Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

Department of Mechanical Engineering

B.Tech. II Mechanical Engineering

Sr. No.	Subject	Code	Scheme L-T-P	Credits (Min.)	Notional hours of Learning (Approx.)
	Third Semester (2nd year of UG)				
1	Measurement and Instrumentation	ME201	3-0-2	4	85
2	Theory of Machines	ME203	3-1-2	5	100
3	Metallurgy	ME205	3-0-2	4	85
4	Fluid Mechanics	ME207	3-1-2	5	100
5	Elective-I	ME2xx	3-0-0	3	55
			Total	**21**	**425**
6	Vocational / Professional Mechanical Practice - II	MEv03	0-0-8	**5**	200 (20 x 10)
	Fourth Semester (2nd year of UG)				
1	Fluid Machines	ME202	3-0-2	4	85
2	Heat Transfer	ME204	3-0-2	4	85
3	Industrial Engineering	ME206	3-0-0	3	55
4	Dynamics of Machines	ME208	3-1-2	5	100
5	Elective – II	ME2xx	3-0-0	3	55
			Total	**20**	**380**
6	Vocational / Professional Software Practice – II	MEv04	0-0-8	5	200 (20 x 10)

Sr. No.	Elective	Code	Scheme L-T-P
	Elective - I [Semester - III]		
1	Numerical Methods for Mechanical Engineers	ME251	
2	Energy and Exergy Analysis of Thermal system	ME253	
3	Maintenance and Safety Engineering	ME255	
4	Experimental Stress analysis	ME257	
5	Engineering Estimating & Costing	ME259	
6	Plastics & Ceramics	ME261	
7	Corrosion Engineering	ME263	
	Elective - II [Semester - IV]		
1	Experimental Fluid Mechanics	ME252	
2	Theory of Elasticity and Plasticity	ME254	
3	Condition Monitoring	ME256	
4	Total Quality Management	ME258	
5	Advance Engineering Materials	ME260	
6	Risk, Reliability & Life Testing	ME262	
7	Concurrent Engineering	ME264	

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – III Measurements and Instrumentation ME201	Scheme	L	T	P	Credit
		3	0	2	04

1. **Course Outcomes (COs):** **At the end of the course, students will be able to**	
CO1	Draw block diagram of different measurement instruments.
CO2	Describe basic concepts of mechanical measurement, errors in measurements and uncertainty.
CO3	Identify the type of measurement instruments and their relevant specification for a particular process or parameter measurement.
CO4	Choose the appropriate instrument to measure the temperature, pressure and flow
CO5	Measure the force, torque, strain, displacement, velocity and acceleration in a measurement system
CO6	Characterize the behavior of a control system in terms of different performance parameters.

2.	**Syllabus**	
	BASIC CONCEPTS & IMPORTANCE OF MEASUREMENTS	**(07 Hours)**
	Aim of measurement, methods of measurement, generalized measurement systems, Instruments & its classifications, performance characteristics of instruments, Statistic & dynamic characteristics, Errors in measurements.	
	TEMPERATURE MEASUREMENTS	**(06 Hours)**
	Temperature scales, Ideal gas, Temperature measuring devices, Thermometer, Bi- metallic strip, Electrical resistance thermometer, Thermistors and thermocouples, Laws of thermocouples and their applications, Construction and calibration of thermocouples, Radiation pyrometers, total radiation pyrometers	
	PRESSURE MEASUREMENT	**(07 Hours)**
	Definition of pressure, Units, Types of pressure measurement devices, Manometers, Dead weight tester, Bourdon tube pressure gauge, Diaphragms and bellows, Low pressure measurement, McLeod gauge, Pirani thermal conductivity gauge, Knudsen gauge, Ionization gauge,	

	FLOW MEASUREMENTS	**(07 Hours)**
	Types of flow measuring devices, Constructional features, Obstruction meters like orifice, Venturi nozzle and their calibration, Flow measurement by drag effects (rotameter), Pitot tube, Hot wire anemometers, Magnetic flow Meters, Flow visualization Techniques, Shadowgraph, Interferometer.	
	MEASUREMENT OF FORCE, TORQUE AND STRAIN	**(07 Hours)**
	Load cells, cantilever beams, proving rings, differential transformers. Measurement of torque: Torque measurement on rotating shaft, Prony brake and eddy current dynamometer. Measurement of strain: Mechanical strain gauges, electrical strain gauges, strain gauge: materials, gauge factors, theory of strain gauges and method of measurement, Rosettes, bridge arrangement, temperature compensation.	
	DISPLACEMENT, VELOCITY, SPEED AND ACCELERATION MEASUREMENTS	**(06 Hours)**
	Working principal of Resistive Potentiometer, Linear variable differential transducers, Electro Magnetic Transducers, Mechanical, Electrical and Photoelectric Tachometers, Piezoelectric Accelerometer, Seismic Accelerometer	
	CONTROL SYSTEMS	**(05 Hours)**
	Basic concepts of control systems, classifications of control system, close loop control systems, open loop control system, automatic control systems, servo mechanism, regulator, representation through model, analogous system, block diagram, mathematical block diagram, signal flow graph.	
		(Total Contact Time: = 45 Hours)

3.	Practical
1	To calibrate the thermocouples.
2	To demonstrate temperature by using RTD & thermistor
3	To determine the fluid flow velocity through orifice meter, Venturimeter,
4	To determine the fluid flow velocity through rotameter and magnetic flow meter.
5	To demonstrate temperature of force by using strain gauge.
6	To demonstrate temperature pressure measurement through dead weight tester.
7	To demonstrate temperature measurements of speed of machine elements.
8	To demonstrate temperature measurement of temperature by using optical pyrometer.

5.	Books Recommended
1	O. E. Doeblin and D. N. Manik, Measurements System, 7th Edition, McGraw Hill, 2019

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

2	Richard S. Figiliola,Theory and Design for Mechanical Measurements; 6th Edition, Wiley India, 2015
3	D. S. Kumar, Mechanical Measurement and control,5th edition, Metropolitan Book Co. (P) Ltd.,(2015)
4	A. K. Sawhney and Puneet Sawhney, A Course in Mechanical Measurements and Instrumentation and Control, Dhanpat Rai & Co., 2017
5	R. K. Rajput, Mechanical Measurements and Instrumentation, Kataria and sons, 2013

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – III Theory of Machines ME203	Scheme	L	T	P	Credit
		3	1	2	05

1. Course Outcomes (COs): **At the end of the course, students will be able to**	
CO1	Understanding of various concepts related to machines and mechanisms
CO2	Apply the kinematic analyses in existing real life mechanisms
CO3	Analyze the kinematic requirements and shape of the cam and follower mechanism
CO4	Evaluate gears and gear trains for specific applications
CO5	Design of Belt, Rope and Chain Drives
CO6	Develop steering gear and straight line motion mechanism

2.	**Syllabus**	
	MACHINES AND MECHANISMS	**(06 Hours)**
	Introduction, Mechanism and machine, Rigid and resistant body, Link, Kinematic pair, Types of motion, Degrees of freedom (mobility), Classification of kinematic pairs, Kinematic chain, Linkage, Mechanisms, Kinematic inversion, Inversions of slider crank chain, Double slider-crank chain	
	VELOCITY ANALYSIS	**(09 Hours)**
	Trace the Loci of points in simple mechanisms, Absolute and Relative motions, Vectors, Addition and Subtraction of vectors, Motion of a link, Angular velocity, Rotation of a rigid body, Translation and rotation of a rigid body, Velocity analysis of mechanisms by relative velocity method (graphical), Instantaneous centre, Kennedy's Theorem, Locating I- centres, Velocity analysis by instantaneous centers, Centrode.	
	ACCELERATION ANALYSIS	**(10 Hours)**
	Definition of acceleration, Angular acceleration, A general case of acceleration, Radial and transverse components of acceleration, The Coriolis component of acceleration, Acceleration analysis of mechanisms, Acceleration diagrams, Coriolis Acceleration component, Kinematic analysis of mechanisms with computer assisted software: Modeling and assembly of the linkages, joints and constraints, motion animation of the mechanism, Kinematic analysis of the existing or real life mechanism.	

	BELTS, ROPES AND CHAINS	**(06 Hours)**
	Introduction, Belt and rope drives, Open and crossed belt drives, Velocity ratio, Slip, Materials for belt and ropes, Law of belting, Length of belt, Ratio of friction tensions, Power transmitted, Centrifugal effect on belts, Maximum power transmitted by a belt, Initial tension, Creep, Chains, Cha in length, Angular speed ratio, Classification of chains	
	GEARS AND GEAR TRAINS	**(07 Hours)**
	Introduction, Classification of gears, Gear terminology, Law of gearing, Velocity of sliding, Forms of teeth, Cycloidal profile teeth, Involute profile Teeth, Comparison of cycloidal and involute tooth forms, Birth of contact, Arc of contact, number of pairs of teeth in contact, Interference in involute gears, Minimum number of teeth, Interference between rack and pinion, Undercutting, Introduction to helical, Spiral, Worm, Worm gear and bevel gears. Types of Gear trains. Kinematic analysis of gear trains: Simple, compound and Epicyclic gear trains, Differential of an Automobile.	
	CAMS	**(07 Hours)**
	Introduction, Types of cams, Types of followers, Cam terminology, Displacement diagrams, Motions of the follower, Graphical construction of cam profile for constant velocity, uniform acceleration and retardation, SHM and cycloidal motion of follower, analytical calculation for displacement, velocity and acceleration.	
	(Total Contact Time: = 45 Hours)	

3.	**Tutorials**
1	Draw and explain various types of mechanisms and their inversions.
2	Draw velocity diagram of a mechanisms using instantaneous centre method.
3	Draw velocity and acceleration diagrams for mechanisms.
4	Draw velocity and acceleration diagram of a mechanism involving Coriolis component of acceleration.
5	Demonstration of Kinematic analysis of existing or real life mechanisms with computer assisted software – I
6	Demonstration of Kinematic analysis of existing or real life mechanisms with computer assisted software – II
7	Draw and explain various types of cams and followers.
8	Draw the layout of cam profile for a reciprocating radial knife edge follower to provide constant velocity to the follower, and derive the equation of displacement, velocity and acceleration of follower in terms of cam rotation angle.
9	Draw the layout of cam profile for an offset reciprocating roller follower to provide constant acceleration and retardation motion to the follower, and derive the equation of displacement, velocity and acceleration of follower in terms of cam rotation angle.

