Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VI-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assignment	End Sem	Lab Work	L	T	P	
	ME-1861	Manufacturing Science	70	20	10	30	20	3	-	2	4

Course Outcomes: At the end of the course, the students will able to:

CO 1	Understand mechanics of metal cutting and machining process i.e. stress, strain analysis, velocity etc
CO 2	Understand Mechanism of tool and tool life also understand cutting fluent capabilities for metal cutting
CO 3	Understand mechanics and calculation of sheet metal work, wire drawing and application
CO 4	Design of cutting tools and their parameters. Also understand Jigs and Fixtures, their designing parameters etc
CO 5	(i) Understand Machining measurement equipments and relate terminology i.e. Limits, fits, BIS, BSS, etc (ii) Understand basic of advance Manufacturing techniques and related terms

Mapping of course outcomes with program outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	2	1	1	3	2	1	3	3	1	2
CO 2	3	3		2	3	3	2		3	1	2	1
CO 3	3	3	2	2	2	3	2		3	1	2	
CO 4	3	2	2	2	2	3	2		3	1	2	
CO 5	3	2	2	2		1	1	2	3	2	2	3
ME1861	3	2.6	2	1.8	2	2.6	1.8	1.5	3	1.6	1.8	3

UNIT – 1

Metal cutting theory, geometry of cutting tools, metal machining, chip formation, types of chips, force analysis for orthogonal cutting , velocity relationship, stress and strain analysis, power and energy relationship, thermal aspects, dynamometers for turning and drilling, Standardization, interchangeability, limits, fits BIS, BSS and navel system, selection of fits as per Indians standards, various types of comparators, design of limit gauges, tolerance wear allowance.

UNIT – 2

Evaluation of machinability, Mechanism and types of tool wear, tool life, surface finish, economics of metal machining, functions of cutting fluids, requirements of good cutting fluid, cutting tool materials and their application.

UNIT – 3

Metal working analysis, Deformation behavior of metals, stress and strain analysis, yield criteria, flow lines and plastic deformation of metal, force analysis for strip rolling, wires drawing and

extrusion, slab method, slip line field, upper and lower bound holographs in sheet metal working, formability test, forming limit diagrams and their application.

UNIT – 4

Design of single point cutting tools, rigidity, design of chip breakers, dynamic chip breaking, Usefulness, principle and design of jigs and fixtures, locating and clamping devices, diamond pin locator, jig bushes, drill jigs milling, turning, boring and broaching fixtures, assembly fixtures, welding fixtures indexing devices, materials for jigs and fixtures, economics of jigs and fixtures.

UNIT – 5

Computer aided design, computer aided manufacturing, CIM, computer information system, simultaneous engineering, ERP, IOT in Manufacturing: need, application, advantage, limitation, Case Study.

References:

1. Shekho, Juneja B.L. & Singh, "Fundamentals of metal cutting & machine tools", New age Publisher.
2. C. K. Singh, Pandey P. C., "Production Engineering Science", Standard Publishers
3. Cyril Donaldson, Lechain & gold, "Tool Design" TMH
4. Bhattacharya, "Metal Cutting Principles",
5. Jain & Chitale "A Textbook of Production Engineering" PHI

List of Practical's:

1. Study and design of drill jig.
2. Study and design of milling fixture.
3. Study of construction and working of CNC machines.
4. Preparation of part programming for a given job on CNC machines.
5. Study of tool dynamometer
6. Determination of cutting temperature during turning on lathe.
7. Design of a single point cutting tool

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VI -SEM B.Tech Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assignment	End Sem	Lab Work	L	T	P	
	ME-1862 (E-I) (B)	Mechatronics & Automation	70	20	10	30	20	3	-	2	4

Course Outcomes: At the end of the course, the students will able to:

CO 1	Understand the Control System
CO 2	Understand the Sensors transducers
CO 3	Understand Hydraulic and Pneumatics system and Circuits
CO 4	Understand the Motor and programming Logic Control systems
CO 5	Understand the Automation and industry 4.0

Mapping of course outcomes with program outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3			3	3							
CO 2	3			3								
CO 3	3		3									
CO 4	3				3							
CO 5	3		3	2	3							
ME1862 B	3	2	3	2.66	3							

UNIT – I

Mechatronics Systems: elements of mechatronics systems, measurements systems , control systems, transfer functions, procedure for determining the transfer functions of a control systems, representation of a control system by bock diagram, modeling a control system, transient and steady state response, time response of a first order control systems, time response of a first order control systems

UNIT – II

Sensors and Transducers, characteristics parameters used in transducers, displacement sensor, position sensors, proximity sensor, motion sensors, light sensors, liquid flow sensor , digital transducers, Incremental optical encoders, absolute optical encoders.

