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SYLLABUS BOOK

SECOND YEAR B. TECH MECHANICAL ENGINEERING

P P SAVANI
UNIVERSITY

SCHOOL OF ENGINEERING
DEPARTMENT OF MECHANICAL ENGINEERING

Effective From: 2018-19

Authored by: P P Savani University

P P SAVANI UNIVERSITY														
SCHOOL OF ENGINEERING														
TEACHING & EXAMINATION SCHEME FOR B.TECH. 2nd YEAR MECHANICAL PROGRAMME														
Sem	Course Code	Course Title	Teaching Scheme					Examination Scheme						
			Contact Hours				Credit	Theory		Practical		Tutorial		Total
			Theory	Practical	Tutorial	Total		CE	ESE	CE	ESE	CE	ESE	
3.	SESH2011	Differential Equations	3	0	2	5	5	40	60	0	0	50	0	150
	SEME2011	Engineering Thermodynamics	3	0	1	4	4	40	60	0	0	20	30	150
	SEME2020	Material Science and Metallurgy	3	2	0	5	4	40	60	20	30	0	0	150
	SECV2011	Strength of Materials	3	2	0	5	4	40	60	20	30	0	0	150
	SEME2030	Non Cutting Manufacturing Processes	3	2	0	5	4	40	60	20	30	0	0	150
	SEME2041	Machine Drawing	0	2	0	2	1	0	0	50	0	0	0	50
	SEPD2010	Critical Thinking, Creativity & Decision Making	2	0	0	2	2	40	60	0	0	0	0	100
					Total	28	24							900
4.	SESH2022	Numerical & Statistical Analysis	3	0	2	5	5	40	60	0	0	50	0	150
	SEME2050	Forming & Machining Processes	3	2	0	5	4	40	60	20	30	0	0	150
	SEME2060	Fluid Mechanics	3	2	0	5	4	40	60	20	30	0	0	150
	SEME2070	Mechanical Measurement and Metrology	3	2	0	5	4	40	60	20	30	0	0	150
	SEME2081	Kinematics of Machinery	4	0	1	5	5	40	60	0	0	50	0	150
	SESH2211	Basics of Electrical & Electronics	0	2	0	2	1	00	0	50	0	0	0	50
	SEPD2020	Values and Ethics	2	0	0	2	2	40	60	0	0	0	0	100
					Total	29	25							900

CONTENT

Semester 1

Sr No	Subject Code	Name of Subject	Page No
1	SESH2011	Differential Equations	04-06
2	SEME2011	Engineering Thermodynamics	07-08
3	SEME2020	Material Science and Metallurgy	09-11
4	SECV2011	Strength of Materials	12-13
5	SEME2030	Non Cutting Manufacturing Processes	14-16
6	SEME2041	Machine Drawing	17-19
7	SEPD2010	Critical Thinking, Creativity & Decision Making	20-22

Semester 2

Sr No	Subject Code	Name of Subject	Page No
1	SESH2010	Critical Thinking, Creativity and Decision Making	23-24
2	SEME2022	Numerical & Statistical Analysis	25-27
3	SEME2050	Forming and Machining Processes	28-30
4	SEME2060	Fluid Mechanics	31-33
5	SEME2070	Mechanical Measurement and Metrology	34-37
6	SEME2081	Kinematics of Machinery	38-40
7	SESH2211	Basics of Electrical & Electronics	41-43
8	SEPD2020	Values and Ethics	44-45

P P Savani University
School of Engineering

Department of Science & Humanities

Course Code: SESH2011
Course Name: Differential Equations
Prerequisite Course: SESH1010-Elementary Mathematics for Engineers

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
				Theory		Practical		Tutorial		
Theory	Practical	Tutorial	Credit	CE	ESE	CE	ESE	CE	ESE	Total
3	-	2	5	40	60	-	-	50	-	150

CE: Continuous Evaluation, ESE: End Semester Exam

Objectives of the Course:

To help learners to learn

- Orientation of calculus and its applications in solving engineering problems involving differential equations.
- Introduction of partial differential equations with methods of its solutions.
- Application of Laplace transforms to solve linear differential equations.
- Introduction of periodic functions and Fourier series with their applications for solving ODEs.

Course Content:

Section I

Module	Content	Hours	Weightage
1.	**Ordinary Differential Equation** First order ODEs, Formation of differential equations, Solution of differential equation, Solution of equations in separable form, Exact first order ODEs, Linear first order ODEs, Bernoulli Equation, ODEs of Second and Higher order, Homogeneous linear ODEs, Linear Dependence and Independence of Solutions, Homogeneous linear ODEs with constant coefficients, Differential Operators Nonhomogeneous ODEs, Undetermined Coefficients, Variation of Parameters.	10	20 %
2.	**Partial Differential Equation** Formation of First and Second order equations, Solution of First order equations, Linear and Non-liner equations of first, Higher order equations with constant coefficients, Complementary function, Particular Integrals.	7	18 %
3.	**Applications of ODE and PDE** Orthogonal trajectories, Method of Separation of Variables, D'Albert's solution of wave equation, Solution of heat equation.	5	12 %

Section II			
Module	**Content**	**Hours**	**Weightage**
4.	**Laplace Transform** Laplace Transform, Linearity, First Shifting Theorem, Existence Theorem, Transforms of Derivatives and Integrals, Unit Step Function, Second Shifting Theorem, Dirac's Delta function, Laplace Transformation of Periodic function, Inverse Laplace transform, Convolution, Integral Equations, Differentiation and Integrations of Transforms, Application to System of Differential Equation.	10	20 %
5.	**Fourier Series** Periodic function, Euler Formula, Arbitrary Period, Even and Odd function, Half-Range Expansions, Applications to ODEs.	7	15 %
6.	**Fourier Integral and Transformation** Representation by Fourier Integral, Fourier Cosine Integral, Fourier Sine Integral, Fourier Cosine Transform and Sine Transform, Linearity, Fourier Transform of Derivatives.	6	15 %

List of Practical/Tutorial:

Sr No	Name of Practical/Tutorial	Hours
1.	Ordinary Differential Equation-1	2
2.	Ordinary Differential Equation-2	2
3.	Ordinary Differential Equation-3	4
4.	Partial Differential Equation-1	2
5.	Partial Differential Equation-2	4
6.	Applications of ODE and PDE	2
7.	Laplace Transform-1	2
8.	Laplace Transform-2	2
9.	Laplace Transform-3	4
10.	Fourier Series-1	2
11.	Fourier Series-2	2
12.	Fourier Integral and Transformation	2

Text Books:

Title	Author/s	Publication
Advanced Engineering Mathematics	Erwin Kreyszig	Wiley India Pvt. Ltd.

Reference Books:

Title	Author/s	Publication
Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers
Advanced Engineering Mathematics	R. K. Jain, S.R.K. Iyengar	Narosa Publishing House Pvt. Ltd.
Differential Equations for Dummies	Steven Holzner	Wiley India Pvt. Ltd.
Higher Engineering Mathematics	H.K. Dass, Er. Rajnish Verma	S. Chand & Company Pvt. Ltd.

Web Material Links:

1) http://nptel.ac.in/courses/111105035/
2) http://nptel.ac.in/courses/111106100/
3) http://nptel.ac.in/courses/111105093
4) http://nptel.ac.in/courses/111108081/

Course Evaluation:

Theory:

- Continuous evaluation consists of two tests each of 15 Marks and 1 Hour of duration.
- Submission of assignments which consists of 10 Questions to be answered under each module and it carries 10 Marks of continuous evaluation.
- End Semester Examination will consist of 60 Marks..