10	Draw the layout cam profile for a flat faced reciprocating follower to provide SHM motion to the follower, and derive the equation of displacement, velocity and acceleration of follower in terms of cam rotation angle.
11	Draw the layout of cam profile for an oscillating follower to provide cycloidal motion to the follower, and derive the equation of displacement, velocity and acceleration of follower in terms of cam rotation angle.

4.	**Practical**
1	To study and demonstrate various types of mechanisms and their inversions.
2	To draw velocity diagram of a mechanisms using instantaneous centre method.
3	To draw velocity and acceleration diagrams for mechanisms.
4	To draw velocity and acceleration diagram of a mechanism involving Coriolis component of acceleration.
5	Kinematic analysis of existing or real life mechanisms with computer assisted software – I
6	Kinematic analysis of existing or real life mechanisms with computer assisted software – II
7	To study and demonstrate various types of cams and followers.
8	To draw the layout of cam profile for a reciprocating radial knife edge follower to provide constant velocity to the follower
9	To draw the layout of cam profile for an offset reciprocating roller follower to provide constant acceleration and retardation motion to the follower
10	To draw the layout cam profile for a flat faced reciprocating follower to provide SHM motion to the follower
11	To draw the layout of cam profile for an oscillating follower to provide cycloidal motion to the follower

5.	**Books Recommended**
1	S. S. Rattan, Theory of machines. Tata McGraw-Hill Education, 2014.
2	J. J. Uicker, G. R. Pennock and J.E. Shigley, Theory of Machines and Mechanisms, 3rd Edition, Oxford University Press, 2011.
3	J.S., Rao and R.V. Dukkipati, Mechanism and Machine Theory, New edge international publishers, 2007.
4	A. Ghosh, and A.K. Mallik, Theory of mechanisms and machines, Affiliated East-West Press Private Limited, 2002.
5	A. G. Ambekar, Mechanism and Machine Theory, Prentice Hall of India Private Limited, 2007.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – III Metallurgy ME205	Scheme	L	T	P	Credit
		3	0	2	04

1. **Course Outcomes (COs):** **At the end of the course, students will be able to**	
CO1	Describe the importance of metallurgical industries and explain the basic principles of metallography and extraction of metallic elements.
CO2	Explain the microstructure of ferrous and non-ferrous alloys with their properties and applications.
CO3	Explain the phase-equilibria and phase diagrams for binary alloys.
CO4	Interpret the elastic and plastic deformation of metallic materials.
CO5	Analyse solidification mechanisms and heat-treatment techniques of ferrous and nonferrous alloys.
CO6	Choose the non-destructive testing technique based on the advantages and limitations.

2.	**Syllabus**	
	INTRODUCTION AND SCOPE	**(07 Hours)**
	Various fields of metallurgical engineering, Status of metallurgical industry in India, Sources of metals, Basic outline of the principles of production of iron and steel, copper, aluminium. Basic concepts of metallography. Testing of material with UTM, Testing of hardness and impact strength, Non-Metals: Plastics, Ceramics, Composite materials, Nano materials, Powder Metallurgy	
	STRUCTURE-PROPERTY CORRELATIONSHIP IN METALS	**(06 Hours)**
	Ferrous: Allotropic forms of Iron, Wrought Iron, Cast Irons - Grey, White, Malleable and Spheroidal Graphite, Steel - Plain carbon steel, Alloying of steels, Stainless steels, Tool steels, Maraging steels, Applications of ferrous metals. Non-ferrous: Copper & Copper alloys - Brass, Bronze, Cupro-Nickel; Aluminum and Aluminum alloys, Titanium alloys, Nickel based super alloys, Applications of Non-ferrous metals.	

	SOLIDIFICATION OF METALS	**(04 Hours)**
	Solidification of pure metals, Nucleation, Growth, Applications of controlled Nucleation & controlled growth.	
	DEFORMATION OF METALS	**(06 Hours)**
	Elastic & plastic deformation of metals, Strengthening mechanisms, Importance of grain size, directional properties, Recovery, Recrystallization and grain growth	
	EQUILIBRIUM PHASE DIAGRAMS	**(08 Hours)**
	Objectives & classification, Basic terms - system, phases & structural constituent, Phase systems – Isomorphous, Eutectic. Eutectoid, Peritectic. Interpretation of phase diagrams - Lever rule, Gibb's phase rule, Equilibrium phase diagram of Fe-Fe3C system, Equilibrium phase diagrams of non-ferrous alloys.	
	HEAT TREATMENT	**(08 Hours)**
	Purpose, Definition and Classification of heat-treatment processes for steels, Heat treatments for bulk materials - Annealing, Normalizing, Hardening, Tempering, Isothermal cooling transformation diagram (ICT/TTT) and Continuous cooling transformation (CCT) diagrams for steels, Various surface hardening heat-treatment of steels; Heat-treatment of Al alloys - Solution treatment, Solution quenching & Precipitation hardening.	
	NON-DESTRUCTIVE TESTING TECHNIQUES	**(06 Hours)**
	Importance, principle, procedure, equipment, advantages & limitations of various non-destructive techniques - visual inspection, radiography, ultrasonic testing, magnetic particle inspection, liquid penetrant inspection, eddy current testing	
	(Total Contact Time: = 45 Hours)	

3.	**Practical**
1	To study construction and working of metallurgical microscope.
2	To preparation specimen for microscopic observation
3	To study structure, properties and applications of ferrous alloys.
4	To study Fe-Fe3C equilibrium phase diagram and its applications.
5	To study Fe-Fe3C equilibrium phase diagram and its applications.
6	To study T-T-T & C-C-T diagram of steels.
7	To estimate effect of severity of quenching media in hardening heat-treatment of steels.
8	To determine hardenability of steel using Jominy end quench test.

4.	**Books Recommended**
1	R. Balasubramanian, Callister's Materials Science and Engineering, John Wiley & Sons, 2014.
2	D. R. Askland, P. P. Fulay, W. J. Wright, The Science and Engineering of Materials, Cengage Learning, 2015.
3	S. H. Avner, Introduction to Physical Metallurgy, McGraw-Hill, 2017.
4	O. P. Khanna, A Text book of Materials Science And Metallurgy, Dhanpat Rai Publications.
5	W. Smith, J. Hashemi, R. Prakash, Materials Science & Engineering, McGraw Hill, 2014.

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B. Tech. II (DoME) Semester – III Fluid Mechanics ME207	Scheme	L	T	P	Credit
		3	1	2	05

1. **Course Outcomes (COs):** **At the end of the course, students will be able to**	
CO1	Understand the concept of performance evaluation of Prototypes using dimensionless numbers.
CO2	Analyse mass balance in a flow system using continuity equations in Cartesian and cylindrical coordinates.
CO3	Compute local Velocity and Acceleration in the complex fluid flow domain.
CO4	Use Bernoulli's equation for the solution of fluid dynamic problems.
CO5	Evaluate fluid flow properties for laminar and turbulent flow through pipes and channels
CO6	Apply Navier Stokes equations to analyse fluid flow systems

2.	**Syllabus**	
	FLUID KINEMATICS	**(12 Hours)**
	Velocity Field, Steady and unsteady Flows, One, Two and Three Dimensional Flows, Uniform and non-uniform flows, Steam Lines and Stream Tubes, Path Lines and Streak Lines, Euler and Lagrangian Methods, Substantial Derivative and Acceleration, Translation, Rotation and Deformations, Vorticity, Rotational and Irrotational flows, Circulation, Velocity Potential function, Equation of Continuity in differential form for Cartesian and cylindrical coordinate system, Equation of Stream Line, Discharge in Terms of Steam Function, Stream Function and Velocity Potential function, Laplace Equation in terms of Stream Function and Velocity Potential function, Boundary Conditions, Flow Nets, Differential and Integral Approach Applied to Conservation of Mass, Momentum and Energy Principles..	
	FLUID DYNAMICS	**(10 Hours)**
	Newton's Laws of Motion, Reynold's Transport Theorem, Euler's Equation, Bernoulli's Equation, Flow Through Confined Passages, Navier-Stokes Equation, Exact solution of Navier-Stokes Equation for simple flows. Vortex flow, Free vortex flow and forced vortex flow.	

