

B.Tech. (Sixth semester) Mechanical engineering
ME 302 E Refrigeration and Air-Conditioning

L	T	P/D	Total
3	1	-	4

Theory: 100 Marks
Sessional: 50 marks

Duration of Exam: 03 hours

(a) Refrigeration

UNIT I

Basics of heat pump & refrigerator; Carnot's refrigeration and heat pump; Units of refrigeration; COP of refrigerator and heat pump; Carnot's COP; ICE refrigeration; evaporative refrigeration; refrigeration by expansion of air; refrigeration by throttling of gas; Vapor refrigeration system; steam jet refrigeration; thermoelectric cooling; adiabatic demagnetization.

Basic principles of operation of air refrigeration system, Bell-Coleman air refrigerator; advantages of using air-refrigeration in aircrafts; disadvantages of air refrigeration in comparison to other cold producing methods; simple air refrigeration in air craft; simple evaporative type air refrigeration in aircraft; necessity of cooling the aircraft.

UNIT II

Simple Vapor Compression Refrigeration System; different compression processes(wet compression, dry or dry and saturated compression, superheated compression); Limitations of vapour compression refrigeration system if used on reverse Carnot cycle; representation of theoretical and actual cycle on T-S and P-H charts; effects of operating conditions on the performance of the system; advantages of vapour compression system over air refrigeration system.

Methods of improving COP; flash chamber; flash inter cooler; optimum interstate pressure for two stage refrigeration system; single expansion and multi expansion processes; basic introduction of single load and multi load systems; Cascade systems.

Basic absorption system; COP and Maximum COP of the absorption system; actual NH₃ absorption system; functions of various components; Li-Br absorption system; selection of refrigerant and absorbent pair in vapour absorption system; Electro refrigerator; Comparison of Compression and Absorption refrigeration systems; nomenclature of refrigerants; desirable properties of refrigerants; cold storage and ice-plants.

(b) Air conditioning

UNIT III

Difference in refrigeration and air conditioning; Psychometric properties of moist air (wet bulb, dry bulb, dew point temperature, relative and specific humidity of moist air, temperature of adiabatic saturation); empirical relation to calculate P_v in moist air.

Psychometric chart, construction and use, mixing of two air streams; sensible heating and cooling; latent heating and cooling; humidification and dehumidification; cooling with dehumidification; cooling with adiabatic humidification; heating and humidification; by-pass factor of coil; sensible heat factor; ADP of cooling coil; Air washer.

UNIT IV

Classification; factors affecting air conditioning systems; comfort air-conditioning system; winter air conditioning system; summer air-conditioning system; year round air conditioning. unitary air-conditioning system; central air conditioning system; room sensible heat factor; Grand sensible heat factor; effective room sensible heat factor.

Inside design conditions; comfort conditions; components of cooling loads; internal heat gains from (occupancy, lighting, appliances, product and processes); system heat gain (supply air duct, A.C. fan, return air duct); external heat gain (heat gain through building, solar heat gains through outside walls and roofs); solar air temperature; solar heat gain through glass areas; heat gain due to ventilation and infiltration.

Transport air conditioning; evaporative condensers, cooling towers; heat pumps.

References and Text books

Refrigeration and air-conditioning by C.P arora

Basic Refrigeration and air-conditioning by Annanathana and Rayanan, TMG

Refrigeration and air-conditioning BY Arora and Domkundwar, Dhanpat rai

NOTE: In the semester examination, the examiner will set 8 questions in all, at least two question from each unit, and students will be required to attempt only 5 questions, at least one from each unit.

B.Tech. (Sixth semester) Mechanical engineering

ME 304 E

TRIBOLOGY

L	T	P/D	Total
3	1	-	4

Theory: 100marks
Sessional: 50 marks
Duration of Exam: 03 hours

UNIT I

Introduction to tribological systems and their characteristic features; analysis and assessment of surface; topography; deterministic and stochastic tribo-models for asperity contacts; techniques of surface examination; technological properties of surfaces.

Quantitative laws of sliding friction, causes of friction, adhesion theory, laws of rolling friction, measurement of friction

UNIT II

Introduction, mechanism of wear, types of wear, quantitative laws of wear, measurement of wear, wears resistance materials

UNIT III

Introduction, dry friction, boundary lubrication, hydrodynamic, hydrostatic and elasto-hydrodynamic lubrication, functions of lubricants, types and properties, lubricant additives.