Tutorial:

- Continuous evaluation consists of performance of tutorial which should be evaluated out of 10 Marks for each tutorial and average of the same will be converted to 30 Marks.
- MCQ based examination of 10 Marks.
- Internal Viva of 10 Marks.

Course Outcomes:

The students will be able to

- grasp the respective 1st and 2nd order ODE and PDE.
- analyze engineering problems (growth, decay, flow, spring and series/parallel electronic circuits) using 1st and 2nd order ode.
- classify differential equations and solve linear and non-linear partial differential equations.
- apply understanding of concepts, formulas, and problem solving procedures to thoroughly investigate relevant real world problems.

P P Savani University
School of Engineering

Department of Mechanical Engineering

Course Code: SEME2011
Course Name: Engineering Thermodynamics
Prerequisite Course: Elements of Mechanical engineering (SEME1030)

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
				Theory		Practical		Tutorial		
Theory	Practical	Tutorial	Credit	CE	ESE	CE	ESE	CE	ESE	Total
03	00	01	04	40	60	--	--	20	30	150

CE: Continuous Evaluation, ESE: End Semester Exam

Objectives of the Course:

To help learners to learn

- identify different aspects of thermodynamics and its application.
- interpret different laws of thermodynamics and their application to field and daily life.
- understand various gas laws and equations of state and their application.
- understand the role of entropy, exergy to the universe.

Course Content:			
Section I			
Module	**Content**	**Hours**	**Weightage**
1.	**Basic Concepts of Thermodynamic** Classical and statistical thermodynamic approach, Thermodynamic: system, properties, states, processes, cycle & equilibrium, Concepts of: control volume and control surface, Specific heat capacity, Internal Energy, Enthalpy, Specific Volume, heat and work.	05	07 %
2.	**First and Second law of Thermodynamics** First law for a closed system undergoing a cycle and change of state, energy, PMM1, First law of thermodynamics for a non-flow and flow process. Limitations of first law of thermodynamics, Statements of second law of thermodynamics and their equivalence, PMM2, Carnot's theorem, Corollary of Carnot's theorem, Causes of irreversibility.	08	20 %
3.	**Entropy** Clausius theorem, property of entropy, Clausius inequality, entropy change in an irreversible process, principle of increase of entropy, entropy change for non-flow and flow processes, third law of thermodynamics, PPM3.	05	15 %
4.	**Exergy** Energy of a heat input in a cycle, exergy destruction in heat transfer process, exergy of finite heat capacity body, exergy of closed and steady flow system, irreversibility and Gouy-Stodola theorem and its applications, second law efficiency.	05	08 %
Section II			
5.	**Vapour Power Cycles** Carnot vapor cycle, Rankine cycle, comparison of Carnot and Rankine cycle, carnot cycle efficiency, variables affecting efficiency of Rankine cycle.	06	15%
6.	**Gas Power Cycles** Carnot, Otto and Diesel cycle, Dual cycle, Comparison of Otto, Diesel and Dual cycles, air standard efficiency, mean effective pressure, brake thermal efficiency, relative efficiency, Brayton cycle.	06	15%
7.	**Properties of gases and gas mixtures** Avogadro's law, equation of state, ideal gas equation, Vander Waal's equation, reduced properties, law of corresponding states, compressibility chart, Gibbs-Dalton law, internal energy; enthalpy and specific heat of a gas mixtures.	06	12%
8.	**Refrigeration and Liquefaction** Carnot refrigeration cycle, air refrigeration cycle, absorption refrigeration, choice of refrigeration,	03	08%

List of Practical/Tutorial:

Sr No	Name of Practical/Tutorial	Hours
1.	To interpret comparison of heat and work and solution of basic numerical on heat and work interaction.	01
2.	To solve numerical on S.F.E.E and its application to engineering devices like boiler, heat exchanger, turbine compressor etc.	02
3.	To understand concept of heat engine, heat pump, refrigerator based on second law of thermodynamics.	01
4.	To solve basic numerical on concept of Entropy.	01
5.	To solve numerical on vapour power cylces.	02
6.	To understand reheat cycle, regenerative cycle, reheat-regenerative cycle, feedwater heaters for rankine cycle.	02
7.	To solve numerical on gas power cycles.	02
8.	To understand effect of reheat, regeneration and intercooling on brayton cycle.	02

Text Books:

Title	Author/s	Publication
Engineering Thermodynamics	P.K. Nag	McGraw-Hill Education

Reference Books:

Title	Author/s	Publication
Fundamentals of Thermodynamics	Borgnakke & Sonntag	Wiley India (P) Ltd.
Thermodynamics - An Engineering Approach	Yunus Cengel & Boles	McGraw-Hill Education
Engineering Thermodynamics	Gordon Rogers and Yon Mayhew,	Pearson Education Ltd.
Engineering Thermodynamics	Jones and Dugan,	PHI Learning Pvt. Ltd

Web Material Links:

http://nptel.ac.in/courses/112105123/1

Course Evaluation:

Theory:

- Continuous Evaluation Consist of Two Tests Each of 15 Marks and 1 Hour of duration.
- Submission of assignment which consists of 5 Questions to be answered under each module and it carries 10 Marks of Evaluation.
- End Semester Examination will consist of 60 Marks Exam..

Tutorial:

- Circuits and charts for gas & vapour power cycle consist of 10 marks.
- Internal Viva component of 10 Marks.
- Viva/Oral performance of 30 Marks during End Semester Exam.

Course Outcomes:

Students will be able to

- interpret basics terms of thermodynamics.
- define and demonstrate laws of thermodynamics and its application.
- interpret differentiate concept of entropy, energy and exergy and their application.
- analyze different gas and vapour power cycles and its applications.
- identify behavior and properties of gases and its mixtures.

P P Savani University
School of Engineering

Department of Mechanical Engineering

Course Code: SEME2020
Course Name: Materials Science & Metallurgy

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
				Theory		Practical		Tutorial		
Theory	Practical	Tutorial	Credit	CE	ESE	CE	ESE	CE	ESE	Total
03	02	00	04	40	60	20	30	--	--	150

CE: Continuous Evaluation, ESE: End Semester Exam

Objectives of the Course:

To help learners to

- identify the different materials and their properties described.
- understand the microstructures, crystallography, defects, and phase diagrams of different materials.
- help the students understand the process involved in mechanical testing of materials and their deformation under certain conditions.
- understand the role of heat treatment to achieve desired variation in properties of materials.

Course Content:			
Section I			
Module	**Content**	**Hours**	**Weightage**
1.	**Introduction to Materials** Classification of Engineering Materials, Engineering requirements of materials, Methods/Tools to reveal the different levels of structure. Defects-Point, Line, Planar; Crystal geometry and Crystal Imperfections: Unit Cell, Crystal structure, Bravise lattice, atomic packing, coordination number, crystal structures of metallic elements, crystal directions and planes, Miller indices, Polymorphism or Allotropy. Crystal structure and correlated properties. diffusion processes, Mechanism of crystallization – nucleation and growth, factors influencing nucleation and growth, Imperfections in crystals and their effect on properties, Solute strengthening	06	12 %
2.	**Phase Diagrams and Phase Transformation** Phase, Gibbs's Phase rule, Solubility and Solid Solutions, Iso-morphous alloy system, Eutectoid and Peritectic system, Evolution of Microstructure, Phase Transformation-Temperature-Time-Transformation (TTT) and Continuous Cooling Transformation (CCT) Diagrams.	06	10 %
3.	**Solidification of Metals** Solidification of metals and an alloy, Nucleation and Growth during freezing of pure metal and alloy ingot/a casting Resultant macrostructures; Effects of Structure on Mechanical Properties, Methods to control the grain structure resulting from solidification, Solidification defects like porosity and shrinkage and remedies. Cooling curve of pure metal and alloy.	05	10 %
4.	**Heat Treatment** Annealing and its types, Normalizing, Aus-tempering, Mar-tempering, Quenching and Temper heat treatment, Hardenability, Applications of above processes for the industrial practices. Surface hardening processes Flame and induction hardening, Carburizing, Nitriding and Carbonitriding, Applications of above processes for the industrial practices.	05	13 %
5.	**Powder Metallurgy** Application and advantages, Production of powder, Compacting, Sintering, Equipment and process capability.	Laboratory	05 %