	DIMENSIONAL ANALYSIS	**(04 Hours)**
	Dimensions, Dimensional Homogeneity, Buckingham-π Theorem, Dimensional Grouping, Non - Dimensional Numbers, Geometrical, Kinematics and Dynamic Similarity.	
	LAMINAR AND TURBULENT FLOWS	**(06 Hours)**
	Concepts of Laminar and Turbulent Flows, Laminar Flow Through Round Pipes, Laminar Flow between Parallel Plates for Moving and Stationary plates, Measurement of Viscosity. Concept of Eddy Viscosity, Prandtl's Mixing Length Theory, Viscous Sub layer, Smooth and Rough Pipes, Nickuradse Experiment, Moody's Chart, Viscous flow of incompressible fluids.	
	PIPE SYSTEMS	**(05 Hours)**
	Major and Minor losses in pipes, Losses in Fittings, Power Transmission Through Pipes, Pipes connected in Series and Parallel, Branched Pipes, Total Energy line and Hydraulic Gradient Lines. Water distribution system.	
	BOUNDARY LAYER THEORY	**(05 Hours)**
	Concept of Boundary Layer, Boundary Layer over Flat Plates and Tubes, Boundary Layer Parameters, Boundary Layer Thickness, Momentum Thickness, Displacement Thickness, Von - Karman Momentum Integral Equation, Boundary Layer Separation and Control, Concept of Drag, Streamlined and Bluff Bodies.	
	COMPRESSIBLE FLOW	**(03 Hours)**
	Classification and properties of fluids, compressible fluid flow, effect of mach number and compressibility, normal and oblique shocks, one dimensional isentropic flow.	
		(Total Contact Time: = 45 Hours)

3.	**TUTORIAL**
	Solve Numericals based on following topics
1	Fluid kinematics - I
2	Fluid kinematics - II
3	Fluid Dynamics - I
4	Fluid Dynamics - II
5	Dimensional Analysis
6	Laminar flow

7	Turbulent flow
8	Pipe systems
9	Numerical and equation derivations based on boundary layer theory
10	Numerical and equation derivations based on Compressible flow

4.	**Practical**
1	Flow of an Incompressible Fluid through an Orifice meter and its calibration for measurement of discharge.
2	Flow of an Incompressible Fluid through a Nozzle meter and its calibration it for measurement of discharge.
3	Flow of an Incompressible Fluid through a Venturi Meter and its Calibration for measurement of discharge.
4	Flow of an Incompressible Fluid through a Centrifugal Head Meter and its Calibration for measurement of discharge.
5	Forced Vortex flow of water in the vessel.
6	Variation of friction factor with Reynolds number for Laminar flow through circular pipe
7	Variation of friction factor with Reynolds number for Turbulent flow through circular pipe
8	Determination of the velocity distribution in circular pipe.
9	Study of types of Pipes, Pipe symbols, Pipe Fittings and Valves.

5.	**Books Recommended**
1	F. M. White, Fluids Mechanics, McGraw -Hill Inc., 2015.
2	V. L. Streeter, E. B. Wylie, Fluid Mechanics, McGraw -Hill Book Co. Inc., 2001.
3	A. K. Mohanty, Fluid Mechanics, Prentice -Hall India Private Ltd., 2004.
4	J. F. Douglas, J. M. Gasiorek, J. A. Swaffield, Fluid Mechanics, Pearson Education Pvt. Ltd., 2001.
5	S. K. Som, G. Biswas, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill Co. Pvt. Ltd., 2017.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – III Numerical Methods for Mechanical Engineers ME251	Scheme	L	T	P	Credit
		3	0	0	03

1. **Course Outcomes (COs):** **At the end of the course, students will be able to**	
CO1	Formulate mathematical model, apply numerical methods to solve the engineering problems, and estimate errors associated with numerical methods
CO2	use computer language to solve the problem numerically
CO3	perform integration and differentiation using numerical techniques
CO4	apply bracketing and close methods to find root of the given problem
CO5	solve ODEs and PDEs using numerical methods
CO6	apply optimization method to solve 1-D optimization problem

2.	**Syllabus**	
	INTRODUCTION	**(04 Hours)**
	Introduction to Numerical Methods, Mathematical Modelling and Engineering Problem Solving, conservation laws and engineering	
	Programming and Software	**(04 Hours)**
	Introduction to packages and programming, Structured programming, Modular Programming, Excel, Basics of C/C++/Python/MATLAB/FORTRAN	
	Approximations and Errors	**(04 Hours)**
	Measuring Errors, Sources of Error, Binary Representation of numbers, Propagation of Errors, Taylor Theorem Revisit, Truncation errors, Round off errors	
	Roots of Equations	**(05 Hours)**
	Bracketing Method: Graphical Method, Bisection method, False position method, Incremental Searches. Open Method: Fixed point iteration, Newton-Rapson method, Secant method	
	Simultaneous Linear Equations	**(05 Hours)**
	Introduction to Matrix Algebra, Systems of Equations, Gaussian Elimination, Gauss-Seidel Method, LU Decomposition, Adequacy of Solutions, Cholesky and LDLT Method	

	Differentiation	**(05 Hours)**
	Primer on Differential Calculus, Differentiation of Continuous Functions: Forward difference approximation, backward difference approximation, central difference approximation, higher order finite difference approximation, Richardson extrapolation differentiation, Differentiation of Discrete Functions	
	Integration	**(04 Hours)**
	Primer on Integral Calculus, Trapezoidal Rule, Simpson's 1/3rd Rule, Romberg Integration, Gauss-Quadrature Rule, Discrete Data Integration, Improper Integration, Simpson's 3/8 Rule	
	Ordinary Differential Equations	**(05 Hours)**
	Primer on Ordinary Differential Equations, Initial Value Problems, Euler's Methods, Runge-Kutta methods, Predictor - Corrector Method, Higher Order/Coupled ODEs, Boundary Value Problems, Shooting Method, Finite Difference Method	
	Partial Differential Equations	**(04 Hours)**
	Introduction to Partial Differential Equations, Parabolic Partial Differential Equations, Elliptic Partial Differential Equations	
	Optimization	**(05 Hours)**
	Golden Section Search Method, Newton's Method, Multidimensional Direct Search Method, Multidimensional Gradient Method	
	(Total Contact Time: = 45 Hours)	

3.	**Books Recommended**
1	Chapra, S.C., Canale, R.P., "Numerical Methods for Engineers", 8th edition, Mcgraw hill, 2021
2	Grewal, B.S., "Numerical Methods in Engineering & Science", 11th edition, Khanna Publication, 2013
3	Cheney, W., Kincaid, D., "Numerical Mathematics and Computing", 7th edition, Cengage, 2013
4	Gerald, C., Wheatley, P., "Applied Numerical Analysis", 7th edition, Pearson Education India, 2007
5	Isaacson, E., H. B. Keller, H.B., "Analysis of Numerical Methods", Dover Publications, 1994

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – III Energy and Exergy Analysis of Thermal Systems ME253	Scheme	L	T	P	Credit
		3	0	0	03

1. Course Outcomes (COs): At the end of the course, students will be able to	
CO1	Explain the importance of the exergy and its difference from energy analysis
CO2	Apply the first law and second law of thermodynamics to various thermal systems
CO3	Determine the physical and chemical exergy of a given system
CO4	Illustrate pictorial representation of exergy balance
CO5	Perform exergy analysis of different thermal systems
CO6	Apply exergy analysis knowledge to thermal systems to improve the overall performance of plant

2.	Syllabus	
	INTRODUCTION	**(06 Hours)**
	Fundamentals of mass, energy and entropy balance, and requirement of exergy analysis	
	BASICS OF EXERGY ANALYSIS	**(10 Hours)**
	Energy and exergy analysis, Exergy classifications, Exergy of closed systems, Exergy of flows, Exergy consumption, Procedure for energy and exergy analysis, reference environment, Exergy analysis implications	
	EXERGY ANALYSIS OF THERMODYNAMIC PROCESSES	**(11 Hours)**
	Mixing and separation process, heat transfer across a finite temperature difference, expansion and compression processes, Chemical process in combustion.	
	ELEMENTS OF PLANT ANALYSIS	**(06 Hours)**
	Control mass analysis, control region analysis, Criteria of performance, Pictorial representation of exergy balance, Energy and exergy properties diagram	
	EXERGY ANALYSIS OF THERMAL POWER PLANTS	**(12 Hours)**
	Gas turbine power plant with external and internal irreversibility, regeneration cogeneration, reheater, and intercooler, combined steam and gas turbine power plant, Brayton cycle steam turbine power plants with external and internal irreversibility, super	

	heater, reheater, vacuum condenser, regenerative feed water heating, combined feed water heating and reheating. Combined power plants
	(Total Contact Time: = 45 Hours)

3.	**Books Recommended**
1	Bejan, G. Tsatsaronis, M. J. Moran, M. Moran, Thermal Design and Optimization, John Wiley & Sons, Inc.. 2012
2	Dincer Marc A. Rosen, Exergy, Energy, Environment and Sustainable Development, Elsevier Science, 2013.
3	Bejan, Advanced Engineering Thermodynamics, John Wiley & Sons, Inc., New York. 2016
4	T. J. Kotas, The exergy Method of Thermal Plant Analysis, Butterworth-Heinemann,2013
5	M. J. Moran, Availability Analysis – A Guide to Efficient Energy Use, ASME, 1989

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B. Tech. II (DoME) Semester – III Maintenance and Safety Engineering ME255	Scheme	L	T	P	Credit
		3	0	0	03

1. Course Outcomes (COs): **At the end of the course, students will be able to**	
CO1	Explain the principles, functions and practices adapted in industry for the successful management of maintenance activities.
CO2	Apply the knowledge of Predictive maintenance and conditioning monitoring concepts for industrial applications.
CO3	Distinguish various repair methods of basic machine elements
CO4	Apply the concept of failure pattern, system reliability: Series, Parallel and Mixed configurations.
CO5	Explain the safety engineering aspects in industry.
CO6	Explain the safety codes and standards.

