



**INSTITUTE OF TECHNOLOGY  
GURU GHASIDAS VISHWAVIDHALAYA**

(A CENTRAL UNIVERSITY ESTABLISHED BY THE CENTRAL UNIVERSITY ORDINANCE 2009, NO: 3 OF 2009)

**DEPARTMENT OF MECHANICAL ENGINEERING  
STUDY & EVALUATION SCHEME**

**W.E.F. SESSION 2012-2013**

**Year: B.Tech-IV Year**

**SEMESTER: VII**

S No.	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			Credits
			L	T	P	INTERNAL ASSESSMENT*	ESE	SUB TOTAL	
<b>(THEORY )</b>									
1.	ME- 471	Refrigeration & Air Conditioning	3	1	-	40	60	100	4
2.	ME- 472	Turbo Machinery	3	1	-	40	60	100	4
3.	ME- 473	Production Planning & Control	3	1	-	40	60	100	4
4.	ME- 474	Computer Aided Design and Manufacturing(CAD/CAM)	4	-	-	40	60	100	4
5.	ME -475	Elective-I*	3	1	-	40	60	100	4
<b>Total</b>			<b>16</b>	<b>4</b>		<b>200</b>	<b>300</b>	<b>500</b>	<b>20</b>
<b>( PRACATICALS)</b>									
6.	ME- 476	Refrigeration & Air Conditioning Lab	-	-	3	30	20	50	2
7.	ME- 477	Project	-	-	4	50	-	50	2
8.	ME- 478	Seminar on Summer training** (About 30 Days)	-	-	3	50	-	50	2
<b>Total</b>					<b>10</b>	<b>130</b>	<b>20</b>	<b>150</b>	<b>6</b>

\*\* 30 days summer training after the end semester examination of VI semester and students are required to submit detailed training report & presentation during the seventh semester.

<b>Elective – I*</b>	
ME - 475 A	Theory of Vibration
ME - 475 B	Finite Element Method
ME - 475 C	Mechatronics
ME - 475 D	Organization & Management

Total Credits: 26

Total Contact Hour: 30

Total Marks: 650

**\*INTERNAL ASSESSMENT-(MSE- Mid Semester Examination of 20 Marks, Two Class Test/Assignment/Quizzes/Group Discussion etc.)**

**L-LECTURE, T-TUTORIAL, P-PRACTICAL,CT-CLASS TEST, E.S.E –END SEMESTER EXAMINATION.**

Category of Course	Course Code	Course Title	Periods/Week				Theory Paper
			L	T	P	C	
Mechanical Engg. B. TECH-VII Sem	ME-471	REFRIGERATION & AIR CONDITIONING	3	1	-	4	Max Marks-60 Min Marks- Duration-3Hrs

## ME-471 REFRIGERATION & AIR CONDITIONING

### UNIT – I

Carnot Refrigerator & Heat pump, air refrigeration systems, bell Coleman air refrigeration cycle. Air craft system & its performance.

**Vapour compression refrigeration:** simple cycle, t-s and p-h charts analysis of vapor compression cycle, factors effecting performance of vapor compression cycle, actual vapour compression cycle, multi stage compression system.

### UNIT – II

**Vapour absorption refrigeration systems:** description of system components, aqua ammonia and water lithium bromide systems. Its analysis & advantages over vapour compression system.

**Refrigeration equipment:** constructional details, capacity, control and performance of compressors, condensers, evaporators, expansion devices, thermostatic expansion valve.

### UNIT – III

**Production of low temperature** - cascade system, Joule Thomson effect & liquefaction of gases, liquefaction of hydrogen & helium, application of cryogenics.

**Nonconventional refrigeration system**-thermo-electric refrigeration, vortex tube, steam jetrefrigeration system.

**Refrigerants:** classification, properties & selection of refrigerants.

**UNIT – IV Psychrometrics:** Psychrometry and psychometric properties, psychometric relations, psychometric chart and its use, psychometrics processes, human comfort, factors affecting comfort, comfort chart.

**Requirements of comfort air conditioning:** thermodynamics of human body, comfort chart, factors governing optimum effective temperature.

**Cooling load calculations & design of a.c. system-** different heat sources, design of air conditioning system, bypass factors, effective sensible heat factor, cooling coils.

**UNIT – V Fluid flow, duct design & air distribution system-** various losses in fluid flow, different methods of duct design & arrangement system, air distribution system & ventilation system.

**Automotive air conditioning:** system location and layout, components, system maintenance. Car, Railway air conditioning & marine air conditioning.

