+ **Second Year**

SN	Course Code	Course Title	Teaching Scheme				Evaluation Scheme				
			L	T	P	CA	MSE	TW	ESE	Total	Credits
Semester III											
1	20UME301B	Engineering Mathematics-III	3	1	---	20	20		60	100	4
2	20UME302D	Machine Drawing	2	---	---	10	10		30	50	2
3	20UME303D	Engineering Thermodynamics	3	---	---	20	20		60	100	3
4	20UME304D	Strength of Material	3	---	---	20	20		60	100	3
5	20UME305D	Manufacturing Processes	2	---	---	20	20		60	100	2
6	20UME306L	Engineering Thermodynamics Lab.	---	---	2	30	---		20	50	1
7	20UME307L	Strength of Material Lab.	---	---	2	30	---		20	50	1
8	20UME308L	Workshop Practice-I	---	---	2	30	---		20	50	1
9	20UME309L	Machine Drawing & CAD Lab	---	---	4*	30	---		20	50	2
10	20UME310L	Design Thinking Lab	---	---	2		---	50		50	Audit Course
11	20UME311I	Industrial Internship	2 Weeks				---	50		50	1
		Total	**13**	**1**	**12**	**210**	**90**	**100**	**350**	**750**	**20**
Semester IV											
1	20UME401D	Numerical Methods and Computer Programming	2	---	---	10	10		30	50	2
2	20UME402D	Engineering Materials & Metallurgy	2	---	---	10	10		30	50	2
3	20UME403D	Mechanisms of Machines	2	1	---	20	20		60	100	3
4	20UME404D	Advanced Machine Tools	3	---	---	20	20		60	100	3
5	20UME405D	Mechatronics	2	---	---	10	10		30	50	2
6	20UME406D	Product Design-I	2	---	---	10	10		30	50	2
7	20UME407N	Interpersonal Skill	2	---	---	---	---	50	---	50	Audit Course
8	20UME408L	Engineering Materials & Metallurgy Lab.	---	---	2	30	---		20	50	1
9	20UME409L	Mechanisms of Machines Lab.	---	---	2	30	---		20	50	1
10	20UME410L	Mechatronics Lab.	---	---	2	30	---		20	50	1
11	20UME411L	Product Design-I Lab.	---	---	2	---	---	50		50	1
12	20UME412I	Industrial Internship	2 Weeks				---	50		50	1
		Total	**15**	**1**	**8**	**170**	**80**	**150**	**300**	**700**	**19**

SEMESTER III

Course Code:- 20UME301B	*Course Title*	*Total credits : 04*
Teaching Scheme	***ENGINEERING MATHEMATICS - III***	***Evaluation Scheme***
Theory : 3 Hrs /week		CA – 20 Marks
Tutorial: -- 1 Hr /week		Mid Sem -20 Marks
Exam Duration:- 3 Hours		End Sem Exam : 60 Marks

Course Objectives	1. To develop Logical understanding of the subject. 2. To develop mathematical skill so that students are able to apply mathematical methods & Principle's involving problems from engineering fields. 3. To produce graduates with mathematical knowledge & computational skills
Course Outcomes	**At the end of course, students will be able to,** 1. Understand concept of Laplace Transform and find Laplace Transform using definition, standard formulae and shifting theorem, Quantify the performance characteristics of various transistors. 2. Study special functions such as periodic, Heaviside and unit impulse functions 3. Find inverse Laplace Transform and solve IVP by Laplace Transform. 4. Understand Fourier Transforms and integrals and solve examples 5. Solve one dimensional and two dimensional heat equations. 6. Understand the concept of complex functions, its derivative and phenomenon such as an analyticity and Harmonicity and mobius transformation with examples & complex integrals by Cauchy's integral theorem, Cauchy's integral formula and Cauchy's residue theorem.
Pre-requisites	Student to know about pre-university mathematics and calculus.
Course Type	Basic Science course

Course Contents

	PO Mapping	*PSO Mapping*	*Teaching Methodology*	*Competency*	*PI*
***UNIT 1:* Linear Algebra- Matrices**					
Inverse of a matrix by Gauss-Jordan method; Rank of a matrix; Normal form of a matrix ;Consistency of non- homogeneous and homogeneous system of linear equations ; Eigen values and eigen vectors ; Properties of eigen values and eigen vectors (without proofs); Cayley Hamilton's theorem (without proof) and its applications.	1, 2	1,2	Lecture	1.1	1.1.4

UNIT 2: **Laplace Transform**					
Definition, Transforms of elementary functions,Properties & theorems of Laplace transforms(without proof), transforms of periodic function,Heaviside unit step function, displaced unit step function, Dirac delta function, error function,Bessel' function of zero order.	1, 2	1,2	Lecture	1.1	1.1.5
UNIT 3: **Inverse Laplace transform and its applications**					
Inverse Laplace transforms by using (i) properties, ii) partial fractions, iii) Convolution theorem, Applications to solve linear differential equations with constant coefficients (Initial value problems), Simultaneous Linear differential equations .	1, 2	1,2	Lecture	1.1	1.1.5
UNIT 4: **Fourier Transform**					
Fourier Transform, Fourier sine and cosine transform, Fourier integral, Fourier sine and cosine integral.	1, 2	1,2	Lecture	1.1	1.1.5
UNIT 5: **Partial Differential Equations and Their Applications**					
Formation of Partial differential equations by eliminating arbitrary constants and functions; Equations solvable by direct integration; Linear equations of first order (Lagrange's linear equations); Method of separation of variables – applications to find solutions of one dimensional heat flow equation and two dimensional heat flow equation (i.e. Laplace equation).	1, 2	1,2	Lecture	1.1	1.1.6

Text Books / Reference Books:

1. P.N.Wartikar and J. N. Wartikar, A Text Book of Engineering Mathematics (Volume-I, II,III), Pune Vidyarthi Griha Prakashan, Pune.
2. B. S. Grewal, "Higher Engineering Mathematics," Khanna Publications, New Delhi
3. H.K. Das, "Advanced Engineering Mathematics," S. Chand & Company.
4. B.V. Ramana, "Higher Engineering Mathematics ," (Tata McGraw-Hill).
5. Erwin Kreyszig, "Advanced Engineering Mathematics," Wiley Eastern Ltd.
6. Ravish R Singh, Mukul Bhat, "Engineering Mathematics A Tutorial Approach," by,Mc Graw Hill

Course Code:- 20UME302D	*Course Title*	*Total credits : 02*
Teaching Scheme	***MACHINE DRAWING***	***Evaluation Scheme***
Theory : 2 Hrs /week		CA – 10 Marks
		Mid Sem -10 Marks
Exam Duration:- 2 Hours		End Sem Exam : 30 Marks

Course Objectives	1. Develop the visualization regarding the component or object details 2. Draw assembly and details 3. Represent different standard machine elements 4. Understand Production drawing and Blue print reading
Course Outcomes	1. Interpret the visualization of object with the help of given sectional and orthographic views 2. Construct the curve of intersection of two solids 3. Draw machine element using keys, cotter, knuckle, bolted and welded joint 4. Assemble details of any given part. i. e. valve, pump, machine tool part etc. 5. Represent tolerances and level of surface finish on production drawings 6. Apply various tools of CAD Software for Drafting and 3D modeling.
Pre-requisites	Engineering Graphics / Engineering Drawing.
Course Type	***Program Core Course***

Course Contents

Unit No.	***PO Mapping***	***PSO Mapping***	***Teaching Methodology***	***Competency***	***PI***
Unit 1 : **Sectional Views**					
Full section, half section, partial section, off-set section, revolved sections, removed sections, auxiliary section, guidelines for hatching, examples on all above types of sections of machine elements.	1,5,8,9,10 ,12	1,2	Brain Storming, Problem Solving, Activity based learning	1.3 1.4 5.1 8.2 9.2 10.1 12.2	1.3.1 1.4.1 5.1.1 5.1.2 8.2.2 9.2.1 10.1.1 12.2.2
Unit 2 : **Interpenetration and Development of Surfaces**					
a. Interpenetration of surfaces - Line or curve of intersection of two penetrating cylinders, Cone and cylinder, prism and a Cylinder, cone and prism, Forged ends, etc. (Emphasis on Applied Cases) **b. Development of Surfaces** Development of lateral surfaces of soli- Prisms, Cylinders etc, Development of Radial surfaces like Pyramids, Cones etc. Applications based problem with dev of surfaces with sectioned solid and composite solid etc	1,2,3,9,10 ,12	1,2	Brain Storming, Problem Solving , Activity based learning	1.3 1.4 2.2 3.4 9.2 10.1 12.3	1.3.1 1.4.1 2.2.3 3.4.1 9.2.1 10.1.1 12.3.1
Unit 3 : **Computer Aided Drafting**					

Introduction to CAD, CAD software packages, Advantages of CAD, GUI, Co-ordinate system , study and demonstration of standard tool bars for drafting and solid modeling in AUTO CAD.	1,3,5,8,9, 10	1,2	Simulation, PPT, Problem Solving	1.3 1.4 3.2 5.1 8.2 9.2 10.3	1.3.1 1.4.1 3.2.2 5.1.1 5.1.2 8.2.2 9.2.1 10.3.1
Unit 4: **Assembly Drawing and Details**					
Types of production drawings, size, shape and description; limits, fits and tolerances, surface roughness and surface roughness symbols, reading the blue prints. Part drawing of standard machine components such as valves, components of various machine tools, pumps, shaft couplings, joints, pipe fittings, engine parts, etc.	1,2,3,5,8 ,9, 10,	1,2	Simulations, Prototype models, Discussion, Problem Based Learning PBL	1.3 1.4 2.1 3.1 5.1 8.2 9.2 10.1 10.3	1.3.1 1.4.1 2.1.3 3.1.4 5.1.1 5.1.2 8.2.1 9.2.1 10.1 10.3.1

Text Books:

1. N. D. Bhatt,"Engineering Drawing", Charotar Publishing House, Anand, India.
2. R.V.Mali and chaudhari," A textbook of Machine Drawing",Vrinda Publication
3. N. D. Bhatt, "Machine Drawing", Charotar Publishing House, Anand, India
4. Ajeet Sing, "Working with AutoCAD 2000", Tata McGraw Hill, New Delhi.