2.	**Syllabus**	
	OBJECTIVE OF MAINTENANCE	**(09 Hours)**
	Types of maintenance Breakdown, preventive and predictive maintenance - Repair cycle - Repair Complexity, Lubrication and Lubricants. Maintenance of Mechanical transmission systems and process plants.	
	PREDECTIVE MAINTENANCE	**(09 Hours)**
	Vibration and noise as maintenance tool - wear debris analysis - Condition monitoring concepts applied to industries - Total Productive Maintenance (TPM) - Economics of Maintenance- Computer aided maintenance	
	RELIABILITY	**(10 Hours)**
	Definition, concept of reliability based design, failure rate, MTTF, MTBF, failure pattern, system reliability: Series, Parallel and Mixed configurations - Availability and Maintainability concepts- Applications	

	SAFETY AND PRODUCTIVITY	**(09 Hours)**
	Causes of accidents in industries accident reporting and investigation - measuring safety performance - Safety organizations and functions - Factories act and rules	
	SAFETY CODES AND STANDARDS	**(08 Hours)**
	General Safety considerations in Material Handling equipment - Machine Shop machineries- pressure vessels and pressurized pipelines, welding equipment operation and inspection of extinguishers prevention and spread of fire emergency exit facilities	
		(Total Contact Time: = 45 Hours)

3.	**Books Recommended**
1	P. Gopalakrishnan, Maintenance and Spare Parts Management, 2nd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2013
2	L. S. Srinath, Reliability Engineering, Affiliated East West press, 2005
3	Rolland P. Blake, Industrial Safety, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2003.
4	R. C. Mishra and K. Pathak, Maintenance Engineering and Management, 2nd Edition, Prentice Hall of India Pvt.Ltd.,New Delhi, 2012.
5	E. Balagurusamy, Reliability Engineering, McGraw Hill Education, 2017
6	H. P. Garg, Industrial Maintenance, S. Chand & Co Ltd., New Delhi, 2010

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – III Experimental Stress Analysis ME257	Scheme	L	T	P	Credit
		3	0	0	03

1. **Course Outcomes (COs):** **At the end of the course, students will be able to**	
CO1	Illustrate theoretical concepts of stress and strain measurements.
CO2	Evaluate stress and strain of mechanical systems using electrical resistance strain gauges.
CO3	Understand the utility of strain rosettes.
CO4	Apply the photo elastic technique for principal stress measurement on 2-D and 3-D objects.
CO5	Analyse various brittle coating techniques.
CO6	Evaluate stress analysis through destructive and non-destructive techniques.

2.	**Syllabus**	
	INTRODUCTION	**(04 Hours)**
	Basic concepts in dynamic measurements, calibration, standards, measurement systems and system response, general consideration in data analysis, distortion, analysis of experimental data, types and causes of experimental errors.	
	DISPLACEMENT SENSORS	**(05 Hours)**
	Mechanical, optical, acoustical and electrical extensometers, principles of measurements, accuracy, sensitivity and range of measurements, capacitance gauges, laser displacement sensors	
	ELECTRICAL RESISTANCE STRAIN GAGES	**(05 Hours)**
	Introduction to strain gauge, principle of operation, types and their uses, materials for strain gauges, calibration and temperature compensation, data acquisition, strain sensitivity in metallic alloys, gauge construction, adhesives and mounting techniques, gauge sensitivity and gauge factor, performance characteristics, environmental effects, strain gauge circuits, potentiometer, Wheatstone's bridge, constant current circuits.	

	STRAIN ANALYSIS METHODS	**(07 Hours)**
	Introduction to rosettes, two element, three element rectangular and delta rosettes, stress gage, plane shear gauge, stress intensity factor gauge. Mass balance measurement, elastic element for force measurements, torque measurement.	
	PHOTO ELASTICITY	**(08 Hours)**
	Introduction to photoelasticity, two dimensional photo elasticity, photo elastic materials, photo elastic effects, stress optic law, transmission photo elasticity, plane and circular polariscopes, interpretation of fringe pattern, introduction to three dimensional photo elasticity	
	BRITTLE COATING TECHNIQUES	**(09 Hours)**
	Types of brittle coatings, coating stresses, crack pattern in brittle coating, refrigeration and load relaxation techniques, crack detection, strain analysis through Moire fringes, geometrical and displacement approach	
	EXPERIMENTS IN MATERIAL TESTING	**(07 Hours)**
	Creep test, fatigue test, calibration of proving rings, calibration of photo elastic model for stress fringe value, fundamentals of NDT, radiography, thermography, ultrasonic, eddy current testing, fluorescent penetrant testing.	
		(Total Contact Time: = 45 Hours)

3.	**Books Recommended**
1	K. Ramesh. Digital Photo elasticity – Advanced Techniques and Applications, Springer, 2000.
2	S. Singh. Experimental Stress Analysis, Khanna Publishers, New Delhi, 1996
3	A. Freddi, G. Olmi and L. Cristofolini. Experimental Stress Analysis for Materials and Structures, Springer International Publishing, 2015.
4	W. Dally and W.F. Riley. Experimental Stress Analysis, McGraw-Hill, 1991
5	U. C. Jindal. Experimental Stress Analysis, Pearson Publications, 2018

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – III Engineering Estimation and Costing ME259	Scheme	L	T	P	Credit
		3	0	0	03

1. **Course Outcomes (COs):** **At the end of the course, students will be able to**	
CO1	Analyze the concept of estimation for various industrial applications
CO2	Analyze the concept of cost accounting and control.
CO3	Apply engineering economics and analyze the breakeven point for single and multiple product production cases.
CO4	Demonstrate the effects of depreciation and replacement policy in engineering economic analysis problems.
CO5	Explain the concepts of financial management and accounting.

2.	**Syllabus**	
	ESTIMATING	**(06 Hours)**
	Objectives of estimating –constituents of estimate, mechanical estimating – costing and cost estimation, functions of estimation organization and prerequisites of estimation, estimating such as design and drafting period, time & motion studies, time allowances etc., estimation of material, labour cost, production estimate sheet, advantages & elements of costing, classification of cost	
	COST ACCOUNTING AND CONTROL	**(06 Hours)**
	Cost accounting, elements of cost, factors affecting selling price, fixed cost, variable cost, computation of actual cost, nature of cost, type of cost and cost control	
	ENGINEERING ECONOMICS & BREAK EVEN ANALYSIS	**(11 Hours)**
	Introduction, time value of money, cash flows, taxation concept, tools for engineering economics, models, operation research, value engineering, make and buy decisions, economic batch size, locational economics, benefits cost ratio, break even analysis, analytical and graphical methods, single products and multiple product cases	

	DEPRECIATION AND REPLACEMENT ANALYSIS	**(11 Hours)**
	Concepts, classification, methods of depreciation, comparison of different depreciation method, selection of depreciation methods, obsolescence, reasons for replacement of equipment, development of systematic replacement programme/policy, replacement models, sudden failure,	
	FINANCIAL MANAGEMENT AND ACCOUNTING	**(11 Hours)**
	Definitions and functions of financial management, sources of funds, capitals and its classification, capitalization, sourcing of funds, shares, debentures, trade credits, pubic deposits, banking, foreign exchange and trade, nature of accounting, accounting terminology and types, rules for debit and credit, financial ratios, budget and budgetary control	
	(Total Contact Time: = 45 Hours)	

3.	**Books Recommended**
1	J. Heizer, B. Render, C. Munson, and A. Sachan, Operations Management, 12th Edition, Pearson Education, 2017.
2	M. Mahajan, Industrial Engineering and Production Management, 1st Edition, DhanpatRai & Co. (P) Limited, 2015.
3	B.P. Sinha, Mechanical Estimating and Costing, 1st Edition, Tata McGraw Hill Publishing Co. Ltd., 1995.
4	T.R. Banga and S. C. Sharma, Industrial Organization and Engineering Economics, 24th Edition, Khanna Publishers, 2013.
5	S. K. Sharma and S. Sharma, Industrial Engineering &Organization management, Reprint Edition, S K Kataria and Sons, 2013.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – III Plastics and Ceramics ME261	Scheme	L	T	P	Credit
		3	0	0	03

1. Course Outcomes (COs): At the end of the course, students will be able to	
CO1	Describe fundamentals of plastic and ceramic materials.
CO2	Identify the importance of manufacturing processes used to manufacture plastic and ceramic products.
CO3	Establish design guidelines and testing associated with production of plastic products.
CO4	Analyze plastic recycling and waste management practices.
CO5	Distinguish sintering mechanisms considered for ceramic materials.
CO6	Compile properties of various plastic and ceramic materials and its comparison with other classes of materials.

2.	Syllabus	
	INTRODUCTION	**(06 Hours)**
	Classification of materials, history of plastic materials, comparison of plastics with other engineering materials. Classification of plastics, thermoplastic, thermoset plastics, elastomers and polymers. Polymer structures, polymerization, properties of polymers, additive methods to modify polymers. National and International organizations dealing with plastic materials.	
	PROCESSING OF PLASTICS	**(10 Hours)**
	Injection molding, extrusion molding, blow molding, rotational molding, vacuum molding, thermoforming, compression molding, resin transfer molding, calendaring process, etc. Secondary processes for plastics i.e. machining, joining, painting, etc. Defects during processing of plastic products.	
	DESIGN AND TESTING OF PLASTICS PRODUCTS	**(06 Hours)**
	Commodity plastics, engineering plastics, specialty plastics. Design guidelines for products, design guidelines for various processes, importance of mold making. Concept of testing, specification and standards. Overview of various tests, significance of important thermal and mechanical properties of plastic materials.	