Section II			
Module	**Content**	**Hours**	**Weightage**
6.	**Cast Iron and Alloy steel** Iron-Iron Carbide and Iron-carbon diagrams, Transformations resulting into White Cast Iron, Grey Cast Iron, Malleable Cast Iron, S. G. Iron, Alloy Cast Iron. Their microstructures and correlated properties and applications, IS Codification, Purpose of alloying, General effect of alloying elements on ferrite, carbide, transformation temperature, hardenability and tempering. Types of steel: Chromium, Manganese, Molybdenum and Manganese steels, IS Codification, Tool Steels Classification, properties, applications and IS and ISO Codification.	09	20 %
7.	**Non-Ferrous Alloys** Non-Ferrous Alloys of Aluminium, Magnesium, Copper, Nickel, Titanium, Microstructure and mechanical property relationships; Composite, Classification, Processing, Metal Matrix	Laboratory	05 %
8.	**Mechanical Behavior of Metals** Properties of metals, Deformation of metals, Mechanisms of deformation, Deformation in polycrystalline materials, Mechanical testing of materials (destructive & nondestructive) testing methods.	07	15 %
9.	**Polymers, Ceramics and Composites** Definition, Classification & characteristics of polymers, Types of polymerization, Polymer processing, polymer matrix, properties and applications Elastomers, Properties of ceramic materials, Cermets, Ceramic Matrix, Ceramics, Alumina, Zirconia, Silicon Carbide, Sialons, Reaction Bonded Silicon Nitride, Processing Composite materials, Fiber reinforced plastic (FRP), Glasses properties and applications.	07	10 %

List of Practical :

Sr No	Name of Practical/Tutorial	Hours
1.	To understand construction and working of metallographic microscope.	02
2.	To study procedure of specimen preparation for microscopic examination and to carry out a specimen preparation.	02
3.	To understand what is micro examination, importance of micro examination and to study various ferrous, non-ferrous microstructures.	02
4.	To show the effect of different quenching media like Oil, Water and Brine on the hardness of medium carbon steel.	02
5.	To find out the effect of varying section size on hardenability of steel and obtain hardness distribution curves of hardened steel cross-section.	02
6.	To determine machine defects by dye -penetrant test and magnetic particle test.	02
7.	To determine the hardenability by Jominy end quench test.	02
8.	Study of different heat treatment processes- annealing, normalizing, hardening and tempering, surface and casehardening to improve properties of steel during processes and applications with the help of muffle furnace.	02

Text Books:

Title	Author/s	Publication
Callister's Material Science and Engineering	R. Balasubramaniam	Wiley India

Reference Books:

Title	Author/s	Publication
Materials Science and Metallurgy	O. P. khanna	Dhanpatrai Publication
Principles of Materials Science and Engineering	W F Smith	McGraw Hill
Elements of Material Science and Engineering	Lawrence H. Van Vlack,	Pearson Education

Web Material Links:

http://nptel.ac.in/downloads/113106032/

Course Evaluation:

Theory:

- Continuous Evaluation Consist of Two Tests Each of 15 Marks and 1 Hour of duration.
- Submission of assignment which consists of 5 Questions to be answered under each module and it carries 10 Marks of Evaluation and Banner preparation.
- End Semester Examination will consist of 60 Marks Exam.

Tutorial:

- Continuous Evaluation Consist of solution of Practical which should be evaluated out of 10 for each Tutorial and average of the same will be converted to 10 Marks.
- Internal Viva component of 10 Marks.
- Performance/Problem solution/quiz/test of 15 Marks during End Semester Exam.
- Viva/Oral performance of 15 Marks during End Semester Exam.

Course Outcomes:

Students will be able to

- interpret important mechanical properties and classification of engineering materials and metals.
- define different heat treatment process used in industrial applications.
- understand the solidification process of metals and alloys.
- analyze different microstructure, crystallography and defects of cast iron and steel specimen.
- identify different destructive & nondestructive testing methods used in the practical field and their applications.
- understand the use powder metallurgy and their application to industries.

P P Savani University
School of Engineering

Department of Civil Engineering

Course Code: SECV2011
Course Name: Strength of Materials
Prerequisite Course: Engineering Mechanics (SECV1030)

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
				Theory		Practical		Tutorial		
Theory	Practical	Tutorial	Credit	CE	ESE	CE	ESE	CE	ESE	Total
3	2	0	4	40	60	20	30	0	0	150

CE: Continuous Evaluation, ESE: End Semester Exam

Objectives of the Course:

To help learners to

- understand the stresses developed under the application of force.
- understand the physical and mechanical properties of materials.
- understand behavior of structural element under the influence of various loads.

Course Content:

Section I

Module	Content	Hours	Weightage
1.	**Introduction to Physical and Mechanical Properties of Material** Introduction, Classification of materials, Properties related to axial, bending, and torsional & shear loading, Toughness, hardness, Ductility, Brittleness. Proof stress, Factor of safety, Working stress, Load factor.	04	8%
2.	**Simple Stress and Strain** Definition of stress and strain, Tensile & compressive Stresses: Shear and complementary shear Strains, Linear, shear, lateral, thermal and volumetric. Hooke's law, Stresses and strain in bars of Varying, Tapering & Composite section, Principle of Superposition, Elastic Constants: Modulus of elasticity, Poisson's ratio, Bulk modulus, Shear modulus (Modulus of rigidity), Modulus of rigidity.	06	12%
3.	**Bending Stress and Strain** Theory of simple bending, assumptions, derivation of flexural formula, second moment of area of common cross sections(rectangular, I,T,C) with respective centroid & parallel axes, bending stress distribution diagrams, moment of resistance & section modulus calculations. Concept, derivation of shear stress distribution formula, shear stress distribution diagrams for common symmetrical sections, maximum and average shears stresses, shear connection between flange & web.	08	20%
4.	**Principal Stress and Strain** Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stress	04	10%

Section II			
5.	**Shear Force and Bending Moment** Introduction, Types of loads, supports and beams, Shear force, Bending Moment, Sign conventions for shear force & Bending moment. Statically determinate beam, support reactions, SFD and BMD for concentrated load and uniformly distributed load, Uniformly varying load, Point of contra-flexure.	12	20%
6.	**Column and Strut** Introduction, Failure of a column and strut, Euler's column theory, Types of end conditions of columns, Columns with both ends hinged, Columns with one end fixed and the other hinged, Euler's formula and Equivalent length of a column, Slenderness Ratio, Limitations of Euler's Formula.	10	18%
7.	**Torsion** Derivation of equation of torsion, Assumptions, application of theory of torsion equation to solid & hollow circular shaft, torsional rigidity, Power Transmitted by shaft, Polar moment of Inertia.	08	12%

List of Practical :

Sr No	Name of Practical/Tutorial	Hours
1.	Tensile test on Ductile materials (Mild steel, Copper, Wood)	04
2.	Tensile test on Brittle Materials (Cast iron, Concrete)	04
3.	Compression test on Ductile materials (Mild steel, Copper, Wood)	04
4.	Compression test on Brittle Materials (Cast iron, Concrete)	04
5.	Determination of hardness of metals (Brinell hardness test)	02
6.	Determination of impact of metals (Izod/Charpy impact test)	02
7.	Tutorials on Principle stress & Principle strain.	04
8.	Tutorials on SFD & BMD.	04
9,	Tutorials on Column & Strut.	02

Text Books:

Title	Author/s	Publication
Strength of Materials (SI Units)	R S Khurmi, N Khurmi	S. Chand & Company Pvt. Ltd.