Reference Books:

1. Narayana, Kannaiah, Reddy, "Machine Drawing", New Age International Publishers.
2. ISCode: SP46-1988, Standard Drawing Practices for Engineering Institutes
3. Sham Tickoo, "AutoCAD LT 2020 for Designers", CADCIM Technologies USA

E-Resources:

1. https://nptel.ac.in/courses/112103019/
2. https://academy.autodesk.com/

Course Code:- 20UME303D	***Course Title***	***Total credits : 03***
Teaching Scheme	***ENGINEERING THERMODYNAMICS***	***Evaluation Scheme***
Theory : 3 Hrs /week		CA – 20 Marks
		Mid Sem -20 Marks
Exam Duration:- 3 Hours		End Sem Exam : 60 Marks

Course Objectives	1. To learn basic concepts and Laws of Thermodynamics 2. To learn properties of steam 3. To learn vapour power cycles 4. To learn gas power cycles 5. To learn compressors 6. To learn gravimetric and volumetric analysis of combustion of fuel
Course Outcomes	After completing this course, students will be able to: 1. Apply Laws of Thermodynamics to flow and non-flow systems 2. Evaluate changes in thermodynamic properties of substances using steam table and Mollier chart 3. Get a good understanding of various practical power cycles 4. Analyze the performance of compressors 5. Understand principle of combustion of fuels
Pre-requisites	None
Course Type	***Program Core Course***

Course Contents

Unit No.	***PO Mapping***	***PSO Mapping***	***Teaching Methodology***	***Competency***	***PI***
Unit 1 : **Laws of Thermodynamics**					
Fundamental concepts and definitions, heat and work, Zeroth law of Thermodynamics, First law of thermodynamics applied to non-flow and flow systems. Second Law of Thermodynamics. Heat engine, refrigerator and heat pump, Kelvin- Plank and Clausius statements and their equivalence, Reversibility and Irreversibility, Carnot cycle, Carnot theorem, Absolute thermodynamic temperature scale. Introduction to Entropy. (Descriptive and Numerical Treatment)	1,2	1,2	Lecture	1.3 1.4 2.2	1.3.1 1.4.1 2.2.3
Unit 2 : **Properties of Steam or Pure Substance**					
Pure substance, phase transformation of water at constant pressure, p-v phase diagram, critical point, Triple point, Different stages, Entropy of steam, steam tables, processes of steam, Enthalpy-Entropy diagram, steady flow process and	1,2	1	Lecture, PPT	1.3 1.4 2.2	1.3.1 1.4.1 2.2.3

determination of dryness fraction of steam. (Descriptive and Numerical Treatment)					
Unit 3 : **Vapour Power Cycles**					
Carnot cycle, ideal Rankine cycle, modified Rankine cycle, Reheat and Regenerative cycles with bleeding of steam, thermal efficiency, specific steam consumption, work ratio, power output, effect of superheat, inlet pressure and back pressure on performance of Rankine cycle. (Descriptive and Numerical Treatment)	1,2,3	1,2	Lecture, PPT	1.3 1.4 2.2 3.1	1.3.1 1.4.1 2.2.3 3.1.6
Unit 4 :**Gas Power Cycles**					
Concept of air standard cycle, assumptions, Carnot, Otto, Diesel and dual air standard cycles with representation on P-V & T-S planes, mathematical analysis for efficiency, mean effective pressure and power output, comparison. (Descriptive and Numerical Treatment)	1,2,3	1,2	Lecture, PPT	1.3 1.4 2.2 3.1	1.3.1 1.4.1 2.2.3 3.1.6
Unit 5 :**Air Compressors**					
(a) Reciprocating compressors: Classification and working principles, Terminologies used, effect of clearance volume, actual indicator diagram, and multistage compression. (Descriptive and Numerical Treatment) (b) (b) Rotary compressors: Working principles, Centrifugal compressor and axial flow compressor. (c) Comparison between reciprocating and rotary compressors. Vacuum pumps, air motors. (Descriptive Treatment)	1,2	1,2	Lecture, PPT	1.3 1.4 2.2	1.3.1 1.4.1 2.2.3
Unit 6 :**Fuels and Combustion**					
Definition of Fuel, calorific values, Definition of combustion, mass fraction, mole fraction, combustion equation, stoichiometric air, excess air, and deficient air, analysis of product of combustion, gravimetric and volumetric analysis and their conversion, determination of actual and excess air quantity from combustion analysis and stoichiometric and actual air to fuel ratios. Orsat apparatus, methods to determine flue gas analysis – CO, CO2, CO2. (Descriptive and Numerical Treatment)	1,2	1,2	Lecture, PPT	1.3 1.4 2.2	1.3.1 1.4.1 2.2.3

***Text Books*:**

1. P.K.Nag, "Engineering Thermodynamics", Tata McGraw Hill, New Delhi, 3rd edition,2005.

2.G. J. Van Wylen, R. E. Sonntag, "Fundamental of Thermodynamics", John Wiley and Sons, 5 thedition, 1998

3.M. J. Moran, H. N. Shaprio, "Fundamentals of Engineering Thermodynamics", John Wiley and Sons, 4th edition, 2004.

4.E. Rathakrishnan, "Fundamentals of Engineering Thermodynamics" Prentice Hall of India Privite Limited New Delhi, 2000.

***Reference Books*:**

1.Y. A.Cengel, M. A. Boles, "Thermodynamics - An Engineering Approach", Tata McGraw Hill, 5thedition, 2006

2. J P Howell and P O Buckius, Fundamentals of Engineering Thermodynamics, McGraw Hill, 1992.

E-sources:

1. www.nptel.com
2. www.ocw.mit.edu
3. www.bodhitree.com

Course Code:- 20UME304D	*Course Title*	*Total credits : 03*
Teaching Scheme	***STRENGTH OF MATERIALS***	***Evaluation Scheme***
Theory : 3 Hrs /week		CA – 20 Marks
		Mid Sem -20 Marks
Exam Duration:- 3 Hours		End Sem Exam : 60 Marks

Course Objectives	1. To provide the basic concepts and principles of strength of materials 2. To analyze and understand different internal forces and stresses induced due to representative loads on structural elements 3. To give an ability to apply the knowledge of strength of materials on engineering applications and design problems.
Course Outcomes	After completing this course, students will be able to: 1. To evaluate the stress, strain, deformation and material behavior of various structural elements under different types of loading such as compression, tension, shear, bending and torsion 2. To determine Shear force and Bending Moment in Beams 3. To determine Bending and shear stresses in beam 4. To evaluate the behavior and strength of structural elements under the action of combined stresses 5. Analyze the elastic stability of column and struts. 6. Perform stress analysis of thin-walled members 7. To evaluate the behaviour and strength of structural elements under the action of combined stresses 8. To evaluate the torque and shear stress produced in the shafts. 9. Analyze the elastic stability of column and struts. Also Perform stress analysis of thin-walled members
Pre-requisites	Engineering Mechanics
Course Type	***Program Core Course***

Course Contents

Unit No.	***PO Mapping***	***PSO Mapping***	***Teaching Methodology***	***Competency***	***PI***
***Unit 1 :* Simple Stresses and Strain**					
Introduction, Mechanical properties of Materials, Definition and concept of stress and strain, Stress – Strain Curve, Hooke's Law, normal stress, shear stress, Elastic deformation of axially loaded members, Modulus of Elasticity, Modulus of Rigidity, Thermal Stresses, Poission's Ratio, Volumetric stress, Bulk Modulus, Relation between Elastic constants	1,12	2	Laboratory Experiment, Animations, Explanation	1.3 2.1 3.1 12.3	1.3.1, 2.1.2, 3.1.6, 12.3.2
***Unit 2 :* Shear Force and Bending moment**					
Introduction to types of beams, supports and loadings. Definition of bending moment and shear force, Sign conventions, relationship between load intensity, bending moment and shear force. Shear force and bending moment diagrams for statically determinate beams subjected to points load, uniformly distributed loads, uniformly varying loads, couple and their combinations.	1,2,12	2	Physical Models, Explanation	1.3 2.1 3.1 12.3	1.3.1, 2.1.2, 3.1.6, 12.3.2

Unit 3 : Bending and Shear Stresses in Beams					
Introduction, pure bending theory, Assumptions, derivation of bending equation, modulus of rupture, section modulus, flexural rigidity. Expression for transverse shear stress in beams, Bending and shear stress distribution diagrams for circular, rectangular, 'I', and 'T' sections. Shear centre (only concept)	1,2,12	2	Laboratory Experiment, Explanation	1.3 2.1 3.1 12.3	1.3.1, 2.1.2, 3.1.6, 12.3.2
Unit 4 : Principal stresses and Strains					
Principal Plane, Uniaxial stress, Biaxial stress, principal stresses and maximum shear stress, Mohr's circle for plane stress. Plane strain: transformations of strains in a plane; principal strains; Mohr's circle for strain; measurement of strain; strain rosettes. **Combined Stresses:-** Combined axial and Flexural load, Middle Third rule, Kernel of section, uniaxial eccentricity and Biaxial eccentricity of load	1,2,12	2	Animations, Explanations	1.3 2.1 3.1 12.3	1.3.1, 2.1.2, 3.1.6, 12.3.2
***Unit 5 :*Torsion**					
Assumptions, derivation of Torsion formula, torsion of Circular shaft, stresses and deformation in solid, hollow and composite shafts, power transmitted by shaft. **Strain Energy**, Resilience, Proof Resilience, Modulus of resilience, Stresses due to gradually applied load, suddenly applied load and Impact loadings, axial strain energy, shear strain energy, Flexural strain energy and Torsion strain energy.	1,2,12	2	Laboratory Experiment, Physical Models, Animations, Explanation	1.3 2.1 3.1 12.3	1.3.1, 2.1.2, 3.1.6, 12.3.2
Unit 6 :Column and Struts					
Short and Long column, Euler's and Rankine's formula, Limitations of Euler's formula, equivalent length, eccentrically loaded short columns. Thin and Thick Cylinders: - Introduction, Thin cylinders subjected to internal pressure; Hoop stresses, Longitudinal stress and change in volume. Thick cylinders subjected to both internal and external pressure; Lame's equation, radial and hoop stress distribution.	1,2,12	2	Animations, Explanations	1.3 2.1 3.1 12.3	1.3.1, 2.1.2, 3.1.6, 12.3.2