**Text Books:**

- 1.Refrigeration and Air Conditioning C. P. Arora - TMH.
- 2.Refrigeration and Air Conditioning – Manohar Prasad – New-Age International Pub
3. Refrigeration and Air Conditioning – Arora & Domkundwar – Dhanpat Rai & Sons
4. Refrigeration and Air Conditioning – P.L. Ballaney – Khanna Pub.

Category of Course	Course Code	Course Title	Periods/Week				Theory Paper
			L	T	P	C	
Mechanical Engg. B. TECH-VII Sem	ME-472	TURBO MACHINERY	3	1	-	4	Max Marks-60 Min Marks- Duration-3Hrs

**ME-472 TURBO MACHINERY****UNIT-I**

**Gas dynamics:** Isentropic flow, Shock waves, fanno & Raleigh lines, lines converging diverging nozzles flow, adiabatic flow with friction in conducts. Frictionless flow & steady isothermal flow through ducts with heat transfer, design performance of steam nozzle.

**UNIT-II**

**General analysis of turbo machines :** Turbo machines, compressible flow machines, incompressible flow machine, turbine & compressor stages, radial stages, mixed flow stages, impulse stages, reaction stages multi stage machine, polytropic & isentropic efficiency Euler energy equation, work & efficiency of turbine stages, optimum performance of stage, effect of degree of reaction.

**Steam turbines-**Impulse turbines, velocity diagram, influence of ratio of blade speed & steam speed on blade efficiency in single stage turbine efficiency, impulse blade section, choice of blade angles.

**UNIT -III**

**Impulse-reaction turbine:** Impulse-Reaction turbines, degree of reaction, height of reaction blading, stages efficiency of impulse-Reaction turbines with half degree of reaction, various losses in steam turbines.

**State points & reheat factors:** State point locus, h-s charts for multi stages turbines, condition curve, reheat factor, internal efficiency.

**Governing:** requirement of steam turbine, Governing, function of governing, nozzles & throttle governing method & their effect on performance, William's line.

**UNIT -IV**

**Gas turbine:** Principles of Gas turbine, open & closed cycle, Efficiency & work out put, reheat cycle with heat exchanger , regenerative cycle, performance of practical Gas turbine cycle, compressor & turbines efficiency, pressure losses, mechanical losses, performance from design point of view, calculation for simple & practical cycle, polytropic Efficiency ,general performance of simple cycle.

## UNIT -V

**Turbo compressors:** Centrifugal & axial flow Compressor, Components comparison, theory & performance of Compressor, multi stage Compression with inter cooling, surging & chocking, H.P. requirement, Efficiency, blade-angles, surging & stalling, losses and radial equilibrium theory

### Text Books:

1. Principle of Turbo Machinery by D. G. Shepherd –McMillan.
2. Fluid Mechanics by V. L. Streeter – Mc-GrawHill.
3. Gas Turbine Theory & Jet Propulsion – J.K. Jain.
4. Gas Turbine – V. Ganeshan – TMH.
5. Turbine, Compressors and Fans – S.M. Yahya – TMH.
6. Steam and Gas Turbine – R. Yadav by C.P.H. Publication, Allahabad.

Category of Course	Course Code	Course Title	Periods/Week				Theory Paper
			L	T	P	C	
Mechanical Engg. B. TECH-VII Sem	ME-473	PRODUCTION PLANNING AND CONTROL	3	1	-	4	Max Marks-60 Min Marks- Duration-3Hrs

### ME -473 PRODUCTION PLANNING AND CONTROL

## UNIT - I

**Introduction:** Introduction to various Types of Production System viz. Mass Production, Job Shop, Batch Production System, Continuous Production System, Concept of Production and Operation Management, Objective & functions of PPC.

**Forecasting:** Time Series method, moving average, weighted average, Trend, Seasonality, Regression Technique, Delphi Method.

## UNIT - II

**Aggregate Planning:** Definition, Strategies, Pure and mixed strategies, methods.

**Master Production Schedule:** objective and functions, Design of MPS, Bill of Materials.

**Material Requirement Planning:** objectives, functions, MRP, MRP-II, limitations.

**Capacity Requirement Planning:** Definition, Objectives, Process of CRP, Process Sheet, Rough Cut Capacity Planning, Loading, and Preparation of CRP chart.

## UNIT - III

**Scheduling:** Types, Single Machine Scheduling, Job shop Scheduling, Flow Scheduling;

**Sequencing:** various priority rules; Line of Balancing: Rank and positional weight method, Kilbridge westner method.

**Facility location and facility location problems:** Factors affecting plant locations, single facility locations problems and its methods.

