5047 - PRINCIPLES OF AIR CONDITIONING

Teaching Schedule Per Week			Progressive Assessment		Examination Schedule (Marks)			
Lectures	Practical	Credit			Theory		Practical Ex.	Total
3	2	5	25	25	3 HRS	100	ORAL/25	175

Pre-requisite	Source
~~5047~~	MEC

Semester	Theory	Test	Total	TW	PR	Gr Total
	75	25	100	25	50	175

Rationale: The Technicians with specialisation in Heat Power Engineering having developed a clear understanding of various concepts of Refrigeration and Air conditioning should be in a position to contribute towards the designing of any refrigeration and Air conditioning system. This necessitates thorough knowledge of psychometry. The course is designed to facilitate acquaintance with principles of load estimations for various applications of refrigeration and air conditioning. The student will be familiarised with various air conditioning methods, air distribution patterns and air conditioning controls. The course also covers design of refrigeration piping and air conditioning ducting in sufficient depth.

COURSE CONTENTS	Hrs.	MKs
1. PROPERTIES OF MOIST AIR Working substance in Air Conditioning: Gibbs – Dalton Laws, Gas Constant and Molecular weight of mixture, Molecular weights and gas constants for dry air and water vapour. Psychrometric properties: a. dry bulb temperature b. wet bulb temperature, c. specific humidity ratio, d. Dew point temperature, e. Degree of saturation, f. relative humidity g. Enthalpy of moist air h. Humid specific heat. Wet bulb temperature and its measurement: a. Laboratory psychrometer b. Sling psychrometer c. Aspirating psychrometer, Adiaratic saturation temperature Psychrometric chart: a. Saturation line b. Relative humidity c. Constant specific volume d. Relative humidity lines e. Constant enthalpy lines.	06	12
2. PSYCHROMETRY OF AIR CONDITIONING PROCESSES 1 Mixing processes: Mixing with condensation 2 Basic processes in conditioning of air: a. Sensible heating b. Sensible cooling c. Humidifying d. De-humidifying e. Heating and humidifying f. Cooling and dehumidifying g. Cooling and humidifying h. Heating and dehumidifying 3 Psychrometric processes in Air conditioning Equipment: a. Bypass factor b. Cooling and dehumidfying coils c. Heating coils d. Air washer e. Adiabatic dehumidifier f. Water injection g. Steam injection 4 Simple air conditioning system and state and mass rate of supply air. 5 Summer Air conditioning – Apparatus Dew point; Summer Air – conditioning system with ventilation Air –zero bypass factor; Summer Air conditioning system with ventilation Air – bypass factor X. 6 Winter Air conditioning; Year round Air conditioning system; Requirements of comfort Air conditioning	10	18
3. LOAD CALCULATIONS AND APPLIED PSYCHROMETRICS Preliminary considerations Internal heat gains: a. Occupancy load b. Lighting load c. Appliances load d. Piping, tanks, evaporation of water from a free surface and steam e. Product load f. Process load. System heat gains: a. Supply air duct heat gain and leakage loss b. Heat gain from Air conditioning fan. c. Return Air duct Heat and leakage gain Break-up of ventilation load and effective sensible heat factor; Cooling load estimate, Heating load estimate Selection of air conditioning apparatus for cooling and Dehumidification: a. High latent cooling load application b. All out door air application.	06	12
4. AIR CONDITIONING SYSTEM AND APPLICATIONS 1. Central station Air conditioning system. 2. Unitary air conditioning system; 3. District air conditioning system; Self contained air conditioning units; Direct expansion system; All – water system; All – Air system; All – water system. Arrangement of the components of some Air conditioning system used in practice. Special features considered for Air conditioning of computer centre, hospital, theatres, photographic industries, hotels & restaurants.	06	15
5. AIR CONDITIONING EQUIPMENT Air cleaning: a. Air – filtration b. Air – sterilisation c. Air – ionisation d. Odour suppression Air – Filters: a. Dry filters b. Self cleaning viscous filters c. Wet filters d. Electric filters e. Centrifugal dust collector; Selection of Air filters Humidifiers: a. Steam injection type humidifier b. Atomisation type humidifier c. Impact type humidifier d. Pan and coil type humidifier e. Air washer humidifier Dehumidifiers: a. Spray type dehumidifier b. Dehumidification by absorption Fans and Blowers; Grills and Registers	06	15

6. AIR DISTRIBUTION SYSTEMS AND DUCT DESIGN 05 12

Room air distribution; Definition of throw, drop, entertainment ratio and spread; Types of supply air outlets; Considerations for selection and location of outlets; Distribution patterns of outlets; Locating return air openings; Flow through a duct; Pressure drop in ducts; Rectangular equivalent of circular ducts; Duct design procedures;: a. Equal friction method, b. velocity reduction method, c. static regain method; Duct arrangement systems.

7. THERMAL INSULATION FOR AIR CONDITIONING SYSTEMS 03 06

Introduction; Desired properties of idea insulating materials; Factors affecting the thermal capacity; Types of insulation materials; Economical thickness of insulation Insulated systems: a. Insulation applied to cold surface b. Insulation applied to heated buildings c. Controlling moisture migration from conditioned space where very low humidity is maintained d. Insulation of refrigeration pipeline.

8. AIR CONDITION CONTROL SYSTEMS 06 10

Basic elements of control system; Temperature control elements; Humidity control elements; Actuators; Two position pneumatic control system; Two position electrical control system; Face and by pass control system; Zone control system.

Total

List of Experiments:

1. Experiments on Air conditioning tutor
2. Experiments on window air conditioner
3. Performance of experimental cooling tower
4. Estimation of cooling load for at least three different air conditioning system
5. Design of ducts
6. Study of control systems