UNIT – III

Hydraulic and Pneumatic Actuating systems, Hydraulic systems, pneumatic systems, control valves, components of electro pneumatic systems, Pneumatic and hydraulic circuits.

UNIT – IV

Mechanical and electrical actuating systems, D.C. motors, A.C. motors, stepper motors, servomotor, programmable logic controllers: introduction of PLC, PLC programming, application of PLC.

UNIT – V

Automation: introduction, Principles and Strategies of Automation, safety Monitoring, maintenance and repair Diagnostics, error Detection and Recovery, levels of automations, Merits and Demerits of automation. Automated Guided Vehicles (AGV's) , Automated Storage and Retrieval System (ASRS), **Automatic identification methods**: Overview of Automatic Identification Methods, Bar Code Technology, Radio Frequency Identification, Other AIDC Technologies. **Industry 4.0:** Introduction, IoT Techniques, Cloud computing, machine learning,

Reference Books:

1. Mechtronics, K P Ramchandran , Wiley India Pvt. Ltd.

2. Mechanical measurement and instrumentation, R. K. Rajput, S.K. Kataria and Sons.

3. Mechatronics, W. Boltan, Pearson Education.

4. Mechatronics, N P Mahalik,Tata McGraw-Hill Publishing Limited

5. Modern Control Systems, Katsuhiko Ogata, Prentice Hall

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VI-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assign ment	End Sem	Lab Work	L	T	P	
	ME-1862 (E-I) (C)	Computer Integrated Manufacturing	70	20	10	30	20	3	-	2	4

Course Outcomes: At the end of the course, the students will able to:

CO 1	A knowledge of automated process is a Modern manufacturing Environment
CO 2	An understanding of using Automation, Control Strategies towards numerical control, robotics, automated storage, CIM, expert systems in manufacturing
CO 3	An understanding of contemporary manufacturing/production strategies such as group technology and agils manufacturing

Mapping of course outcomes with program outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3											1
CO 2	3	2		2	1							1
CO 3	3	2			1							1
ME1862 C	3	2		2	1							1

UNIT I :

Introduction - Introduction, Modern manufacturing, Integration and rationalization, Elements of CIM system, CIM hardware and software, Implementing CIM, Advantages and limitations.

UNIT II :

Automation and Production Systems - History of automation. Building block of automation Technology, Types of automation systems. Automation production economics, Viability appraisal for automated production.

Control Strategies for Automation Systems - Control process, Electrical and Mechanical Analogies, Laplace Transform, Transfer Function, Linear and Non-linear systems. Adaptive Control. Logical Sequence Control. PLCs and Networking for Automation.

UNIT III :

Computer Aided Manufacturing (CAM) - Introduction, CAM hierarchy, Elements of CAM systems, CNC machines-types, Classification, File formats, Controllers, Hierarchical controls, Tooling on CNC,-Fixtures on CNC, Rationale for CAD/CAM, NC, DNC, CNC and adaptive control, Methods of part-programming. CAM software.

UNIT IV :

Robot, Automated Material handling and storage system - Robot anatomy, Robot configuration, Robot control systems. Accuracy, Repeatability. End effectors. Robot programming, Robot languages, Robot applications. Automated material handling and storage system, Functions, Type of material handling system, Design of system, Automated guided vehicle systems. Automated Retrieval systems.

UNIT V :

Group Technology (GT), Computerized Manufacturing Planning System - Introduction. Part families, Parts Classification and Coding. Production Flow Analysis, Machine cell design, Cellular Manufacturing systems , Agile Manufacturing, Flexible manufacturing Systems (FMS), Types of flexibility and uncertainty.

Expert Systems - Introduction to expert systems, Need and classification, Artificial Intelligence

References:

1. Production System & CIM, Groover, P.H.I.
2. Automation Production Systems and Computer – Integrated Manufacturing by Mikell P Groover : P.H.I.
3. Principle of Automation and Advanced Manufacturing systems by Dr. K.C. Jain & Sanjay Jain
4. Robotics – Control, sensing, vision, and intelligence by K.S. Fu, RC Gonzalez, and C.S.E. Lee: Tata McGraw Hill Education Pvt. Ltd.
5. CAD/CAM : Principles and Applications by P N Rao : Tata McGraw Hill Education Pvt. Ltd
6. CIM : Principle of Computer Integrated Manufacturing by J B Waldner : John Wiley & sons

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VI-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assign ment	End Sem	Lab Work	L	T	P	
	ME-1862 (E-I) (D)	Robotics	70	20	10	30	20	3	-	2	4

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the basic components of robots, classification and robot grippers.
CO2	Model forward and inverse kinematics of robot manipulators.
CO3	Analyze forces in links and joints of a robot.
CO4	Programme a robot to perform tasks in industrial applications.
CO5	Design intelligent robots using sensors.