Text Books:

1. Ferdinand P. Beer, E. Russell Johnston and Jr.John T. DeWolf "Mechanics of Materials", Tata McGraw-Hill, 7th Edition, 2015, ISBN 978-0-07-339823-5.
2. James M. Gere, Barry J. Goodno. Mechanics of Materials. 7th ed. CENGAGE Learning, ISBN-10: 0-534-55397-4

Reference Books:

1. Hibbeler, R.C.,Pearson, Mechanics of Materials, 10th Edition, Prentice Hall, 2014, ISBN:978-0-13-431965-0
2. 2. E. P. Popov, Engineering Mechanics of Solids, , Prentice-Hall,
3. 3. D.H. Young, S.P. Timoshenko " Elements of Strength of Materials" East West Press Pvt. Ltd., 5th Edition (Reprint 2014)
4. 4. R K Bansal, "A Textbook of Strength of Materials", 4th Edition, Laxmi Publications, 2010
5. 5. S.S. Rattan " Strength of Materials" McGraw Hill Education (India) Pvt. Ltd., 2nd Edition

(Sixth reprint 2013)
6. 6. Vazirani, V N, Ratwani M M. and S K Duggal "Analysis of Structures Vol. I", 17th Edition, Khanna Publishers, New Delhi.
7. 7. Punmia B. C., Strength of Materials, Laxmi Publications (p) Ltd. New Delhi, 2015

***E-sources*:**

1. NPTEL Videos
2. NPTEL Lectures

Course Code:- 20UME305D	*Course Title*	*Total credits : 02*
Teaching Scheme	**MANUFACTURING PROCESSES**	***Evaluation Scheme***
Theory : 2 Hrs /week		CA – 20 Marks
		Mid Sem -20 Marks
Exam Duration:- 3 Hours		End Sem Exam : 60 Marks

Course Objectives	1. Select the casting process for manufacturing particular products 2. Identify suitability of forging processes for manufacturing of particular parts. 3. Explain important characteristics of sheet metal & shearing process. 4. Explain different types of processes used for metal joining. 5. Differentiate between polymer processing methods 6. Explain need of finishing processes employed in powder metal processing
Course Outcomes	**After completing this course, students will be able to:** 1. Design gating system for particular application. 2. Determine power requirement in rolling and differentiate between forging processes. 3. Select the sheet metal forming process suitable for particular application. 4. Analyze the performance of welding processes. 5. Illustrate working of various methods used for polymer processing 6. Recommend the suitable process for powder metal processing.
Pre-requisites	NIL
Course Type	***Program Core Course***

Course Contents

Unit No.	**PO Mapping**	**PSO Mapping**	**Teaching Methodology**	**Competency**
Unit 1 : **Casting Process**				
Introduction to metal casting; solidification of metals; heat transfer and solidification time; pattern, core and mould making; sand casting; special casting processes: shell molding, investment casting, permanent mold casting, vacuum casting, die casting, centrifugal casting; principles of gating and riser design; melting practice and furnaces; casting defects; casting inspection and testing; selection of casting process.	1	1,2	ICT Based	1.1, 1.2, 1.3, 1.4
Unit 2 : **Metal Forming Processes**				
Rolling process: Terminology used in rolling; roll force, torque and power requirement in flat rolling process; rolling operations; rolling mills; defects in rolling process Forging: forging materials; classification of forging process; open die, closed die and impression die forging; forging operations; forgeabilty; defects; forging machines; Die: material, design, lubrication, manufacturing, and failures.	1	1,2	ICT based, activity based learning	1.1, 1.3, 1.4

Unit 3 : Sheet Metal Processes				

Sheet metal forming; shearing and its operations; shearing dies; characteristics and formability of sheet metals; bending of sheet, metal and tubes; bending operations; deep drawing; spinning; specialized forming processes; sheet metal forming equipment.	1	1,2	ICT based, activity based learning	1.2, 1.3, 1.4	1.2.1, 1.3.1, 1.4.1
Unit 4 : **Joining Processes**					
Classification of joining processes; basic working principle of adhesive bonding, fusion welding, solid state welding, soldering and brazing; detailed study: oxyfuel gas welding, TIG welding, Plasma arc welding, MIG welding, shielded metal arc welding, submerged arc welding, electro slag welding, electron beam welding, laser beam welding, thermit welding, ultrasonic welding, friction welding, resistance welding, explosion welding, diffusion bonding, adhesive bonding, soldering, brazing; electrodes for welding; welding joints; weld defects and testing.	1,4,9,10,11	1,2	ICT based, Project based learning	1.2, 1.3, 1.4, 4.1, 4.2, 4.3, 9.2, 9.3, 10.1, 10.2, 11.3	1.2.1, 1.3.1, 1.4.1, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 9.2.1, 9.3.1, 10.1.2, 10.2.2, 11.3.2
Unit 5 :**Polymer Processing**					
Polymers: basic types, forms, characteristics and applications; extrusion; injection molding; rotational molding; blow molding; thermoforming; transfer molding; compression molding; foam molding; casting; wire drawing; calendaring; processing of polymer matrix composites.	1	1,2	ICT Based	1.2, 1.3, 1.4	1.2.1, 1.3.1, 1.4.1
Unit 6 : **Ceramic, Glass & Powder metal processing**					
Powder metals: basic characteristics; production of powder: atomization, production methods, particle shape, size and distribution; blending; compaction: equipment, isostatic processing, miscellaneous compaction processes; sintering: mechanism; finishing operations.	1	1,2	ICT Based	1.2, 1.3, 1.4	1.2.1, 1.3.1, 1.4.1

Text Books:-

1. Serope Kalpakjian and Steven R. Schmid, “Manufacturing Engineering and Technology”, Addison Wesley Longman (Singapore) Pte. India Ltd., 6th edition, 2009.
2. Geoffrey Boothroyd, Winston Knight, “Fundamentals of Machining and Machine Tools”, Taylor and Francis, 3rd edition, 2006.

Reference Books:-

1. B. S. Raghuwanshi, "A Course in Workshiop Technology", Dhanpat Rai & Co., 10th edition,2009
2. Mikell P. Groover, “Fundamentals of Modern Manufacturing: Materials, Processes, and Systems”, John Wiley and Sons, New Jersey, 4th edition, 2010.
3. O. P. Khanna, "A Textbook of Welding Technology", Dhanpat Rai Publications, 19th edition, 2009.

E-sources**:**

3. NPTEL Videos
4. NPTEL Lectures

Course Code:- 20UME306L	*Course Title*	*Total credits : 01*
Teaching Scheme	**ENGINEERING THERMODYNAMICS LAB**	***Evaluation Scheme***
Practical : 2 Hrs /week		CA – 30 Marks
		End Sem Exam : 20 Marks
		Total :- 50 Marks

Lab outcomes	**Students will be able to,** ***1.*** Understand the procedure do determine calorific value of a fuel ***2.*** Understand the procedure to determine dryness fraction of steam ***3.*** Determine flue gas analysis ***4.*** Evaluate performance of reciprocating air compressor ***5.*** Understand the working principle of thermal power plant and evaluate its performance ***6.*** Apply the First and Second Laws of thermodynamics to flow and non-flow systems

Course Contents

Sr.No.	Name Of Practical	PO Mapping	PSO Mapping	Teaching Methodology	Competency	PI
1	Determination of calorific value of solid / liquid fuel by using calorimeter	1	1	Trial	1.4	1.4.1
2	Determination of calorific value of gaseous fuel by using calorimeter	1	1	Trial	1.4	1.4.1
3	Determination of dryness fraction of steam using calorimeters	1	1	Trial	1.4	1.4.1
4	Trial on Flue gas analysis using gas analyzer	1, 6	1	Trial	1.4 6.1 6.2	1.4.1 6.1.1 6.2.1
5	Performance evaluation of single/multistage reciprocating air compressor.	1	1	Trial	1.4	1.4.1
6	Visit to a thermal power plant.	1,2,12	1,2	Study / Demonstration	1.4 2.1 12.1 12.2 12.3	1.4.1 2.1.1 2.1.2 12.1.1 12.1.2 12.2.1 12.2.2 12.3.1 12.3.2
7	Assignment on unit1: Apply the Laws of Thermodynamics to solve open ended problems	1,2	1,2	Problem Based Learning	1.3 1.4 2.2 2.3 2.4	1.3.1 1.4.1 2.2.3 2.2.4 2.4.4

8	Assignment based on unit 2: Solve open ended problems using steam table/chart/software	1,2	1,2	Problem Based Learning	1.3 1.4 2.2 2.3 2.4	1.3.1 1.4.1 2.2.3 2.2.4 2.4.4
9	Assignment based on unit 3: Solve open ended problems on vapour power cycles.	1,2,3	1,1	Problem Based Learning	1.3 1.4 2.2 2.3 2.4 3.2	1.3.1 1.4.1 2.2.3 2.2.4 2.4.4 3.2.1 3.2.3
10	Assignment based on unit 4: Solve open ended problems on gas power cycles.	1,2,3	1,1	Problem Based Learning	1.3 1.4 2.2 2.3 2.4 3.2	1.3.1 1.4.1 2.2.3 2.2.4 2.4.4 3.2.1 3.2.3

Course Code:- 20UME307L	*Course Title*	*Total credits : 01*
Teaching Scheme	**STRENGTH OF MATERIALS LAB**	***Evaluation Scheme***
Practical : 2 Hrs /week		CA – 30 Marks
		End Sem Exam : 20 Marks
		Total :- 50 Marks

Course Outcomes	***1.*** Apply the basic concepts of strength of materials. ***2.*** Interpret properties of different materials through experimentation. ***3.*** Demonstrate behavior of materials under various types of load.