Principles, application to rolling contact bearings, cams, Gears

UNIT IV

Geometry and pressure equation of journal bearing, hydrostatic bearings, thrust bearings, porous bearings and hydrodynamic gas bearings. Journal bearings with specialized applications. General requirements and different types of bearing materials.

Suggested Reading

Tribology in Indertrion- By Sushil Kumar Srivastava

Introduction to Tribology of Bearings- By B.C. Majumdar ; A.H.Wheeler

Principles of Tribology – By J. Halling, Macmillan

Mechanics and Chemistry in Lubrication- By Dorinson and Ludema , Elsevier

Friction and wear of Materials- By E. Robinowicz, Johan Wiley

Principles of Lubrication-By A. Cameron, Longmans

NOTE: In the semester examination, the examiner will set 8 questions in all, at least two question from each unit, and students will be required to attempt only 5 questions, at least one from each unit.

B.Tech. (Sixth semester) Mechanical engineering

ME 306 E

MECHANICAL VIBRATION

L	T	P/D	Total
3	1	-	4

Theory: 100 Marks

Sessional: 50 marks

Duration of Exam: 03 hours

UNIT I

Kinematics of simple vibrating motion, Simple harmonic motions, Vectorial representation of harmonic motion. Degree of freedom, Equations of motions, general solution of free vibration, Phase plane method

UNIT II

Damped free vibration, undamped and damped forced vibrations, Vibrating isolation, Vibrating instruments.

Undamped free vibration ,Principle modes , Influence coefficients, Coordinate coupling, Orthogonality, Vibration absorbers.

UNIT III

Geometric method, Stability of equilibrium points, Method of harmonic balance.

Influence coefficients, Dunkerleys equation, Matrix iteration, Holzer method, Rayleigh method, and Rayleigh-Ritz method.

UNIT IV

Transverse vibration of strings, Longitudinal vibrations of bars, Lateral vibration of beams, Torsional vibration of circular shafts, Whirling of shafts.

Introduction, Method of Laplace transformation and response to an impulsive output, response to step-input, pulse-input, and phase plane method.

REFERENCE AND TEXT BOOKS: -

Mechanical vibration - By G.K. Grover; Nemchand Chand and Sons

Mechanical Vibration – By Thomson; Prentice Hall

Mechanical Vibration - By Den Hartog; Mc Graw Hill

Introductory course to mechanical vibrations – By Rao and Gupta; Wiley Eastern

NOTE: In the semester examination, the examiner will set 8 questions in all, at least two question from each unit, and students will be required to attempt only 5 questions, at least one from each unit.

B.Tech. (Sixth semester) Mechanical engineering
ME 308 E COMPUTER AIDED DESIGN AND MANUFACTURING

L	T	P/D	Total
4	1	-	5

Theory: 100 Marks
Sessional: 50 marks
Duration of Exam: 03 hours

UNIT I

Introduction to CAD/CAM, Historical Development, Industrial look at CAD/CAM, Introduction to CIM Basic of Geometric & Solid modeling, Coordinate systems, Explicit, Implicit, Intrinsic and parametric equation
Part families, Part classification and coding, product flow analysis, Machine cell Design, Advantages of GT

UNIT II

Introduction, Transformation of points & line, 2-D rotation, Reflection, Scaling and combined transformation, Homogeneous coordinates, 3-D scaling, shearing, rotation, reflection and translation, combined transformations, Orthographic and perspective projections
Algebraic and geometric forms, tangent & normal blending functions, reparametrization
Straight line, conics, cubic splines, bezier curves and B-spline curves

UNIT III

Algebraic and geometric forms, tangent & twist vectors, normal blending function, reparametrization, Sixteen point form, four Curve form, Plane surface, ruled surface
Surface of revolution, tabulated cylinder Bi-cubic surface, bezier surface, B-spline surface
Solid models and representation scheme B-rep & CSG, sweep representation, Cell decomposition, spatial occupancy enumeration

UNIT IV

Introduction, fixed programmable and flexible automation, Types of NC systems, MCU & other components, Co-ordinate system, NC manual part programming, G & M codes, part program for simple parts, Computer assisted part programming
Introduction, FMS component, Types of FMS, FMS layout, Planning for FMS, advantage and applications
Introduction, conventional process planning, Steps in variant process planning, types of CAPP, planning for CAPP

Suggested Reading:

- ❖ CAD/CAM theory & practice (Ibrahim Zeid)
- ❖ CAD/CAM (Groover & Zimmer)
- ❖ Numerical control and computer aided manufacturing by RAO and Tiwari, Tmg

NOTE: In the semester examination, the examiner will set 8 questions in all, at least two question from each unit, and students will be required to attempt only 5 questions, at least one from each unit.