## UNIT - IV

**Types of layout-** layouts design procedure such as CORELAP, CRAFT etc.  
Material handling system & their classification, principles. JIT & KANBAN.  
Depreciation & methods of depreciation.

## UNIT-V

**Maintenance Management:** Types of maintenance strategies, Breakdown and Preventive Maintenance, Predictive and Total Productive Maintenance, Condition monitoring, Individual and group replacement policies. Make or Buy Decision, concept of original equipment effectiveness.

### Text Books:

1. Production and operation management, O.Paneerselvem, TMH.
2. Production and operation management, Adem Ebert
3. Production and operation management, Charry S.N. TMH
4. Production and operations management Theory and practice Mahadevan.B
5. Production and operation management, Joseph .G. Monks, TMH
6. Handbook of Material Handling, Ellis Horwood limited
7. Operations Management: Design Planning and control for the manufacturing and services Lawrence.P.Atkin, James B. Dilworth Tata Mc Graw Hill
8. Production and Operations management, R.B Khanna, PHI.
9. Production operations management S.N.Buffa, PHI.

Category of Course	Course Code	Course Title	Periods/Week				Theory Paper
			L	T	P	C	
Mechanical Engg. B. TECH-VII Sem	ME-474	COMPUTER AIDED DESIGN AND MANUFACTURING (CAD/CAM)	3	1	-	4	Max Marks-60 Min Marks- Duration-3Hrs

## ME -474 COMPUTER AIDED DESIGN AND MANUFACTURING (CAD/CAM)

### UNIT-I

**Basics of CAD:** Computer hardware, input and output devices, aspect ratio, software, random and raster scan, image and screen resolutions, anti-aliasing, line drawing algorithms, conic section, circle drawing algorithms, basic of curves, cubic spline, bezier & B-spline curve, database structure, graphics standard.

### UNIT- II

**Geometric Transformation:** Computer Aided Design (CAD) methodology, coordinate system, theory and applications, wireframe, surface of revolution, sweep surface, development surface and solid modeling, methods of solid modeling, CSG, B-Rep, advantages and disadvantages of CAD, 2D and 3D transformation, homogeneous transformation, concatenation, rapid prototype.

### UNIT - III

**Basics of CAM :** Basic concept of numerical control (NC) System, NC coordinate system, NC motion control, Application of NC, concepts of computer numeric control(CNC) system, concept of distributed numeric control (DNC) system, problems with conventional, NC, CNC and DNC, advantages and disadvantages of NC,CNC and DNC, concurrent engineering.

### UNIT- IV

**Part Programming:** Introduction to NC part programming, manual part programming, computer assisted part programming, Automatically Programming Tool (APT) language, statements and code of APT, programming methods, advantages of CAD/CAM programming.

### UNIT- V

**Advance Manufacturing System :** Concept of computer integrated method (CIM), Flexible manufacturing system(FMS), benefits and applications of CIM and FMS, group technology(GT), parts classification and coding systems, benefits and applications of GT, automated storage and retrieval system (AS/RS), Automated guided vehicle(AGV).

#### Text Books:

1. CAD/CAM. Groover & Zimmer, Prentice Hall, India
2. Production System & Automation, Groover, Prentice Hall, India
3. Computer Graphics & CAD, Ramamurthy, T.M.H.
4. Industrial Robotics & CIM, Surendra Kumar I.B.H.
5. CAD/CAM, P.N.Rao, Prentice Hall, India.
6. CAD/CAD Theory & Practice-I.Zeid & R. Sivasubramaniam, TMH
7. CAM T.C. Chang & Wang, Pearson

Category of Course	Course Code	Course Title	Periods/Week				Theory Paper
			L	T	P	C	
Mechanical Engg. B. TECH-VII Sem	ME-475 A	THEORY OF VIBRATION (Elective)	3	1	-	4	Max Marks-60 Min Marks- Duration-3Hrs

### ME – 475A THEORY OF VIBRATION (Elective)

#### UNIT I

**Element of vibration system:** - lumped mass, stiffness and damping, simple harmonic motion, vector representation.

**Single degree of freedom system:** equation of motion by energy method & Newton law of motion , general solution, free and forced vibration.

## UNIT II

**Damped and undamped motion-** Equation of motion for single and two degree of freedom equivalent damping, logarithmic decrement. Damping measurement, rotating and reciprocating unbalance, vibration absorber, Seismic instruments.