	Name of Practical	**Type/ Methodology**	**PO Mapping**	**PSO Mapping**	**Competency**	**PI**
1	Tension test on Mild steel, High Yield strength deformed bars	Experimental	1,9,12	3	1.2, 9.1 12.3	1.2.1, 9.1.2 12.3.2
2	Cold bend test on Mild steel bars. (I.S. 1608)	Experimental	1,9,12	3	1.2, 9.1, 12.3	1.2.1, 9.1.2, 12.3.2
3	Compression test on Concrete Block.	Experimental	1,9,12	3	1.2, 9.1, 12.3	1.2.1, 9.1.2, 12.3.2
4	Compression test on Wood (parallel and perpendicular to grains). (IS:1708)	Experimental / Virtual	1,5, 9,12	3	1.2, 5.1 9.1, 12.3	1.2.1, 5.1.1 9.1.2, 12.3.2
5	Direct shear test (Single and Double) on Metals (IS: 5242- 9779).	Experimental	1,9,12	3	1.2, 9.1, 12.3	1.2.1, 9.1.2, 12.3.2
6	Rockwell Hardness test on metals. (ASTM E18 – 19)	Experimental	1,9,12	3	1.2, 9.1, 12.3	1.2.1, 9.1.2, 12.3.2
7	Brunello Hardness Test (IS: 1500)	Experimental	1,9,12	3	1.2, 9.1, 12.3	1.2.1, 9.1.2, 12.3.2
8	Torsion test on circular mild steel bar (IS: 1717). (Experimental / Virtual)	Experimental / Virtual	1,5,9, 12	3	1.2, 5.1 9.1, 12.3	1.2.1, 5.1.1 9.1.2, 12.3.2
9	Izod and Charpy Impact test on metals (IS: 1598 and IS: 1757 – 1973).	Experimental	1,9,12	3	1.2, 9.1, 12.3	1.2.1, 9.1.2, 12.3.2

10	Bending test on Timber beam	Experim ental	1,9,12	3	1.2, 9.1, 12.3	1.2.1, 9.1.2, 12.3.2

11	Compression and water absorption Test on bricks (IS 3495 (Parts 1 to 4) : 1992)	Experimental	1,9,12	3	1.2, 9.1, 12.3	1.2.1, 9.1.2, 12.3.2
12	Mohr's circle graphical solution method for principal stress problems.	Graphical	1,9,12	3	1.2, 9.1, 12.3	1.2.1, 9.1.2, 12.3.2
13	Assignment on computer programming for simple problems of stress, strain computations.	Programming	1,5, 9,12	3	1.2, 5.1 9.1, 12.3	1.2.1, 5.1.1 9.1.2, 12.3.2

References:

1. Government college of Engineering, Karad.
2. Government college of Engineering, Aurangabad.
3. College of engineering, Pune.

Course Code:- 20UME306L	*Course Title*	*Total credits : 01*
Teaching Scheme	**WORKSHOP PRACTICE - I**	***Evaluation Scheme***
Practical : 2 Hrs /week		CA – 30 Marks
		End Sem Exam : 20 Marks
		Total :- 50 Marks

Lab outcomes	***1.*** To have hands on practice and understanding of lathe processes and tools ***2.*** To make a spur gear on milling machine. ***3.*** To have hands on practice and understanding of pattern making processes and tools.

Course Contents

Sr	*Name Of Practical*	*Type/ Methodology*	*PO Mapping*	*PSO Mapping*	*Competency*	*PI*
1	**Machine Shop:** Study of different simple operations to be carried on the lathe machine. Plain turning, facing, step turning, taper turning, knurling, safety precautions. Study of different operations to be carried on the milling machine, the use of indexing, gear cutting. **Jobs:** 1. Preparing a job on lathe machine involving the operations mentioned above. 2. Preparing a job individually or in a group of students involving indexing operation, spur gear cutting.	Execution of operations practically.	1,2,6,9	1	1.4 2.1 6.2 9.1	1.4.1 2.1.1 6.2.1 9.1.1
2	**Pattern Making:** Study of patterns-material, type of patterns and cores, allowances, pattern making tools, methods. **Jobs:** 1. At least one pattern in Wood, involving details like allowances, core prints (if required) parting line of multi piece pattern etc. in the cope, drag. 2. Preparing a job individually or in a group of students of any useful item of daily use, using wood working operations.	Execution of operations practically.	1,2,6,9	1	1.4 2.1 6.2 9.1	1.4.1 2.1.1 6.2.1 9.1.1

Course Code:- 20UME309L	*Course Title*	*Total credits : 02*
Teaching Scheme	***MACHINE DRAWING AND COMPUTER AIDED DRAFTING***	***Evaluation Scheme***
Practical : 4 Hrs /week		CA – 30 Marks
		End Sem Exam : 20 Marks
		Total :- 50 Marks

Lab outcomes	At the end of this course, students will able to … ***1.*** Understand Conventional representation of standard machine components, welds, materials etc. ***2.*** Find Curves of intersection of penetrating solids ***3.*** Develop Assemble view from details of given component i.e. valve, pump, machine tool part, etc. ***4.*** Apply various tools of AUTO CAD Software for Drafting and 3D Modeling.

Course Contents

Sr	***Name Of Practical***	***Type/ Methodology***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***
1	Assignment on representation of standard components, symbols of pipe joints, weld joints, rivet joint etc., surface finish	Assignment, Brain Storming,	1, 9, 10	1,2	1.3 1.4 9.2 10.1	1.3.1 1.4.1 9.2.1 10.1.1
2	Solve any two problem based on Intersection of Solids.	Brain Storming, Problem Solving, Activity based learning	1,2,3,9,10	1,2	1.3 1.4 2.2 3.4 9.2 10.1	1.3.1 1.4.1 2.2.3 3.4.1 9.2.1 10.1.1
3	Solve any two problems based on Development of Surfaces	Problem Based Learning	1,2,3,9,10	1,2		
4	Two full imperial drawing sheets, one consisting of assembly and the other consisting of details of any one standard component such as valves, components of various machine tools, pumps, joints, engine parts, etc	Problem Based Learning	1,2,3,8,9, 10,12	1,2	1.3 1.4 2.1 3.1 8.2 9.2 10.1 10.3	1.3.1 1.4.1 2.1.3 3.1.4 8.2.1 9.2.1 10.1 10.3.1
5	Two assignments of AutoCAD: Orthographic Projections of simple machine component such as bracket, Bearing Housing or Cast component such as connecting rod, Piston, etc.; with dimensioning and detailing of three views of components.	Activity Based Learning, Problem Based Learning	1,3,5,9,10	1,2	1.3 1.4 3.2 5.1 9.2 10.3	1.3.1 1.4.1 3.2.2 5.1.1 5.1.2 9.2.1 10.3.1
6	3-D model at least two simple machine component.	Activity Based Learning, Problem Based Learning	1,3,5,9,10	1,2		

Course Code:- 20UME310L	***Course Title***	***Total credits : Audit Course***
Teaching Scheme	***DESIGN THINKING LAB***	***Evaluation Scheme***
Practical : 2 Hrs /week		Term Work :- 50 Marks

Lab outcomes	At the end of the course, the students will be able to, ***1.*** Draw Conventional representation of standard machine components, welds, materials, etc. ***2.*** Draw and Understand the sectional view, Auxiliary of a given machine component. ***3.*** Develop Assemble view from details of given component i.e. valve, pump, machine tool part, etc. ***4.*** Combine details of given machine component and draw assembled view.

Course Contents

Sr	***Name Of Practical***	***Type/ Methodology***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***
1	Design thinking process introduction: Defining purpose & understand the needs.	PPT	1	1	1.2	1.2.1
2	Learner persona and KSSL Framework knowledge-skill-self-awareness-Learning to learn	PPT	1,12	1	1.2, 12.1	1.2.1, 12.1.1
3	Active Learning strategies	Analysis	2,3	1,2	2.4, 3.1	2.4.1, 2.4.2, 3.1.1, 3.1.2, 3.1.3
4	Project based learning	Individual Activity, Innovation	1,2,3,4,12	1,2	1.4, 2.4, 3.3, 4.3, 12.1, 2.4, 3.1	1.4.1, 2.4.1, 2.4.2, 3.3.1, 4.3.1, 4.3.2, 12.1.1, 12.1.2,
5	Empathy maps	PPT	2,3	1	2.4, 3.1	2.4.1, 2.4.2, 3.1.1, 3.1.2, 3.1.3
6	Fear, Hope and action responses	PPT	2,3	1	2.4, 3.1	2.4.1, 2.4.2, 3.1.1, 3.1.2, 3.1.3
7	Mindfulness activity	PPT	2,3	1	2.4, 3.1	2.4.1, 2.4.2, 3.1.1, 3.1.2, 3.1.3

Course Code:- 20UME311I	*Course Title*	*Total credits : 1*
Teaching Scheme	***INDUSTRIAL INTERNSHIP***	***Evaluation Scheme***
		Term Work :- 50 Marks

Lab outcomes	At the end of the course, the students will be able to, ***1.*** To make the students aware of industrial culture and organizational setup. ***2.*** To create awareness about technical report writing among the students. ***3.*** Students will learn how to Work effectively as a member & leader in multi-disciplinary team. ***4.*** Students will developed an ability to communicate effectively on various engineering problems. ***5.*** Students will identify their own educational needs and areas of interests.

Course Contents

Name Of Practical

Students will have to undergo 2 weeks training programme in the Industry during the winter vacation after IIIrd semester examination. It is expected that students should understand the organizational structure, various sections and their functions, products/services, testing facilities, safety and environmental protection measures etc. Students will have to submit a detailed report about the training programme to the faculty coordinator soon after joining in IVth semester of second year. They will have to give a power point presentation in front of the group of examiners.