	PLASTICS RECYCLING AND WASTE MANAGEMENT	**(06 Hours)**
	Applicability and statistics of plastics in various sectors. Issues and challenges with plastics. Impact of plastics on environment and its remedies. Utility of plastics wastes, waste management practices, plastic recycling processes. Case studies for recycling and waste management.	
	CERAMIC MATERIALS	**(07 Hours)**
	Introduction to ceramic materials, history of ceramic materials, comparison of ceramics with other engineering materials. National and International organizations dealing with ceramics. Atomic bonding and crystal structures in ceramics, traditional and engineering ceramics, classification of ceramics based on properties and applications. Factors affecting properties of ceramics.	
	PROCESSING OF CERAMICS	**(10 Hours)**
	Material selection. Powder making processes. Processing of ceramic materials i.e. slip casting process, ceramic injection molding, tape casting process, etc. Significance of sintering in ceramics, sintering mechanisms, stages during sintering, Importance of phase equilibrium diagrams, Gibbs phase rule, silica phase diagram, phase diagrams for other ceramics.	
	(Total Contact Time: = 45 Hours)	

3.	**Books Recommended**
1	T. L. Szabo, Plastics – Inside Out, 3rd Edition, Elsevier Butterworth-Heinemann, 2005.
2	R. J. Crawford and P. J. Martin, Plastics Engineering, 4th Edition, Elsevier Butterworth-Heinemann, 2020.
3	J. R. Fried, Polymer Science and Technology, 3rd Edition, Prentice Hall, 2014.
4	M.W. Barsoum, Fundamentals of Ceramics, 2nd Edition, CRC Press, 2019.
5	M. N. Rahaman, Ceramic Processing and Sintering, 2nd Edition, CRC Press, 2003.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – III Corrosion Engineering ME263	Scheme	L	T	P	Credit
		3	0	0	03

1. **Course Outcomes (COs):** **At the end of the course, students will be able to**	
CO1	Describe importance of corrosion and various terminology associated with corrosion.
CO2	Identify various types of corrosion, significance, causes and remedies.
CO3	Interpret corrosion issues of various grades of materials.
CO4	Analyze effect of different environments and conditions on corrosion behavior.
CO5	Predict and test corrosion rate of materials from available data.
CO6	Explain design guidelines and preventive methods to minimize corrosion of materials.

2.	**Syllabus**	
	INTRODUCTION TO CORROSION	**(04 Hours)**
	Definition, corrosion damage, statistics/summary of losses due to corrosion, importance of corrosion control, corrosion rate expressions, standards/societies related to corrosion, NACE terminology, origin of Pourbaix diagram.	
	TYPES OF CORROSION	**(07 Hours)**
	General corrosion, galvanic corrosion, crevice corrosion, pitting corrosion, intergranular corrosion, selective leaching, erosion corrosion, stress corrosion, overview of hydrogen cracking, high temperature corrosion. Case studies of failures due to various types of corrosion.	
	CORROSION OF VARIOUS MATERIALS	**(08 Hours)**
	Corrosion of carbon steels, stainless steels and alloy steels. Corrosion issues of aluminium, magnesium, copper, nickel, titanium, etc. and its alloys. Corrosion issues of composite materials and its control.	
	CORROSION IN SELECTED ENVIRONMENTS AND ITS CONTROL	**(10 Hours)**
	Atmospheric corrosion, corrosion due to sea water, microbiologically induced corrosion, overview of corrosion in human body, overview of corrosion in automobiles, overview of	

	corrosion in aircraft, corrosion of steel in concrete, corrosion in petrochemical industry, corrosion in paper and pulp industry and its control.	
	CORROSION TESTING	**(09 Hours)**
	Purpose of testing, importance of testing, laboratory, semi-plant and field tests, ASTM standards for testing, material selection and sample preparation, sequential procedure for laboratory and on- site corrosion investigations. Various tests like immersion tests, cabinet tests, Huey test, Streicher test, Warren test, slow strain rate test, electrochemical tests, high temperature and pressure test, paint test, etc. Testing of stress corrosion cracking and pitting. Cases studies for failure analysis related to surface degradation.	
	CORROSION PREVENTION	**(07 Hours)**
	Purification and alloying of metal, material selection, alteration of environment, design modifications, cathodic and anodic protection, coatings (metallic, inorganic, non-metallic and organic)	
		(Total Contact Time: = 45 Hours)

3.	**Books Recommended**
1	M. G. Fontana, Corrosion Engineering, 3rd Edition, Tata McGraw-Hill, 2005.
2	R. W. Revie and H. H. Uhlig, Corrosion and Corrosion Control: An Introduction to Corrosion Science and Engineering, 4th Edition, Wiley Publication, 2008.
3	R. Baboian, Corrosion Tests and Standards: Application and Interpretation, 2nd Edition, ASTM International, 2005.
4	E. Bardal, Corrosion and Protection, 1st Edition, Springer-Verlag London Ltd., 2004.
5	A. J. McEvily and J. Kasivitamnuay, Metal Failures: Mechanisms, Analysis, Prevention, 2nd Edition, Wiley Publication, 2013.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – IV Fluid Machines ME301	Scheme	L	T	P	Credit
		3	0	2	04

1. Course Outcomes (COs): At the end of the course, students will be able to	
CO1	Describe basic principles of pumps, fans, blowers and compressors
CO2	Illustrate selection and application of various hydraulic turbines and pumps
CO3	Explain the working principles of hydraulic pumps, and envisage performance curves
CO4	Describe and understand the working principle of hydraulic turbines and its performance
CO5	Analyse the methodology to design and calculation for hydraulic pump and turbines
CO6	Develop the concept of fans, blower and compressor

2.	Syllabus	
	PRINCIPLE OF FLUID MACHINES	**(09 Hours)**
	Classification of fluid machines, Impulse momentum principle, Impact of jet on vanes, Basic equation of energy transfer in a fluid machines, free, force and spiral vortex flow, flow over the immersed bodies, lift & drag, concept of stream line bodies & bluff bodies, flow over cylinder & aerofoil.	
	HYDRAULIC TURBINES	**(12 Hours)**
	Working principle of impulse and reaction turbines, construction details and working of Pelton, Francis and Kaplan turbine, draft tube, velocity triangles, degree of reaction, losses, power and efficiency calculations, cavitation in reaction turbines, unit quantities, specific quantities, governing and performance characteristics curves of water turbines.	
	HYDRAULIC PUMPS	**(12 Hours)**
	Principle of dynamic action & positive displacement type of pump, classification, main components of centrifugal pump and function, priming, velocity triangle, work done and energy transfer in the centrifugal pump, losses, heads, and various efficiencies of the pump, performance characteristics of centrifugal pump, system characteristics, series and parallel operation, model analysis of centrifugal pump & specific speed, cavitation in pump & maximum suction lift, Reciprocating and rotary pumps.	
	FANS, BLOWERS AND COMPRESSORS	**(12 Hours)**

	Introduction to fans and blowers, construction and classification of compressor, governing equation, losses, performance curves, Positive displacement, centrifugal and axial flow compressor, Components & their functions, velocity triangle, performance, slip factor, pre whirl, Choking, Surging & stalling, degree of reaction. Reciprocating compressors: Theory and applications, numerical, Rotary compressors
	(Total Contact Time: = 45 Hours)

3.	**Practical**
1	Impact of jet on vanes
2	Performance test on Pelton Turbine
3	Performance test on Francis Turbine.
4	Performance test on gear pump.
5	Performance test on centrifugal pump
6	Performance test on jet pump.
7	Performance of centrifugal and axial flow compressors.
8	Performance of blower

4.	**Books Recommended**
1	Jagdish Lal, Hydraulic Machines including Fluidics, Metropolitan Book Company, 2016.
2	S. K. Som, G. Biswas, S. Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, McGraw Hill, 2017
3	S.M.Yahya, Turbines, Compressors and Fans, Tata McGraw Hill, 2017
4	Sayers, Anthony Terence. Hydraulic and compressible flow turbomachines. McGraw-Hill Book Company Limited, 1990.
5	Pillai Narayana N. and Ramakrishnan C. R. “Principles of Fluid Mechanics and Fluid Machines”, Universities Press (India), 2006.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – IV **Heat Transfer** **ME204**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**0**	**2**	**04**

1. Course Outcomes (COs): **At the end of the course, students will be able to**	
CO1	Apply appropriate mode of heat transfer while analyzing complex engineering problems.
CO2	Compute steady state and transient heat conduction problems in slab, cylindrical and spherical systems.
CO3	Explore various Nusselt number correlations for forced and free convection systems.
CO4	Calculate surface to surface radiative heat transfer in engineering systems.
CO5	Design the heat transfer equipment
CO6	Investigate the performance of heat exchanger using LMTD and NTU-effectiveness methods.

2.	**Syllabus**	
	INTRODUCTION	**(1 Hours)**
	Modes of heat transfer, conduction, convection and radiation.	
	CONDUCTION	**(14 Hours)**
	Fourier's law. General one and three-dimensional heat conduction equation in Cartesian, cylindrical and spherical co -ordinates. One-dimensional steady conduction through plane wall, cylinder and sphere. Contact Resistance and electrical analogy. Critical radius of insulation. Heat source systems in plane wall and cylinder. Heat conduction through extended surface. Effectiveness and fin efficiency. Derivation of governing differential equation (GDE) for pin fin. Solution GDE of pin fin subjected to different boundary conditions. Heat flow rate from finned system. One-dimensional unsteady state heat conduction. Lumped heat capacity analysis. Analysis of system with considerable temperature gradient. Heisler and Grober charts.	
	CONVECTION	**(15 Hours)**
	Forced Convection: Governing Differential Equation, Dimensionless number and their physical significance, Internal forced convection, External forced convection, Flow over tube banks, Reynolds analogy and Colburn analogy. Free Convection: Governing Differential	

	Equation, Dimensionless number and their physical significance, Empirical relations for plate and cylinder and their use, effect of turbulance. Combined natural and forced convection. Fundamentals of boiling & condensation heat transfer. Heat transfer during laminar and turbulent flow of an incompressible fluid over flat plate, hydrodynamic and thermal boundary layer.	
	RADIATION	**(08 Hours)**
	Thermal radiation, monochromatic and total emissive power. Basic laws of radiation, Stefan Boltzman law, wiens displacement law, plank distribution. Radiation shape factors, black and grey surfaces, heat transfer in presence of re-radiating surfaces, radiation network analysis.	
	HEAT EXCHANGERS	**(07 Hours)**
	Basic types of heat exchangers, fouling factors, LMTD, Effectiveness – NTU methods of design.	
		(Total Contact Time: = 45 Hours)

3.	**Practical**
1	To calibrate copper constantan of thermocouple.
2	To plot temperature distribution and analyse heat transfer through composite wall.
3	To determine thermal conductivity of insulating powder.
4	To find and compare heat transfer coefficient in natural convection
5	To assess emissivity of circular surface
6	To determine and compare heat transfer coefficient in internal forced convection phenomena.
7	To compute Stefan Boltzmann constant value
8	To determine pin-fin efficiency in natural and forced convection.
9	To calculate the overall heat transfer coefficient in shell and tube heat exchanger.

