MAHARASHTRA INSTITUTE OF TECHNOLOGY, AURANGABD

An Autonomous Institute Affiliated to
Dr. Babasaheb Ambedkar Marathwada
University, Aurangabad, Maharashtra (India)

Second Year B.Tech. Syllabus (Mechanical Engineering) 2022-23
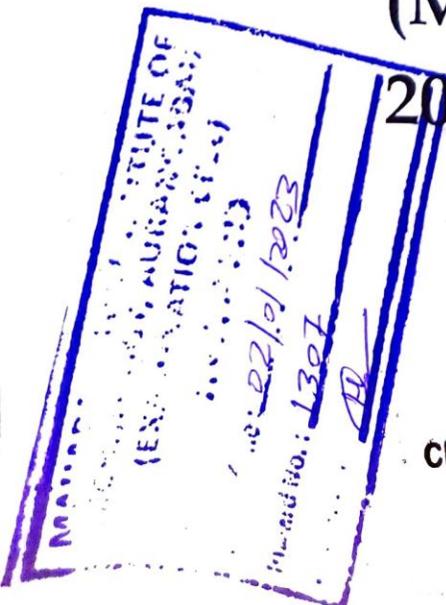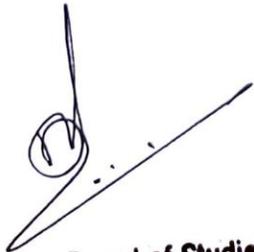
Chairman Board of Studies
Mechanical Engineering
MIT Aurangabad
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Chairman Academic Council
MIT Aurangabad
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Sr. No	Course Category	Course Code	Course Title	L	T	P	Contact Hr /Wk	Credits	MSE-I	MSE-II	CIE	TA	ESE/ Oral	Total
			S. Y. B. Tech. Syllabus Structure w.e.f. 2022-23											
			Mechanical Engineering											
			Orientation Program (2 Days)											
1.1	BSC	BSC204	Linear Algebra & Transform	3	1	-	4	4	15	15	10	10	50	100
1.2	PCC	MED201	Strength of Materials	3	-	-	3	3	15	15	10	10	50	100
1.3	PCC	MED202	Fluid Mechanics and Fluid Machines	3	-	-	3	3	15	15	10	10	50	100
1.4	PCC	MED203	Metrology & Quality Control	3	-	-	3	3	15	15	10	10	50	100
1.5	PCC	MED204	Manufacturing Processes	3	-	-	3	3	15	15	10	10	50	100
1.6	PCC	MED221	Lab-I-Strength of Materials	-	-	2	2	1	-	-	-	-	25	25
1.7	PCC	MED222	Lab-II-Fluid Mechanics and Fluid Machines	-	-	2	2	1	-	-	-	25	-	25
1.8	PCC	MED223	Lab-III-Metrology and Quality Control	-	-	2	2	1	-	-	-	25	25	50
1.9	PCC	MED224	Lab-IV- Workshop Practice	-	-	2	2	1	-	-	-	-	25	25
1.10	PCC	BSC225	Lab-V-R-Programming (Data Analytics Lab)	-	-	2	2	1	-	-	-	25	-	25
1.11	HSM	HSM804	Mandatory Non-credit course	2	-	-	2	Non-Credit Mandatory Course						
S3				**17**	**1**	**10**	**28**	**21**	**75**	**75**	**50**	**125**	**325**	**650**

Sr. No	Course Category	Course Code	Course Title	L	T	P	Contact Hr /Wk	Credits	MSE-I	MSE-II	CIE	TA	ESE/ Oral	Total
2.1	BSC	BSC251B	Complex Variable &Vector Calculus	3	1	-	4	4	15	15	10	10	50	100
2.2	PCC	MED251	Machine Drawing	3	-	-	3	3	15	15	10	10	50	100
2.3	PCC	MED252	Artificial Intelligence in Manufacturing	3	-	-	3	3	15	15	10	10	50	100
2.4	PCC	MED253	Engineering Thermodynamics	3	-	-	3	3	15	15	10	10	50	100
2.5	PEC	MED281 to MED283	Professional Elective I*	3	-	-	3	3	15	15	10	10	50	100
2.6	PCC	MED271	Lab-I- Machine Drawing	-	-	2	2	1	-	-	-	-	25	25
2.7	PCC	MED272	Lab-II-Engineering Thermodynamics	-	-	2	2	1	-	-	-	25	-	25
2.8	PCC	MED273	Lab-III-Workshop Practice (Advanced Manufacturing Processes)	-	-	2	2	1	-	-	-	-	25	25
2.9	HSM	HSM254	Lab-V-Development of Skills	-	-	2	2	1	-	-	-	25	25	50
2.10	PCC	MED274	Lab-IV-Problem Based learning	-	-	2	2	1	-	-	-	25	-	25
2.11	HSM	HSM805 to HSM807	Mandatory Non-credit course	2	-	-	2	Non-Credit Mandatory Course						
S4				**17**	**1**	**10**	**28**	**21**	**75**	**75**	**50**	**125**	**325**	**650**
			MSE- Mid Semester Exam, ESE- End Semester Examination, TH-Theory, OR- Oral, TA-Teacher Assessment, TW- Term Work, PR- Practical, Tut- Tutorial, CIE-Continuous Internal Evaluation											

Semester-3 Mandatory Non-Credit Course

HSM804 Constitution of India

Semester-4 Mandatory Non-Credit Course

HSM805 Professional Ethics and Corporate Social Responsibility

HSM806 Emotional Intelligence

HSM807 Stress Management Through Yoga

Semester-4 Professional Elective-I

MED281 Additive Manufacturing

MED282 Modern Energy Sources

MED283 Industrial Hydraulics & Pneumatics

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Faculty of Science & Technology	
Syllabus of S. Y. B.Tech. Mechanical Engineering (Semester III)	

Course Code: BSC204	Mid Semester Examination-I: 15 Marks
Course: Linear Algebra & Transform	Mid Semester Examination-II: 15 Marks
Teaching Scheme:	Continuous In-semester Evaluation: 10 Marks
Theory: 03 Hrs/week	
Tutorial: 01Hr/week	Teacher Assessment: 10 Marks
Credits: 3-1-0	End Semester Examination: 50 Marks
	End Semester Examination (Duration): 2 Hrs

Prerequisite	Basic formulae of trigonometry, Derivative, Integration, Basic knowledge of Determinant and Matrices.
Objectives	1. To know the application of the matrix technique in finding find solution of system of linear equations that arises in many engineering problems. 2. To understand and solve higher order differential equations and apply them by mathematical modelling in various engineering problems. 3. To study and apply concept of transform.
Unit-I	**Complex Number**: Introduction to complex number, De-Moivrer's theorem, root of complex number, circular function & hyperbolic function, relation between circular & hyperbolic function, inverse hyperbolic functions, separation of real & imaginary parts, Logarithm of complex quantity. (07 Hrs)
Unit-II	**Matrix**: Introduction to matrix, rank of matrix-echelon form, normal form, solution of simultaneous linear equations (homogeneous & nonhomogeneous). Eigen values and Eigen vectors, Cayley-Hamilton theorem. (06 Hrs)
Unit-III	**Probability Distribution:** Introduction, Probability distribution: Binomial distribution, Poisson distribution,

	Normal distribution. (05 Hrs)
Unit-IV	**Linear Differential Equation & Its Applications**: Solution of nth order linear differential equation with constant coefficients: Complementary function, Particular integral- short method, method of variation of parameters, Application of Linear differential equation to electrical circuit, Civil and mechanical. (06 Hrs)
Unit-V	**Laplace Transform** : Definition, Laplace Transforms of elementary functions, Theorems and properties of Laplace transform (without proof): First shifting and second shifting theorem, Change of scale, Multiplication by t , Division by t, Laplace transform of Derivatives, Laplace transform of integral, Evaluation of integrals using Laplace transform, Laplace transform of Unit step function and Dirac's delta function. (06 Hrs)
Unit-VI	**Inverse Laplace transform**: Definition, Inverse Laplace transforms using: a) Some elementary functions; b) Theorem and properties of Laplace transform c) Partial fraction method; d) Convolution theorem; Application of Laplace transform to solve linear differential equations with given initial conditions. (06 Hrs)

References	Sr. No.	Title	Author	Publication	Edition
	1.	Advanced Engineering Mathematics	Erwin Kreyszig	Wiley eastern Ltd	10th Edition
	2.	Higher Engineering Mathematics	B.V. Ramana	Tata McGraw-Hill	1st Edition
	3.	Higher Engineering	Dr. B. S. Grewal	Khanna	43rd

		Mathematics		Publications	Edition
	4.	Applied Mathematics	P. N. Wartikar & J. N. Wartikar	Pune Vidyarthi Griha Prakashan, Pune	9th Edition
	5.	A textbook of Engineering Mathematics	N.P. Bali and Manish Goyal	Laxmi Publications	
	6.	Advanced Engineering Mathematics.	H. K. Dass	S. Chand And Co. Ltd	18th Edition

<table>
<tr><td colspan="2" align="center">Faculty of Science & Technology

Syllabus of S. Y. B.Tech. Mechanical Engineering (Semester III)</td></tr>
<tr><td>
Course Code: MED201

Course: Strength of Materials

Teaching scheme:

Theory: 3 Hrs/week

Tutorial: - NA

Credits: 3-0-0
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Mid Semester Examination-I: 15 Marks