SEMESTER IV

Course Code:- 20UME401D	***NUMERICAL METHODS AND COMPUTER PROGRAMMING***	***Total credits: 02***
Teaching Scheme		***Evaluation Scheme***
Theory : 2Hrs/week		***CA : 10 Marks***
		Mid Sem: 10 Marks
Exam Duration :- 2 Hours		***End Sem: 30 Marks***

Course Objectives	1- To develop Logical understanding of the subject. 2- To develop mathematical skill so that students are able to apply numerical methods & Principle's in solving problems from engineering fields. 3- To produce graduates with mathematical knowledge & computational skill.
Course Outcomes	**Students will be able to -** 1-To solve problems on statistical analysis. 2-To solve real life problems based on Statistics and Numerical Methods in Engineering
Pre-requisites	Students to know about pre-university mathematics and calculus.
Course Type	Basic Science course
Course Contents	

Unit No.	***PO Mapping***	***PSO Mapping***	***Teaching Methodology***	***Competency***	***P. I.***	
Unit 1: Solution of Simultaneous equations and Solution of algebraic and transcendental equations:						
Gauss-Jordan elimination method, Gauss-Seidel method. Engineering applications. Bisection method, Secant method, Newton -Raphson method. Engineering applications.	1,2,3	1,2	Lecture	1	1.4	1.4.1
Unit 2: Solution of differential equations with initial conditions						
Euler's method, Euler's modified method, Runge-Kutta fourth order method. Engineering applications.	1,2,3	1,2	Lecture	1	1.4	1.4.1
Unit 3: Interpolation						
Using forward, backward, central differences. Lagrange's formula for unequal intervals. Divided differences. Newton's divided difference formula. Engineering applications.	1,2,3	1,2	Lecture	2	2.2	2.2.2
Unit 4: Numerical differentiation and Numerical Integration						
First and second order derivatives using forward, backward, central differences. Engineering applications. Trapezoidal rule, Sterling's one - third and three-eighth formulas, Weddle's formula. Engineering applications.	1,2,3	1,2	Lecture	2	2.2	2.2.3
Unit 5: Probability						

Addition and multiplication rules. Probability distribution. Binomial, Poisson, Normal distributions. Engineering applications.	1,2,3	1,2	Lecture	3	3.3	3.3.1
Unit 6: Statistics						
Mean, Mode, Median, Quartile deviation, Mean deviation, Standard deviation, Moments, Skewness, Kurtosis.	1,2,3	1,2	Lecture	3	3.3	3.3.1

Reference Books:

1. P.N.Wartikar and J. N. Wartikar, A Text Book of Engineering Mathematics (Volume-I, II, III), Pune Vidyarthi Griha Prakashan, Pune.
2. B. S. Grewal, "Higher Engineering Mathematics," Khanna Publications, New Delhi
3. H.K. Das, "Advanced Engineering Mathematics," S. Chand & Company.
4. Dhavan & Srivastava : Statistics and Probability
5. Numerical Methods by M.K.Jain

Course Code:- 20UME402D	***ENGINEERING MATERIALS AND METALLURGY***	***Total credits: 02***
Teaching Scheme		***Evaluation Scheme***
Theory : 2 Hrs/week		***CA : 10 Marks***
		Mid Sem: 10 Marks
Duration of Exam – 02 Hours		***End Sem: 30 Marks***

Course Objectives	1- To understand the different types of structures of solid, defects in solids and analysis of crystal structure by X-ray diffraction technique. 2- To understand the different types of solid solution formation, steels and Cast Irons microstructures with Iron-iron carbide equilibrium diagram. 3- To understand the different types of Mechanical Properties of different materials and their Testing 4- To understand the different types of Heat Treatment processes 5- To understand the specimen preparation for macroscopic, examination and study the microstructure. 6- To understand the different types of Non-Destructive Testing methods used in industries for diff. materials.
Course Outcomes	**After learning the course, the students should be able**: 1. Study various crystal structures of materials. 2. Evaluate phase diagrams of various materials. 3. Understand mechanical properties of materials and calculations of same using appropriate equations. 4. Suggest appropriate heat treatment process for a given application. 5. Prepare samples of different materials for metallographic. 6. Recommend appropriate NDT technique for a given application.
Pre-requisites	Elements of Mechanical Engineering, Engineering Physics
Course Type	**Program Core Course**
Course Contents	

Unit No.	***PO Mapping***	***PSO Mapping***	***Teaching Methodology***	***Competency***	***P. I.***	
Unit 1: Crystal Geometry						
Space Lattices, Unit cells, Crystal Structure, Crystal directions and planes, Crystal Imperfections: Line defects, Point defects, Surface defects, Geometry and Properties of dislocation.	1,12	1	Lecture, Charts, Model, Animation etc	1.2 12.2	1.2.1 12.2.1	
Unit 2: Equilibrium Diagrams						
Definitions of terms, rules of solid-solubility, Gibb's phase rule, solidification of a pure metal, plotting of equilibrium diagrams, lever rule, Iron-iron carbide equilibrium diagram, critical temperatures, solidification and microstructure of slowly cooled steels, non-equilibrium cooling of steels, property variation with microstructures, classification and application of steels, specification of	1,12	1,2	Lecture, Charts, Model, Demonstration, etc.	1.3 12.2	1.3.1 12.2.1 12.2.2	

steels, and transformation products of austenite.						
Unit 3: Mechanical Properties and their Testing						
Tensile test, engineering stress-strain curve, true stress-strain curve, compression test, bend test, torsion test, formability, hardness testing, different hardness tests-Vickers, Rockwell, Brinell, Impact test, fatigue test, creep test.	1,3,7,12	1,2	Lecture, Charts, Model, Demonstration, Participatory learning method etc	1.1 3.1 7.1 12.1 12.3	1.1.1 3.1.1 7.1.1 12.1.1 12.3.1	
Unit 4: Heat Treatment						
TTT diagram, critical cooling rate, CCT diagram. Hardenability: Jominy end-quench test, Heat treatment of steels, cooling media, annealing processes, normalizing, hardening, tempering, quenching, surface hardening processes-nitriding, carbonitriding, flame hardening, induction hardening. Heat treatments of non-ferrous alloys. e.g. age hardening in Al-Cu-X alloys.	1,3,7,12	1,2	Lecture, Charts, Model, Demonstration, Participatory learning method etc	1.1 3.1 7.1 12.1 12.3	1.1.1 3.1.1 7.1.1 12.1.1 12.3.1	
Unit 5: Metallography						
Microscopy, specimen preparation, polishing abrasives and cloths, specimen mounting, electrolytic polishing, etching procedure and reagents, macroscopy, examination of microstructure, spark test, electron microscope.	9,12	1,2	Lecture, Charts, Model, Demonstration , Participatory learning , Activity Based learning etc	.1 2.1 2.3	9.1.1 9.1.2 12.1.1 12.3.1	
Unit 6: Non-Destructive Testing						
Magnetic particle inspection, dye Penetrant inspection, ultrasonic inspection, radiography, eddy current testing, acoustic emission inspection.	1,3,7,12	1,2	Lecture, Charts, Model, Demonstration, Participatory learning , Activity Based learning etc.	1.1 3.1 7.1 12.1 12.3	1.1.1 3.1.1 7.1.1 12.1.1 12.3.1	

Text Books:

1) V. D.Kodgire, S.V.Kodgire, "Material Science and Metallurgy for Engineers", Everest Publishing House, Pune, 24th edition, 2008.
2) W. D.Callister, "Materials Science and Engineering: An Introduction", John Wiley and Sons, 5th edition, 2001.
3) V.Raghvan, "Material Science Engineering", Prentice Hall of India Ltd., 1992.
4) S. H.Avner, "Introduction to Physical Metallurgy", Tata McGraw Hill, 2nd edition, 1997.

Reference Books:

1. V. B.John, "Introduction to Engineering Materials", ELBS, 6th edition, 2001.
2. G. F.Carter,D. E.Paul, "Materials Science and Engineering", ASM International, 3rd edition, 2000.
3. T. E.Reed-Hill, R.Abbaschian, "Physical Metallurgy Principles", Thomson, 3rd edition, 2003.

Course Code:- 20UME403D	***MECHANISM OF MACHINES***	***Total credits: 03***
Teaching Scheme		***Evaluation Scheme***
Theory : 2 Hrs/week		***CA : 20 Marks***
Tutorial: 1 Hr / Week		***Mid Sem: 20 Marks***
Duration of Exam – 03 Hours		***End Sem: 60 Marks***

Course Objectives	1. Know different machine elements and mechanism. 2. Understand Kinematics and Dynamics of different machines and mechanisms. 3. Select suitable drives and mechanisms for a particular application. 4. Comprehend the power transmission elements. 5. Know application of Cam and followers. 6. Know the concept of balancing.
Course Outcomes	**After learning the course, the students should be able**: 1. Define and identify links, pairs, and simple mechanisms. 2. Determine velocity and acceleration using graphical and numerical methods. 3. Determine inertia force and inertia torque using graphical and numerical method 4. Selection of Belt, rope and chain drive. 5. Classify cam, follower and construct different types of cam profile for required motion. 6. Analyze balancing of rotating and reciprocating masses.
Pre-requisites	Basic integral and differential calculus, vectors, engineering mechanics and engineering drawing
Course Type	**Program Core Course**
Course Contents	

