

Course code	Course Name	L-T-P-Credits	Year of Introduction
ME 405	REFRIGERATION AND AIR CONDITIONING	2-1-0-3	2016
Prerequisite: ME205 Thermodynamics			
Course Objectives: <ol style="list-style-type: none"> 1. To introduce vapour compression and vapour adsorption systems 2. To impart knowledge on refrigeration cycles and methods to improve performance 3. To familiarize the components of refrigeration systems 4. To introduce air conditioning systems 5. To know the applications of refrigeration and air conditioning systems 			
Syllabus Introduction, Thermodynamics of refrigeration, Air refrigeration systems, Vortex tube refrigeration, Adiabatic demagnetization of paramagnetic salts, Vapour compression systems, Refrigerants and their properties, Application of refrigeration, Refrigeration system components, Air conditioning, Psychrometry, Air conditioning systems.			
Expected outcome: The students will be able to <ol style="list-style-type: none"> i. Understand the principles refrigeration of air-conditioning and basic design considerations. ii. Carry out analysis of refrigeration cycles iii. Apply the concepts of indoor environmental comfort. iv. Perform psychrometric calculations, humidity control and analysis of air-conditioning processes v. Know the various applications of Refrigeration and air conditioning 			
Text Books: <ol style="list-style-type: none"> 1. Arora C. P, Refrigeration and Air-Conditioning, McGraw-Hill, 2008 2. Arora S. C. and Domkundwar, Refrigeration and Air-Conditioning, Dhanpat Rai, 2010 3. Ballaney P. L, Refrigeration and Air-Conditioning, Khanna Publishers, New Delhi, 2014 4. Manohar Prasad, Refrigeration and Air-Conditioning, New Age International, 2011 			
References Books: <ol style="list-style-type: none"> 1. ASHRAE Handbook 2. Dossat. R. J, Principles of Refrigeration, Pearson Education India, 2002 3. Stoecker W.F, Refrigeration and Air-Conditioning, McGraw-Hill Publishing Company, 2009 			
Course Plan			
Module	Contents	Hours	Sem. Exam Marks
I	Introduction – Brief history and applications of refrigeration. Thermodynamics of refrigeration- reversed Carnot cycle- heat pump and refrigeration machines, Limitations of reversed Carnot cycle. Unit of refrigeration- Air refrigeration systems- Reversed Joule cycle, Air craft refrigeration systems, simple bootstrap- Regenerative and reduced ambient system	6	15%

II	Vortex tube refrigeration-Very low temperature refrigeration systems (concept only). Adiabatic demagnetization of paramagnetic salts Vapour compression systems-simple cycle - representation on T- s and P- h Diagrams. COP- Effect of operating parameters on COP – methods of improving COP of simple cycle- super- heating , under cooling, Liquid suction heat exchanger, actual cycle.	8	15%
FIRST INTERNAL EXAM			
III	Multi pressure systems - multi compression and multi evaporator, systems. Inter cooling - flash inter cooling and flash gas removal-Different combinations of evaporator and compressor for different applications, Cascade system Refrigerants and their properties-Eco-friendly Refrigerants, mixed refrigerants, selection of refrigerants for different applications Vapour absorption systems - Ammonia – water system - simple system- drawbacks-Lithium Bromide water system- Electrolux-comparison with vapour compression system- steam jet refrigeration.	7	15%
IV	Application of refrigeration- domestic refrigerators- water coolers-ice plants. Cold storages- food preservation methods- plate freezing , quick-freezing. Refrigeration system components- Compressors, condensers, expansion devices, evaporators. Cooling towers- Different types and their application fields- Refrigerant leakage and detection – charging of refrigerant – system controls.	6	15%
SECOND INTERNAL EXAM			
V	Air conditioning – meaning and utility, comfort and industrial air conditioning. Psychrometric properties- saturated and unsaturated air, dry, wet and dew point temperature – humidity, specific humidity, absolute humidity, relative humidity and degree of saturation-thermodynamic equations- enthalpy of moisture- adiabatic saturation process -psychrometers. Thermodynamic wet bulb temperature, psychrometric chart- Psychrometric processes- adiabatic mixing-sensible heating and cooling- humidifying and dehumidifying, air washer – bypass factor- sensible heat factor-RSHF and GSHF line-Design condition- Apparent dew point temperature – Choice of supply condition, state and mass rate of dehumidified air quantity – Fresh air supplied –air refrigeration. Comfort air conditioning- factors affecting human comfort. Effective temperature – comfort chart. Summer air conditioning- factors affecting-cooling load estimation.	8	20%
VI	Air conditioning systems- room air conditioner- split system-packaged system-all air system-chilled water system. Winter air conditioning – factors affecting heating system, humidifiers. Year round air conditioning AC system controls-thermostat and humidistat. Air distribution systems- duct system and design- Air conditioning of restaurants, hospitals, retail outlets, computer center, cinema theatre, and other place of amusement. Industrial applications of air conditioning.	7	20%
END SEMESTER EXAM			

Question Paper Pattern

Use of approved Refrigerant tables permitted

Maximum marks: 100

Time: 3 hrs

The question paper should consist of three parts

Part A

There should be 2 questions each from module I and II

Each question carries 10 marks

Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part B

There should be 2 questions each from module III and IV

Each question carries 10 marks

Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part C

There should be 3 questions each from module V and VI

Each question carries 10 marks

Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

Note: Each question can have a maximum of four sub questions, if needed.