Mid Semester Examination-II: 15 Marks

Continuous In-semester Evaluation: 10 Marks

Teacher Assessment: 10 Marks

End Semester Examination: 50 Marks

End Semester Examination (Duration) :2 Hrs
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Prerequisite	Knowledge of Engineering Mechanics
Objectives	1. To provide the basic concepts and principles of strength of materials. 2. To develop the theoretical basis and to derive the theories of the strength of materials and to enable students to systematically solve engineering problems and design engineering systems.
Unit-I	**Stresses & Strains** Concept, Types of Stresses and Strains, Poison's Ratio, Stresses and Strains in Simple and Compound Bars under Axial Loading, Stress-Strain Diagram, Hooks Law, Elastic Constants and Relationships, Temperature Stresses and Strains In Simple Bars under Axial Loading, Volumetric Stresses and Strains (06 Hrs)
Unit-II	**Bending of Beam** Bending stresses in the beam, Shear force and bending moment diagrams. Slope and Deflection: Moment area method and Macaulay's method. (08 Hrs)
Unit-III	**Thin Cylindrical and Spherical Shells** Thin Pressure Vessels, Circumferential and Longitudinal Stresses, Cylindrical and Spherical Objects Subjected to Internal Fluid Pressure, Volumetric Strains. (04 Hrs)
Unit-IV	**Principal Stresses** Direct and Bending Stresses with Axial Loads, Core of Section, eccentrically

	Loaded Short Struts, Concept of Stress on Oblique Plane in Two Dimensional Stress System, Planes of Maximum Shear, Mohr's Circle of 2D Stress condition. (07 Hrs)
Unit-V	**Theory of Torsion** Torsion of Thin Circular Tube, Solid and Hollow Circular Shafts, Tapered Shaft, Stepped Shaft and Composite Circular Shafts, Combined Bending and Torsion, Equivalent Torque, Torsional Moment Diagrams. (06 Hrs)
Unit-VI	**Energy Methods** Strain Energy due Gradually Applied Loads, Suddenly Applied Loads & Impact Loads. Stored Energy in Elastic Members, Castigliano's First & Second Theorem. (05 Hrs)

References	Sr. No.	Title	Author	Publication	Edition
	1.	Strength of Materials	S. Ramamrutham	Dhanpatrai & Sons	5th edition
	2.	Strength of Materials	R. K. Bansal	Laxmi Prakashan	6th edition
	3.	Strength of Materials	R. S. Khurmi	S Chand & Co ltd	26th edition
	4.	Strength of Materials	S. S. Ratan	TMH Publication	2nd edition
	5.	Strength of Materials	Timoshenko	D Van Nostrand Company Inc	5th edition

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Faculty of Science & Technology	
Syllabus of S. Y. B.Tech. Mechanical Engineering (Semester III)	

Course Code: MED202	Mid Semester Examination-I: 15 Marks
Course: Fluid Mechanics and Fluid Machines	Mid Semester Examination-II: 15Marks
	Continuous In-semester Evaluation: 10 Marks
Teaching scheme:	Teacher Assessment: 10 Marks
Theory: 3 Hrs/week	End Semester Examination: 50 Marks
Credits: 3-0-0	End Semester Examination (Duration) :2 Hrs

Prerequisite	Knowledge of basic concepts of Physics and Mathematics
Objectives	1. To understand properties of fluid and study different pressure measuring devices. 2. To study the behavior of fluid when fluid is in rest or in motion 3. To study the energy losses in the pipes. 4. To introduce the concepts of momentum principles. 5. To impart the knowledge on pumps and turbines
Unit-I	**Basics of Fluid and Fluid Statics** Units and Dimensions, Properties of fluids - Density, Specific gravity, Specific weight, Viscosity; Compressibility, Vapour pressure, Capillarity and surface tension; Forces on immersed surfaces, Introduction about center of pressure and buoyancy, Piezometer, U-tube and Differential Manometers. (04 Hrs)
Unit-II	**Fluid Kinematics and Dynamics** Introduction, Classification of flow, continuity equation, Cartesian coordinates, types of flow line, Velocity acceleration, Velocity Potential, Stream Function, Forces acting on fluids in motion, Euler's equation of motion, Bernoulli's equation, Practical application of Bernoulli's equation such as Venturi meter, Orifice meter, Pitot tube. (07 Hrs)
Unit-III	**Flow through Pipes** Major losses, Minor Losses, Darcy's Equation, Hydraulic Gradient Line, Total

	Energy Line, Flow through pipes in series and parallel, Equivalent pipes, Branched pipes Losses in power transmission in pipes.
	(07 Hrs)
Unit-IV	**Dimensional Analysis**
	Dimensional homogeneity, Rayleigh's method, Buckingham-pi theorem, Dimensionless Numbers, Geometrical, Kinematics and Dynamic Similarity.
	(04 Hrs)
Unit-V	**Hydraulic Turbines**
	Introduction, Force exerted by jet on stationary vertical, inclined & curved plate Classification, Impulse Turbine, Construction & working of Pelton wheel, Work done & efficiency of a Pelton wheel, Definition of heads &efficiency, design aspects of Pelton wheel, Radial flow Reaction Turbine, Construction &working of Francis turbine, , Axial flow reaction turbine, Propeller Turbine, Kaplan Turbine, Runway speed, Draft Tube, Draft tube Theory, Types of draft tubes, Specific Speed, unit quantities Cavitation.
	(07 Hrs)
Unit-VI	**Centrifugal Pumps**
	Introduction, Construction & Working of Centrifugal Pumps (C.P.) Work done by the impeller on water, Definition of Heads & efficiencies of C. P. Losses in C. P. Minimum Speed for Starting a C.P., Effect of variation of Discharge on efficiency, Effect of no. of vanes of impeller on head & efficiency, Single and Multistage C.P., Pumps in Series, Pumps in Parallel, NPSH, cavitation and Priming. (07 Hrs)

References	Sr. No.	Title	Author	Publication	Edition
	1.	Fluid mechanics & Hydraulic Machine	K. Subramanya,	TATA McGraw Hill publications	2nd Edition, 2018

	2.	Fluid mechanics and Hydraulics	Dr.R.K.Bansal ,	Laxmi Publications (P) LTD	11th edition, 2019
	3.	Fluid mechanics and Hydraulic machines	Dr. S.K.Agrawal,	TMH Publications	2nd edition
	4.	Hydraulics and Fluid Mechanics,	Modi & Seth,	Standard Book House	14th edition
	5.	Fluid Mechanics and Hydraulic Machines	, S. Ramamrutham,	Dhanpatrai Publications	8th edition
Additional Reference	1.	Fluid Mechanics,	V.L. Streeter &E.B. Wylie,	TMH,	3rd edition.

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Faculty of Science & Technology	
Syllabus of S. Y. B.Tech. Mechanical Engineering (Semester III)	
Course Code: MED203	Mid Semester Examination-I: 15 Marks
Course: Metrology and Quality Control	Mid Semester Examination-II: 15 Marks
Teaching scheme:	Continuous In-semester Evaluation: 10 Marks
Theory: 3 Hrs/week	Teacher Assessment: 10 Marks
Tutorial: NA	End Semester Examination: 50 Marks
Credits: 3-0-0	End Semester Examination (Duration) :2 Hrs

Prerequisite	Knowledge of basics of Physics and Mathematics
Objectives	1. To understand the significance of measurements. 2. To Understand the use of standards in measurement, gauges, and tolerances 3. To make students understand various types of measuring processes and instruments. 4. To understand the concept of quality control and SQC techniques. 5. To measure quality parameters and apply quality inspection methods to decide the quality of the product and the process capabilities
Unit-I	**Introduction to Metrology** Role of Legal Metrology - Need of measurement, types of measurement - Precision & Accuracy - Errors in measurement & its types - Standards of Measurements, line and End Standard. Slip gauges - Calibration - Interchangeability and selective assembly. Introduction to Comparator-Mechanical, Optical, Electrical Electronic, and Pneumatic. Coordinate Measuring Machine. (06 Hrs)
Unit-II	Introduction to Limits, Fits, and Tolerances & their types. Introduction to GO & NO GO gauges. **Metrology of Screw Threads and Gears** Terminology of screw threads, Different errors in screw threads, Pitch measurement, Measurement of thread diameters with standard wire. Best size wire - Two and three wire method. **Gears**: Constant chord method - Base tangent

	method.	(06 Hrs)
Unit-III	**Surface Finish Measurement and Interferometry** Surface topography definitions, Method of Evaluation of Surface finish. Meaning of RMS and CLA values, Grades of roughness and its specifications. Interferometry: Principle of light wave interference - Light sources - Types of Interferometers. Measurement of straightness, Flatness, Squareness, Parallelism and Circularity. Numerical assessment of surface roughness.	(06 Hrs)
Unit-IV	**Concept of Quality**: Definition of Quality, Quality assurance, Specification of quality, Factors controlling the quality of design and conformance, Cost of quality, Seven QC tools **Statistical Quality Control Introduction** - Chance Causes and assignable Causes - SQC Benefits and Limitations. Fundamental concepts in probability – Normal curve - Measures of Dispersion**.**	(06 Hrs)
Unit-V	**Theory of Control Charts:** - Control Charts for Variables - X bar and R charts, Standard deviation charts – run up - run down - Process capability studies. Control Charts for attributes - Fraction defectives and number of defects. Numerical on control charts.	(06 Hrs)
Unit-VI	**Acceptance Sampling** Basic concept of sampling inspection, Single and double and sequential sampling plans, Operating characteristic curves. AQL - LTPD - AOQL - stratified sampling plans for variables.	(06 Hrs)

References	Sr. No.	Title	Author	Publication	Edition
	1.	Engineering Metrology	Jain. R. K	Khanna Publishers	21st
	2.	Engineering Metrology	Hume K.J	Macdonald Publications	1st Edition, 1970

