Course code	Course Name	L-T-P-Credits	Year of Introduction
ME216	MECHANICAL TECHNOLOGY	4-0-0-4	2016

Prerequisite : Nil

Course Objective

The main objectives of this course are

- To make the students aware of the area of heat transfer and allied fields.
- To give students knowledge of mechanical power generation devices and its applications
- To impart knowledge of low temperature and its applications.
- To analyse the aspects of engineering problems solvable by applying the subject.

Syllabus

Heat transfer - Field of application- Modes of heat transfer- conduction, convection and radiation. Combined conduction and convection. Buckingham's Pi theorem and its application. Heat exchangers- Parallel flow and counter flow heat exchangers - I C Engines- mean effective pressure– Brake power, Indicated power, efficiencies. Performance test- Morse test – Retardation test – Heat balance test. Gas turbine – open and closed cycles – thermodynamics cycles. Compressors - Classifications- reciprocating compressor- Introduction to Rotary compressors, Roots blowers and vane compressors. Principles of refrigeration-unit of refrigeration- Vapour compression system, Vapour Absorption refrigeration. Air conditioning – Psychrometry- Summer and Winter Air conditioning Window type Air conditioning system

Expected Outcome

After successful completion of the course, the student will be able to

(i) identify heat transfer equipment and the theory behind them.

(ii) understand working principles and performances of I C engines, which leads him to know more about automobiles and to search for improved performances.

(iii) understand the working of different type of compressors.

(iv) know the principles and working of refrigerators and air conditioning equipments.

References

1. Rajput R K, Heat and Mass Transfer, S. Chand publishing., 2015. ,
2. Eastop T. D. and A. McConkay, Applied Thermodynamics , Pearson Education, 5th Ed
3. Thermal Engineering, Ballaney P. L., Khanna publishers, 1994. ,
4. Arora C. P., Refrigeration and Air conditioning, Tata McGraw Hill, 2000
5. Sachdeva R. C., Fundamentals of Engineering Heat and Mass Transfer, New Age Science Ltd., 2009.
6. Rajput R. K., Thermal Engineering, Laxmi Publications, 2010.

Course Plan			
Module	Contents	Hours	Sem. exam marks
I	Heat transfer - Field of application- Modes of heat transfer- Conduction- Fourier law of heat conduction, heat flux and thermal conductivity-Factors affecting conductivity- General Heat Conduction Equation in Cartesian Coordinate- thermal diffusivity, One-dimensional steady state conduction through plane walls, hollow cylinders, hollow spheres and their composites with constant conductivity- thermal resistance and equivalent thermal resistance. Transient heat conduction- lumped heat capacity method. Critical radius of insulation and its significance	9	15%
II	Convection - classification-Newton law of cooling, heat transfer coefficient, laminar and turbulent flow. Dimensionless numbers and its significance. Buckingham's Pi theorem and its application to Natural and forced convection heat transfer. Combined conduction and convection-overall heat transfer coefficient, Critical radius of insulation and its significances. Heat exchangers - Classifications- temperatures variation in Parallel flow, counter flow HE- Analysis of Heat Exchangers – Derivation of LMTD and simple problems with NTU method.	6 5	15%
First Internal Exam			
III	Radiation heat transfer - Basic theory of radiation-Spectrum of electromagnetic radiation, Reflection, Absorption and Transmission of radiation - absorptivity, reflectivity and transmissivity-Monochromatic radiation-Laws of radiations- Stefan Boltzman law, Planck's law, Kirchoff's law and Wien's displacement law, Total emissive power-. Black body, Grey body and emissivity Heat exchange between non black bodies- surface and shape resistances- electrical network analogy- heat transfer between parallel surfaces – radiation shields. Simple problems	4 6	15%
IV	I C Engines – Classification - two-stroke and four stroke engines(Working), theoretical and actual working cycles– SI and CI engines – mean effective pressure– Brake power , Indicated power, efficiencies. Performance test- Morse test – Retardation test – Heat balance test. Combustion phenomena in SI and CI engines- detonation, knocking and alternate fuels.	5 4	15%

Second Internal Exam			
V	Gas turbine – open and closed cycles – thermodynamics cycles – regeneration – reheating – intercooling – efficiency and performance of gas turbines . Compressors - Classifications- reciprocating compressor-p-v diagram, work done, effect of Clearance, efficiencies, volumetric efficiency and free air delivered (FAD), two stage compressions, optimum pressure ratio, effect of intercooling. Introduction to rotary compressors, Roots blowers and vane compressors	4 4	20%
VI	Principles of refrigeration-unit of refrigeration - capacity - Coefficient of Performance – reversed Carnot cycle , Bell-Coleman cycle-Vapour compression system-thermodynamic analysis on T-S diagram and p-h diagram-refrigerants - thermodynamic, physical and chemical properties of refrigerants - selection criteria of refrigerants –designation of refrigerants, eco friendly refrigerants Vapour Absorption refrigeration – Layout Ammonia –water system and Electrolux system. Air conditioning – Psychrometry - basic definitions, psychometric chart, psychometric processes - human comfort - comfort chart and limitations (brief discussion only) Summer and Winter Air conditioning Window type Air conditioning system	5 4	20%
End Semester Exam			

Question Paper Pattern

Max. marks: 100, Time: 3 hours

The question paper shall consist of three parts

Part A

4 questions uniformly covering modules 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

4 questions uniformly covering modules 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

6 questions uniformly covering modules V and VI. Each question carries 10 marks

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

Note: In all parts, each question can have a maximum of four sub questions, if needed.