Unit No.	***PO Mapping***	***PSO Mapping***	***Teaching Methodology***	***Competency***	***P. I.***	
Unit 1: Fundamentals of kinematics and mechanisms						
Kinematic link, Types of links, Kinematic pair, Types of constrained motions, Types of Kinematic pairs, Kinematic chain, Types of joints, Mechanism, Machine, Degree of freedom (Mobility), Kutzbach crieterion, Grubler's criterion, Inversion, Four bar chain and its inversions, Grashoff's law, Slider crank chain and its inversions, Double slider crank chain and its inversions, straight line mechanisms, pantograph, Geneva mechanism, steering gear mechanisms, Hooke's joint, Introduction to Compliant mechanism.	1,2,3,12	1,2	PPT /Chalk/Video	1.2 2.2 3.3 12.2	1.2.1 2.2.2 3.4.1 12.2.2	
Unit 2: Velocity and acceleration analysis						
Relative velocity acceleration methods, Corioli's component of acceleration, instantaneous center of Rotation method, Kennedy theorem of three center in line,	1,2,3,4,12	1,2	PPT /Chalk/Video	1.2 2.2 3.3 4.1	1.2.1 2.2.2 3.4.1 4.1.1	

body and space Centrode, Klein's construction, Position analysis of links with vector and complex algebra methods, Loop closure equation, Chace solution, Velocity and acceleration analysis of mechanisms using vector and complex algebra methods				12.2	12.2.2	
Unit 3: Static and dynamic force analysis of slider crank mechanism						
Analytical method for displacement, velocity and acceleration of slider crank mechanism, D'Alembert's principle, static and dynamic force analysis of slider crank mechanism, dynamically equivalent system, correction couple, graphical and analytical method for determination of torque on crankshaft.	1,2,3,4,12	1,2	PPT /Chalk/Video	1.2 2.2 3.3 4.1 12.2	1.2.1 2.2.2 3.4.1 4.1.1 12.2.2	
Unit 4: Belt & Chain Drives						
Introduction, Type of belts, Tension ratio in belts, Initial tension, Open & cross belt drive, Length of belt, Power transmitted by belt, chain drives. Advantages & Disadvantages of chain drive.	1,2,3,4,12	1,2	PPT /Chalk/Video	1.2 2.2 3.3 4.1 12.2	1.2.1 2.2.2 3.4.1 4.1.1 12.2.2	
Unit 5: Cams and followers						
Types of cams and followers, types of follower motion, velocity and acceleration diagrams, profile of cam cams with specified contours.	1,2,3,4,12	1,2	PPT/Chalk/ Video	1.2 2.2 3.3 4.1 12.2	1.2.1 2.2.2 3.4.1 4.1.1 12.2.2	
Unit 6: Balancing						
Static and dynamic balance, balancing of revolving several masses on several planes, Balancing of reciprocating masses in single and multi-cylinder engines, balancing Machines	1,2,3,4,12	1,2	PPT /Chalk/Video	1.2 2.2 3.3 4.1 12.2	1.2.1 2.2.2 3.4.1 4.1.1 12.2.2	

Text Books:-

1. Ballaney, P., "Theory if Machines and Mechanisms", 2005Khanna Publications
2. Ratan S. S. "Theory of Machines", Tata McGraw Hills

Reference Books:-

1. Uicker Jr, J. J., Penock G. R. and Shigley, J. E., "Theory oif Machines and Mechanisms' 2003, Tata· McGraw Hill.
2. Ramamurthy V., "Mechanisms of Machines", 3rd edition, ISBN 978-1842654569, Narosa Publishing House.
3. Bevan Thomas, "The Theory of Machines", 3rd edition, CBS publication.
4. Bansal, R. K., "Theory of machines", Laxmi Publications Pvt. Ltd, New Delhi

Course Code:- 20UME404D	**ADVANCE MACHINE TOOLS**	***Total credits: 03***
Teaching Scheme		***Evaluation Scheme***
Theory : 3 Hrs/week		***CA : 20 Marks***
		Mid Sem: 20 Marks
Duration of Exam – 03 Hours		***End Sem: 60 Marks***

Course Objectives	1. To explain mechanics of cutting by using single point cutting tool. 2. To describe need of finishing operations employed in manufacturing process. 3. To explain parts and working of different types of milling machine. 4. To describe parts and working of different types of lathe and drilling machine. 5. To differentiate between advanced machining processes. 6. To understand applications of additive manufacturing processes in various fields.
Course Outcomes	**After learning the course, the students should be able**: 1. To determine cutting forces and power in metal cutting processes. 2. To estimate time required for grinding operation 3. To determine material removal rate and power required in milling operation. 4. To analyze effect of turning input parameters on output parameters. 5. To illustrate process capability and application of modern machining processes 6. To recommend suitable additive manufacturing process for particular applications.
Pre-requisites	None
Course Type	**Program Core Course**
Course Contents	

Unit No.	***PO Mapping***	***PSO Mapping***	***Teaching Methodology***	***Competency***	***P. I.***	
Unit 1: Theory of Metal Cutting						
Fundamentals of machining: geometry of single point cutting tools, orthogonal and oblique cutting, chip formation and chip morphology, process parameters; Mechanics of cutting: determination of cutting forces and power, theory of Ernst & Merchant; Thermal aspects: heat generation, temperature distribution, measurement of cutting temperature; tool life and tool wear; surface finish and machinability; tool material; cutting fluids.	1	1,2	ICT based, Activity based learning	1.1 1.2 1.3 1.4	1.1.1 1.2.1 1.3.1 1.4.1	
Unit 2: Abrasive Machining						
Abrasives; Grinding wheels: types of wheels and bond, wheel grade and structure, selection of wheel; Grinding operations and machines: cylindrical grinding, surface grinding, centerless grinding, internal grinding, tool and cutter	1	1,2	ICT Based Teaching	1.1 1.3 1.4	1.1.1 1.3.1 1.3.2 1.4.1	

grinder; time estimation for grinding operations; Grinding terms: loading, glazing, dressing, trueing and grinding ratio; Finishing processes: honing, lapping, buffing, polishing and deburring.						
Unit 3: Milling Machines						
Introduction; milling process parameters; Milling operations: up and down milling, peripheral milling, end milling, face milling, slab milling; determination of material removal rate, power and cutting time; parts and working of different milling machine: column and knee type, fixed bed type, CNC Milling; Special purpose milling machine: profile milling, gear milling and thread milling; milling cutter; tool holders; attachments of milling machine.	1	1,2	ICT Based	1.2 1.3 1.4	1.2.1 1.3.1 1.4.1	
Unit 4: Lathe and Drilling Machines						
Introduction; lathe machine operations; turning process parameters; determination of material removal rate, power and cutting time; parts and working of different lathe machine; effect of input parameters on output parameters; work and tool holders; attachments of lathe machines; process capabilities. Hole making: Boring and broaching machine; Drilling: process parameters; parts and working of different drilling machine; Drill: nomenclature, material and size; reaming and tapping.	1,4,9,10,11	1,2	ICT based, Project based learning	1.2, 1.3, 1.4, 4.1,4.2, 4.3, 9.2, 9.3, 10.1, 10.2, 11.3,	1.2.1, 1.3.1 1.4.1, 4.1.1 4.1.2, 4.1.3 4.1.4, 4.2.1 4.2.2, 4.3.1 4.3.2, 4.3.3 4.3.4, 9.2.1 9.3.1, 10.1.2 10.2.2, 11.3.2	
Unit 5: Advance Machining						
Operation, machine, process parameters, metal removal rate of: ultrasonic machining, chemical machining, electrochemical machining, electro discharge machining, wire cut EDM, laser beam machining, electron beam machining, water jet machining, abrasive jet machining; Comparative study of advanced machining: process capability, economics and application.	1	1,2	ICT Based	1.2, 1.3, 1.4	1.2.1, 1.3.1, 1.4.1	
Unit 6: Additive Manufacturing						
Evolution of additive processes; Generalized AM process: characteristics, information flow and data formats, related hardware and software; Working, characteristics and capabilities of: vat photo polymerization, powder bed fusion, binder jetting, material jetting, sheet lamination,	1	1,2	ICT based, Activity based learning	1.2, 1.3, 1.4	1.2.1, 1.3.1, 1.4.1	

material extrusion, directed energy deposition; application of additive manufacturing in industrial product development and nonconventional fields.						

Text Books:-

1. Serope Kalpakjian and Steven R. Schmid, “Manufacturing Engineering and Technology”, Addison Wesley Longman (Singapore) Pte. India Ltd., 6th edition, 2009.
2. Geoffrey Boothroyd, Winston Knight, “Fundamentals of Machining and Machine Tools”, Taylor and Francis, 3rd edition, 2006.

Reference Books:-

1. B. S. Raghuwanshi, "A Course in Workshop Technology", Volume II, Dhanpat Rai & Co., 10th edition,2009
2. Mikell P. Groover, “Fundamentals of Modern Manufacturing: Materials, Processes, and Systems”, John Wiley and Sons, New Jersey, 4th edition, 2010.
3. Ian Gibson, David Rosen and Brent Stucker, "Additive Manufacturing Technologies: 3d Printing, Rapid prototyping, and Direct Digital Manufacturing", Springer, 2nd edition, 2015.

Course Code:- 20UME405D	**MECHATRONICS**	***Total credits: 02***
Teaching Scheme		***Evaluation Scheme***
Theory : 2 Hrs /week		***CA : 10 Marks***
		Mid Sem: 10 Marks
Duration of Exam – 2 Hours		***End Sem: 30 Marks***

Course Objectives	1. To study Mechatronics System and its Importance 2. To study basic working principles and components of Mechatronics system 3. To extend the knowledge of students for Industrial Fluid power and sensorics systems involved in Mechatronics 4. To study PLC and HMI Integration along with Pneumatics system 5. To design and implement Mechatronics system
Course Outcomes	**After learning the course, the students should be able to**: 1. Understand basics behind of mechatronics system 2. Inspect components of mechatronics system 3. Integrate Pneumatics and sensorics system to build Electromechanical system 4. Execute and design PLC Logics and HMI Screens 5. To build a mechatronics system
Pre-requisites	Basic fundamentals of Digital Electronics and Sensors.
Course Type	**Program Elective Course**
Course Contents	