	3.	Statistical Quality Control & Quality Management	Gupta. R. C.	Khanna Publishers	10th
	4.	Engineering Metrology and Measurements	N.V. Raghavendra L. Krishnamurthy	Oxford	1st Edition 2013
	5.	Statistical Quality Control	Eugene Grant, Richard Leavenworth	Tata McGraw Hill Publication	7th
	6.	Quality Control	Kulkarni V. A. and Bewoor A. K	John Wiley Publication	1st Edition, 2009
Additional Reference	https://nptel.ac.in/courses/112106179 https://nptel.ac.in/courses/112104250				

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Faculty of Science & Technology	
Syllabus of S. Y. B.Tech. Mechanical Engineering (Semester III)	
Course Code: MED204	Mid Semester Examination-I: 15 Marks
Course: Manufacturing Processes	Mid Semester Examination-II: 15 Marks
Teaching scheme:	Continuous In-semester Evaluation: 10 Marks
Theory: 3 Hrs/week	Teacher Assessment: 10 Marks
Tutorial: NA	End Semester Examination: 50 Marks
Credits: 3-0-0	End Semester Examination (Duration) : 2 Hrs

Prerequisite	1. Ability to understand and visualize a component from its drawing. 2. Knowledge of basic manufacturing process like Turning, Drilling, Milling, Grinding, Shaping etc.
Objectives	1. To understand the classification, advantages, disadvantages and applications of various manufacturing processes. 2. To understand the working principle of different conventional and unconventional manufacturing processes 3. To understand construction, working and specifications of machinery/ machine tools required for manufacturing. 4. To understand the process variables affecting the product quality in manufacturing processes. 5. To choose the appropriate manufacturing processes for producing a given component
Unit-I	**Introduction to overview of manufacturing** Manufacturing definition, manufacturing industries and products, classification of manufacturing processes, classification of material removal processes, introduction to additive manufacturing. **Metal casting processes** Introduction and classification of metal casting processes ;Heating and pouring: foundry practices-cupolas, direct fuel-fired furnaces, crucible furnaces, electric-arc furnaces, induction furnaces; Solidification and cooling: solidification of

	metals, shrinkage, directional solidification, calculation of solidification time; Sand casting: patterns and cores, molds and mold making, casting operation; Expendable mould casting processes :shell molding, vacuum molding, investment casting, plaster-mold and ceramic-mold casting; Permanent mould casting processes : basic permanent-mold process, variations of permanent-mold casting, die casting, squeeze casting and semisolid metal casting, centrifugal Casting; Casting quality : casting defects, inspection methods. (08 Hrs)
Unit-II	**Metal forming processes** Introduction and classification of metal forming operations, material behaviour in metal forming, temperature in metal forming, strain rate sensitivity, friction and lubrication in metal forming; Rolling: flat rolling and its analysis, shape rolling, rolling mills; Forging : open-die forging, impression-die forging, flash less forging, forging hammers, presses, and dies; Extrusion : types of extrusion, extrusion dies and presses, extrusion processes, defects in extruded products;Wire and bar drawing : analysis of drawing, drawing practice, tube drawing. (04 Hrs)
Unit-III	**Turning and related operations** Operations related to turning; Cutting tools and cutting conditions in turning; The engine lathe, turret, capstan, semi/automatic lathe, CNC turning centre; Boring operation and machines; Machining time calculations for turning operation **Drilling and related operations** Operations related to drilling; Cutting conditions in drilling; Geometry of twist drill; Drill machines: types, construction and operations; Machining time calculations for drilling operation. (06 Hrs)
Unit-IV	**Milling operations** Operations related to milling; Cutting tools and cutting conditions in milling; Milling machines: types, construction and operations; Indexing methods and its

	calculation; Machining time calculations for milling operation
	Grinding and other abrasive processes
	Grinding operations and grinding machines: surface grinding, cylindrical grinding, centre less grinding; Grinding wheel: abrasive material, grain size, bonding materials, wheel structure and wheel grade, grinding wheel specification.
	(08 Hrs)
Unit-V	**Non-conventional machining processes**
	Need, benefits, classification; Mechanism of metal removal, parameters, advantages disadvantages and applications of EDM, ECM, LBM, USM, AJM, WJM; MRR calculations for the listed processes.
	(04 Hrs)
Unit-VI	**Metal joining processes**
	Welding processes: classification of welding processes, types of joints, types of welds, HAZ; Arc welding with consumable and non-consumable electrodes; Resistance welding processes and power source in resistance welding; Oxy-fuel gas welding, alternative gases for oxy-fuel welding; Solid state-welding processes; Brazing and soldering processes; Weld quality: welding defects.
	(06 Hrs)

References	Sr. No.	Title	Author	Publication	Edition
	1.	Fundamentals of Modern Manufacturing	Mikell P. Groover	John Wiley & Sons	4th Edition
	2.	DeGarmo's Materials and Processes in Manufacturing	J. T. Black, Ronald A. Kohser	John Wiley & Sons	11th Edition
	3.	Production Technology	Jain R.K.	Khanna Publications	17th Edition

4.	Workshop Technology	B S Raghuwanshi	Dhanpat Rai and Sons	10th Edition
5.	Workshop Technology	Hajra Chaudhary	Dhanpat Rai and Sons	10th Edition
6.	Manufacturing Science	Amitabh Ghosh	East-West press	2nd Edition
7.	Processes and Materials of Manufacture	Roy A. Lind Berg	Prentice Hall Publications	4th Edition

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Faculty of Science & Technology	
Syllabus of S. Y. B.Tech. Mechanical Engineering (Semester III)	
Course Code: MED221	Credit: 0-0-1
Course: Lab-I-Strength of Materials	Practical/Oral Exam: - 25 Marks
Teaching Scheme:	Teacher's Assessment: NA
Practical: 2 hrs. /week	
Course Objectives	1. To test/demonstrate the basic concepts, principles, and theories of the strength of materials in laboratory.
List of Practical's	1) Tension Test on Ductile Material Like Mild Steel or TOR Steel
	2) Flexural Test on Timber Beam
	3) Single shear Test on Metals
	4) Double shear Test on Metals
	5) Izod Impact Test on Metals
	6) Charpy Impact Test on Metals
	7) Torsion Test on Mild Steel
	8) Rockwell Hardness Test on Metals
	9) Brinell Hardness Test on Metals
	10) Assignment on shear force diagram and bending moment diagram of beam.

Faculty of Science & Technology	
Syllabus of S. Y. B.Tech. Mechanical Engineering (Semester III)	
Course Code: MED222 Course: Lab-II-Fluid Mechanics and Fluid Machines **Teaching Scheme:** Practical: 2 hrs. /week	Credit: 0-0-1 Practical/Oral Exam: NA Teacher's Assessment: 25 Marks
Course Objectives	1. To understand various concepts, theorems in fluid mechanics by performing following experiments. 2. To introduce the concepts of the working and design aspects of hydraulic machines like turbines and pumps and their applications
List of Practical's	**Practical's Based on the syllabus minimum ten shall perform** 1. Study of pressure measuring devices. 2. Determination of Kinematic Viscosity using Redwood Viscometer. 3. Determination of metacentric height. 4. Verification of Bernoulli's theorem. 5. Determination of coefficient of discharge of Venturi meter or Orifice meter 6. Determination of coefficient of friction in pipe. 7. Determination of minor losses and Major losses 8. Trial on Pelton Turbine 9. Trial on Francis Turbine 10. Trial on Kaplan Turbine 11. Trial on Centrifugal Pump 12. Trial on Gear Pump 13. Industrial Visit to Hydraulic Power Station

	Faculty of Science & Technology	
	Syllabus of S. Y. B.Tech. Mechanical Engineering (Semester III)	
Course Code: MED223		Credit: 0-0-1
Course: Lab-III-Metrology and Quality Control		Practical/Oral Exam: 25 Marks
		Teacher's Assessment: 25 Marks
Teaching Scheme:		
Practical: 2 hrs. /week		
Course Objectives	1) Selection of tool and techniques for determining geometry and dimensions.	
	2) Design and calibration of measuring tools and equipment's.	
	3) Application of Quality Control Techniques.	
	4) Application of Quality Management Concept	
List of Practical's (Any 10)	1	Determination of linear / angular dimensions and errors in a measurement of components using precision / non precision measuring instruments.
	2	Verification of dimensions & geometry of given components using mechanical & pneumatic comparator.
	3	Calibration of Micrometer
	4	Calibration of Vernier Caliper
	5	Determination of geometry & dimensions of given composite object using profile projector.
	6	Measurement of various angles of single point cutting tool using tool maker's microscope.
	7	Measurement of thread parameters using floating carriage diameter measuring machine.
	8	Measurement of spur gear parameters using gear tooth vernier, span, gear rolling tester.
	9	Identification of surfaces using optical flat/interferometers and measure surface roughness using surface roughness tester
	10	Case study on process capability to plot variable control chart/ attribute chart.

| | 11 | Machine Tool Alignment Test on any machine like-Lathe, Milling, Drilling. |
| | 12 | Determination of given geometry using coordinate measuring machine (CMM) |

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Faculty of Science & Technology		
Syllabus of S. Y. B.Tech. Mechanical Engineering (Semester III)		
Course Code: MED224		Credit: 0-0-1
Course: Lab-IV-Workshop Practice		Practical/Oral Exam: 25 Marks
Teaching Scheme:		Teacher's Assessment: NA
Practical: 2 hrs. /week		
Course Objectives	1. To make the students aware and understand the basic manufacturing operations in Engineering fields. 2. To have understanding and practice of various measurement devices and Techniques. 3. To have hands understanding and practice of various cutting tools and machines used in manufacturing work. 4. To develop work culture and ability to work in a team and as an individual to acquire the skills	
Section	**Contents**	**Duration**
Plumbing	Study of plumbing tools and their uses, standards accessories used in plumbing, List of various operations and tools.; **Workshop diary** – Sketch of job; **Practical:** one job of thread cutting on G.I. Pipe	20 Hrs
Pattern Making	Study of pattern making tools and their uses. standards accessories used in pattern making. List of various operations and tools; **Workshop diary** – Sketch of job; **Practical**: one job of pattern making.	
Foundry	Study of sand molding, Types of sands and molding equipment's, List of various operations and tools; **Workshop diary** – Sketch of job **Practical:** One job of molding (Single or multi -piece pattern)	

Welding	Study of arc welding machines, MIG welding machine, TIG welding machine and welding equipment's, List of various operations and tools used; **Workshop diary** – Sketch of job; **Practical:** One job of welding individually or in group of students of any useful item of daily use using various welding operations.
Term work	Term work will consist of submitting a workshop diary and minimum one job of all the above four manufacturing processes with neatly written records of the study and diagrams. A workshop diary should be maintained by students to record the progress of the jobs done.