Reference Books:

Title	Author/s	Publication
Strength of Materials (SI Units)	Er. R . K. Rajput	S. Chand & Company Pvt. Ltd.
Mechanics of Structure-Vol.I	Dr. H.J. Shah & S. B. Junarkar	Charotar Publishing House Pvt. Ltd.
Strength of materials	R. Subramanian	Oxford Publications
Strength of materials	S. Ramamrutham	Dhanpat Rai Publishing Company

Course Evaluation:

Theory:

- Continuous Evaluation Consist of Two Tests Each of 30 Marks and 1 Hour of duration and average of the same will be converted to 30 Marks.
- Submission of assignment which consists of solving numerical and it carries 10 marks of evaluation.
- End semester examination will consist of 60 marks exam

Practical/Tutorial:

- Continuous evaluation consists of performance of practical/tutorial which should be evaluated out of 10 for each practical/tutorial and average of the same will be converted to 10 marks.
- Internal viva component of 10 marks.
- Practical performance/quiz/drawing/test of 15 marks during end semester exam.
- Viva/Oral performance of 15 marks during end semester exam.

Course Outcomes:

After learning the course the students should be able to:

- Understand the physical properties of materials.
- Apply mathematical knowledge to calculate the deformation behavior of simple structure.
- Critically analyze problem and solve the problem related to mechanical elements and analyze the deformation behavior for different types of loads.
- Understand the different types of stresses and strains developed in the member subjected to axial, bending, shear & torsional effects.

P P Savani University
School of Engineering

Department of Mechanical Engineering

Course Code: SEME2030
Course Name: Non cutting Manufacturing Processes

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
				Theory		Practical		Tutorial		
Theory	Practical	Tutorial	Credit	CE	ESE	CE	ESE	CE	ESE	Total
3	2	0	4	40	60	20	30	0	0	150

CE: Continuous Evaluation, ESE: End Semester Exam

Objectives of the Course:

To help learners to

- introduce the students about various manufacturing techniques.
- provide background for higher level subjects in engineering like Production Technology.
- understand the relevance and importance of the Different manufacturing techniques and real life application in industry.

Course Content:

Section I

Module	Content	Hours	Weightage
1.	**Manufacturing Processes** Basic Introduction, Economics and Technological Definition, Importance of Manufacturing, Classification and Selection of Manufacturing Processes.	02	05%
2.	**Patternmaking and Foundry** Patterns, Allowances, Types of patterns, Moulding materials, Moulding sands; properties and sand testing: Grain fineness, moisture content, clay content and permeability test. Core materials and core making, Gating & Riser systems, Spure, Gating, Ration, Cupola, Inspection and Cleaning of casting, Casting defects.	12	25%
3.	**Miscellaneous Casting Process** Shell moulding, Die casting, investment Casting, Carbon dioxide molding process, Centrifugal casting, Slush casting, Continuous casting process, Advanced technologies in casting.	08	20%

Section II			
Module	**Content**	**Hours**	**Weightage**
4.	**Gas Welding** Principles of gas welding, Types of gases used, Types of flames, Welding techniques, Edge preparation, Equipment used, Torch, Regulators, Welding filler rods, Gas cutting, Principles of gas cutting, Position of torch, Soldering, Brazing, Adhesive bonding.	08	18%
5.	**Electric Arc Welding** Principles of electric arc welding, A.C. / D.C. welding, Edge preparation, Equipment used, ISI electrode classification: Designation and selection, Manual metal arc welding, Carbon arc welding, Inert gas shielded arc welding, TIG & MIG, Submerged arc welding, Atomic hydrogen arc welding, Plasma arc welding, Stud arc welding, Arc cutting.	08	18%
6.	**Resistance Welding** Principles of resistance welding, Heat balance, Electrodes, Spot welding, Seam welding, Projection welding, Upset welding, Flash welding, Fusion welding processes: Thermit welding, electro-slag welding, Electron beam and laser beam welding.	07	14%

List of Practical :

Sr No	Name of Practical/Tutorial	Hours
1.	Study of different types of patterns & types of molding methods	02
2.	Design of Gating system & Design of Riser	02
3.	To Find out the Moisture Content, Permeability and Hardness of Moulding Sand	04
4.	Casting Defects, their Causes and Remedies	02
5.	Tutorial on Casting Simulation	04
6.	Study different Welding Processes, Weld Joint Design as per I.S. code and Weld Symbols	04
7.	Gas Welding and Gas Cutting Processes	04
8.	MIG & TIG Welding Process	04
9.	Resistance Welding Process	04

Text Books:

Title	Author/s	Publication
Manufacturing Technology Vol. II	P. N. Rao	Tata McGraw Hill
A Textbook of Production Technology	Sharma P.C.	S. Chand

Reference Books:

Title	Author/s	Publication
Manufacturing Technology - I	Rao	Tata McGraw Hill
A Textbook of Production Engineering	Sharma P.C.	S. Chand
Manufacturing Processes and Systems	Phillip F., Ostwald, Jairo Munoz	Wiley India
Elements of Workshop Technology V. II	Chaudhary	MPP
Manufacturing technology	Rao	Atul
Work shop Technology -1	Hajra	MPP

Web Material Links:

https://nptel.ac.in/courses/112107145

Course Evaluation:

Theory:

- Continuous Evaluation Consist of Two Tests Each of 15 Marks and 1 Hour of duration.
- Submission of assignment which consists of 5 Questions to be answered under each module and it carries 10 Marks of Evaluation and Industry based learning report.
- End Semester Examination will consist of 60 Marks Exam.

Practical/Tutorial:

- Continuous Evaluation Consist of Performance of Practical/Tutorial which should be evaluated out of 10 for each practical/Tutorial and average of the same will be converted to 10 Marks.
- Internal Viva component of 10 Marks.
- Practical performance/quiz/drawing/test of 15 Marks during End Semester Exam.
- Viva/Oral performance of 15 Marks during End Semester Exam.

Course Outcomes:

After learning the course the students should be able to:

- acquire basic knowledge of various casting processes and to analyze casting defects.
- conduct various experiment on manufacturing processes and to automate them.
- understand the different types of welding processes in depth.
- demonstrate an ability to use manufacturing techniques for economic production.
- choose correct manufacturing process for a particular application.

P P Savani University
School of Engineering

Department of Mechanical Engineering

Course Code: SEME2041
Course Name: Machine Drawing
Prerequisite Course: Engineering Graphics (SEME1010)

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
				Theory		Practical		Tutorial		
Theory	Practical	Tutorial	Credit	CE	ESE	CE	ESE	CE	ESE	Total
0	2	0	1	0	0	50	0	0	0	50

CE: Continuous Evaluation, ESE: End Semester Exam

Objectives of the Course:

To help learners to

- Industrial Drawing.
- Machining and Welding Symbols.
- Part and Assembly Drawings.
- Application of Screw threads, Screw Fasteners, Welding and Riveted Joints.