UNIT-I

Introduction: Robotics-classification, Sensors-Position sensors, Velocity sensors, Proximity sensors, Touch and Slip Sensors, Force and Torque sensors. Grippers and Manipulators-Gripper joints, Gripper force, Serial manipulator, Parallel Manipulator, selection of Robot-Selection based on the Application

UNIT-II

Kinematics: Manipulators Kinematics, Rotation Matrix, Homogenous Transformation Matrix, Direct and Inverse Kinematics for industrial robots for Position and orientation.

Statics & dynamics: Differential Kinematics and static- Dynamics-Lagrangian Formulation, Newton Euler Formulation for RR & RP Manipulators,

UNIT-III

Trajectory planning: Motion Control- Interaction control, Rigid Body mechanics.

Control: architecture- position, path velocity and force control systems, computed torque control, Adaptivecontrol, and Servo system for robot control.

UNIT-IV

Robot programming: Programming of Robots and Vision System- overview of various programming Languages.

UNIT-V

Applications: Application of Robots in production systems- Application of robot in welding, machine tools, material handling, and assembly operations parts sorting and parts inspection.

References:

1. Craig, J.J., *Introduction to Robotics Mechanics and Control*, AddisonWesley, 1999.

2. Saha, Subir Kumar. Introduction to robotics. Tata McGraw-Hill Education, 2014.

3. Spong, Mark W., Seth Hutchinson, and Mathukumalli Vidyasagar. Robot modeling and control. Vol. 3. New York: Wiley, 2006.

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VI-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assign ment	End Sem	Lab Work	L	T	P	
	ME-1863 (E-II) (A)	Automobile Engineering	70	20	10	30	20	3	-	2	4

Course Outcomes: At the end of the course, the students will able to:

CO 1	Understand the basic lay-out of Automobiles
CO 2	Understand the basic principles of Chassis and frames
CO 3	Understand the Operation of transmission Suspension, Steering and Breaking system
CO 4	Understand Automotive Electronics and Control system
CO 5	Understand latest technological development in IC Engine

Mapping of course outcomes with program outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3		2			1	1	1				
CO 2	3	3	2	1			1					
CO 3	3	3	2	1	1	1		1			1	
CO 4	3	2	1	1	1	1	1					
CO 5	1	1			3		2	1		1		1
ME1863A	2.6	1.8	1.75	1	1.66	1	1.66	1		1	1	1

UNIT – I

Chassis & Body Engg: Types, Technical details of commercial vehicles, types of chassis, layout, types of frames, testing of frames for bending & torsion on unutilized body frame, vehicle body and their construction, driver's visibility and methods for improvement, safety aspects of vehicles, vehicle aerodynamics, front wheel and rear wheel drive, four wheel drive.

UNIT – II

Steering System: front axle beam, stub axle, front wheel assembly, principles of types of wheel alignment, front wheel geometry viz. camber, Kingpin inclination, castor, toe-in and toe-out, condition for true rolling motion, centre point steering, directional stability of vehicles, power steering, slip angle, cornering power, over steer & under steer.

UNIT – III

Transmission System: Function and types of clutches, clutch lining and bonding, double declutching, types of gear Boxes, synchronizer, gear materials, determination of gear ratio for vehicles, automatic transmission, torque converters, fluid coupling, principle of hydrostatic drive, propeller shaft, differential gear box, rear axle construction.

UNIT – IV

Suspension system : Basic suspension movements, Independent front & rear suspension, shock absorber, type of springs, location of shackles, power calculations, resistance to vehicle motion during acceleration and breaking, power & torque curve, torque & mechanical efficiency at different vehicle speeds. **Brakes**: Principle of braking system, braking mechanism, mechanical and hydraulic brakes, power brakes, vacuum and air brakes.

Wheels and Tyres: Wheel drum, tyre, materials and manufacturing of tyers, trouble shooting and maintenance.

UNIT – V

Electrical and Control Systems: construction and operation of lead acid battery, principle of operation of starting mechanism, different drive systems, starter relay switch, regulator electric fuel gauge, horn, wiper, Lighting system, head light dazzling, exhaust gas recirculation, electronic control unit (ECU), turbo charging, Multi valve engines.
Introduction of the latest technological developments which are being used in I.C. Engines.

Note – One assignment should be given to study and write the User's Manual of any four wheeler of your interest. (in hand writing).