Faculty of Science & Technology	
Syllabus of S. Y. B.Tech. Mechanical Engineering (Semester III)	
Course Code: BSC225	Credit: 0-0-1
Course: Lab-V- R-Programming (Data Analytics Lab)	Practical/Oral Exam: NA
	Teacher's Assessment: 25 Marks
Teaching Scheme:	
Practical: 2 hrs. /week	

Course Objectives	1. Understand the R Programming Language.
	2. Exposure on visualizing data science problems.
	3. Understand the classification and Regression Model.

List of Practical's	**1. Introduction to R Programming and Study of basic Syntax in R**
	2. R as a Calculator application:
	a. Using with and without R objects on console
	b. Using mathematical functions on console
	c. Write an R script, to create R objects for calculator application and save in a specified location in disk.
	3. Descriptive Statistics In R
	a. Write an R script to find basic descriptive statistics using summary, str, quartile function
	b. Write an R script to find subset of dataset by using subset (), aggregate () functions on sample dataset
	4. Reading and Writing Different Types of Datasets
	a. Reading different types of data sets (.txt, .csv) from Web and disk and writing in file in specific disk location.
	b. Reading Excel data sheet in R.
	c. Reading XML dataset in R.
	5. Visualizations
	a. Find the data distributions using box and scatter plot.
	b. Find the outliers using plot.
	c. Plot the histogram, bar chart and pie chart on sample data

Study and implementation of various control structures in R and calculate mean mode median for a dataset

6. Correlation and Covariance

  a. Find the correlation matrix.

  b. Find the outliers using plot.

  c. Plot the correlation plot on dataset and visualize giving an overview of relationships among data.

7. Regression Model

Import a data from web storage. Name the dataset and now do Linear/Logistic Regression to find out relation between variables that are affecting the admission of a student in an institute based on his or her entrance score

8. Classification Model

  a. Install relevant package for classification.

  b. Choose classifier for classification problem.

  c. Evaluate the performance of classifier.

9. Clustering Model

  a. Clustering algorithms for unsupervised classification.

  b. Plot the cluster data using R visualizations.

10. Mini Project

Maharashtra Institute of Technology, Aurangabad
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Faculty of Science & Technology	
Syllabus of S. Y. B.Tech. Mechanical Engineering (Semester III)	
Course Code: HSM804 Course: Constitution of India (Mandatory non-credit course) **Teaching scheme:** Theory: 2 hrs. / week	Credits: 0-0-0
Prerequisite	Willingness to learn
Objectives	1.To create awareness about the constitution of India 2.To know different sections/articles of the constitution of India and their significance.
Unit-I	Meaning and Concept of Indian Constitution; Nature of Constitution; Brief Idea of Indian Constitution [Parts, Articles and Schedule] (02 Hrs)
Unit-II	**Salient Features of Indian Constitution** Written and Enacted Constitution; The longest and most detailed Constitution of the World; Rigidity and Flexible Constitution; Parliamentary system of Government; Federal system with unitary bias; Adult Franchise; Single Citizenship; Sovereign, Democratic, Republic; Secularism; Directive Principles of State Policy; Independent Judiciary; Fundamental Rights; Fundamental Duties. (05 Hrs)
Unit-III	**A. Fundamental Rights** Concept of State (Art. -12); Right to Equality (Art. -14 to 18); Right to Freedom (Art. -19 to 22); Right against Exploitation (Art. -23 & 24); Right to Religion (Art. -25 to 28); Right of Minorities (Art. -29 & 30); Constitutional Remedies (Art.-32). **Fundamental Duties (Art.-51 A)** (05 Hrs)
Unit-IV	**Directive Principles of State Policy (DPSP's)**

	Meaning and Significance of Directive Principles; Classification/ Principles of D.P.S.P.; Relationship between F.Rs. and D.P.S.P. (04 Hrs)		

Unit-V	**Executives** **A) Union Government** The President, Council of Ministers, and Prime Minister. **B) State Government** The Governor, Council of Ministers and Chief Minister (04 Hrs)

Unit-VI	**Election Commission:** Election Commission: Role and Functioning; Chief Election Commissioner and Election Commissioners; State Election Commission: Role and Functioning; Institute and Bodies for the welfare of SC/ST/OBC and women. (04 Hrs)

References	Sr. No.	Title	Author	Publication	Edition
	1.	Constitution of India, Bare Act. Govt. of India	Constitution of India, Bare Act. Govt. of India	Constitution of India, Bare Act. Govt. of India	-
	2.	Our Constitution (AN Introduction of Indians Constitution and Constitutional tow,	Subhash C Kashyap	National Book Trust, India	2001
	3.	Indian Constitution,	Avasthi &, Maheshwarii	Lakshmi Narain Agrawal Agra,	2017
	4.	Introduction to the Constitution of India,	Basu D.D.,	Lexis Nexis,	2013

5.	Indian Prime Minister	Sharma L.N.	the Macmillan Company of India,	1976
6.	Union Executive,	Jain H.M.	Chaitanya Publishing House,	1969.
7.	Dr. B.R. Ambedkar, Framing of Indian Constitution (1 to 6 Volume)	Dr. S.N. Busi,	Ava Publishers	First Edition, 2016
8.	Indian Constitution Law,	M.P. Jain,	Nexis	7th Edn. 2014
9.	Outlines of Indian Legal and Constitutional History,	M.P. Jain,	Lexis Nexis,	2014

All latest volumes of above-mentioned books must be preferred.
The above list of books is not an exhaustive one.

<table>
<tr><td colspan="2" align="center">**Faculty of Science & Technology**</td></tr>
<tr><td colspan="2" align="center">**Syllabus of S. Y. B.Tech. Mechanical Engineering (Semester IV)**</td></tr>
<tr>
<td>
Course Code: BSC251B

Course: Complex Variable &Vector Calculus

Teaching Scheme:

Theory: 03 Hrs/week

Tutorial: 01 Hr/week

Credits: 3-1-0
</td>
<td>
Mid Semester Examination-I: 15 Marks

Mid Semester Examination-II: 15 Marks

Continuous In-semester Evaluation: 10 Marks

Teacher Assessment: 10 Marks

End Semester Examination: 50 Marks

End Semester Examination (Duration): 2 Hrs
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<tr>
<td>**Prerequisite**</td>
<td>Basic formulae of trigonometry, Derivative, Integration, algebra of complex numbers, fundamentals of vector algebra.</td>
</tr>
<tr>
<td>**Objectives**</td>
<td>
1. To develop the mathematical skills of the students related to function of complex variables.

2. To make the students familiarize with concept of vector differentiation and vector integration.

3. To apply mathematical concepts for solving the practical problems in engineering and technology.
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<tr>
<td>**Unit-I**</td>
<td>
Function of Complex Variable:

Introduction, Analytic function ,Cauchy-Riemann equation in Cartesian and polar coordinates ,Harmonic function, orthogonal system , Integration in complex plane: Line integral, Contour integral, Cauchy's integral theorem , Cauchy's integral formula, Extension of Cauchy's theorem on multiply connected region, Singularities, Residues, Cauchy's residue theorem. (07 Hrs)
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<tr>
<td>**Unit-II**</td>
<td>
Fourier Series:

Definition, Dirichlet's conditions; Fourier series for function having period 2L; Fourier series for even and odd function, half range expansion; Fourier sine and cosine series. (06 Hrs)
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<tr>
<td>**Unit-III**</td>
<td>
Fourier Transform:

Fourier integral theorem (without proof), Fourier sine and cosine integral, Fourier sine and cosine transform, inverse Fourier transform, inverse Fourier sine and
</td>
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	cosine transform.				(05 Hrs)
Unit-IV	**Vector Differentiation**: Differentiation of vectors, Scalar and Vector point functions, Gradient of a scalar point function, Directional derivative, Divergence and Curl of vector point function, Irrotational and Solenoidal vector fields. (06 Hrs)				
Unit-V	**Vector Integration**: Line integral, Work done by a force, Surface integral, green's theorem, Stokes's theorem. (06Hrs)				
Unit-VI	**Application of Partial Differential Equation** Solution of partial differential equation by method of separation of variables, Applications to:- i. Vibration of a string (Wave equation) (without proof); ii. One dimensional heat flow equation (Diffusion equation) (without proof); iii. Two-dimensional heat flow equation (Diffusion equation) (without proof). (06 Hrs)				

References	Sr. No.	Title	Author	Publication	Edition
	1.	Advanced Engineering Mathematics	Erwin Kreyszig	Wiley eastern Ltd	10th Edition
	2.	Higher Engineering Mathematics	B.V. Ramana	Tata McGraw-Hill	1st Edition
	3.	Advanced Engineering Mathematics	C. R. Wylie	McGraw Hill Publications	6th Edition
	4.	Higher Engineering Mathematics	Dr. B. S. Grewal	Khanna Publications	43rd Edition
	5.	Applied Mathematics	P. N. Wartika & J. N. Wartikar	Pune Vidyarthi	9th Edition