Course Content:			
Section I			
Module	**Content**	**Hours**	**Weightage**
1.	**Machining Symbols and Surface Roughness** Symbols used for machining processes, Symbols used for indication of surface roughness	--	5%
2.	**Limit, Fits and Tolerances** Tolerance, Limits, Allowance, Basic Size, Design Size, Actual Size, Unilateral and Bilateral Tolerance and its representation, Fits and its types(Clearance, Transition and Interference), Introduction of Hole Basic and Shaft Basic Method	--	5%
3.	**Screw Threads** Forms of screw threads, Representation of external and internal thread, Unified thread, Whitworth thread, Seller thread, British Association thread, Square thread, Acme thread, Knuckle thread, Buttress thread, Right and left hand threads	--	15%
4.	**Screwed Fastening** Types of Nuts (Hexagonal, Square, Flanged, Cap, Dome, Capstan, Ring and Wing), Types of Bolt (Hexagonal, Square, Cylindrical, Cup headed, Countersunk headed, Hook, Headless tapered, Eye bolt, Lifting bolt, Stud bolt)	--	15%
5.	**Keys, Cotter and Pin Joint** Key and keyways, Types of Keys (Taper Key, Saddle Key, Round or Pin Key, Gib Head Key, Feather or Parallel Key, Woodruff Key), Cotter and Cotter Joint, Pin Joint or Knuckle Joint	--	10%
Section II			
6.	**Riveted Joints, Welding Joints and Welding Symbols** Riveted Joint, Forms of riveted head (Cup, Pan, Conical, Countersunk, Rounded Countersunk and Ellipsoid), Riveted Lap and Butt Joints, Welding Joints and Symbols (Lap, Butt, Tee, Corner or Edge)	--	15%
7.	**Drafting Software** Introduction of Software, Part Drafting Exercise (2D as well as 3D)	--	35%

List of Practical :

Sr No	Name of Practical/Tutorial	Hours
1.	Sheet of Machining Symbols and Surface Textures	02
2.	Sheet of Types of Screw Threads	02
3.	Drafting Exercise of Types of Nuts and Bolts	04
4.	Sheet of Types of Keys, Cotter and Knuckle Joint	04
5.	Sheet of Types of Riveted Joints, Welding Joints and Welding Symbols	02
6.	Sheet of Plummer Block or Pedestal Bearing	02
7.	Drafting Exercise of Part in Drafting software	14

Text Books:

Title	Author/s	Publication
Machine Drawing	N. D. Bhatt, V. M. Panchal	Charotar Publishing House Pvt. Ltd.
Machine Drawing	N. Sidheshwar, P. Kannaiah, V. V. S. Sastry	Tata McGraw Hill Publication

Web Material Links:

http://nptel.ac.in/syllabus/112106075/

Course Evaluation:

Practical/Tutorial:

- Continuous Evaluation Consist of Performance of Practical/Tutorial (Drawing Sheets) which should be evaluated out of 10 for each practical/Tutorial and average of the same will be converted to 15 Marks.
- Internal Viva component of 10 Marks.
- Practical performance/quiz/drawing/test of 15 Marks during End Semester Exam.
- Viva/Oral performance of 10 Marks during End Semester Exam.

Course Outcomes:

After learning the course the students should be able to:

- interpret Industrial Drawings.
- interpret Machining and Welding Symbols.
- interpret Part and Assembly Drawings.
- select Screw Threads, Screw Fasteners, Welding and Riveted Joints.

P P Savani University
School of Engineering

Centre for Skill Enhancement & Professional Development

Course Code: SEPD2010
Course Name: Critical Thinking, Creativity and Decision Making

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
				Theory		Practical		Tutorial		
Theory	Practical	Tutorial	Credit	CE	ESE	CE	ESE	CE	ESE	Total
02	00	00	02	40	60	--	--	--	--	100

CE: Continuous Evaluation, ESE: End Semester Exam

Objectives of the Course:

To help learners to

- develop a familiarity with the mechanics of critical thinking and logic.
- understand basic concepts of critical and creative thinking.
- explore and understand critical thinking for the purpose of creativity in context of professional, social and personal spectrum.
- explore an application critical thinking and creativity in personal, social, academic, global and profession life.
- understand Decision making as a skill to be learned through critical thinking.

Course Content:

Section I

Module	Content	Hours	Weightage
1.	**Introduction to Critical Thinking** • Concept and meaning of Critical Thinking • Significance of Critical Thinking in personal, social and professional life • Thinking with arguments, evidences and language	06	20 %
2.	**Applied Critical Thinking** • Inductive and Deductive Thinking • Questioning for Generating Ideas	06	20 %
3.	**Conceptual Thinking** • Second order thinking • Three step technique • Synthesizing	06	20 %

Section II			
Module	**Content**	**Hours**	**Weightage**
4.	**Creative Thinking and Decision Making** • Problem Solving • Adapting Various Structures of Decision Making	06	20 %
5.	**Moral Thinking** • Generating and structuring ideas • Designing and Evaluating the solutions • Case Study	06	20 %

Text Books:

Title	Author/s	Publication
Thinking Skills for Professionals	B. Greetham, Palgrave	Macmillan, 2010

Reference Books:

Title	Author/s	Publication
An Introduction to Critical Thinking and Creativity: Think More, Think Better	J. Y. F. Lau	John Wiley & Sons., New hercy
Critical Thinking: A Beginner's Guide to Critical Thinking, Better Decision Making and Problem Solving	Jennifer Wilson	CreateSpace Independent Publishing Platform, 2017
Creativity and Critical Thinking	edited by Steve Padget	Routledge 2013

Course Evaluation:

Practical/Tutorial:

- Continuous Evaluation Consist of Two Tests Each of 15 Marks and 1 Hour of duration.
- Submission of assignment which consists of 5 Questions to be answered under each module and it carries 10 Marks of Evaluation.
- End Semester Examination will consist of 60 Marks Exam.

Course Outcomes:

Students will be able to :

- Comprehend the concept and application of critical thinking as well as its applications.
- Understand the critical thinking in context of creativity, logical arguments, moral reasoning.
- Understand the application of critical thinking for social, academic, global and professional spectrum.
- Correlate their thinking skills for better productivity and outcome based tasks.
- Be in a better position to apply 360o analysis of the situation for decision making.

P P Savani University
School of Engineering

Department of Science & Humanities

Course Code: SESH2022
Course Name: Numerical & Statistical Analysis
Prerequisite Course/s: SESH1020-Linear Algebra & Vector Calculus, SESH2011-Differential Equations/ SESH2031-Differential Methods for Chemical Engineers

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
				Theory		Practical		Tutorial		
Theory	Practical	Tutorial	Credit	CE	ESE	CE	ESE	CE	ESE	Total
3	-	2	5	40	60	-	-	50	0	150

CE: Continuous Evaluation, ESE: End Semester Exam

Objectives of the Course:

To help learners to

- provide with the knowledge of numerical analysis & statistical methods to the students.
- mentally prepare the students to identify and formulate the engineering problem and obtain their solution.
- inculcate the analytical skills to apply the Numerical & Statistical techniques to the problems of respective field.