References Books:

1. Crouse, Automotive Mechanics TMH.
2. Automobile Engg. TR Banga & Nathu Singh
3. Srinivasan S; Automotive engines; TMH
4. Automobile Engg. GBS Narang
5. Joseph Heitner, Automotive Mechanics, Principles and Practices, CBS Pub.
6. Kripal Singh, Automotive Engineering Khanna Pub.
7. Newton & Steeds, Automotive Engineering
8. Automotive Mechanics Heitner

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VI-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assignment	End Sem	Lab Work	L	T	P	
	ME-1863 (E-II) (B)	Turbo Machinery	70	20	10	30	20	3	-	2	4

Course Outcomes: At the end of the course, the students will able to:

CO 1	Understand the principles and application of Turbo Machines
CO 2	Analysis of turbo Machines
CO 3	Understand various types of turbo turbines and its applications
CO 4	Understand Rotary fans, Blowers, Compressors
CO 5	Understand principles and applications of Power transmitting turbo machines

Mapping of course outcomes with program outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	3	3	3	3						3
CO 2	3	3		2	3	2						3
CO 3	2	2	3			2						
CO 4	3		2									3
CO 5	2		3									2
ME1863B	2.6	2.33	2.75	2.5	3	2.33						2.75

UNIT – I

Energy transfer in turbo machines: application of first and second laws of thermodynamics to turbo machines, moment of momentum equation and Euler turbine equation, principles of impulse and reaction machines, degree of reaction, energy equation for relative velocities, one dimensional analysis only.

UNIT – II

Steam turbines: impulse staging, velocity and pressure compounding, utilization factor, analysis for optimum U.F Curtis stage, and Rateau stage, include qualitative analysis, effect of blade and nozzle losses on vane efficiency, stage efficiency, analysis for optimum efficiency, mass flow and blade height.

Reactions staging: Parson's stages, degree of reaction, nozzle efficiency, velocity coefficient, stator efficiency, carry over efficiency, stage efficiency, vane efficiency, conditions for optimum efficiency, speed ratio, axial thrust, reheat factor in turbines, problem of radial equilibrium, free and forced vortex types of flow, flow with constant reaction, governing and performance characteristics of steam turbines.

UNIT – III

Water turbines: Classification, Pelton, Francis and Kaplan turbines, vector diagrams and work-done, draft tubes, governing of water turbines. Centrifugal Pumps: classification, advantage over reciprocating type, definition of mano-metric head, gross head, static head, vector diagram and work done. Performance and characteristics: Application of dimensional analysis and similarity to water turbines and centrifugal pumps, unit and specific quantities, selection of machines,

Hydraulic, volumetric, mechanical and overall efficiencies, Main and operating characteristics of the machines, cavitations.

UNIT – IV

Rotary Fans, Blowers and Compressors: Classification based on pressure rise, centrifugal and axial flow machines. Centrifugal Blowers Vane shape, velocity triangle, degree of reactions, slip coefficient, size and speed of machine, vane shape and stresses, efficiency, characteristics, fan laws and characteristics. Centrifugal Compressor – Vector diagrams, work done, temp and pressure ratio, slip factor, work input factor, pressure coefficient, Dimensions of inlet eye, impeller and diffuser. Axial flow Compressors- Vector diagrams, work done factor, temp and pressure ratio, degree of reaction, Dimensional Analysis, Characteristics, surging, Polytrophic and isentropic efficiencies.

UNIT – V

Power Transmitting turbo machines: Application and general theory, their torque ratio, speed ratio, slip and efficiency, velocity diagrams, fluid coupling and Torque converter, characteristics, Positive displacement machines and turbo machines, their distinction. Positive displacement pumps with fixed and variable displacements, Hydrostatic systems hydraulic intensifier, accumulator, press and crane.

References Books:

1. Venkanna BK; Turbomachinery; PHI
2. Shepherd DG; Turbo machinery
3. Csanady; Turbo machines
4. Kadambi V Manohar Prasad; An introduction to EC Vol. III-Turbo machinery; Wiley Eastern Delhi
5. Bansal R. K; Fluid Mechanics & Fluid Machines;
6. Rogers Cohen & Sarvan Multo Gas Turbine Theory
7. Kearton W. J; Steam Turbine: Theory & Practice

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VI-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assignment	End Sem	Lab Work	L	T	P	
	ME-1863 (E-II) (C)	Gas Dynamics	70	20	10	30	20	3	-	2	4

Course Outcomes: At the end of the course, the students will able to:

CO1	Solve flow equations for quasi one dimensional flow through variable area ducts.
CO2	Analyze the flow through constant area ducts with friction and heat transfer.
CO3	Analyze flows with normal and oblique shocks.
CO4	Solve flow problems with supersonic velocities using shock-expansion theory.
CO5	Design experimental setup.