				Griha Prakashan, Pune	
	6.	A text book of Engineering Mathematics	N. P. Bali and Manish Goyal	Laxmi Publications	Laxmi Publications
	7.	Advanced Engineering Mathematics.	H. K. Dass	S. Chand And Co. Ltd	18th Edition

Faculty of Science & Technology

Syllabus of S. Y. B.Tech. Mechanical Engineering (Semester IV)

Course Code: MED251	Mid Semester Examination-I: 15 Marks
Course: Machine Drawing	Mid Semester Examination-II: 15 Marks
Teaching Scheme:	Continuous In-semester Evaluation: 10 Marks
Theory: 03 Hrs/week	Teacher Assessment: 10 Marks
Tutorial: NA	End Semester Examination: 50 Marks
Credits: 3-0-0	End Semester Examination (Duration): 2 Hrs

Prerequisite	Basic understanding of concepts pf Engineering Graphics
Objectives	1. The subject intends to make the students understand various curves used in machine components and their development.
	2. Interpret the industrial drawings and understand various conventions of machine components.
	3. Visualize and construct the assembly of given set of individual components.
Unit-I	**Orthographic views and Sectional views**
	Conversion of pictorial view into orthographic views and sectional views. Types of sections. (06 Hrs)
Unit-II	**Development of Surfaces**
	Draw the development of surfaces for sections of Prisms, Cylinders, Pyramids and Cones. (06 Hrs)
Unit-III	**Interpenetration of solids**
	Draw the curves of interpenetration of the surfaces of the solids such as Cylinder, Prism, Pyramid, Cone, and Sphere. (06 Hrs)
Unit-IV	**Engineering curves**
	Draw the various curves like ellipse, Parabola, Hyperbola, Involute, Cycloid, Epicycloid, Hypocycloid and Helix. (04 Hrs)

Unit-V	**Conventional representations**				
	Representation of elements of machine drawing: Engineering Materials, Surface finishes, tolerances, Different types of Screw threads.				
	Component Drawings: Bolts and Nuts, Locking devices, Keys and Cotter joints, welded joints, Knuckle Joint, Riveted joints, Shaft Couplings, Bearings and Pipe joints. (07 Hrs)				
Unit-VI	**Preparing assembly from given component details**				
	Constructing the Assembly drawing of Footstep Bearing, Steam Stop Valve, Screw Jack, Safety Valve, Cross Head, Piston and Connecting Rod, Lathe Tail Stock, Drill jig etc. from the given component details. (07 Hrs)				
References	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1.	Machine Drawing	N. D. Bhatt	Charotar Publishing House Pvt. Ltd.	53rd
	2.	Machine Drawing	Dr. R.K. Dhawan	S. Chand and company Pvt. Ltd.	15th
	3.	A Textbook of Machine Drawing	P.S. Gill	S.K Kataria & Sons	2013
	4.	Machine Drawing	N. Sidheswar, P. Kannaiah and V.V.S. Sastry	McGraw Hill Education	2017

Faculty of Science & Technology	
Syllabus of S. Y. B.Tech. Mechanical Engineering (Semester IV)	
Course Code: MED252 Course: Artificial Intelligence in Manufacturing **Teaching Scheme:** Theory: 03 Hrs/week Credits: 3-0-0	Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous In-semester Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisite	Basic understanding of concepts of engineering materials and types of Manufacturing Processes.
Objectives	1) To introduce the students with the concept of Artificial Intelligence. 2) To give the broad understanding of various domains of Artificial Intelligence. 3) To give understanding about ‗How Artificial Intelligence can be applied in manufacturing domain'.
Unit-I	**Introduction to Artificial Intelligence:** Concept of AI, Brief history of AI, Goals of Artificial Intelligence, current status, scope, three main categories of AI - Artificial Narrow Intelligence (ANI), Artificial General Intelligence (AGI), Artificial Super Intelligence (ASI) (04 Hrs)
Unit-II	**Domains Of Artificial Intelligence:** Machine Learning, Deep Learning, Natural Language Processing, Robotics, Expert Systems, Fuzzy Logic and Computer vision. Role of each AI domain in manufacturing (05 Hrs)
Unit-III	**Machine Learning:** Introduction, Supervised learning, Unsupervised learning, Reinforcement learning, Linear Regression with One Variable, Linear Regression with Multiple Variables, Logistic Regression, Neural Networks- Representation, Neural Networks: Learning, Support Vector Machines. Machine learning model in Python by using any of the ML algorithms Use cases - Product recommendation on a shopping website, spam filter on email, Chatbots (09 Hrs)

Unit-IV	**Computer vision:** Fundamentals of image processing, deep learning and convolutional neural network (CNN) for Image classification, Object detection, Object tracking, Content-based image retrieval. Applications of computer vision in manufacturing. (06 Hrs)
Unit-V	**Robotics:** Basics of robotics, components of robot, Pr-programmed robots, Humanoid robots, Autonomous robots, Teleoperated robots, augmenting robots, AI based robots, AI technology used in Robotics - Computer Vision, NLP, Edge Computing, Complex Event Process, Complex Event Process, Transfer Learning and AI, Reinforcement Learning, Affective computing, Artificial intelligence and IoT. (06 Hrs)
Unit-VI	**AI use cases related to manufacturing:** AI in process automation, AI based visual inspections and quality control, AI in autonomous vehicles, AI based connected factory, AI based Predicts Equipment Failure, AI for predictive maintenance, AI for Improving Manufacturing Processes, AI for Plant Productivity, AI for factory automation, AI based Digital Twins, AI in supply chain management, AI for Process Monitoring. (06 Hrs)

References	Sr. No.	Title	Author	Publication	Edition
	1.	Artificial Intelligence: A Modern Approach	Stuart Russell and Peter Norvig,	Prentice Hall	3rd Edition,
	2.	Introduction to Robotics	Saha, S.K.	McGraw-Hill Higher Education, New Delhi, 2014	2nd Edition,
	3.	Artificial Intelligence	Elaine Rich and Kevin Knight	Tata McGraw Hill	2017
	4.	Intelligent Manufacturing	Andrew Kusiak	Prentice Hall,	1990

	Systems			
5.	Thinking Machines	Aleksander, Igor and Burnett	Oxford,	1987
6.	Python Machine Learning	Sebastian Raschka,	Packt Publishing.	2016
7.	Machine Learning	E. Alpaydin	MIT Press,	2010
8.	Understanding Machine Learning: From Theory to Algorithms	Shai Shalev-Shwartz, Shai Ben-David	Cambridge University Press,	2014
9.	Machine Learning For Dummies	John Mueller & Luca Massaron	John Wiley & Sons,	2016
Additional References	1. https://onlinecourses.nptel.ac.in/noc21_ge20/preview 2. https://onlinecourses.nptel.ac.in/noc22_cs97/preview 3. https://onlinecourses.nptel.ac.in/noc22_cs89/preview 4. https://onlinecourses.nptel.ac.in/noc22_cs73/preview			

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Faculty of Science & Technology	
Syllabus of S. Y. B.Tech. Mechanical Engineering (Semester IV)	
Course Code: MED253	Mid Semester Examination-I: 15 Marks
Course: Engineering Thermodynamics	Mid Semester Examination-II: 15 Marks
Teaching Scheme:	Continuous In-semester Evaluation: 10 Marks
Theory: 03 Hrs/week	Teacher Assessment: 10 Marks
Tutorial: NA	End Semester Examination: 50 Marks
Credits: 3-0-0	End Semester Examination (Duration): 2 Hrs

Prerequisite	Basic understanding of concepts of physics and thermodynamics.
Objectives	1. To understand energy conservation and essence of first law of thermodynamics. 2. To make analysis of flow and non-flow processes regarding relationship between parameters, evaluation of work, heat and internal energy applied for varies thermodynamics systems. 3. To understand statements second law of thermodynamics and concept of availability and irreversibility and its analysis. 4. To study the concept of entropy, including the Clausius Inequality. 5. To understand concept of pure substance and analysis of different processes including use of Mollier chart.
Unit-I	Review of basic concepts, First law of thermodynamics for cyclic and non-cyclic process, Limitations of first law of thermodynamics, thermal reservoir, heat engine, refrigerator and heat pump, Kelvin-Plank statement, Clausius statement, Equivalence of Kelvin Plank and Clausius statements, violations of Kelvin Plank and Clausius statements (Theoretical and Numerical treatment) (06 Hrs.)
Unit-II	Properties and important definitions of pure substance, phases of a pure substance, phase-change processes of pure substances compressed liquid and saturated liquid saturated vapour and superheated vapour, saturation temperature and saturation pressure some consequences of saturation temperature and

	saturation pressure dependence, thermodynamic relations involving entropy, properties of steam, enthalpy-entropy (h-s) chart or mollier diagram, dryness fraction measurement (Theoretical and Numerical treatment) (06 Hrs.)
Unit-III	Carnot cycle, Rankine cycle, comparison with Carnot cycle, modified Rankine cycle, reheat cycle, regenerative cycle, binary vapor cycle (theoretical and numerical treatment) (06 Hrs.)
Unit-IV	Introduction to internal combustion engine and related definitions, air standard analysis, Carnot cycle, Stirling cycle, Otto cycle, Diesel cycle, duel cycle, comparison of Otto and Diesel cycle, Lenoir cycle, Atkinson cycle (theoretical treatment) (06 Hrs.)
Unit-V	Types of steam nozzles, divergent nozzle, convergent-divergent nozzle, steam flow through a nozzle, velocity of nozzle, discharge through an isentropic nozzle, condition for maximum discharge, critical velocity, critical pressure ratio, flow through actual nozzle (theoretical and numerical treatment) Steam condenser, function of a condenser, elements of condensing plant, types of condensers, jet condenser, low level counter flow jet condenser, low- level parallel flow jet condenser, high-level jet condenser, ejector condenser, surface condenser, shell-and- tube type surface condenser, evaporative condenser, condense efficiency (theoretical treatment) (06 Hrs.)
Unit-VI	Use of compressed air, classification of compressor, reciprocating compressor terminology, construction, working of single-acting air compressor, mean effective pressure, power and mechanical efficiency, minimizing compression work, adiabatic efficiency, compressor efficiency, isothermal efficiency, methods for improving isothermal efficiency, clearance volume, volumetric efficiency (theoretical treatment) (06 Hrs.)