Course Content:

Section I

Module	Content	Hours	Weightage
1.	**Complex Variables** Complex numbers with operators and geometric representation, Analytic function, Derivative of complex function, Cauchy-Riemann equation, Trigonometric and Hyperbolic functions, Complex Integration, Conformal Mapping, Linear functional transformations, Cauchy's Integral, Calculation of residue	10	20 %
2.	**Numerical Solutions of Linear and Non-linear Equations** Errors and Their computations, General error formula, Bisection Method, Iteration Method, Newton-Raphson Method, Solution of system of non-linear equation, Solution of linear system, Gauss Elimination	6	13 %
3.	**Numerical Differentiation and Integration** Interpolation, Finite Differences, Error in numerical differentiation, Cubic Splines Method, Differentiation Formulae, Numerical solution of ODEs, Picard's Method, Euler's Method, Runge-Kutta Method, Numerical Integration, Trapezoidal Rule, Simpson's 1/3-rule, Simpson's 3/8-rule, Euler-Maclaurin Formulae	7	17 %

Section II			
Module	**Content**	**Hours**	**Weightage**
4.	**Basics of Statistics** Elements, Variables, Observations, Quantitative and Qualitative data, Corss-sectional and Time series data, Frequency distribution, Dot plot, Histogram, Cumulative distribution, Measure of location, Mean, Median, Mode, Percentile, Quartile, Measure of variability, Range, Interquartile Range, Variance, Standard Deviation, Coefficient of Variation, Regression Analysis, Regression line and regression coefficient, Karl Pearson's method.	7	15 %
5.	**Probability Distribution** Introduction, Conditional probability, Independent events, independent experiments, Theorem of total probability and Bayes' theorem, Probability distribution, Binomial distribution, Poisson distribution, Uniform distribution, Normal distribution.	8	18 %
6.	**Testing of Hypothesis** Introduction, Sampling, Tests of significance for parametric test, Null Hypothesis, Type 1 and Type 2 errors, Level of significance, Chi-square test, Student's t-test, Seducer's f-test	7	17 %

List of Practical :

Sr No	Name of Practical/Tutorial	Hours
1.	Complex Variables-1	4
2.	Complex Variables-2	2
3.	Numerical Solutions of Linear and Non-linear Equations-1	2
4.	Numerical Solutions of Linear and Non-linear Equations-2	4
5.	Numerical Differentiation and Integration-1	2
6.	Numerical Differentiation and Integration-2	2
7.	Basics of Statistics-1	2
8.	Basics of Statistics-2	4
9.	Probability-1	2
10.	Probability-2	2
11.	Testing of Hypothesis-1	2
12.	Testing of Hypothesis-2	2

Text Books:

Title	Author/s	Publication
Advanced Engineering Mathematics	Erwin Kreyszig	Wiley India Pvt. Ltd., New Delhi.
Probability and Statistics for Engineers	Richard A. Johnson Irwin Miller, John Freund	Pearson India Education Services Pvt. Ltd., Noida.

Reference Books:

Title	Author/s	Publication
Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers, New Delhi
Advanced Engineering Mathematics	R. K. Jain, S. R. K. Iyengar	Narosa Publishing House, New Delhi
Introductory Methods of Numerical Analysis	S. S. Sastry	PHI Learning Pvt. Ltd. New Delhi.

Web Material Links:

1) http://nptel.ac.in/courses/111106094/
2) http://nptel.ac.in/courses/111106084/
3) http://nptel.ac.in/courses/111105035/
4) http://nptel.ac.in/courses/111101003/
5) http://nptel.ac.in/courses/111105090/

Course Evaluation:

Theory:

- Continuous evaluation consists of two tests each of 15 Marks and 1 Hour of duration.
- Submission of assignments which consists of 10 Questions to be answered under each module and it carries 10 Marks of continuous evaluation.
- End Semester Examination will consist of 60 Marks.

Tutorial:

- Continuous evaluation consists of performance of tutorial which should be evaluated out of 10 Marks for each tutorial and average of the same will be converted to 30 Marks.
- MCQ based examination of 10 Marks.
- Internal Viva of 10 Marks.

Course Outcomes:

Students will be able to

- derive numerical solution of linear and non-linear system of equation.
- acquire knowledge of finite differences, interpolation, numerical differentiation and numerical integration.
- select appropriate method to collect data and construct, compare, interpret and evaluate data by different statistical methods.
- apply concept of probability in decision making, artificial intelligence, machine learning etc.

P P Savani University
School of Engineering

Department of Mechanical Engineering

Course Code: SEME2050
Course Name: Forming and Machining Processes

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
				Theory		Practical		Tutorial		
Theory	Practical	Tutorial	Credit	CE	ESE	CE	ESE	CE	ESE	Total
3	2	0	4	40	60	20	30	0	0	150

CE: Continuous Evaluation, ESE: End Semester Exam

Objectives of the Course:

To help learners to

- understand the basic operation involved in various machines.
- understand the machining science using conventional machines.

Course Content:

Section I

Module	Content	Hours	Weightage
1.	**Mechanical working of Metals** Introduction, Classification of Forming Processes, Mechanics of Metal Working, Various Temperatures in Metal Working, Cold and Hot Working, Formability, Strain Rate Effects on metal forming, Effects of Metallurgical Structure on Metal Forming, Hydro Static Pressure, Residual Stresses.	07	16%
2.	**Metal Rolling** Introduction and classification of Rolling processes, Principles of Metal Rolling, Simplified Analysis of Rolling Load, Various Rolling Parameters, Defects in rolled products and remedies of it.	03	07%
3.	**Forging** Introduction and classification of Forging Processes, Various Forging operations, Forging Die Materials and Lubrication, Forge ability, Forging, Defects and remedies.	04	08%
4.	**Extrusion** Introduction and classification of Extrusion Processes, Various Extrusion Operations, Metal Deformation and Forces in Extrusion. Materials and Lubrication considerations in Extrusion Process, Extrusion Defects, Extrusion of Tubing, Production of Seamless Pipe and Tubing. Drawing of Rods, Wires and Tubes, Sizing.	05	12%
5.	**Press Working and Dies** Types of presses drive and feed mechanisms, press tools. Various press working operations and its parameters, Elements of press, Various Metal Forming Operations. Stock strip layout, study of sheet metal nesting software.	03	07%

Section II			
Module	**Content**	**Hours**	**Weightage**
6.	**Turning Machine** Engine Lathes, Construction, Arrangement and Principle, Units of engine lathes, Type and size range of engine lathes; Operations carried on engine lathe, Attachment extending the processing capacities of engine lathes; Description of other types of lathes, Plain turning lathes, Facing lathes, Multiple tool lathes; Simple purpose lathes, Turret lathes, Horizontal and Vertical lathes.	08	18%
7.	**Drilling and Boring Machines** Purpose and field of application of drilling and boring machines. Upright drill processes, radial drills, Horizontal and Precision Boring Machines.	03	07%
8.	**Milling Machines** Purpose and types of milling machines, general purpose milling machines. Different types of milling operations. Milling cutters, attachments extending the processing capabilities of general purpose milling machines.	04	08%
9.	**Planers, Shapers and Slotters** Classification, Attachments extending the processing capacities of each.	03	07%
10.	**Sawing and Broaching Machines** Metal sawing – classification; Reciprocating sawing machines, Circular sawing machines, Band sawing machines. Types of broaching machines, Advantages and Limitations of Broaching.	02	04%
11.	**Grinding Machines and Abrasives** Classifications of grinding machines, Cylindrical grinders, Internal grinders, Surface grinders, Tool and Cutter grinders. Surface finishing, Abrasives, Manufacture of grinding wheels.	03	07%

List of Practical :

Sr No	Name of Practical/Tutorial	Hours
1.	Rolling Operation Using Three Roller Bending Machine	02
2.	Forging Operation	02
3.	Bending Operation Using Hydraulic Pipe Bender	02
4.	Press and Press Working Operations	04
5.	Turning practices for Step turning and thread cutting	06
6.	Capstan and Turret Lathe	02
7.	Spur Gear Cutting on Milling Machine	04
8.	Planers, Shapers and Slotters Machine	04
9.	Drilling machine	02
10.	Grinding machine	02

Text Books:

Title	Author/s	Publication
Manufacturing Processes vol I	O.P. Khanna	Dhanpatrai Publication
Workshop Technology Vol. I, II & III	WAJ Chapman	Elseveir

Reference Books:

Title	Author/s	Publication
Workshop Technology Vol. II	Hajra & Choudhari	Media promoters & publishers pvt. Ltd.
Metal Cutting Principles, 2E	Shaw	Oxford
A Textbook of Production Technology	Sharma P.C.	S Chand

Web Material Links:

https://nptel.ac.in/courses/112107145

Course Evaluation:

Theory:

- Continuous Evaluation Consist of Two Tests Each of 15 Marks and 1 Hour of duration.
- Submission of assignment which consists of 5 Questions to be answered under each module and it carries 10 Marks of Evaluation and Industry based learning report.
- End Semester Examination will consist of 60 Marks Exam.