**Transient vibration:** - impulse response, Convolution integral, Fourier analysis.

## UNIT III

**Multi degree freedom system:** - equation of motion, co-ordinate coupling, undamped forced vibration, principal modes, generalized co-ordinates, semi definite system, orthogonality of modes, modal analysis, Lagrange's equation.

## UNIT IV

**Natural frequency numerical solution:** - Rayleigh's method, Dunkerley's method, Holzer method, Transfer matrix, Iteration method.

**UNIT V : Continuous system:** - Vibration of stretched cord, torsional vibration, longitudinal vibration of slender rod, lateral vibration of beams, Shear deformation and rotary inertia effect, Rayleigh's quotient, Rayleigh's-Ritz method.

### Text Books:

1. Tse.S,Morse R Rolland T . Hinkle. Ivan E. “ Mechanical vibrations theory and application” Published by Allyn and Bacon ,Tne
2. Thomson T. Milliam “theory of vibrations with applications” Prentice Hall of India
3. Hartog Den ,J.P. “mechanical vibrations” Tata McGraw Hills, 4<sup>th</sup> edition 1956)
4. Meirovitch L. “elements of vibration analysis McGraw Hills -1956
5. Anderson R.A. “fundamentals of vibration” Mecomillan press 1967
6. Kbstad ,N.O. “fundamentals of vibration analysis” McGraw Hills -1956
7. Robert K. Vicrck “vibration analysis” Published by Harper & Row
8. Timoshenko ,s.,young ,D.H. & Weavev W.Jr “vibration problem in engineering 4<sup>th</sup> ed,New York Wilay 1974
9. Mecrovitch,L., “analytical methods in vibration” published by macmillam(1967)
10. Stoker J.J “non linear vibration” Wilay 1950
11. Minorsky .N. “non linear oscillations” Published by Van Nostrand 1962.

Category of Course	Course Code	Course Title	Periods/Week				Theory Paper
			L	T	P	C	
Mechanical Engg. B. TECH-VII Sem	ME-475 B	FINITE ELEMENT METHOD (Elective)	3	1	-	4	Max Marks-60 Min Marks- Duration-3Hrs

### **ME – 475 B FINITE ELEMENT METHOD (Elective)**

#### **UNIT-I**

**Introduction:** general, general description of the method, brief explanation of FEA for a stress analysis problem, finite element method vs classical method, FEM vs FDM, a brief history of FEM, need for studying FEM, warning to FEA Package users.

**Basic equations in elasticity:** stresses in a typical element, equations of equilibrium, strains, strain displacement equations, linear constitutive law.

**Matrix displacement formulation:** matrix displacement equations, solution of matrix displacement equations, techniques of saving computer memory requirements.

#### **UNIT-II**

**Element shapes, Nodes, Nodal unknowns and Coordinate systems.**

**Shape functions:** polynomial shape functions, convergence requirements of shape functions, derivation of shape functions using polynomials, finding shape functions using Lagrange polynomials, shape functions for serendipity family elements, Hermite polynomials as shape functions, construction of shape functions by degrading technique.

#### **UNIT III**

**Strain displacement matrix:** strain-displacement matrix for bar element, strain displacement matrix for CST element, strain displacement relation for beam element.

**Assembling stiffness equation-direct approach:** element stiffness matrix for CST element by direct approach, nodal loads by direct approach.



**Assembling stiffness equation-Galerkin's method, virtual work method:** Galerkin's method, Galerkin's method applied to elasticity problems.

#### UNIT IV

**Assembling stiffness equation-variational method:** general variational method in elasticity problems, potential energy in elastic bodies, principles of minimum potential energy, Rayleigh-Ritz method, variational formulation in finite element analysis.

**Discretization of a structure:** nodes as discontinuities, refining mesh, use of symmetry, finite representation of infinite bodies, element aspect ratio, and higher order element vs mesh refinement, numbering system to reduce band width.

#### UNIT V

**Finite element analysis-bars and trusses:** Tension bars/columns, two dimensional trusses (plane trusses), three dimensional trusses (space trusses).

**Finite element analysis-plane stress and plane strain problems:** general procedure when CST elements are used, use of higher order elements.

**Analysis of beams and rigid frames:** beams analysis using two noded elements, analysis of rigid plane frame using 2 Nodes beam elements, a three dimensional rigid frame element, Timoshenko beam element.