Mapping of course outcomes with program outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2				2	2					1
CO2	3	3	3	1	2	2	2					1
CO3	3	3	3	3	3	3	3					1
CO4	3	3	2	3	3	3	1					1
CO5	3	3	3	2	3	3	3	2	3	3	3	1

Unit-1

Introduction: Review of basic fluid dynamic and thermodynamic principles, Conservation equations for inviscid flows.

Unit-2

One Dimensional flow: One-dimensional wave motion, normal shock waves, Oblique shock waves, Prandtl-Meyer expansions and applications, Generalized one-dimensional flow

Unit-3

Nozzle Flow: Isentropic flow with area change, Flow with friction (Fanno flow), Flow with heat addition (Rayleigh flow), Method of characteristics (application to one-dimensional unsteady isentropic flow)

Unit-4

Supersonic Flow: Velocity Potential Equation, Numerical Techniques for Steady Supersonic Flow, Time Marching Technique for Supersonic Blunt Bodies and Nozzles

Unit-5

Experimental setups: Shock Tubes, Compressible flow facilities, Measurement Techniques, Experiment Design

References Books:

1. Anderson, J.D Jr., Modern Compressible Flows, Tata McGraw Hill, 2012.
2. Yahya, S.M., Fundamentals of Compressible Flow, New age International Pub., 2013.
3. Zucrow, M., Gas Dynamics, Wiley India, 2013

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VI-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assign ment	End Sem	Lab Work	L	T	P	
	ME-1863 (E-II) (D)	CFD	70	20	10	30	20	3	-	2	4

Course Outcomes: At the end of the course, the students will able to:

CO1	Develop mathematical models for flow phenomena.
CO2	Analyze mathematical and computational methods for fluid flow and heat transfer simulations
CO3	Solve computational problems related to fluid flows and heat transfer.
CO4	Evaluate the grid sensitivity and analyze the accuracy of a numerical solution.
CO5	Evaluate flow parameters in internal and external flows.
CO6	Develop flow simulation code for fluid flow and heat transfer problems.

Mapping of course outcomes with program outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2		2	2	2		1			1
CO2	3	3	3		2	2	2		2			1
CO3	2	3	2	3	3	3	3		3			1
CO4	3	1	2	3	3	3	1		2			1
CO5	3	3	3	3	3	3	3		1			1
CO6	2	3	2	3	3	3	3	3	3			1

Unit -1

Introduction: History and Philosophy of computational fluid dynamics, CFD as a design and research tool, Applications of CFD in engineering, Programming fundamentals, MATLAB programming, Numerical Methods

Governing Equations of Fluid Dynamics: Models of the flow, The substantial derivative, Physical meaning of the divergence of velocity, The continuity equation, The momentum equation, The energy equation, Navier-Stokes equations for viscous flow, Euler equations for inviscid flow, Physical boundary conditions, Forms of the governing equations suited for CFD, Conservation form of the equations, shock fitting and shock capturing, Time marching and space marching.

Mathematical Behavior of Partial Differential Equations: Classification of quasi-linear partial differential equations, Methods of determining the classification, General behavior of Hyperbolic, Parabolic and Elliptic equations.

Unit-2

Basic Aspects of Discretization: Introduction to finite differences, Finite difference equations using Taylor series expansion and polynomials, Explicit and implicit approaches, Uniform and unequally spaced grid points.

Grids With Appropriate Transformation: General transformation of the equations, Metrics and Jacobians, The transformed governing equations of the CFD, Boundary fitted coordinate systems, Algebraic and elliptic grid generation techniques, Adaptive grids.

Unit-3

Parabolic Partial Differential Equations: Finite difference formulations, Explicit methods – FTCS, Richardson and DuFort-Frankel methods, Implicit methods – Laasonen, Crank-Nicolson and Beta formulation methods, Approximate factorization, Fractional step methods, Consistency analysis, Linearization.

Elliptic Equations: Finite difference formulation, solution algorithms: Jacobi-iteration method, Gauss-Siedel iteration method, point- and line-successive over-relaxation methods, alternative direction implicit methods.

Hyperbolic Equations: Explicit and implicit finite difference formulations, splitting methods, multistep methods, applications to linear and nonlinear problems, linear damping, flux corrected transport, monotone and total variation diminishing schemes, tvd formulations, entropy condition, first-order and second-order tvd schemes.

Unit-4

Stability Analysis: Discrete Perturbation Stability analysis, von Neumann Stability analysis, Error analysis, Modified equations, Artificial dissipation and dispersion.

Scalar Representation of Navier-Stokes Equations: Equations of fluid motion, numerical algorithms: ftcs explicit, ftbcs explicit, Dufort-Frankel explicit, Maccormack explicit and implicit, btcs and btbcs implicit algorithms, applications.