Practical/Tutorial:

- Continuous Evaluation Consist of Performance of Practical/Tutorial which should be evaluated out of 10 for each practical/Tutorial and average of the same will be converted to 10 Marks.
- Internal Viva component of 10 Marks.
- Practical performance/quiz/drawing/test of 15 Marks during End Semester Exam.
- Viva/Oral performance of 15 Marks during End Semester Exam.

Course Outcomes:

After learning the course, the students will be able to:

- understand metal forming processes like forging, drawing, rolling, extrusion, and deep drawing.
- understand the basic concept of machining operations of different machines.
- analyze any conventional machining processes.
- identify and suggest correct manufacturing process for particular application.
- generate the sequence of machining operation to produce the end product.
- judge the limitations and scope of machines to perform variety of operations.
- understand metal forming processes like forging, drawing, rolling, extrusion, and deep drawing.

P P Savani University
School of Engineering

Department of Mechanical Engineering

Course Code: SEME2060
Course Name: Fluid Mechanics

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
				Theory		Practical		Tutorial		
Theory	Practical	Tutorial	Credit	CE	ESE	CE	ESE	CE	ESE	Total
3	2	0	4	40	60	20	30	0	0	150

CE: Continuous Evaluation, ESE: End Semester Exam

Objectives of the Course:

To help learners to

- understand basic fundamentals of Fluid Mechanics, which is used in the applications of Aerodynamics, Hydraulics, Marine Engineering, Gas dynamics etc.
- learn Fluid Properties.
- understand the importance of flow measurement and its applications in Industries and to obtain the loss of flow in a flow system.

Course Content:

Section I

Module	Content	Hours	Weightage
1.	**Properties of Fluids** Density, Viscosity, Surface Tension, Compressibility, Capillary, Vapour Pressure, Bulk Modulus, Cavitation, Classification of Fluids	02	5%
2.	**Fluid Statics** Force and Pressure, Pascal's law of Pressure at a point, Pressure measurement by Manometers – U tube, Inclined U tube and Differential, Centre of Pressure, Hydrostatic forces on surface – Vertical, Horizontal and Inclined, Forces on curved Surfaces, Buoyancy and Buoyant Force, Centre of Buoyancy and Meta Centre, Determination of Metacentric Height, Stability of Floating and Submerged Body, Position of metacenter relative to Centre of buoyancy.	07	15%
3.	**Fluid Kinematics** Steady and Unsteady Flow, One – two and three Dimensional Flow, Uniform and Non Uniform Flow, Rotational and Irrotational Flow, Stream Lines and Stream Function, Velocity Potential Function, Relation between stream and velocity potential function, Flow nets, Continuity Equation for 2D and 3D flow in Cartesian co-ordinates system	07	15%
4.	**Fluid Dynamics** Newton's law of motion, Euler's Equation and its applications, Bernoulli's Equation and its applications, Momentum Equation, Pitot Tube, Determination of volumetric flow with pitot tube, Principle of Venturimeter, Pipe Orifice and Rotameter.	06	15%

Section II			
Module	**Content**	**Hours**	**Weightage**
5.	**Dimensional Analysis** Dimensions, Dimensional Homogeneity, Raleigh and Buckingham π Theorem, Non Dimensional Numbers, Similarities – Geometrical, Kinematics and Dynamic.	05	10%
6.	**Flow Through Pipes** Major and Minor Losses in Pipes, Losses in Pipe Fittings, Hydraulic Gradient line and Total energy line, Equivalent Pipes, Pipes in series and parallel, Siphon, Power transmission through pipe, Moody's Diagram, Dracy Weishbach Equation.	05	10%
7.	**Flow Through Open Channels** Types of open channel flow, Specific Energy and Specific Force, Critical Flow, Hydraulic Jump, Measurement of Discharge in open Channels.	05	10%
8.	**Viscous Flow** Reynolds number and Reynolds experiment, flow of viscous fluid through circular pipe- Hagen Poiseuille formula, Flow of viscous fluid between two parallel fixed plates, power absorbed in viscous flow through - journal, foot step and collar bearing, measurement of viscosity.	04	10%
9.	**Boundary Layer Theory** Concept of Boundary Layer, Boundary layer Thickness, Momentum Thickness, Displacement Thickness, Drag and Lift, Separation of Boundary layer, Streamlined and Bluffed Bodies.	04	10%

List of Practical :

Sr No	Name of Practical/Tutorial	Hours
1.	Determine metacentric height of floating body.	02
2.	Measurement of pressure using different types of manometers.	02
3.	Determine Co-efficient of Discharge by venturimeter, Orificemeter and Rotameter.	02
4.	Verification of Bernoulli's apparatus.	02
5.	Measurement of velocity of flow using Pitot tube.	02
6.	Measurement of Friction factor for Different pipes.	02
7.	Measurement of viscosity using Redwood Viscometer.	02
8.	Determine discharge through triangular notch.	02
9.	Determine discharge through trapezoidal notch.	02
10.	Determine discharge through rectangular notch.	02
11.	Determine different flow patterns by Reynolds's apparatus.	02

Text Books:

Title	Author/s	Publication
Textbook of Fluid Mechanics and Hydraulic Ma-chines	R. K. Bansal	Laxmi Publications
Introduction to Fluid Mechanics and Fluid Ma-chines	S.K.Som & Biswas.G	Tata McGraw Hill Publication

Reference Books:

Title	Author/s	Publication
Fluid Mechanics	Frank M. White	Tata McGraw Hill Publication
Fluid Mechanics	R.K.Rajput	Schand Publication

Web Material Links:

http://nptel.ac.in/courses/112105171/1

Course Evaluation:

Theory:

- Continuous Evaluation Consist of Two Tests Each of 15 Marks and 1 Hour of duration.
- Submission of assignment which consists of 5 Questions to be answered under each module and it carries 10 Marks of Evaluation and Industry based learning report.
- End Semester Examination will consist of 60 Marks Exam.

Practical/Tutorial:

- Continuous Evaluation Consist of Performance of Practical/Tutorial which should be evaluated out of 10 for each practical/Tutorial and average of the same will be converted to 15 Marks.
- Internal Viva component of 10 Marks.
- Practical performance/quiz/drawing/test of 15 Marks during End Semester Exam.
- Viva/Oral performance of 10 Marks during End Semester Exam.

Course Outcomes:

After learning the course, the students will be able to:

- understand fundamentals of fluids.
- analyze various flow problems and flow characteristics.
- determine major and minor losses through different pipes.
- apply the concept of fluid mechanics to design various system.