Unit No.	***PO Mapping***	***PSO Mapping***	***Teaching Methodology***	***Competency***	***P. I.***	
Unit 1: Introduction to Mechatronics						
Definition of Mechatronics, Disciplinary Foundations of Mechatronics, Components of mechatronics system, Examples of mechatronics system, benefits of mechatronics system, Commissioning of mechatronics system.	1	1	PPT, Documentaries videos on history of Mechatronics system	1.4	1.4.1	
Unit 2: Mechanical Inspection & Mechanical Assembly						
Understanding the design of mechanical system, studying different subsystems in mechanical design, study of different components involved in the system, Mechanical assembly and study of Factory Automation system.	1,3,5	1,2	PPT, Videos on Mechatronics system	1.3 3.1 5.1	1.3.1 3.1.6 5.1.1	
Unit 3: Pneumatics & Electrical Actuators						
Fundamental of pneumatics system, Air Generation and distribution, Pneumatic components, Design Procedure of Pneumatics and, Examples and applications of pneumatic, Electro pneumatics, Selection of components and their ratings Actuators: Electrical systems, Electrical	1,3,5	1,2	PPT, Windows journal, Videos on construction & Working of Industrial Pneumatics	1.3 2.1 5.1	1.3.1 2.1.2 5.1.2	

actuators, brushless permanent magnet DC motor, Interfacing of DC motors, stepper motor, interfacing of stepper motors, Encoders						
Unit 4: Sensor technology and Electrical Wiring						
Types of sensors: Inductive and Capacitive proximity sensors, thermal sensors, Depth sensors, color sensors ,optical sensors, Barcode and QR code sensors ,RFID, working principle of sensors, control system, open loop and closed loop systems, study of electrical symbols, types of electrical wirings.	1,2,3	1,2	PPT, Windows journal, Videos on different sensor working	1.1 2.3 3.1	1.1.1 2.3.1 3.1.6	
Unit 5: PLC and HMI Integration						
PLC BASICS, PLC Hardware Components, Various INPUT /OUTPUT Devices and its interfacing with PLC, SIMATIC S7 1500/300 training kit, PLC Instructions: Bit logic, Timer, counters, analog, HMI basics, Screen design, alarm generations and Integration with PLC system.	1,4,5	1,2	PPT, Windows journal, Classroom Teaching	1.3 4.1 5.1	1.3.1 4.1.3 5.1.2	
Unit 6: Integration of Factory Automation Unit						
Assembly and Programming of Pneumatic Press Unit, Magazine Unit, Conveyor system and ASRS system	3,5,12	1,2	Actual Demonstration	3.4 5.2 12.1	3.4.1 5.2.1 12.1.2	

Text Books:-

1. Groover, M. P., Automation, Production System & Computer Integrated Manufacturing, Pearson Education Asia (2009)
2. Mechatronics by K P Ramachandran, G K Vijayaraghavan, M S Balasundaram, Wiley India Pvt.Ltd.
3. Mechatronics System Design , Shetty and Kolk CENGAGE Learning, India Edition

Reference Books:-

1. Electromechanical Design Handbook , Walsh, McGraw-Hill
2. Mechatronics, Nitaigour Mahalik, Tata McGraw-Hill
3. Smaili,Mrad,"Mechatronics: Integrated Technologies for Intelligent Machines",Oxford Publication2008

E-Resources:-

1. NPTEL SWAYAM, YouTube
2. Elsevier Journals
3. Springer Journals

Course Code:- 20UME406D	**PRODUCT DESIGN - I**	***Total credits: 02***
Teaching Scheme		***Evaluation Scheme***
Theory : 2 Hrs /week		***CA : 10 Marks***
		Mid Sem: 10 Marks
Duration of Exam – 2 Hours		***End Sem: 30 Marks***

Course Objectives	1. To design a product by following the process of product design engineering 2. Understand the basic techniques and procedure for new product design.
Course Outcomes	**After learning the course, the students should be able to**: 1. To understand the meaning of Prototyping & its applications. 2. To study basic steps & tools of Engineering Design. 3. To plan & work in team for effective product design.
Pre-requisites	Basic fundamentals of engineering drawing, & design softwares.
Course Type	**Program Core Course**
Course Contents	

Unit No.	***PO Mapping***	***PSO Mapping***	***Teaching Methodology***	***Competency***	***P. I.***
Unit 1: Introduction					
Introduction of product design engineering, definition of product design, approach for product design, different steps involved in product design Engineering, study of different products in market, relation of components with each other, reverse engineering concept.	1,2	1	PPT	1.2 2.1	1.2.1 2.1.1
Unit 2: Idea Generation					
Generating ideas, Funneling of ideas, sorting ideas for product development, different methods for sorting ideas, market survey, finding customer needs, sorting prominent needs for product development.	2	1	PPT, Case Study on different product development papers.	2.1 2.2	2.1.1 2.1.2 2.2.2
Unit 3: Concept Development					
Generating different concepts, sorting of concepts by review method, sketching the finalized concept, design of different components or parts of the product, 3 D modeling of the concept, Engineering drawing of all the components or parts.	2,3	1,2	PPT, Performing different activities in the class.	2.2 2.3 3.3	2.2.1 2.2.2 2.2.3 2.3.1 2.3.2 3.3.1
Unit 4: Prototyping					
Specifications of the product, material selection, introduction to Additive manufacturing, different manufacturing techniques, generation of final product, documentation.	1,3	2	Case study & Activities in the class.	1.2 1.3 1.4 3.3 3.4	1.2.1, 1.3.1 1.4.1, 3.3.1 3.3.2, 3.4.1 3.4.2

Reference Books:-

1. Model Curriculum for "Product Design Engineer – Mechanical", NASSCOM (Ref. ID: SSC/Q4201, Version 1.0, NSQF Level: 7)
2. Eppinger, S., & Ulrich, K.(2015). Product design and development. McGraw-Hill Higher Education.
3. Green, W., & Jordan, P. W. (Eds.).(1999).Human factors in product design: current practice and future trends. CRC Press.

4. Sanders, M. S., & McCormick, E. J. (1993). Human factors in engineering and design. McGRAW-HILL Book Company.

Course Code:- 20UME407N	**INTERPERSONAL SKILLS**	***Total credits: Audit Course***
Teaching Scheme		***Evaluation Scheme***
Theory : 2 Hrs /week		***TW : 50 Marks***
Duration of Exam – 2 Hours		***TOTAL : 50 Marks***

Course Objectives	1. To gain different skills for good communication, presentation & develop skills to work independently.
Course Outcomes	**After learning the course, the students should be able to**: 1. Acquire interpersonal communication skills 2. Develop the ability to work independently. 3. Develop the qualities like self-discipline, self-criticism and self-management. 4. Have the qualities of time management and discipline. 5. Present themselves as an inspiration for others 6. Develop themselves as good team leaders
Pre-requisites	Communication skills
Course Type	**Professional Course**
Course Contents	

Unit No.	***PO Mapping***	***PSO Mapping***	***Teaching Methodology***	***Competency***	***P. I.***
Unit 1: Development of Proficiency in English					
Speaking skills, Feedback & questioning technique, Objectivity in argument (Both one on one and in groups). 5 Wsand 1 H and 7 Cs for effective communication. Imbibing etiquettes and manners. Study of different pictorial expressions of non-verbal communication and their analysis	1,2,6	1	PPT, Documentaries videos	1.2 2.1	1.2.1 2.1.1
Unit 2: Self-Management					
Self-Management, Self-Evaluation, Self-discipline, Self-criticism; Recognition of one's own limits and deficiencies, dependency, etc.; Self-Awareness, Self-Management, Identifying one's strengths and weaknesses, Planning & Goal setting, Managing self-emotions, ego, pride. Leadership and Team Dynamics	1,3	1	PPT, Case Study video	1.2 3.3	1.2.1 3.3.1
Unit 3: Time Management Techniques					
Practice by game playing and other learning strategies to achieve the set targets Time Management Concept; Attendance, Discipline and Punctuality; Acting in time, Quality /Productive time.	1,3	1,2	PPT, Documentaries videos	1.2 3.3	1.2.1 3.3.1
Unit 4: Motivation/Inspiration					

Ability to shape and direct working methods according to self-defined criteria, Ability to think for oneself, Apply oneself to a task independently with self-motivation. Motivation techniques: Motivation techniques based on needs and field situation.	1	1,2	PPT, Documentaries videos	1.2	1.2.1
Unit 5: Interpersonal Skills Development					
Positive Relationship, Positive Attitudes, Empathies: comprehending others' opinions, points of views, and face them with understanding, Mutuality, Trust, Emotional Bonding, Handling Situations (Interview), Importance of interpersonal skills.	1,6	1,2	PPT, Documentaries videos	1.2 6.1	1.2.1 6.1.1
Unit 6: Effective Computing Skill					
Designing an effective Presentation; Contents, appearance, themes in a presentation, Tone and Language in a presentation, Role and Importance of different tools for effective presentation.	1,3	1,2	PPT, Documentaries videos	1.2 3.3	1.2.1 3.3.1

Reference Books:-

1. Mitra, Barun, "Personality Development and Soft Skills", Oxford University Press, 2016.
2. Ramesh, Gopalswamy, "The Ace of Soft Skills: Attitude, Communication and Etiquette for Success", Pearson Education, 2013.
3. Stephen R. Covey, "Seven Habits of Highly Effective People: Powerful Lessons in Personal Change", Free Press Publisher, 1989.
4. Rosenberg Marshall B., "Nonviolent Communication: A Language of Life" 3rd edition, Puddle dancer Press, 1st September, 2003

Course Code:- 20UME408L	*Course Title*	*Total credits : 01*
Teaching Scheme	**ENGINEERING MATERIALS AND METALLURGY LAB**	***Evaluation Scheme***
Practical : 2 Hrs /week		CA – 30 Marks
		End Sem Exam : 20 Marks
		Total :- 50 Marks

Lab outcomes	At the end of the course, the students will be able to, ***1.*** Overview of Principle parts of metallurgical microscope and understand metallographic. ***2.*** Significance of observation of microstructure of plain carbon steels. ***3.*** To be able to interpret and observe microstructure of Cast iron. ***4.*** Exposure to study of microstructure of Nonferrous alloys. ***5.*** Understanding heat treatment procedures and the change of properties ***6.*** Understanding mechanical properties & their testing.

