencies as 80% 75% find Kw capacity and C.O.P of system.	▫ Lecture / Discussion ▫ Problem solving	Mid-Test 1 (Week 9)
3	Refrigerants - types, properties, and selection.Refrigeration system components - compressors – general classification – comparison – advantages and disadvantages, condensers and cooling towers – classification – working principles, evaporators – classification –	CO1	1. Explain the effects of low suction pressure on the volumetric efficiency of a reciprocating compressor 2. Explain the working of evaporative condenser with neat diagram. 3. What problems does lubricating oil cause in the evaporator. 4. What are essential properties of a good	▫ Lecture	Seminar (Week 3 – 4) Mid-Test 1 (Week 9)

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	working principles, expansion devices – types – working principles.		refrigerant.		
4	Vapor compression refrigeration -working principle and essential components of the plant – simple vapor compression refrigeration cycle – COP – representation of cycle on T-S and p-h charts – effect of sub cooling and super heating – cycle analysis – methods to improve the COP - use of p-h charts – wet versus dry compression.	CO2	1. Why a throttle valve is used in vapour compression refrigerator rather than an expansion cylinder to reduce the pressure between condenser and evaporator. 2. Distinguish between dry and wet compression .	▫ Lecture / Discussion ▫ Problem solving	Assignment (Week 4 - 6) Mid-Test 1 (Week 9)
5	Multi-evaporator and compressors - methods of improving COP, sub-cooler heat exchanger, optimum inter stage pressure for two stage refrigeration system –single load systems-multi load systems with single compressor-multiple evaporator and compressor system - dry ice system-cascade systems.	CO2	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)
6	Vapor absorption system – simple absorption system –practical ammonia absorption system – Electrolux Refrigerator- comparison of VARS COP with Carnot COP- Domestic Electrolux Refrigerator-Lithium–Bromide system-actual analysis of ammonia absorption system-advantages of VARS over VCRS.	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	Steam jet refrigeration system - analysis-components of plant-advantages, limitations and applications –performance.	CO3	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	Non-conventional refrigeration systems - thermoelectric refrigerator - Vortex tube or Hilsch tube.	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	Methods of defrosting - automatic periodic defrosting–solid absorbent system- water defrosting-defrosting by reversing cycle-automatic hot gas defrosting-thermo bank defrosting-electric defrosting -electric air switch defrosting system-two outdoor unit system-multiple evaporators defrosting system. Applications: Food processing and storage by refrigeration.	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	Air-conditioning- psychometric properties-psychrometric processes- summer air-	CO4	1. Draw a neat diagram o air conditioning system required in winter season. Explain the working of components in the circuit.	▫ Lecture ▫ Discussion Problem solving	Mid-Test 2 (Week 18)

	conditioning systems-winter air conditioning systems-year around air – conditioning		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		
12	requirements of comfort air-conditioning-thermodynamics of human body- comfort chart-design considerations- need for ventilation.	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	Air conditioning systems -classification of equipment - filters, grills and registers, fans and blowers, humidifiers, dehumidifiers-central station air-conditioning system-unitary air-conditioning system-self-contained air-conditioning units.	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	Design of air conditioning systems	CO5	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 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.	▫ Lecture	Assignment (Week 14 - 16) (Mid-Test 2 (Week 18)
15	cooling load calculations	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	different heat sources-bypass factor (BF)	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	effective sensible heat factor (ESHF) - cooling coils and dehumidifying air washers.	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**				