Reference Books	Sr. No.	Title	Author	Publication	Edition
	1.	Engineering Thermodynamics	P. K. Nag	Tata McGraw Hill	3rd edition, 2006
	2.	Thermodynamics and Thermal Engineering	J. Rajadurai	New age International,	1st edition 2003
	3.	Thermal Engineering,	Mahesh M. Rathore	Tata McGraw Hill	First edition, 2010
	4.	Engineering Thermodynamics	J.B. Jones and Dugan ,	Prentice –Hall Of India,	1st edition, Reprint in India 2006
	5.	Thermodynamics – An Engineering Approach	Y. Cengel & Boles	Tata McGraw Hill	1st edition Reprint 2000
	6.	Fundamental of Engineering Thermodynamics,	Rathakrishnan	Prentice –Hall Of India,	2nd edition, 2005
	7.	Thermal Engineering,	S. Domkundwar, C. P. Kothandaraman, Anand Domkundwar,	Dhanpat Rai Publishers	3rd edition, 2001
Additional References	1. https://nptel.ac.in/courses/112106133/ 2. https://swayam.gov.in/nd1_noc19_me57/preview 3. https://www.britannica.com/science/thermodynamics				

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Faculty of Science & Technology	
Syllabus of S. Y. B.Tech. Mechanical Engineering (Semester IV)	
Course Code: MED281	Mid Semester Examination-I: 15 Marks
Course: (Professional Elective-I)	Mid Semester Examination-II: 15 Marks
Additive Manufacturing	Continuous In-semester Evaluation: 10 Marks
Teaching Scheme:	Teacher Assessment: 10 Marks
Theory: 03 Hrs/week	End Semester Examination: 50 Marks
Credits: 3-0-0	End Semester Examination (Duration): 2 Hrs
Prerequisite	Basic understanding of concepts of manufacturing processes.
Objectives	1. To impart fundamentals of additive manufacturing processes along with the various file formats, software tools, processes, techniques, and applications.
Unit-I	**The Basics of Additive Manufacturing Technology:** Foundation of Additive Manufacturing (AM); Definitions of terms used in AM. Different types of machines, Various machines viz., FDM, SLA & SLS (Basic tech Knowledge), AM Manufacturing Industries, Technology Specifications; emerging trend in AM. Difference between Additive and Subtractive Manufacturing. (04 Hrs)
Unit-II	**Different technologies &processes of AM:** Fused Deposition Modelling (FDM), Stereo lithography & Digital Light Processing (SLA & DLP), Selective Laser Sintering (SLS), Material Jetting (PolyJet), Direct Metal Laser Sintering & Selective Laser Melting (DMLS & SLM), Binder Jetting. (08 Hrs)
Unit-III	**Design for Additive Manufacturing:** Introduction to design in additive manufacturing and principles. Basic Concept of Art design and architecture and use of online model/ resources. Part design considering requirements for 3 D printing, designing supports & slicing techniques, Understand product design. How to get a printable model The STL

		file format, Conversion of CAD file to STL.			
					(08 Hrs)
Unit-IV		**Preprocessing and Post processing techniques:** Understanding process algorithm of slicing software and slicing techniques. Understand Honeycomb structure. Understand Roof & Floor layers in the printers. Understand accessing wall layers. Learn to see the internal view display layer. Understand Turbo print generation, different resolution selection. Different post processing techniques for each process. viz., sanding, cleaning, deburring, curing, painting, polishing etc.			
					(08 Hrs)
Unit-V		**Materials used in Additive Manufacturing:** Comparison of different process and material performances in respect of application, strength, finish, precision, etc. Polymers, Metals, Ceramics, Composites.			
					(04 Hrs)
Unit-VI		**Application of Additive Manufacturing:** Different Applications like Functional prototypes, Health care products etc. Dental and medical Industries Architecture and Design, Automotive Industries, Aerospace Industries, Consumer home Products, Toys and Gadgets, Art and Education. (04 Hrs)			

Reference Books	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1.	Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing.	Gibson,Rosen, Stucker	Springer,	2009.

2.	Rapid Prototyping: Laser-based and Other Technologies.	Patri K. Venuvinod and Weiyin Ma	Springer,	2004.
3.	Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling,	D.T. Pham, S.S. Dimov,	Springer	2001.
4.	Additive Manufacturing, Second Edition	Amit Bandyopadhyay Susmita Bose,	CRC Press Taylor & Francis Group,	2020.
Additional References	1. https://www.nist.gov/additive-manufacturing 2. https://www.metal-am.com/ 3. http://additivemanufacturing.com/basics/ 4. https://www.3dprintingindustry.com/ 5. https://www.thingiverse.com/ 6. https://reprap.org/wiki/RepRap			

Faculty of Science & Technology	
Syllabus of S. Y. B.Tech. Mechanical Engineering (Semester IV)	

Course Code: MED282	Mid Semester Examination-I: 15 Marks
Course: (Professional Elective-I) Modern Energy Resources	Mid Semester Examination-II: 15 Marks
	Continuous In-semester Evaluation: 10 Marks
Teaching Scheme:	Teacher Assessment: 10 Marks
Theory: 03 Hrs/week	End Semester Examination: 50 Marks
Credits: 3-0-0	End Semester Examination (Duration): 2 Hrs

Prerequisite	Basic understanding of concepts of physics and thermodynamics.
Objectives	1. To create awareness amongst students on sources of energy, energy crisis and the alternates available. 2. To get exposure on recent advances in energy in the contemporary world. 3. To know about various miscellaneous energy and its potential.
Unit-I	**Introduction:** Introduction to types of non-conventional energy sources, Energy Scenario in India and world, Review of energy consumption pattern in various sectors in India, Introduction to energy policies and programmes in India like International Solar Alliance, National Solar Mission etc., Introduction to global climate change concerns like: Clean Development Mechanism [CDM], Carbon Fund Concept of Carbon credit, Various international protocols. (06 Hrs.)
Unit-II	**Solar Energy Systems**: Solar radiations, Types of solar radiation collectors, Estimation and measurement of solar energy, Characteristics of Photovoltaic cells, Solar cell arrays , Applications of Solar Heating & Cooling System like Solar still, Solar cooker, Solar pond, Solar passive heating and cooling systems: Trombe wall, Solar power plant, Solar furnaces. (06 Hrs.)
Unit-III	**Biofuels:** Review of Indian edible and non-edible oil sources, Examples of biodiesel crops in India, Storage and Characterization of biodiesel, Environmental and health effects of biodiesel, R&D in biodiesel **Energy Generation from Waste** Types: Biochemical Conversion: Sources of

	energy generation, Industrial waste, agro-residues; Aerobic & Anaerobic treatments, Factors affecting bio digestion. (06 Hrs)
Unit-IV	**Wind Energy Systems:** Basic principles of wind energy conversion, Site selection criteria, Wind data and energy estimation in India, Wind energy conversion systems, Horizontal and Vertical axis wind machines, Applications of wind energy, Environmental aspects, Wind Energy Program in India. (06 Hrs)
Unit-V	**Geothermal Energy:** Structure of earth, Geothermal Regions, Hot springs. Hot Rocks, Hot Aquifers. Analytical methods to estimate thermal potential. Harnessing techniques, Electricity generating systems. **Direct Energy Conversion:** Nuclear Fusion: Fusion, Fusion reaction, P-P cycle, Carbon cycle, Deuterium cycle, Condition for controlled fusion, Fuel cells and photovoltaic. Thermionic & thermoelectric generation, MHD generator. (06 Hrs)
Unit-VI	**Introduction to new energy technology**: Hydrogen production - water splitting - electrolytic methods Chemical cycle - photo splitting - photo galvanic - photo chemical. Application of Hydrogen Fuel for Vehicle, Introduction to Magneto Hydro Dynamic system (MHD) and Electro gas dynamics (EGD): principles and types. (06 Hrs)

Reference Books	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1.	Solar Energy- Principles of Thermal Collection & Storage	S. P. Sukhatme	TMH Publishing Co., New Delhi.	4th edition
	2.	Non-Conventional Energy Sources	G. D. Rai:	Khanna publisher, New Delhi	6th

3.	Non-Conventional Energy Resources.	B.H.Khan	TMH New Delhi	3rd
4.	Technology and Application of Biogas	Srivatsava, Shukla and Ojha	Jain Brothers, New Delhi	1993
5.	Renewable Energy Resources-Basic Principles and Applications	G.N.Tiwari and M.K.Ghosal	Narosa Publications	2004
6.	Biogas systems: Priciples and Applications",	Mital K.M	New Age International Publishers	1996
7.	Basics of Solid & Hazardous Waste Management Technology,	Shah, Kanti L.	Prentice Hall,	2007
8.	Engine for biogas	Klaus Von Mitzlaff	Friedr Vielveg and Sohn Braunschweig	1988
9.	–Wind Power Plants: Theory & Design‖,	Desire Le Gouriers:	Pergamon Press,	1982
10.	Solar Energy – Fundamentals and Applications‖,	H P Garg & J Prakash	Tata McGraw Hill	2000
11.	Solar energy Thermal Processes	John A Duffie & William A Beckman	Wiley–Inter science publication, New	1974