B. Tech. (Sixth semester) Mechanical Engineering
FUNDAMENTALS OF MANAGEMENT

HUT-302E

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Theory : 100 Marks
Sessionals : 50 Marks
Total : 150 Marks
Time : 3 Hours

UNIT – I Financial Management

Introduction of Financial Management, Objectives of Financial Decisions, Status and duties of Financial Executives. Financial Planning - Tools of financial planning. Management of working capital, Factors affecting requirements of working capital. Capital structure decisions. Features of appropriate capital structure. Sources of finance.

UNIT-II Personnel Management

Personnel Management - Meaning, Nature and Importance; Functions of Personnel Management - (a) Managerial Functions and (b) Operative functions. Job Analysis: Meaning and Importance; Process of Job Analysis; Job Description and Job specification. Human Resource Development-Meaning and concept.

UNIT-III Production Management

Production Management : Definition and Objectives
Plant location : Ideal plant location. Factors affecting plant location.
Plant Layout : Ideal plant layout, factors affecting plant layout.
Work Measurement: Meaning, Objectives and Essentials of work measurement.
Production Control: Meaning and importance of production control and steps involved in production control.

UNIT-IV Marketing Management

Nature, scope and importance of marketing management. Modern Marketing concepts. Role of marketing in economic development. Marketing Mix. Marketing Information System. Meaning, nature and scope of International Marketing.

NOTE :

The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all, selecting at least one question from each unit.

**B.Tech. (Sixth semester) Mechanical engineering
ME 312 E Refrigeration and Air Conditioning (Practical)**

L	T	P/D	Total
-	-	2	2

**Practical: 25Marks
Sessional: 25 marks
Duration of Exam: 03 hours**

List of Experiments

1. Study & Performance of basic vapour compression Refrigeration Cycle.
2. To find COP of water cooler.
3. To study the walk in cooler.
4. To study and perform experiment on vapour absorption apparatus.
5. Perform the experiment & calculate various. Performance parameters on a blower apparatus.
6. To find the performance parameter of cooling tower.
7. To study various components in room air conditioner.
8. To find RH of atmosphere air by using sling Psychometric and Psychometric.
9. To find performance of a refrigeration test rig system by using different expansion devices.
10. To study different control devices of a refrigeration system.
11. To study various compressor.
12. To find the performance parameters of Ice Plant.

Note: Total Ten experiments must be performed. At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or outside the list.

B.Tech. (Sixth semester) Mechanical engineering
ME 314 E TRIBOLOGY & MECHANICAL VIBRATION (PRACTICAL)

L	T	P/D	Total
-	-	2	2

Practical: 25Marks
Sessional: 50 marks

Duration of Exam: 03 hours

LIST OF EXPERIMENT:

1. To study undamped free vibrations of equivalent spring mass system and determine the natural frequency of vibrations
2. To study the free vibration of system for different damper settings. Draw decay curve and determine the log decrement and damping factor. Find also the natural frequency
3. To study the torsional vibration of a single rotor shaft system and to determine the natural frequency.
4. To determine the radius of gyration of given bar using bifilar suspension.
5. To verify the dunker ley's rule
6. To study the forced vibration of system with damping. Load magnification factor vs. Frequency and phase angle vs frequency curves. Also determine the damping factor.
7. To study the pressure distribution of a journal bearing using a journal bearing apparatus.
8. To determine the rate of wear of a metallic pin from the plot of displacement vs time curves by using friction and wear monitor apparatus.
9. To determine abrasion index of a material with the help of dry abrasion test rig.
10. To evaluate the load wear index and the weld point of a lubricant with the help of a four ball stream pressure tester.
11. To determine the two frequencies of torsional spring type double pendulum & compare them with theoretical values.
12. To determine the radius of gyration of a compound pendulum.
13. To determine the radius of gyration of disc using trifilar suspension.

Note: Total Ten experiments must be performed. At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or outside the list.

B.Tech. (Sixth semester) Mechanical engineering
ME 316 E COMPUTER AIDED DESIGN & MANUFACTURING (Practical)

L	T	P/D	Total
-	-	2	2

Practical: 25Marks

Sessional: 50 marks

Duration of Exam: 03 hours

List of Experiments

Note: Practical will base on course No. ME 308 E.