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	**:** 13ME1151	**L T P C**	**: 4**
Program:	**: B.Tech**		
Specialization:	**: Mechanical Engineering**		
Semester	**:VIII**		
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	Explain different refrigerants ,refrigeration components and analyze simple vaopor compression refrigeration systems
3	Explain different vapor absorption, steam jet and non conventional refrigeration systems.
4	Outline psychrometric properties and explain comfort 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 1	Apply the knowledge of mathematics, science, engineering fundamentals to solve complex mechanical engineering problems
PO 2	Attain the capability to identify, formulate and analyse problems related to mechanical engineering
PO 3	Design solutions for mechanical system components and processes that meet the specified needs with appropriate consideration for public health and safety
PO 4	Perform analysis, conduct experiments and interpret data by using research methods such as design of experiments to synthesize the information and to provide valid conclusions
PO 5	Select and apply appropriate techniques from the available resources and current mechanical engineering and software tools
PO 6	Carry out their professional practice in mechanical engineering by appropriately considering and weighing the issues related to society
PO 7	Understand the impact of the professional engineering solutions on environmental safety and legal issues
PO 8	Transform into responsible citizens by resorting to professional ethics and norms

	of the engineering practice
PO 9	Function effectively in individual capacity as well as a member in diverse teams and in multidisciplinary streams
PO 10	Communicate fluently with the engineering community and society, and will be able to prepare reports and make presentations effectively
PO 11	Apply knowledge of the engineering and management principles to managing projects and finance in multidisciplinary environments
PO 12	Engage themselves in independent and life-long learning to continuing professional practice in their specialized areas of mechanical engineering

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	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.	▫ Lecture ▫ Problem solving	Assignment (Week 4 - 6) Mid-Test 1 (Week 8)

	refrigeration.Air Refrigeration - Bell-Coleman cycle and Brayton Cycle, open and dense air systems – actual air refrigeration system problems		Expansion and compression follow the law $p.v^{1.35}$ = constant. Determine theoretical C.O.P of the system.		
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 8)
3	Refrigerants - types, properties, and selection.Refrigeration system components - compressors – general classification – comparison – advantages and disadvantages, condensers and	CO1	1. Explain the effects of low suction pressure on the volumetric efficiency of a reciprocating compressor 2. What are essential properties of a good refrigerant.	▫ Lecture	Seminar (Week 3 – 4) Mid-Test 1 (Week 8)
4	cooling towers – classification – working principles, evaporators – classification – working principles, expansion devices – types – working principles.	CO2	1. Explain the working of evaporative condenser with neat diagram. 2. What problems does lubricating oil cause in the evaporator.	▫ Lecture / Discussion ▫ Problem solving	Assignment (Week 4 - 6) Mid-Test 1 (Week 8)
5	Vapor compression refrigeration - working principle and essential	CO2	1. Why a throttle valve is used in vapour compression refrigerator	▫ Lecture ▫ Problem	Assignment

	components of the plant – simple vapor compression refrigeration cycle – COP		rather than an expansion cylinder to reduce the pressure between condenser and evaporator.	solving	(Week 4 - 6) Mid-Test 1 (Week 8)
6	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.Distinguish between dry and wet compression .Explain the effect of super heating and subcooling in vapour refrigeration. 2. An ammonia refrigerator works between -6.7^{0}C & 26^{0}C . The vapour is dry saturated at the end of compression. Determine a) Theoretical COP b) Power required to drive the compressor if the cooling capacity of the refrigerator is 5 tons.	▫ Lecture ▫ Problem solving	Mid-Test 1 (Week 8)
7	**VAPOR ABSORPTION SYSTEM:** Calculation of max COP – description and working of NH3 – water system and Li Br –water (Two shell & Four shell) System. Principle of operation, three Fluid absorption systems (Domestic Electrolux Refrigerator).	CO3	1. 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. 2. Explain Electrolux refrigerator with neat diagram	▫ Lecture ▫ Problem solving	Mid-Test 1 (Week 8)
8	**Mid-Test 1**	CO1, CO2, CO3			
9	**STEAM JET REFRIGERATION SYSTEM:** Working principle and basic components, advantages and disadvantages. .	CO3	1. explain steam jet refrigeration with neat diagram	▫ Lecture ▫ Discussion	Assignment (Week 9) Mid-Test 2 (Week 16)
10	Non conventional refrigeration systems: Thermoelectric refrigerator – Vortex tube or Hilsch tube	CO4	1. Explain the working principle of thermo electric refrigeration system. 2. What are advantages of vortex tube over other refrigeration	▫ Lecture ▫ Discussion Problem solving	Mid-Test 2 (Week 16)

			systems		
11	Psychrometric properties -air conditioning processes- need for ventilation, consideration of infiltration – load concepts of RSHF, GSHF- Problems, concept of ESHF and ADP.	CO4	1. The DBT and RH of air are 35^0 C and 60% respectively. The pressure of the air is 1.033 bar. Determine specific humidity and vapour pressure in the air. If 5 gms of water vapour is removed from the air and temperature is reduced to 25^0C, find out the relative humidity and DPT of the air. 2. Bypass factor 3. Explain ESHF, RSHF, GSHF	▫ Lecture ▫ Discussion	Assignment (Mid-Test 2 (Week 16)
12	Requirements of human comfort and concept of effective temperature- comfort chart – comfort air conditioning – requirements of industrial air conditioning, air conditioning load calculations. (Simple problems).	CO4	1.Write short notes on requirements of comfort air conditioning 2. Define term Effective Temperature and explain its importance in air- conditioning system	▫ Lecture ▫ Discussion	Assignment (Mid-Test 2 (Week 16)
13	Air conditioning systems: Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers fans and blowers.	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	Assignment (Mid-Test 2 (Week 16)
14	Heat pump – heat sources – different heat pump circuits	CO5	Explain different heat pump circuits	▫ Lecture Problem solving	Assignment (Mid-Test 2 (Week 16)
15	Design of air conditioning systems: Cooling load calculations-Bypass Factor (BF)-Effective Sensible Heat Factor (ESHF)-cooling coils	CO5	1. A cinema hall of 2000 seating capacity is air-conditioned for summer conditions. Outdoor conditions: 40^0C DBT and 45% R.H, Required conditions 24^0C DBT and 60% R.H, amount of free air supplied is 0.25 m^3/min/person. 60% of the conditioned air is recirculated and mixed with 40% fresh air. The required condition is achieved first by cooling and dehumidifying and then heating. Find the capacity of cooling coil in tons of refrigeration and capacity of	▫ Lecture Problem solving	Assignment (Mid-Test 2 (Week 16)

			heating coil in kW. Also find the bypass factor of the cooling coil if the dew point temperature of the coil is 13^0C. If the bypass factor of heating coil is 0.3, then find the surface temperature of the heating coil.		
16	& Dehumidifying Air Washers.	CO5		▫ Lecture Problem solving	Assignment (Week 14 -16) (Mid-Test 2 (Week 18)
18					
19/20	**END EXAM**				