4.	**Books Recommended**
1	S. P. Sukhatme, Heat Transfer, Universities Press, 2012.
2	J. P. Holman, Heat Transfer, McGraw Hill, 2017.
3	Y. A. Cengel, A. J.Ghajar, Heat and Mass Transfer, McGraw Hill, 2017.
4	N. V. Suryanarayana, Engineering Heat Transfer, Penram International Publishing, 2015.
5	R. C. Sachdeva, Fundamentals of Heat and Mass Transfer, New Age International Publications, 2012.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – IV Industrial Engineering ME206	Scheme	L	T	P	Credit
		3	0	0	03

1. Course Outcomes (COs): At the end of the course, students will be able to	
CO1	Identify the factors influencing productivity in industrial engineering.
CO2	Classify the tools of method study and time study for creating the improved process and timing for doing a job.
CO3	Examine the factors affecting the plant layout and location decisions.
CO4	Explain qualitative and quantitative techniques for solving the problems of forecasting.
CO5	Compare deterministic and probabilistic inventory control models for evaluating the inventory level.
CO6	Develop an understanding of functions of production planning, control and human resources.

2.	Syllabus	
	INDUSTRIAL ENGINEERING AND PRODUCTIVITY	**(04 Hours)**
	Introduction, history, objectives, organization structure, scope, Productivity, factors influencing productivity, Productivity measurement, causes of low productivity and techniques of their elimination, Introduction to advance industrial engineering techniques.	
	WORK STUDY AND ERGONOMICS	**(10 Hours)**
	History, Scope, Objectives, Overview, Method study Objectives and procedure, Micro motion study, Method study tools, Time study procedure, Performance rating, Allowances, Predetermined Motion Time Systems (PMTS), Work Sampling, Ergonomics, Work science, Design factors, Effect of environment, Man-Machine System, Workload and Fatigues.	
	PLANT LOCATION AND LAYOUT	**(07 Hours)**
	Factors affecting location decisions, Methods of evaluating location alternative, Layout types, Work cells, Repetitive and product oriented layout, Computerized layout design procedure	

	FORECASTING	**(06 Hours)**
	Steps, qualitative and quantitative approaches, Monitoring and controlling forecast, Forecasting in service sector	
	INVENTORY CONTROL	**(07 Hours)**
	Managing inventory, Inventory models for independent demand, Probabilistic models and safety stock, Single period model, Fixed period model	
	PRODUCTION PLANNING AND CONTROL (PPC)	**(07 Hours)**
	Production Systems, Job, Batch, Mass and Continuous production system, Objectives of PPC, Functions of PPC. Forecasting models, Aggregate production planning, scheduling, material requirement planning, lean manufacturing.	
	HUMAN RESOURCE MANAGEMENT	**(04 Hours)**
	Functions of Human Resource Manager, Training and development, Job evaluation and Merit rating, Wage and Wage Incentives, Grievance handling, Discipline and welfare	
	(Total Contact Time: = 45 Hours)	

3.	**Books Recommended**
1	J. Heizer, B. Render, C. Munson, and A. Sachan, Operations Management, 12th Edition, Pearson Education, 2017.
2	E. S. Buffa and R. K. Sarin, Modern Production/ Operations Management, 8th Edition, John Wiley & Sons, 1987.
3	S. Eilon, Elements of Production Planning and Control, 3rd Edition, Universal Publishing Corporation, 1991.
4	N.V. S. Raju, Industrial Engineering and Management, 1st Edition, Cengage Learning, 2013.
5	M. Mahajan, Industrial Engineering and Production Management, 1st Edition, Dhanpat Rai & Co. (P) Limited, 2015.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – IV Dynamics of Machines ME208	Scheme	L	T	P	Credit
		3	1	2	05

1. **Course Outcomes (COs):** **At the end of the course, students will be able to**	
CO1	Understand and apply free-body diagrams in existing mechanisms for static and dynamic analysis
CO2	Analyze and solve different types of governors' problems.
CO3	Apply and solve the effect of balancing for rotating unbalanced masses
CO4	Analyze and solve the effect of balancing for reciprocating unbalanced masses
CO5	Demonstrate the stability of automobiles, naval ships and other related devices considering the gyroscopic effect
CO6	Design and analysis of the flywheel considering the turning moment diagram

2.	**Syllabus**	
	STATIC FORCE ANALYSIS	**(10 Hours)**
	Forces, couples, conditions of static equilibrium, free body diagrams, static force analysis of mechanisms, spur gears, worm gears, principle of virtual work, Friction in Mechanisms	
	DYNAMIC FORCE ANALYSIS	**(13 Hours)**
	Inertia forces, D'alembert's principle, kinematics and inertia forces on planer mechanism, Dynamic analysis of four link and slider crank mechanism: Inertia force in reciprocating engines, Dynamic force analysis of different plane mechanisms graphical method, Flywheels: Turning moment diagrams, fluctuation of speed and energy.	
	BALANCING	**(09 Hours)**
	Introduction, static balancing, dynamic balancing of several masses in different planes. Balancing of inline engines, V-engines, radial engines, balancing machines.	
	GOVERNORS	**(08 Hours)**
	Introduction, types of governors, sensitiveness of a governor, hunting, isochronisms, stability, effort and power of a governor, controlling force.	

	GYROSCOPE	**(05 Hours)**
	Angular velocity, angular acceleration, gyroscopic couple, gyroscopic effect on naval ships and aircraft, stability of an automobile, stability of a two-wheel vehicle.	
	(Total Contact Time: = 45 Hours)	

3.	**TUTORIAL**
	Numerical based on following topics
1	Static force analysis of planer mechanism
2	Static force analysis of gears
3	Dynamic force analysis of planer mechanism-I
4	Dynamic force analysis of planer mechanism-II
5	Engine flywheel
6	Balancing of several masses rotating in different planes
7	Dynamic force analysis of reciprocating mass
8	Governors
9	Gyroscopic couple on naval ship and aircraft
10	Stability of automobile including two wheel vehicles considering gyroscopic effect

3.	**Practical**
1	To determine mass moment of inertia of connecting rod by compound pendulum mentioned.
2	To determine mass moment of inertia of connecting rod by bifilar method.
3	To determine mass moment of inertia of connecting rod by trifilar method.
4	To balance multi-rotor system by experimental and validation with analytical and graphical method.
5	To prepare the performance characteristic curves on Porter governor.
6	To prepare the performance characteristic curves on Proell governor.
7	To prepare the performance characteristic curves on Watt governor.
8	To find the gyroscopic couple acting on rotating disc.

4.	**Books Recommended**
1	S. S. Rattan, Theory of Machines, McGraw Hill Education (India) Private Limited, 2009.
2	J.E. Shigley, J. J. Uicker and G. R. Pennock, Theory of Machines and Mechanisms, 3rd Edition,

	Oxford University Press, 2005.
3	R. S. Khurmi and J. K. Gupta, Theory of Machines, S. Chand and Company Ltd., 2003.
4	J.S. Rao, and R.V. Dukkipati, Mechanism and Machine Theory, Wiley Eastern Ltd.,1989
5	A. Ghosh and A. K. Malick, Theory of Mechanisms and Machines, 3rd Edition, East West Press Pvt. Ltd., 2000.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – IV Experimental Fluid Mechanics ME 252	Scheme	L	T	P	Credit
		3	0	0	03

1. **Course Outcomes (COs):** **At the end of the course, students will be able to**	
CO1	Explain the need of experiments in fluid mechanics.
CO2	Explain the concepts and methods of various measurements techniques in fluid mechanics.
CO3	Explore different analysis techniques commonly used in experimental work.
CO4	Explore modern experimental techniques in fluid mechanics.
CO5	Illustrate the techniques for flow visualization..
CO6	Interpret experimental data in fluid mechanics

2.	**Syllabus**	
	INTRODUCTION	**(04 Hours)**
	Need of Experiments, Model making, non-dimensional parameters	
	WIND TUNNELS	**(08 Hours)**
	Low Speed wind tunnel, Losses in wind tunnel Circuit, High Speed/ supersonic wind tunnels, Shock tubes, Hypersonic facilities.	
	MEASUREMENT OF MATERIAL PROPERTIES	**(10 Hours)**
	Density, Surface tension, Contact Angle, Viscosity, Thermal conductivity, Thermal diffusivity, Diffusion.	
	PRESSURE MEASUREMENTS	**(04 Hours)**
	Measurements of the pressure with the wall tapings, Measurements of the pressure with the static tubes, Pressure sensitive paints	
	VELOCITY, VORTICITY AND MACH NUMBER	**(04 Hours)**
	Pressure based velocity measurements, Thermal Anemometry, Particle based techniques	

	DENSITY BASED TECHNIQUES	**(05 Hours)**
	Shadow graphy, Schlieren method, background-oriented Schlieren, Interferometry.	
	TEMPERATURE MEASUREMENTS	**(05 Hours)**
	Thermochromics Liquid Crystals, infrared imaging, Temperature measurement by absorption, light scattering and laser induced fluorescence, Temperature sensitive paints	
	FLOW VISUALIZATION	**(05 Hours)**
	Aims and principles of flow visualizations, dye lines and contours in liquid flow, smoke visualization in air flows, hardware of flow visualization experiments, modern flow visualization techniques, image processing.	
	(Total Contact Time: = 45 Hours)	

3.	**Books Recommended**
1	C. Tropea and A.L. Yarin, Springer handbook of experimental fluid mechanics, Springer Science & Business Media, 2007.
2	E.O. Doebelin and D. N. Manik. Measurement systems: application and design, Mc. GrawHill, 2019.
3	R. Goldstein, Fluid mechanics measurements, Taylor & Francis 1996.
4	S. P. Venktesh, Mechanical measurements, John Wiley & Sons, Ltd, 2015.
5	J. P. Holman, Experimental methods for engineers, Mc. Graw Hill, 2017.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – IV Theory of Elasticity and Plasticity ME254	Scheme	L	T	P	Credit
		3	0	0	03

1. **Course Outcomes (COs):** **At the end of the course, students will be able to**	
CO1	Examine the theoretical concepts and principles underlying elasticity and plasticity.
CO2	Define plane stress and plane strain condition.
CO3	Apply concept of material yielding and plastic behaviour to solve engineering problems.
CO4	Explain stress-strain relations in elastic and plastic deformation
CO5	Explain load instability and tearing in sheet metal forming.
CO6	Describe slip - line field theory in plastic deformation.