#### Text Books:

1. Huebner, K.H. and Thorton, E.A., "The Finite Element Methods for Engineers" John Wiley & Sons.
2. Cook, R.D., Malkus, D.S. and Plesha, M.E., "Concepts and Applications of Finite Element Analysis", 3 rd Ed., John Wiley & Sons.
3. Bathe, K.J., "Finite Element Procedures", Prentice Hall of India, New Delhi.
4. Zienewicz, O.C. and Taylor, R.L., "The Finite Element Methods", Vol.1 and Vol.2, McGraw Hill.
5. Finite element analysis- S.S.Bhavikatti, New Age

Category of Course	Course Code	Course Title	Periods/Week				Theory Paper
			L	T	P	C	
Mechanical Engg. B. TECH-VII Sem	ME-475 C	MECHATRONICS (Elective)	3	1	-	4	Max Marks-60 Min Marks- Duration-3Hrs

### **ME -475C MECHATRONICS (Elective)**

**UNIT-I Introduction to Mechatronics:** Sensors and actuators type, selection and interfacing, Digital electronics and microprocessors in Mechatronic systems, Mechatronic systems modeling, Analysis and control of analog, digital and hybrid systems, Mechatronic systems design principles.

**UNIT-II Introduction to Mechatronics Systems:** Measurement Systems-Control Systems-Mechatronics approach.

**Sensors and Transducers:** Introduction-Performance Terminology-Displacement, position and Proximity-Velocity and Motion-Fluid Pressure-Temperature Sensors-Light Sensors-Selection of Sensors –signal Processing

**UNIT-III Microprocessor:** Introduction-Architecture-Pin Configuration-Instruction set-Programming of Microprocessor using 8085 Instructions-Interfacing input and output devices-Interfacing D/A convertors and A/D converters-Applications-Temperature control-Steeper moter control-traffic light controller.

**UNIT-IV Programmable Logic Controller:** Introduction-Basic structure-Input/output Processing-Programming-Mnemonics-Timers, Internal relays and Counters-Data handling-Analog input/output Selection of a PLC.

**UNIT-V Design and Mechatronics:** Stages in Designing Mechatronic systems, Traditional and Mechatronic design, possible design solutions, case studies of mechatronic systems, pick and place robot, automatic car park system, engine, management system.

**Text Books :**

1. Bolton W., "Mechatronics", Longman, Second Edition, 2004
2. Histan Micheal B and Aiciatore David G., "Introduction to Mechatronics and Measurement system, McGraw Hill International editions, 2003
3. HMT Ltd, "Mehatronics", tata McGraw Hill Publishing Co.Ltd.,1998
4. Bradley D.A., Dawson D., Burn N.C. and Loader A.J., "Mechatronics", Chapman and Hall, 1993.
5. Gaonkar Ramesh S. "Microprocessor Architecture, programming and Applications", Wiley Eastern, 1997

Category of Course	Course Code	Course Title	Periods/Week				Theory Paper
			L	T	P	C	
Mechanical Engg. B. TECH-VII Sem	ME-475 D	ORGANIZATION MANAGEMENT (Elective)	3	1	-	4	Max Marks-60 Min Marks- Duration-3Hrs

### ME – 475 D ORGANIZATION MANAGEMENT (Elective)

#### UNIT-I

**Introduction:** Origin of management concept, Management process. Principles of management, various approaches to management, the scientific management. **Planning:** Concept, nature & process of planning, types of planning, instrument of planning, strategies, policies, rules, methods standards, programmes, budgets.

#### UNIT- II

**Decision making:** theory, types of decisions. Organization, its role and importance, principles related to organization, Theories of organization, Departmentation, Delegation & Decentralization Span of control, line and staff relationship.

#### UNIT- III

**Motivation and Leadership:** Need analysis, theories of motivation, Different approaches to leadership. **Management control:** concept and process of control, performance standards, measurement of performance against standards, types of controls, principles.

#### UNIT – IV Marketing Management

The core concept- need, wants, demands, standardization, simplification, diversification & specialization.

Marketing Management: production, selling, product and marketing concept, distribution channels, four 'P', organization of marketing management.

#### UNIT – V

**Personnel Management:** Role and functions of personnel management, Organization of personnel dept., Personnel problems and their solution welfare techniques. **Manpower Selection and Development:** Sources of recruitment, Selection methods, Interviewing and testing, Training methods, Performance appraisal and its methods.

#### Text Books:

1. Essential of management, Koontz & O'Donnel, McGraw-Hill.
2. Organizational Behavior, Stephen P. Robbins, PHI.
3. Organization and Management, Agrawal R.D, TMH.
4. Management, Stonner and Phillips, PHI.
5. Principles of Management, Terry & Francklin, Richard – Frwin