Grid Generation: Algebraic Grid Generation, Elliptic Grid Generation, Hyperbolic Grid Generation, Parabolic Grid Generation

Unit-5

Finite Volume Method For Unstructured Grids: Advantages, Cell Centered and Nodal point Approaches, Solution of Generic Equation with tetra hedral Elements, 2-D Heat conduction with Triangular Elements.

References Books:

1. Anderson, J.D.(Jr), Computational Fluid Dynamics, McGraw-Hill Book Company, 1995.

2. Hoffman, K.A., and Chiang, S.T., Computational Fluid Dynamics, Vol. I, II and III, Engineering Education System, Kansas, USA, 2000.

3. Chung, T.J., Computational Fluid Dynamics, Cambridge University Press, 2003.

4. Anderson, D.A., Tannehill, J.C., and Pletcher, R.H., Computational Fluid Mechanics and Heat Transfer, McGraw Hill Book Company, 2002.

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VI-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assign ment	End Sem	Lab Work	L	T	P	
	ME-1864 (E-III) (A)	Industrial Engineering & Management	70	20	10	-	-	3	-	-	3

Course Outcomes: At the end of the course, the students will able to:

CO 1	Able to perform Method Study and Time Study in a real time application using Maclern Tools
CO 2	Able to analyze Ergonomics and human factor demands of Industrial Environment
CO 3	Able to prepare Planning related to Manufacturing
CO 4	Able t suggest Jigs and fixtures as per job requirement
CO 5	Able to analyze production process performance

Mapping of course outcomes with program outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3			3	2				2	3	1	
CO 2	3	2	2	2		3	1	1	1		2	
CO 3	3	1	2						2	2	1	
CO 4	3											
CO 5	3	2		3	1				2	2	3	2
ME1864A	3	1.66	2	2.66	1.5	3	1	1	1.66	2.33	1.75	2

UNIT – I

Productivity: Concept of production, types of production, concept of productivity, production Vs productivity, factors influencing productivity, Moslow's theory of hierarchy of needs, productivity Vs standard of living.

UNIT – II

Method Study: Introduction to work study, definition of method study, basic steps of method study, process chart, recording techniques, diagrams and templates, Therblig, micro-motion study, SIMO chart, memo-motion study, principles of motion economy.

UNIT – III

Time Study: Procedure of work measurement, apparatus required for time study, Rating, measuring the job, elements, allowances, standard time , synthetic data , analytical estimating, PMTS, work factor, MTM, activity sampling , applications, numerical problems.

UNIT – IV

Human Factors Engineering: Introduction to ergonomics and human factors Engineering, physiological basis of human performance, Biomechanics, Psychology of work and work load perception, Physical work environment, Basis of ergonomic problem identification, Safety.

UNIT – V

Production Planning and control: Types of production function of production planning and control, organization of production planning and control, pre-planning operation, planning of productive capacity plant, requirements of special tooling like jigs and fixtures. Routing, loading, scheduling, dispatching and follow-up, production control in intermittent manufacture and continuous manufacturing, bar chart, operation chart, flow chart, Gantt chart, sequencing, numerical problems

Reference Book:

1. Benjamin .W. Neibel, Motion and Time Study, Richard D. Irwin Inc., Seventh Edition, 1982.
2. Barnes, R.M. Motion and Time study, John Wiley, 1980.
3. Stephen Konz, Work Design, Publishing Horizon Inc., Second Edition, 1979.
4. Bridger R.S., Introduction to Ergonomics, McGraw Hill, 1995.
5. Industrial Engineering and Production Management by Jain, Verma & Kartikeya, Dreamtech Publication 2013.
6. ILO, Work Study, ILO Publication.
7. Buffa, sarin, Modern Production/Operations Management, 8/e, John Wiley & Sons
8. Jain and Agrawal, Production Planning & Control and Industrial Management, Khanna publishers

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VI-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assignment	End Sem	Lab Work	L	T	P	
	ME-1864 (E-III) (B)	Production Planning & Control	70	20	10	-	-	3	-	-	3

Course Outcomes: At the end of the course, the student will be able to:

CO1	Explain production systems and their characteristics.
CO2	Evaluate MRP and JIT systems against traditional inventory control systems.
CO3	Evaluate basics of variability and its role in the performance of a production system.
CO4	Analyze aggregate planning strategies.
CO5	Apply forecasting and scheduling techniques to production systems.
CO6	Apply theory of constraints for effective management of production systems.

UNIT-I

Introduction to Production Systems: Production Systems: Classification & Characterization, Overview of Production Planning and Control issues, Review of EOQ & inventory control systems.