2.	**Syllabus**	
	STRESS & STRAIN ANALYSIS	**(08 Hours)**
	Introduction, Definition of stress & strain, Stress & Strain Tensor, Principal Stresses & Strains, Stress & Strain invariants, Stress & Strain Deviator Tensor, for state of stress and state of strain, generalized Hooke's law, Hooke's law for isotropic and homogeneous materials, plane stress and plane strain	
	YIELD CRITERIA	**(06 Hours)**
	Criteria for yielding – Tresca criterion, Von mises Criterion, Effective stress -strain.	
	PLASTIC STRESS - STRAIN RELATIONSHIPS	**(12 Hours)**
	Stress - strain relation in plasticity, State of plastic stress - strain rate, Strain rate sensitivity, plastic Anisotropy, stress - stain relations for strain hardening metals, Saint Venant's theory of plastic flow, Levy-Mises (flow rule), Prandtl - Reuss Theory of elastic and plastic deformation	
	LOAD INSTABILITY AND TEARING	**(12 Hours)**
	Uniaxial tension of a perfect strip, Tension of an imperfect strip, Tensile instability in stretching continuous sheet - condition for local necking in uniaxial and biaxial tension.	

	SLIP - LINE FIELD THEORY	**(07 Hours)**
	Slip line theory, Hencky's theory of small plastic deformation plasticity conditions, Velocity Equations, Geometry of Slip-line, Geometrical Construction of Slip-line fields, Upper and Lower Bounds, Slip Line Characteristics, Hodograph.	
	(Total Contact Time: = 45 Hours)	

3.	**Books Recommended**
1	R. Hill, The Mathematical Theory of Plasticity, Oxford University Press, London, 2004
2	S. J. Hu, Z. Marciniak, J. L. Duncan, Mechanics of Sheet Metal Forming, Butterworth-Heinemann, 2002.
3	S. Singh, Theory of Elasticity, Khanna Publishers, New Delhi, 2000.
4	U. C. Jindal, Experimental Stress Analysis, Pearson Education India, 2012.
5	H. Jane Helena, Theory of Elasticity and Plasticity, PHI, 2011

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – IV CONDITION MONITORING ME256	Scheme	L	T	P	Credit
		3	0	0	03

1. **Course Outcomes (COs):** **At the end of the course, students will be able to**	
CO1	Describe basic terminologies used in condition monitoring of rotating machinery.
CO2	Examine vibration analysis problems of simple rotating systems.
CO3	Understand and analyze geared nad branched rotor systems.
CO4	Identify rotating machinery faults using different methods.
CO5	Understand the utility of instrumentation and terminology used in signal analysis for condition monitoring.
CO6	Analyse various plots used in condition monitoring of rotors to predict rotor faults.

2.	**SYLLABUS**	
	INTRODUCTION TO CONDITION MONITORING	**(07 Hours)**
	Introduction to condition monitoring and Maintenance approach, Basics of vibration conventions and characteristics	
	VIBRATION ANALYSIS OF SIMPLE ROTOR SYSTEMS	**(12 Hours)**
	Symmetric rotors, Analytical methods for torsional vibration - Holzer`s method, Transfer Matrix method, Geared and Branched systems, Effect of isotropic and anisotropic supports, Whirling of rotor, Campbell diagram.	
	FAULT DIAGNOSIS IN ROTATING MACHINERY	**(14 Hours)**
	Types of rotating machinery faults and its detection - Unbalance, Misalignment, Bent rotors, Bearing defects, Oil Whirl, Oil whip, Looseness, Electric motor defect, Rotor stator rub etc., Non-destructive testing, Acoustic emission technique and applications	

	SIGNAL ANALYSIS IN CONDITION MONITORING	**(12 Hours)**
	Instrumentation and types of Transducers - Displacement, Velocity and Acceleration, Computer aided data acquisition, Oscilloscope, Vibration Exciter systems, Signal Analysis, Basics of FFT, Trend plot, Time domain plot, Frequency domain plot, Spectrum plot, Waterfall plot, RMS, Peak and Peak-peak value.	
	(Total Contact Time: = 45 Hours)	

3.	**Books Recommended**
1	Rajiv Tiwari, Rotor Systems: Analysis and identification, CRC Press, 1st edition, 2017
2	Michael I. Friswell, John E. T. Penny, Seamus D. Garvey, Arthur W. Lees, Dynamics of Rotating machines, Cambridge University Press, 2010
3	A. Davies, Handbook of Condition Monitoring: Techniques and Methodology, Springer Science & Business Media, 1998.
4	J. S. Rao, Rotor Dynamics, New Age International Ltd. 3rd edition, 2018
5	Peter Tavner, Li Ran and Christopher Crabtree, “Condition Monitoring of Rotating Electrical Machines”, The Institution of Engineering and Technology, 3 rd Edition, 2020.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – IV Total Quality Management ME258	Scheme	L	T	P	Credit
		3	0	0	03

1. **Course Outcomes (COs):** **At the end of the course, students will be able to**	
CO1	Student will be familiarized with Quality Concepts, philosophies of Quality Gurus, Total Quality Management (TQM) and models of TQM.
CO2	Students will learn the key aspect of quality improvement cycle and learn to select and use appropriate tools and techniques for controlling, improving and measuring quality such as 5S, Kaizan, TPM, Poka Yoke, QFD, TEI, Quality Circles and Lean Manufacturing.
CO3	Students will learn the concept and methodology of Six Sigma.
CO4	Students will learn the basic frameworks for quality and performance improvement such as ISO Certifications, Total Quality Management (TQM).
CO5	Students will learn the Costs of Quality (COQ).
CO6	Students will learn to review and summarize the case studies of quality improvement in the manufacturing organizations.

2.	**Syllabus**	
	QUALITY CONCEPTS AND TOTAL QUALITY MANAGEMENT (TQM)	**(10 Hours)**
	Quality concepts & Quality management philosophies, TQM linkages with productivity - factors affecting quality & productivity, Quality – Productivity Determinant model, Traditional versus modern quality management, principles of Total Quality (TQ). Concepts, features and element of TQM, TQM versus traditional management practices, Models of TQM, TQM implementation – Strategic framework and Roadblocks. Philosophies of Quality Gurus	
	QUALITY TOOLS	**(04 Hours)**
	Seven basic (Fishbone Diagrams, Histograms, Pareto Analysis, Flowcharts, Scatter Plots and Run Charts) quality tools. Seven new quality tools (Affinity Diagrams, Relations Diagrams, Tree Diagrams, Matrix Diagrams, Arrow Diagrams, Process Decision Program Charts, Matrix Data Analysis)	
	QUALITY COST AND QUALITY CIRCLE	**(04 Hours)**

	Costs of quality (COQ), Juran's model of optimum quality costs, analysis of COQ for improvement, Quality Circle Philosophy, its structure, implementation & operation, Brainstorming – field of application, Types of Brainstorming, 5 – M checklists.	
	TOTAL ORGANIZATIONAL INVOLVEMENT AND TOTAL PRODUCTIVE MAINTENANCE	**(04 Hours)**
	Total employees involvement (TEI), Effective communications, training & mentoring, recognition & reward, feedback & performance appraisal competencies required for different managerial roles, techniques of TEI, reward, techniques of zero defects programme, Features of TPM, Causes of machine failures, types of maintenance, overall equipment effectiveness (OEE), Case studies	
	QUALITY FUNCTION DEPLOYMENT	**(03 Hours)**
	Voice of Customer (VOC), House of Quality, QFD methodology, Case studies	
	5 - S OF HOUSEKEEPING	**(04 Hours)**
	Seiri, Seiton, Seiso, Seiketsu and Shjitsuke, Audit of 5 - S (Auditor's checklist and Display of 5 - S status), Case studies	
	KAIZEN PDCA CYCLE AND POKA YOKE	**(05 Hours)**
	Kaizen versus innovation, The seven wastes, Techniques of Kaizen, kaizen implementation, Techniques, Pillars and working principles of Poka yoke, Case studies	
	SIX SIGMA AND PROCESS CAPABILITY ANALYSIS	**(05 Hours)**
	Methodology of Six Sigma – DMAIC, Statistics associated with Six Sigma, Determination of First– time yield (FTY) of process, Z value, Defects per unit (DPU), Defects per million opportunities (DPMO) and calculating of sigma value of the process, Process capability index, upper and lower capability indices, The CpK index, capability ratio, the Taguchi capability index etc.	
	QUALITY CERTIFICATIONS AND QUALITY AWARDS	**(03 Hours)**
	ISO 9000 series and QS 9000 series certification, ISO 9000 series of standards, ISO 9001 requirements Implementation, Documentation, Internal Audits, Registration.	
	FAILURE MODE & EFFECT ANALYSIS	**(03 Hours)**
	Design and Process FMEA, Case studies	
		(Total Contact Time: = 45 Hours)