				York	
Additional References		1. https://isolaralliance.org/publications/annual-reports 2. https://mnre.gov.in/img/documents/uploads/file_f-1618564141288.pdf 3. https://mnre.gov.in/knowledge-center/publication			

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Faculty of Science & Technology

Syllabus of S. Y. B.Tech. Mechanical Engineering (Semester IV)

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Course Code: MED283	Mid Semester Examination-I: 15 Marks
Course: (Professional Elective-I)	Mid Semester Examination-II: 15 Marks
Industrial Hydraulics and Pneumatics	Continuous In-semester Evaluation: 10 Marks
Teaching Scheme:	Teacher Assessment: 10 Marks
Theory: 03 Hrs/week	End Semester Examination: 50 Marks
Credits: 3-0-0	End Semester Examination (Duration): 2 Hrs

Prerequisite	Basic understanding of Engineering concepts and practices
Objectives	1. Understanding of Hydraulics and Pneumatics 2. Working mechanism and components used 4. Various applications and structure of these systems and their usage.
Unit-I	Introduction: Introduction, Global fluid power Scenario, Basic system of Hydraulics-Major advantages and disadvantages, Principles of Hydraulic Fluid power, Hydraulic Symbols, Electrical Elements used in hydraulic circuits. (06 Hrs)
Unit-II	Hydraulic Pumps, Motors and Actuators: Classification of hydraulic pumps, Gear Pumps, Vane Pumps, Piston Pumps, Axial piston pumps, Hydraulic motors, Linear and Rotary, Actuators, Hydrostatic Transmission Systems. (06 Hrs)
Unit-III	Hydraulic Valves and Hydraulic system Accessories: Direction control valves, Pressure control valves, Flow control valves, non-return valves, Reservoirs, Accumulators, Heating & cooling devices, Hoses. (06 Hrs)
Unit-IV	Design of hydraulic circuits: Basic hydraulic circuits, Industrial hydraulic circuits, Power losses in flow control circuits. (06 Hrs)
Unit-V	Introduction to Pneumatics: Basic Requirements for Pneumatic System, Applications. Basic pneumatic circuits, Development of single Actuator Circuits. (06 Hrs)

Unit-VI	Pneumatic Cylinders, Motors and Valves: Types of Pneumatic Cylinders & Air motors, Cushion assembly, mounting Arrangements, Pneumatic Direction control valves, Quick exhaust, Time delay Shuttle and Twin pressure valves. (06 Hrs)				
Reference Books	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1.	Oil Hydraulic Systems	S R Majumdar,	TMH	2017
	2.	Pneumatic Systems	S R Majumdar,	TMH	2017
	3.	Industrial Hydraulics	John Pippenger & Taylor Hicks,	McGraw-Hill	1970
	4.	Fluid Power	Anthony Esposito	Prentice Hall	2008

Faculty of Science & Technology	
Syllabus of S. Y. B.Tech. Mechanical Engineering (Semester IV)	
Course Code: MED271 Course: Lab-I-Machine Drawing **Teaching Scheme:** Practical: 2 hrs. /week	Credit: 0-0-1 Practical/Oral Exam: 25 Marks Teacher's Assessment: NA
Course Objectives	1. The subject intends to make the students understand various curves used in machine components and their development. 2. Interpret the industrial drawings and understand various conventions of machine components. 3. Visualize and construct the assembly of given set of individual components
List of Practical's	Term work shall consist of drawing work as given below. 1. Using full size sheet (A-1) draw two problems of each on Orthographic views and Sectional views 2. Using full size sheet (A-1) draw four problems on Development of Surfaces 3. Using full size sheet (A-1) draw four problems on Interpenetration of solids 4. Using full size sheet (A-1) draw four problems on different types of curve 5. Using full size sheet (A-1) draw four problems on Auxiliary views **6.** Using full size sheet (A-1) draw conventions of various machine components **OR** draw various machine components using any drafting software. **7.** Using full size sheet (A-1) draw Assembly drawing of at least one assembly **OR** Draw Assembly drawing of at least one assembly by using any drafting software.

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Syllabus of S. Y. B.Tech. Mechanical Engineering (Semester IV)	
Course Code: MED272	Credit: 0-0-1
Course: Lab-II- Engineering Thermodynamics	Practical/Oral Exam: NA
Teaching Scheme:	Teacher's Assessment: 25 Marks
Practical: 2 hrs. /week	

Course Objectives	1.To understand various concepts thermodynamics
List of Practical's (Any 10)	1. To study Joules Experiment
	2. To study measurement of dryness fraction by Separating and Throttling calorimeter
	3. To study formation of steam
	4. To study non-contact type thermometer
	5. Case Study on Availability of Energy
	6. To Study Principle, Construction and Working of Bomb Calorimeter
	7. To study Convergent-Divergent Nozzle
	8. To Study Steam Condenser
	9. To Study Steam Turbine
	10. To determine isothermal and volumetric efficiency of Air Compressor
	11. Case Study on ‗Waste Heat Recovery'
	12. Visit to Thermal Power Station and Report related to it.

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Syllabus of S. Y. B.Tech. Mechanical Engineering (Semester IV)

Course Code: MED273	Credit: 0-0-1
Course: Lab-III- Workshop Practice (Advanced Manufacturing Processes)	Practical/Oral Exam: - 25 Marks
	Teacher's Assessment: NA
Teaching Scheme:	
Practical: 2 hrs. /week	

Course Objective	1. To make the students aware and understand the advanced manufacturing processes in Engineering fields. 2. To have understanding and practice of subtractive and additive manufacturing 3. To understand the codes and software used in manufacturing work.

Section	Contents	Duration
Turning Shop	Understanding and performing different operations on the lathe machine like turning, facing, taper turning, internal and external threading, grooving, knurling, drilling, boring, chamfering etc. using various operations and tools. **Practical**: Preparing at least one job on lathe machine individually performing all the above operations. **Workshop diary** – Sketch of job.	20 Hrs
Milling	Study of vertical and horizontal milling machines, milling cutters and different operations to be carried on milling machine. **Practical**: Preparing a job individually or in a group of students i.e. Gear blank by turning, external milling of gear teeth involving calculations for indexing. **Workshop diary** – Sketch of job	

Drilling/ Boring/Slotting/ Grinding	Study of different types of drilling, Shaping, Slotting, grinding machines, and various tools like Drills, Single point boring tool, Tools used on slotting and Shaping machines, Grinding wheels. Study and performing various operations on above machines. **Practical**: Preparing a job individually or in a group of students based on drilling, boring internal spline cuts on slotting machine and surface grinding for surface finishing. **Workshop diary** – Sketch of job	
3- D Printing	Study of different processes of Additive Manufacturing and make simple part of Additive Manufacturing viz., Bracket/ Lever, Clamp, Spur Gear, threaded components etc. by extrusion (FFF Technology) and photo-polymerization (SLA).	
CNC Machining	Study the constructional details of CNC lathe and CNC Milling machine and develop a part program for following lathe and milling operations and make the job on CNC machines. Plain turning and facing operations, Taper turning operations, Thread cutting operations, Plain milling - Slot milling - Pocket milling	

Reference Books

Title	Author	Publication	Edition
Workshop Technology Vol. I & II	B.S.Raghuwanshi	Dhanpath Rai & Sons..	4th Edition 2016
Workshop Manual	Kannaiah P. and Narayana K.L.	Scitech publishers.	2nd Edition 2015
Mechanical Workshop Practice	John K.C	PHI 2010	2nd Edition 2019

3- D Printing and additive manufacturing Technologies	Kumar, L.Jyotish	Springer	2019
Computer Aided Manufacturing	P.N. Rao, T.K. Kundra and N.K.Tewari	McGraw Hill Education	2017

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Syllabus of S. Y. B.Tech. Mechanical Engineering (Semester IV)	
Course Code: HSM254	Credit: 0-0-1
Course: Lab-V- Development of Skills	Practical/Oral Exam: 25 Marks
Teaching Scheme:	Teacher's Assessment: 25 Marks
Practical: 2 hrs. /week	

Course Objectives	1. To understand the importance of leadership, personality and entrepreneurship 2. To understand the importance of Report writing and Project management
List of Practical's	1. Entrepreneurship: Definition, need, Requirements, contribution towards society and profession, resource creation, Successful examples of renowned entrepreneurs 2. Leadership: concept, definition, transparency, learning from failure, trust, confidence, humility, creativity, example of leadership skills 3. Personality Development: Positive Attitude, Will Power, Patience, Creativity. Emotional quotient, IQ, Group Discussion, handling failure, confidence. 4. Report writing: Introduction, Importance of report writing, contents, title page, table of content, Executive summary, Introduction, Discussion, Conclusion, Recommendations, References, Appendices 5. Research paper writing: Introduction, Importance of report writing, contents, Title/ cover page, Abstract, Introduction and problem statement, Literature Review, Methodology, Main body of the paper/ Argument, Limitation of the study, Conclusion, Appendices, bibliography. 6. Engineering Project Management: Introduction, concept, Importance, Scope statement, Critical Success Factors, Deliverables, work Breakdown structure, Schedule, Budget , Quality, Human resource plan.