UNIT-II

Material Requirement Planning: Dependent Demand & Material Requirement Planning, Structure of MRP system, MRP Calculations, Planning Issues, Implementation Issues.

UNIT-III

Just in Time Production Systems: Just-in-Time System: Evolution, Characteristics of JIT Systems, Continuous Improvement, Kanban System, Strategic Implications of JIT System. Push and pull production systems.

UNIT-IV

Aggregate Planning: Aggregate Planning: Purpose & Methods, Reactive and Aggressive Alternatives, Planning Strategies, LP Formulation, Master Production Scheduling.Flow Shop, Job Shop Dispatching.

UNIT-V

Forecasting Methods: Demand Forecasting: Principles and Methods, Judgment methods, Causal methods, Time-series methods

Theory of Constraints: Concept of bottleneck, Local and global optima, Five steps of TOC approach, Performance measures.

References:

1. Krajewski L.J. and Ritzmen L.P., "Operations Management: Strategy and Analysis", 9th Edition, Pearson Education, 2010.

2. Chase R.B. Jacobs F.R. and Aquilano N.J., "Operations Management for Competitive Advantage", 11th Edition, Tata McGraw Hill Book Company, New Delhi, 2010.

3. Hopp W. J. and Spearman M. L. "Factory Physics: Foundations of Manufacturing Management", McGraw Hill International Edition, 3rd Edition, 2008.

4. Mukhopadhyay S.K., "Production Planning and Control", 2nd Edition, PHI, Eastern Economy Edition, 2013.

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VI-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assign ment	End Sem	Lab Work	L	T	P	
	ME-1864 (E-III) (C)	Reliability Engineering and TPM	70	20	10	-	-	3	-	-	3

UNIT 1

Basic Concepts of Reliability: Probability distributions used in maintenance engineering-Binomial, Poisson, Exponential, Normal, Log-normal, Gamma and Weibull distribution; failure rate, hazard rate, failure modes, MTTR, MTBF, MTTF

UNIT 2

System Reliability Models: System reliability–n-component series systems, m-component parallel systems and combined system; standby systems; K-out-of-m systems; redundancy techniques in system design; event space, decomposition (Key Stone), cut and tie sets, Markov analysis, reliability and quality, unreliability, maintainability, availability

UNIT 3

Reliability Testing: Introduction**,** testing requirements, testing methods: Marginal Testing, Non-destructive testing, reliability tester, acceleration models, SWOT analysis.

UNIT 4

Total Productive Maintenance: Evolution of TPM, TPM objectives, concept, pillars of TPM,Terro technology, Six Big Losses autonomous Maintenance. **Reliability centered maintenance:** concept, methodology, benefits.

UNIT 5

Failure Modes and Effects Analysis (FMEA) Failure Modes and Effects Analysis **(FMEA)** Failure Modes, Effects and Criticality Analysis **(FMECA)**:Overview, elements of FMECA, applications and benefits, risk evaluation, risk priority numbers, criticality analysis, process FMEA, qualitative and quantitative approach to FMECA; design FMEA and steps for carrying out design FMEA.

References:

1. Ebeling CE; An Introduction To Reliability & Maintainability Engg; TMH
2. Srinath L.S; Reliability Engineering; East West Press.
3. Naikan; Reliability engg and life testing; PHI
4. Kapur KC and Lamberson LR; Reliability in Engineering Design; Wiley India
5. Telang AD and Telang A; Comprehensive Maintanance Management; PHI
6. Mishra R.C; Reliability and Maintenance Engineering; New age International publisher.
7. Balaguruswamy; Reliability Engg; TMH
8. Dhillon; Engg Maitainability- How to design for Reliability and easy maintenance; PHI
9. Davidson John; The Reliability of mechanical system; Institution of Mech. Engineers, London
10. Patrick D.T and O.'Connor; Practical Reliability Engineerin; John Wiley and Sons
11. Modarre M; Reliability and Risk Analysis, Marcel Dekker Inc CRC Press

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VI-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assign ment	End Sem	Lab Work	L	T	P	
	ME-1864 (E-III) (D)	Total Quality Management	70	20	10	-	-	3	-	-	3

UNIT I :

INTRODUCTION : Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM

UNIT II :

TQM PRINCIPLES : Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen – Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III :

TQM TOOLS & TECHNIQUES : The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking Reason to bench mark, Bench marking process – FMEA – Stages, Types. Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures

UNIT IV :

QUALITY SYSTEMS : Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

UNIT V :

IMPLEMENTATION OF TQM - Steps in TQM implementation, national and international quality awards, case studies.