5.	Books Recommended
1	P. N. Mukherjee, Total Quality Management, 1st Edition, Prentice Hall India Learning Private Limited, 2006
2	P. M. Charantimath, Total Quality Management, 1st Edition, Pearson Education, 2003.
3	L. Suganthi and A. A. Samuel, Total Quality Management, New title edition, Prentice Hall India Learning Private Limited, 2004.
4	S. Ramasamy, Total Quality Management, 1st Edition, Tata Mcgraw Hill Publishing Co Ltd, 2015.
5	J. R. Evans and W. M. Lindsay, 6th Edition, The Management and Control of Quality, South-Western College Publication, 2004.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – IV Advanced Engineering Materials ME260	Scheme	L	T	P	Credit
		3	0	0	03

1. Course Outcomes (COs): At the end of the course, students will be able to	
CO1	Explain major types of special steels, their properties and applications
CO2	Find out metals that can be used for high temperature applications
CO3	Select cast-irons for specific engineering applications
CO4	Correlate metallurgical aspects and application of light metals
CO5	Select nanomaterials for different industrial applications
CO6	Describe material properties and select the suitable material for biological, space and cryogenic service applications

2.	Syllabus	
	INTRODUCTION	**(02 Hours)**
	The urge for advancements in material development and processing.	
	SPECIAL STEELS	**(08 Hours)**
	Metallurgical aspects, Composition, Properties and applications of: different types of Stainless steels, Dual phase steels, TRIP steels, Maraging steels, High speed steels, Hadfield steels, Free cutting steels, Ausformed steels, Tool Steels, manganese steels, chrome steels, electrical steels, bearing steels, spring steels, heat resistant steels, creep steels, HSLA steels, materials in nuclear field, materials used in space	
	SPECIAL AND HIGH TEMPERATURE ALLOYS	**(06 Hours)**
	Ti alloys: physical and mechanical properties, thermomechanical treatment of Ti-alloys, Ti shape memory alloys, Fe based super alloys, Ni based alloys, Co based alloys, Strengthening mechanism, Composition, Properties and their applications. Engineering applications at elevated temperatures	

	ALLOY CAST IRON	**(04 Hours)**
	Austempered ductile iron; alloy cast irons, Ni hard, high silicon cast irons, heat resistant cast irons- high chrome cast iron- structure, property and engineering applications.	
	LIGHT METALS AND THEIR ALLOYS	**(04 Hours)**
	Aluminium, magnesium and titanium alloys: Metallurgical aspects, Properties and applications.	
	NANO MATERIALS	**(06 Hours)**
	Definition, Types, Properties and applications, Carbon nano tubes, Methods of production.	
	SMART MATERIALS AND BIOMATERIALS	**(5 Hours)**
	Shape memory alloys, Piezoelectric materials, Electro-rheological fluid, Magneto- rheological fluids, biocompatibility, bio functionality, Important bio metallic alloys like: Ni- Ti alloy and Co-Cr-Mo alloys. Applications	
	COMPOSITE MATERIALS	**(05 Hours)**
	PMC, CMC, MMC, processing and typical application**,** Special High Temperature High performance Carbon-Carbon composites.	
	MISCELLANEOUS ADVANCED MATERIALS	**(05 Hours)**
	Magnetic materials, aerospace materials, cryogenic materials, semi-conducting and superconducting materials.	
	(Total Contact Time: = 45 Hours)	

3.	**Books Recommended**
1	J. F. Shackelford, B. R. W. Alexander, Materials Science and Engineering Handbook, CRC Press, LLC, 2001.
2	K. G. Budinski, M K Budinski, Engineering Materials: Properties and Selection, General Motors Corporation, Pearson, 2010.
3	I. J. Polmear, Light alloys: Metallurgy of Light Metals, Arnold, 1995.
4	Z. Abdullaeva, Nano and Biomaterials: Compounds, Properties, Characterization and Applications, Wiley-VCH Verlag, 2017.
5	K K Chawla, Composite Material Science and Engineering, Springer, 2012.

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B. Tech. II (DoME) Semester – IV Risk, Reliability and Life Testing ME262	Scheme	L	T	P	Credit
		3	0	0	03

1. Course Outcomes (COs): At the end of the course, students will be able to	
CO1	Examine the reliability of any product or system which ultimately maintains the customers' base of any industry.
CO2	Explain the components and systems through its life cycle.
CO3	Evaluate the probabilistic time analysis of products' successes and failures.
CO4	Predict reliability of any component or system which is essential before we put it into any use.
CO5	Estimate the life of a system and their components with concepts of highly accelerated life testing.

2.	Syllabus	
	BASIC CONCEPTS IN RELIABILITY	**(08 Hours)**
	Risk and Reliability, introduction and fundamentals of risk management and reliability engineering, bath tub curve, failure mechanism of mechanical components: causes, modes, function of mechanical elements, failure theories.	
	COMPONENT RELIABILITY	**(06 Hours)**
	Failure data analysis, reliability function, hazard rate, failure rate, and their relationship, MTTF, mean failure rate, MTBF.	
	SYSTEM RELIABILITY	**(06 Hours)**
	Series, parallel, mixed configuration, r-out of-n structure, solving complex systems, Reliability Logic Diagrams (RLD), techniques of reliability estimation: fault tree analysis, tie sets and cut sets, Olean algebra.	
	SYSTEM RELIABILITY IMPROVEMENT	**(08 Hours)**
	Use of better components, simplification, derating, redundancy, working environment control, maintenance, etc. redundancy techniques: introduction, component vs unit	

	redundancy, weakest link technique, mixed redundancy, standby redundancy, redundancy optimization, double failure and redundancy.	
	CASE APPLICATION OF COMPLEX SYSTEM	**(02 Hours)**
	Marine power plant, computer system, nuclear power plant, combats aircraft, etc.	
	RELIABILITY TESTING	**(07 Hours)**
	Introduction, objectives, assumptions, different types of test. Life testing in practice: methodology, problems and difficulties. Economics of reliability engineering.	
	ACCELERATED LIFE TESTING	**(08 Hours)**
	Introduction, basic concepts, data qualification. Accusations faster, stress combination methods, limitations, Accelerated Stress Testing (AST), step stress method for AST, various AST models, recent development recommended approach. Highly Accelerated Life Testing (HALT), Highly Accelerated Stress Screening (HASS).	
	(Total Contact Time: = 45 Hours)	

3.	**Books Recommended**
1	L. S. Srinath, Mechanical Reliability, East-West Press Pvt. Ltd, New Delhi, 2002
2	L. S. Srinath, Reliability Engineering, 4th edition, East-West Press Pvt. Ltd, New Delhi, 2005
3	V. N. A. Naikan, Reliability Engineering and Life Testing, PHI Learning Pvt. Ltd. New Delhi, 2008
4	E. Balagurusamy, Reliability Engineering, TMH, New Delhi, 2017
5	D. T. Patrick, Practical Reliability Engineering, 4th edition, Wiley Publishing company, 2008

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B. Tech. II (DoME) Semester – IV CONCURRENT ENGINEERING ME264	Scheme	L	T	P	Credit
		3	0	0	03

1. **Course Outcomes (COs):** **At the end of the course, students will be able to**	
CO1	Support the multi-disciplinary integrated product development teams and plan and implement a new product development program
CO2	Apply appropriate concurrent engineering tools and techniques to design and develop environment-friendly products by leveraging both manufacturing cost and lifecycle cost
CO3	Determine the customer needs and ensure that the product design is robust and meets the professional standards with better quality.
CO4	Design and develop the products with high reliability, maintainability, and availability.
CO5	Apply the information technology tools for collaborative product design and development.
CO6	Demonstrate the applications of concurrent design of structures, products and components.

2.	**Syllabus**	
	Introduction	**(07 Hours)**
	Motivation, definition, and philosophy of Concurrent Engineering (CE); sequential and concurrent processes; Principles of CE; Organizing for CE; CE teams and team dynamics; Role of CAD/CAM/CAE/CIM and automation in CE; Managing product development projects; Decomposition of product development stages; Benefits of CE; Implementation issues of CE.	
	Concurrent Engineering Tools and Techniques	**(24 Hours)**
	Design for manufacturing (DFM), Design for assembly (DFA); Factors influencing form design; Casting and machining considerations; Design for manufacturing and Assembly (DFMA) guidelines and examples; Lifecycle design of products with circular economy concept; Design for environment (DFE) with examples; Design for (-to-)cost; Design for X (DFX); Value engineering. Design for quality; Taguchi's methods for designing robust products; Design of Experiments (DOE) with examples; Design optimization; Quality function deployment (QFD) with examples. Design for reliability, maintainability and availability with examples; Failure modes and effects analysis (FMEA); Fault tree analysis (FTA); Rapid prototyping methods; Design simulation; Virtual and augmented reality environments for CE.	

	Role of Information Technology in Concurrent Engineering	**(07 Hours)**
	Information technology (IT) components and functions; Artificial Intelligence for IT operations used for product design; Collaborative product development; Collaborative product commerce, Cloud IoT for CE.	
	Selected Applications of Concurrent Engineering	**(076 Hours)**
	Design of aerospace and naval structures made of composite materials; Design of automotive components; Design of medical devices; Design of electronic products; Design of white goods parts.	
		(Total Contact Time: = 45 Hours)

3.	**Books Recommended**
1	B. Prasad. Concurrent Engineering Fundamentals I & II, Prentice Hall, New Jersey, 1996.
2	I. Moustapha. Concurrent Engineering in Product Design and Development, New Age International, New Delhi, 2006
3	G. Boothroyd, P. Dewhurst, and W. Knight. Product Design for Manufacture and Assembly, 3rd Edition, Routledge, Boca Raton, 2010
4	J. R. Hartley. Concurrent Engineering: Shortening Lead Times, Raising Quality, and Lowering Costs, 4th Edition, Routledge, Boca Raton, 2017
5	K. T. Ulrich, S. D. Eppinger, and M. C. Yang. Product Design and Development, 7th Edition, McGraw Hill Education (India), Noida, 2020.