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Syllabus of S. Y. B.Tech. Mechanical Engineering (Semester IV)	
Course Code: MED274	Credit: 0-0-1
Course: Lab:-IV -Problem Based Learning	Practical/Oral Exam: - NA
Teaching Scheme:	Teacher's Assessment/Term Work: 25 Marks
Practical's: 2 Hrs/week	

Prerequisite	Basic understanding of Engineering concepts and practices.
Objectives	On completion of the course, learner will be able to – • To develop positive attitude, new skills, or new ways of thinking. • To introduce independent and group learning by solving real world problem with the help of available resources. • To be able to develop systematic approach in technical documentation. • To select and utilize appropriate Software tools/Equipment/Problem solving tools to solve real life problems.

Guidelines: The students plan, manage and complete a activity which addresses the stated problem.

1. The students must work in group of 3 to solve real life problem.

2. Open ended problems from course teachers can be considered from any course related to engineering field. (It can be domain specific/multidisciplinary but the emphasis on Mechanical Engineering)

3. A mentor to be assigned to 3-4 groups / one batch.

4. The steps to be followed for problem-based learning are as mentioned below:

	Issues	Action
1	Explore the issue	Gather necessary information; learn new concepts, principles, and skills about the proposed topic.
2	Identification of	Identification of the problem from the sources explored

	problem	
3	Formulating the problem	Frame the problem in a context of what is already known and information the students expect to learn.
4	Researching the sources for probable solutions	Find resources and information that will help create a compelling recourses to look out for the solutions
5	Investigate solutions	List possible actions and solutions to the problem, formulate and test potential hypotheses
6	Review the solutions	Students must evaluate their performance and plan improvements for the next problem

Steps involved in Problem based learning:

1. Exploration : searching and identifying of all domains of knowledge to look out for problems

2. Identification of problem
3. Formulating the problem
4. Researching the sources for probable solutions
5. Investigation of the solutions (generation of solutions)
6. Review the solutions

Evaluations and weight age

1	Identification of the Problem	20%
2	Documentation	30%
3	Demonstration	20%

	4	Awareness /Consideration of - Environment/ Social /Ethics/ Safety measures/Legal aspects	10%
	5	Outcome	20%
		Total	100%

	Sr. No.	Title	Author	Publication	Edition
References	1.	A new model of problem-based learning	Terry Barrett	All Ireland Society for Higher Education (AISHE)	2017
	2.	Research Methodology: Methods and Techniques C. R. Kothari	Research Methodology: Methods and Techniques C. R. Kothari	New Age International Publishers;	Fourth edition, 2019
1 Problem based learning: https://www.coursera.org/lecture/universityteaching/problem-based-learning-i-pbl-in-practice-SMXol 2 Problem-Based Learning: https://onlinecourses.swayam2.ac.in/ntr20_ed29/preview					

Faculty of Science & Technology		
Syllabus of S. Y. B.Tech. All Branches (Semester IV)		
Course Code: HSM805 Course: Non-Credits Mandatory course (Professional Ethics and Corporate Social Responsibility) **Teaching Scheme:** Theory: 02 Hrs/week	Credits: 0-0-0	
Objectives	• To develop understanding of professional ethics in different organizational context. • To identify, analyze, and resolve ethical issues in business decision making. • To develop various corporate social Responsibilities and practice in the professional life	
Unit-I	**Professional Ethics and Business**: The Nature of Business Ethics; Ethical Issues in Business; Moral Responsibility and Blame; Utilitarianism: Weighing Social Costs and Benefits; Rights and Duties of Business. (4 Hrs)	
Unit-II	**Professional Ethics in the Marketplace:** Perfect Competition; Monopoly Competition; Oligopolistic Competition; Oligopolies and Public Policy Professional Ethics and the Environment: Dimensions of Pollution and Resource Depletion; Ethics of Pollution Control; Ethics of Conserving Depletable Resources. (4 Hrs)	
Unit-III	**Professional Ethics of Consumer Protection**: Markets and Consumer Protection; Contract View of Business Firm's Duties to Consumers; Due Care Theory; Advertising Ethics; Consumer Privacy. (4 Hrs)	
Unit-IV	**Introduction to Corporate Social Responsibility:** Corporate Social Responsibility: Concept, Scope & Relevance and Importance of CSR in Contemporary Society. CSR and Indian Corporations- Legal Provisions and Specification on CSR, A Score Card, Future of CSR. (4 Hrs)	
Unit-V	Potential Business Benefits—Triple bottom line, Human resources, Risk management, Supplier relations; Criticisms a nd concerns—Nature of business; Motives; Misdirection.	

				(04 Hrs)
Unit-VI	**Corporate Social Responsibility:** Corporate Social Responsibility and Small and Medium Enterprises (SMEs) in India, Corporate Social Responsibility and Public-Private Partnership (PPP) in India. (04 Hrs)			

Textbooks / Reference Books	Sr. No.	Title	Author	Publication	Edition
	1.	Business Ethics: Texts and Cases from the Indian Perspective	Ananda Das Gupta	Springer	2014
	2.	Business Ethics: Concepts and Cases	Manuel G. Velasquez.	Pearson	2014
	3.	Corporate Social Responsibility: Readings and Cases in a Global Context	Andrew Crane, Dirk Matten, Laura Spence;	Routledge	2013
	4.	Corporate Social Responsibility in India	Bidyut Chakrabarty	Routledge	2015

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	Syllabus of S. Y. B.Tech. All Branches (Semester IV)

Course Code: HSM806	Credits: 0-0-0
Course: Non-Credits Mandatory course	
(Emotional Intelligence)	
Teaching Scheme:	
Theory: 02 Hrs/week	

Objectives	1. To interpret and manage emotions.
	2. To learn the four core skills required to practice emotional intelligence.
	3. To relate emotional intelligence to the workplace.
Unit-I	Introduction to emotion, Development of emotions and emotional maturity, intelligence & wisdom, Science of Emotional Intelligence, EQ and IQ (04 Hrs)
Unit-II	Concept, theory, measurement and applications of intelligence, Dimensions of Trait EI Model: Self-awareness, Self-regulation, Motivation, Empathy, Social skills. (04 Hrs)
Unit-III	Emotional intelligence: concept, theory and measurements, Correlates of emotional intelligence (04 Hrs)
Unit-IV	Emotional intelligence, culture, schooling and happiness, Emotional Intelligence at Work place: Importance of Emotional Intelligence at Workplace? Cost–savings of Emotional Intelligence. (04 Hrs)
Unit-V	For enhancing emotional intelligence EQ mapping, Managing stress, suicide prevention, through emotional intelligence, spirituality and meditation. (04 Hrs)
Unit-VI	Application of emotional intelligence at family, school and workplace, Case Studies Measuring Emotional Intelligence: Emotionally Intelligence Tests. (04 Hrs)

Textbooks /	Sr. No.	Title	Author	Publication	Edition
Reference Books	1.	Emotional Intelligence- Why it can Matter More than IQ	Daniel Goleman	Bantam Doubleday Dell Publishing Group	1996
	2.	Working with Emotional Intelligence	Manuel G. Velasquez.	Bantam Doubleday Dell Publishing Group	2000

3.	Emotional Intelligence Coaching	Liz Wilson, Stephen Neale & Lisa Spencer-Arnell	Kogan Page India Private Limited	2012
4.	Corporate Social Responsibility in India	Bradberry, Travis and Jean Greaves	Perseus Books Group	2009

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Syllabus of S. Y. B.Tech. All Branches (Semester II)		

Course Code: HSM807	Credits: 0-0-0
Course: Non-Credits Mandatory course	
(Stress Management Through Yoga)	
Teaching Scheme:	
Theory: 02 Hrs/week	

Objectives	• To identify common stressors inherent in today's global marketplace.
	• To develop an understanding of the impact of stress on physiological, emotional and cognitive processes.
	• To learn to manage the stress through art of Yoga
Unit-I	Mental Health: Meaning and Importance; Yogic Perspective of Mental Health, Indicators of Mental Health, Stress: Meaning and Definition; Symptoms, Causes and Consequences of Stress, Meaning of Management – Stress Management, Stress in Modern Culture & Society. (06 Hrs)
Unit-II	Concept of Stress according to Yoga, Assessing your Stress & Building Resilience. (03 Hrs)
Unit-III	Physiology of Stress on: Autonomic Nervous System (ANS), Endocrine System, Hypothalamus, Cerebral Cortex and Neurohumours. (03 Hrs)
Unit-IV	Mechanism of Stress related diseases: Psychic, Psychosomatic, Somatic and Organic phase. Role of Meditation & Pranayama on stress - physiological aspect of Meditation, Constant stress & strain, anxiety. (04 Hrs)
Unit-V	Meaning and definition of Health: various dimensions of health (Physical, Mental, Social and Spiritual) - Yoga and health -Yoga as therapy. Physical fitness. Stress control exercise - Sitting meditation, Walking meditation, Progressive muscular relaxation, Gentle stretches and Massage. (05 Hrs)
Unit-VI	Preventive and curative effects of Yoga on stress related disorders: Hypertension, Heart problems, Bronchial Asthma, Peptic Ulcer, Diabetes Mellitus, Arthritis, Anxiety Neurosis and Headache (03 Hrs)

Textbooks / Reference	Sr. No.	Title	Author	Publication	Edition
	1.	Stress Control for peace of	Linda Wasmer	Main Street	2005

Books		Mind	Andrews		
	2.	Yoga for stress	Vimla Lalvani	Hamlyn	1998
	3.	Yoga perspective in stress management	H.R. Nagendra, and R. Nagarathana,	Swami Vivekananda Yoga Prakashana	2004
	4.	Yoga practices for anxiety & depression	H.R. Nagendra, and R. Nagarathana,	Swami Sukhabodhanandha Yoga Prakashana	2004
	5.	Stress management by Yoga	K.N. Udupa,	Motilal Banaridass Publishers Private Limited.	1996