REFERENCES:

1. Dale H.Besterfiled, “Total Quality Management”, Pearson Education Asia, (Indian reprint 2011).
2. John Bank, The essence of total quality management PHI 2000.
3. Greg Bounds, Lyle Yorks et al, Beyond Total Quality Management, McGraw Hill, 1994
4. Takashi Osada, The 5S’s The Asian Productivity Organization, 1991.
5. Masaki Imami, KAIZEN, McGraw Hill, 1986.

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VI-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assign ment	End Sem	Lab Work	L	T	P	
	ME-1865 (OE-II)	Refrigeration and Air Conditioning	70	20	10	-	-	3	-	-	3

Course Outcomes: At the end of the course, the students will able to:

CO 1	Understand basic concepts of refrigeration, different types of refrigeration systems and refrigeration cycles including air and vapor refrigeration including multi pressure system
CO 2	Apply knowledge to indentify applications of different refrigeration systems and commonly used refrigerants, impact on environment
CO 3	Understand psychrometric properties of air, psychrometric processes of air, Air-conditioning systems, Human comfort and regulation of human body
CO 4	Formulate and solve numerical problems based on air and vapour refrigeration system, psychrometry, air-conditioning processes and air-conditioning load calculations

Mapping of course outcomes with program outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3		1									1
CO 2	3	2	2	1		1	2					
CO 3	3	2	3	2								
CO 4	3	2	3	3								
ME1865	3	2	2.25	2		1	2					1

UNIT-I

Introduction: (A) History of refrigeration, Principles and methods of refrigeration, ice, evaporative, liquid gas, dry ice, vortex tube, and thermoelectric refrigeration, unit of refrigeration concept of refrigerator, heat engine, heat pump, co-efficient of performance.

(B) Air refrigeration system- reversed Carnot cycle, limitations joule cycle, Boot-strap cycle, reduced ambient cycle and regenerative cooling cycles. Simple numerical problem

UNIT-II

Vapour compression system: Vapor compression cycle, p-h and t-s diagrams, deviations from theoretical cycle, sub-cooling and super heating, effects of condenser and evaporator pressure on cop; multi-pressure system: removal of flash gas, multiple expansion and compression with flash inter cooling; low temperature refrigeration: production of low temperatures, cascade system, dry ice, production of dry ice, air liquefaction system,.

UNIT-III

(a) **Vapour absorption system**: Theoretical and practical systems such as aqua-ammonia, electrolux and other systems;

(b) **Steam jet refrigeration**: Principles and working, simple cycle of operation, description and working of simple system,

(c) **refrigerants:** nomenclature and classification, desirable properties, common refrigeration, comparative study, leak detection methods, environment friendly refrigerants and refrigerant mixtures, brine and its properties

UNIT-IV

Psychrometric: Calculation of psychrometric properties of air by table and charts; psychrometric processes: sensible heating and cooling, evaporative cooling, cooling and dehumidification, heating and humidification, mixing of air stream, sensible heat factor; principle of air conditioning, requirements of comfort air conditioning, ventilation standards, infiltrated air load, fresh air load human comfort, effective temperature and chart, heat production and regulation of human body, bypass factor of coil

UNIT-V

Air conditioning loads: calculation of summer & winter air conditioning load, calculation of supply air rate & its condition, bypass factor, room sensible heat factor, grand sensible heat factor, effective sensible heat factor, dehumidified air quantity. Problems on cooling load calculation.
Air distribution and ventilation systems, air conditioning system, and introduction to air conditioning equipment, introduction to cryogenics.

References:

1. Arora CP; Refrigeration and Air Conditioning; TMH
2. Sapali SN; Refrigeration and Air Conditioning; PHI
3. Ananthanarayan; Basic Refrigeration and Air conditioning; TMH
4. Manohar Prasad; Refrigeration and Air Conditioning; New Age Pub
5. Ameen; Refrigeration and Air Conditioning; PHI
6. Pita; Air conditioning Principles and systems: an energy approach; PHI
7. Stoecker W.F, Jones J; Refrigeration and Air conditioning; McGH, Singapore
8. Jordan RC and Priester GB Refrigeration and Air Conditioning, PHI USA
9. Arora RC; Refrigeration and Air conditioning; PHI Learning

List of Experiments

01. Determination of Psychrometric Properties by Sling Psychrometer.
02. Study and Testing of Simple Vapour Compression Cycle.
03 Study and Testing of Water Cooling Tower.
04 Study of Ice Plant.
05 Determine the Coefficient of Performance of a Refrigeration Test Rig .
06. Study of Refrigerant Charging Unit.
07. Study of Window Air Conditioner.
08. Determine the COP of a Computer Controlled Refrigeration Test Rig .
09. Study of Air Conditioning Duct.
10. Study of Different Psychrometric Processes on Air Conditioning test Rig.
11. Study and Testing of Vapour Absorption Refrigeration System.