Course Contents PART-A

Sr	***Name Of Practical***	***Type/ Methodology***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***
1	Study and demonstration of binocular microscope	Demonstration	1,5,9	1	5.2	5.2.2
2	Specimen Preparation for Microscopy	Demonstration, Participatory learning method etc	1,4,9,12	1	5.2	5.2.2
3	Study and drawing of microstructures of plain carbon steels of varying carbon percentage	Demonstration, Participatory learning method etc	1,4,9,12	1,2	4.3	4.3.1 4.3.2
4	Study and drawing of microstructures of cast irons	Demonstration, Participatory learning method etc	1,4,9,12	1,2	4.3	4.3.1 4.3.2
5	Study and drawing of microstructures of heat-treated steels	Demonstration, Participatory learning method etc	1,4,9,12	1,2	4.3	4.3.1 4.3.2
6	Study and drawing of microstructures of non-ferrous alloys	Demonstration, Participatory learning method etc	1,4,9,12	1,2	4.3	4.3.1 4.3.2
7	Brinell and Rockwell Hardness Test	Participatory learning method etc	1,4,5,9,12	1,2	4.1 9.3 10.1 12.1	4.1.1 9.3.1 10.1.1 12.1.1
8	Spark Test	Participatory learning method etc	1,4,5,9,12	1,2	4.1 9.3 10.1 12.1	4.1.1 9.3.1 10.1.1 12.1.1
9	Jominy End Quench Test	Participatory learning method etc	1,4,5,9,12	1,2	4.1 9.3 10.1 12.1	4.1.1 9.3.1 10.1.1 12.1.1
10	Erichsen Cupping Test	Participatory learning method etc	1,4,5,9,12	1,2	4.1 9.3 10.1	4.1.1 9.3.1 10.1.1

					12.1	12.1.1
11	Magnaflux Test	Participatory learning method etc	1,4,5,9,12	1,2	4.1 9.3 10.1 12.1	4.1.1 9.3.1 10.1.1 12.1.1
12	Dye Penetrant Test	Participatory learning method etc	1,4,5,9,12	1,2	4.1 9.3 10.1 12.1	4.1.1 9.3.1 10.1.1 12.1.1

Reference Books:-

1. V. D.Kodgire, S.V.Kodgire, “Material Science and Metallurgy for Engineers”
2. V.Raghvan, “Material Science Engineering”, Prentice Hall of India Ltd., 1992
3. LAB-MANUAL

Course Code:- 20UME409L	*Course Title*	*Total credits : 01*
Teaching Scheme	**MECHANISMS OF MACHINES LAB**	***Evaluation Scheme***
Practical : 2 Hrs /week		CA – 30 Marks
		End Sem Exam : 20 Marks
		Total :- 50 Marks

Lab outcomes	At the end of the course, the students will be able to, ***1.*** Demonstrate knowledge of various mechanisms in order to design and analyze mechanisms essential in mechanical engineering. ***2.*** Demonstrate ability towards graphically estimating velocity and acceleration. ***3.*** Exhibit skills towards application of principles of static and dynamics force analysis ***4.*** Knowledge attained will comply towards successfully addressing issues relating cams and followers in real life engineering problems.

Course Contents

Sr	*Name Of Practical*	*Type/ Methodology*	*PO Mapping*	*PSO Mapping*	*Competency*	*PI*
1	Graphical solution to problems on velocity acceleration in mechanism by relative velocity and acceleration method including problem with Corioli's component of acceleration.	Demonstration	1,2,3,4,12	1,2	1.2, 2.2 3.3, 4.1 12.2	1.2.1, 2.2.2 3.4.1, 4.1.1 12.2.2
2	Velocity by instantaneous center method	Demonstration	1,2,3,4,12	1,2	1.2, 2.2 3.3, 4.1 12.2	1.2.1, 2.2.2 3.4.1, 4.1.1 12.2.2
3	Klein's construction and inertia force analysis for slider cranks mechanisms	Demonstration	1,2,3,4,12	1,2	1.2, 2.2 3.3, 4.1 12.2	1.2.1, 2.2.2 3.4.1, 4.1.1 12.2.2
4	To draw cam profile for various types of followers motion	Demonstration	1,2,3,4,12	1,2	1.2, 2.2 3.3, 4.1 12.2	1.2.1, 2.2.2 3.4.1, 4.1.1 12.2.2
5	Study of static and dynamic balancing	Demonstration	1,2,3,4,12	1,2	1.2, 2.2 3.3, 4.1 12.2	1.2.1, 2.2.2 3.4.1, 4.1.1 12.2.2
6	Graphical solution of balancing rotating masses	Demonstration	1,2,3,4,12	1,2	1.2, 2.2 3.3, 4.1 12.2	1.2.1, 2.2.2 3.4.1, 4.1.1 12.2.2
7	Graphical solution of balancing reciprocating masses in Inline engine.	Demonstration	1,2,3,4,12	1,2	1.2, 2.2 3.3, 4.1 12.2	1.2.1, 2.2.2 3.4.1, 4.1.1 12.2.2
8	Study of balancing of V engine	Demonstration	1,2,3,4,12	1,2	1.2, 2.2 3.3, 4.1 12.2	1.2.1, 2.2.2 3.4.1, 4.1.1 12.2.2

Course Code:- 20UME410L	*Course Title*	*Total credits : 01*
Teaching Scheme	**MECHATRONICS LAB**	***Evaluation Scheme***
Practical : 2 Hrs /week		CA – 30 Marks
		End Sem Exam : 20 Marks
		Total :- 50 Marks

Lab outcomes	At the end of the course, the students will be able to, ***1.*** Identify the Mechatronics system components ***2.*** Able to build circuits using Pneumatics and sensors ***3.*** Program PLC and HMI and Integrate them ***4.*** Design Electro-pneumatic systems. ***5.*** Implement Mechatronics system

Course Contents

Sr	***Name Of Practical***	***Type/ Methodology***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***
1	Identify components in Mechatronics system	PPT and Video	1,2	1,2	1.4	1.4.1
2	Study of Pneumatics circuits	Components study	1,2,3	1,2	2.3	2.3.1
3	Study of DC, Stepper and Servo motors and their applications	Components study	1,2,3	1,2	1.3	1.3.1
4	Study and Interfacing of Electromechanical Sensors	Components study	1,2,3	1,2	2.2	2.2.3
5	Study PLC Programming instructions	Hands on Computers	1,5	1,2	5.1	5.1.1
6	Perform HMI Screen Design	Hands on Computers	1,5	1,2	5.1	5.1.1
7	Interfacing of PLC and HMI	Hands on Computers	1,5,12	1,2	4.1	4.1.3
8	Identification and Design of Pneumatic Press Assembly	Hands on Session	1,11,12	1,2	4.2	4.2.1
9	Build Pneumatic Press Assembly	Hands on Session	1,9	1,2	5.2	5.2.1
10	Verification of working Pneumatic Press Assembly using PLC and HMI	Hands on Session	1,9,12	1,2	4.3	4.3.2

References:-

1. Mumbai University
2. VIT Vellore

Course Code:- 20UME411L	*Course Title*	*Total credits : 01*
Teaching Scheme	**PRODUCT DESIGN – I LAB**	***Evaluation Scheme***
Practical : 2 Hrs /week		CA – 30 Marks
		End Sem Exam : 20 Marks
		Total :- 50 Marks

Lab outcomes	At the end of the course, the students will be able to, ***1.*** To get the knowledge of Product design Engineering tools ***2.*** To learn the exact meaning and procedure of brainstorming. ***3.*** To be able to apply the knowledge of Engineering drawing in real life problems.

Course Contents

Sr	***Name Of Practical***	***Type/ Methodology***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***
1	Introduction to PDE I: Disassembling existing product & understanding relationship of components.	Case study on existing component with research paper	1,2	1	1.2 1.3 2.1 2.3	1.2.1 1.3.1 2.1.1 2.1.2 2.3.1
2	Generation of ideas for new product development	Individual Activity, Innovation	2	1	2.1	2.1.1 2.1.2
3	Data Collection: collect information related to the idea in the form of images, pdf, ppt, etc.	Analysis	1	1,2	1.1	1.1.1
4	Funneling of ideas: Shortlisting of ideas of product for individual or for group	Analysis	1	1,2	1.2	1.2.1
5	Sketching of Product	Individual Activity, Innovation	1,2	1	1.1 1.2 2.1	1.1.1 1.2.1 2.1.1
6	Conceptualization: computer aided 2D drafting & 3D modeling.	Individual Activity, Innovation	1,2	1	1.1 2.1 2.2	1.1.1 2.1.1 2.1.2 2.2.1
7	Rendering the design for realistic image.	Individual Activity, Innovation	1,2	1	1.1 1.2 2.1 2.2	1.1.1 1.2.1 2.1.1 2.2.1
8	Prototyping using 3D printer.	Actual implementation	3	2	3.1 3.2	3.1.1 3.2.1 3.2.2 3.2.3
9	Testing, Evaluation for finding out errors.	Analysis	1	1,2	1.1 1.3 1.4	1.1.1 1.1.2 1.3.1 1.4.1
10	Documentation	Individual Activity	1	1,2	1.1 1.2	1.1.1 1.2.1

Course Code:- 20UME412I	*Course Title*	*Total credits : 01*
Teaching Scheme	**INDUSTRIAL INTERNSHIP**	***Evaluation Scheme***
		TW – 50 Marks
Two Weeks		

Lab outcomes	At the end of the course, the students will be able to, ***1.*** To make the students aware of industrial culture and organizational setup. ***2.*** To create awareness about technical report writing among the students. ***3.*** Students will learn how to Work effectively as a member & leader in multi-disciplinary team. ***4.*** Students will developed an ability to communicate effectively on various engineering problems. ***5.*** Students will identify their own educational needs and areas of interests.

Course Contents

Sr	***Name Of Practical***
	Students will have to undergo 2 weeks training programme in the Industry during the Summer vacation after IVth semester examination. It is expected that students should understand the organizational structure, various sections and their functions, products/services, testing facilities, safety and environmental protection measures etc. Students will have to submit a detailed report about the training programme to the faculty coordinator soon after joining in Vth semester of third year. They will have to give a power point presentation in front of the group of examiners.