P P Savani University
School of Engineering

Department of Mechanical Engineering

Course Code: SEME2070
Course Name: Mechanical Measurement and Metrology

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
				Theory		Practical		Tutorial		
Theory	Practical	Tutorial	Credit	CE	ESE	CE	ESE	CE	ESE	Total
3	2	0	4	40	60	20	30	0	0	150

CE: Continuous Evaluation, ESE: End Semester Exam

Objectives of the Course:

To help learners to

- know various types and methods of measurement.
- assess the suitability of measuring instruments.
- describe the basic concepts of metrology.
- Know how to operate different types of mechanical measuring instruments.
- explain the different instruments used in industry.
- evaluate quality of surface produced using various methods of measurements.

Course Content:			
Section I			
Module	**Content**	**Hours**	**Weightage**
1.	**Principles of Metrology** Concept of Metrology, Need for inspection, Linearity, Repeatability, Sensitivity and readability, Precision & Accuracy, Standards of measurements.	02	05%
2.	**Screw threads and gear Metrology** Measurement of Screw thread: Screw terminology, Errors in threads, measuring elements of the internal and external threads. Measurement of Gear: Introduction and Classification of gears, Forms of gear teeth, Gear tooth terminology, Measurement and testing of spur gear: Various methods of measuring tooth thickness, tooth profile and pitch, Gear Errors.	08	15%
3.	**Surface Roughness Metrology** Introduction, Surface Texture, Methods of Measuring Surface finish, Comparison Methods and Direct Instrument Measurement, Sample Length, Numerical Evaluation of Surface Texture, Indication of Surface roughness Symbols used, Adverse effects of poor surface finish	04	09%
4.	**Fluid Dynamics** Newton's law of motion, Euler's Equation and its applications, Bernoulli's Equation and its applications, Momentum Equation, Pitot Tube, Determination of volumetric flow with pitot tube, Principle of Venturimeter, Pipe Orifice and Rotameter.	05	12%
5.	**Miscellaneous Metrology** Measurement of Force, Torque, Power, Measurement of displacement, Velocity and Acceleration, Measurement of Speed and Frequency	04	09%
Section II			
6.	**Measurement Concept** Economics of measurement, Need of mechanical measurement, Basic definitions: Hysteresis, Linearity, Resolution of measuring instruments, Threshold, Drift, Zero stability, loading effect and system response. Source of Errors and their classification. Methods of measurement and performance characteristics	04	09%
7.	**Linear Measurements** Precision and Non-precision linear Measurements, Vernier caliper, Micrometer, Use of End standard – Slip Gauge, Indian standard on Slip gauge, Care and use of slip gauge for workshop and inspection purpose, Telescopic gauge, Comparators.	06	14%
8.	**Angular and Taper Measurements** Introduction; Working principle and construction of Angular Measuring instruments like Protractors, Sine bars, Sine Centre, Angle gauges, Spirit level, Clinometers, Angle dekkor, Taper Measuring Instruments: Measurement of taper shafts and holes	04	09%
9.	**Temperature measurement** Temperature scales, Temperature measuring devices, Methods of Temperature Measurement, Expansion Thermometers; Filled System thermometers; Electrical Temperature Measuring Instrument, Pyrometers; Calibration of Temperature Measuring Instruments.	04	09%
10.	**Inspection Technologies** History of Coordinate Measuring Machines, Important feature of CMM, CMM construction, CMM Operation and Programming, Performance of CMM, Possible causes of errors in CMM, Trigger type and Measuring type probes in computer controlled CMM, Accuracy Specification for CMM, Calibration of CMM, CMM Applications and Benefits, Roll of computer in field of Metrology	04	09%

List of Practical :

Sr No	Name of Practical/Tutorial	Hours
1.	Study of various instrument characteristics	02
2.	Study, Use and calibration of Linear Measuring Instruments	08
3.	Study and use of slip gauge	02
4.	Study of angle measurement using (a) Bevel Protractor (b) Combination Set and (c) Sine Bar	08
5.	Study of Temperature Measurement	02
6.	Study of Surface Roughness Tester	02
7.	Study of Gear Tooth Measurement	02
8.	Study Strain gauge Transducer	04
9.	Study of Coordinate Measuring Machines (CMM) (Industrial Visit)	-

Text Books:

Title	Author/s	Publication
Textbook Of Metrology	M. Mahajan	Dhanpat rai & Co.
Mechanical Measurements & Control	D. S. Kumar	Metropolitan books co pvt ltd

Reference Books:

Title	Author/s	Publication
Mechanical Measurement and Metrology	R K Jain	Khanna Publisher
Mechanical Measurements and Instru-mentations	R K Rajput	Kataria Publication
Mechanical Measurements	Beckwith & Buck	Narosa publishing House
Metrology and Measurement	Anand Bewoor & Vinay Kul-karni	McGraw-Hill

Web Material Links:

http://nptel.ac.in/courses/112106179

Course Evaluation:

Theory:

- Continuous Evaluation Consist of Two Tests Each of 15 Marks and 1 Hour of duration.
- Submission of assignment which consists of 5 Questions to be answered under each module and it carries 10 Marks of Evaluation (Banner or Presentation on modern measuring Instruments).
- End Semester Examination will consist of 60 Marks Exam.

Practical/Tutorial:

- Continuous Evaluation Consist of Performance of Practical/Tutorial which should be evaluated out of 10 for each practical/Tutorial and average of the same will be converted to 10 Marks.
- Internal Viva component of 10 Marks.
- Practical performance/quiz/drawing/test of 15 Marks during End Semester Exam.
- Viva/Oral performance of 15 Marks during End Semester Exam.

Course Outcomes:

After learning the course, the students will be able to:

- describe basic concepts of Metrology
- select linear measuring instrument for measurement of various components
- select angular and taper measurement devices for measurement of various components
- distinguish between various screws by measuring their dimensions
- understand different gears through measurement of various dimensions of gears
- measure surface finish of the component produced
- describe basic concepts of mechanical measurement and errors in measurements.
- select appropriate temperature measuring device for various applications
- describe methods of measurement for various quantities like force, torque, power, displacement, velocity and acceleration.
- use Coordinate Measuring Machines (CMM) in industry.

P P Savani University
School of Engineering

Department of Mechanical Engineering

Course Code: SEME2081
Course Name: Kinematics of Machinery
Prerequisite Course: Engineering Mechanics (SECV1030)

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
				Theory		Practical		Tutorial		
Theory	Practical	Tutorial	Credit	CE	ESE	CE	ESE	CE	ESE	Total
4	0	1	4	40	60	0	0	50	0	150

CE: Continuous Evaluation, ESE: End Semester Exam

Objectives of the Course:

To help learners to

- basics types of mechanism, degree of freedom, joints.
- about velocity and acceleration analysis for different mechanism.
- about kinematic analysis of cam and follower motion.
- about types of belts, ropes, chain and gears drives and its applications.

Course Content:

Section I

Module	Content	Hours	Weightage
1.	**Basics of Mechanisms** Introduction, Mechanism and machine, Rigid and resistant body, Link, Kinematic pair, Types of motion, Degrees of freedom (mobility), Classification of kinematic pairs, Kinematic chain, Linkage, Mechanisms, Kinematic inversion, Inversions of slider crank chain, Double slider-crank chain, Quick return mechanism, Limiting Positions and Mechanical Advantage.	06	10%
2.	**Velocity Analysis** Vectors, Displacement of a rigid body, Relative displacement, Definition of velocity, Angular velocity, Rotation of a rigid body, Translation and rotation of a rigid body, Relative velocity method (graphical and analytical), Instantaneous axes of motion, Properties of instantaneous centers, The Aronhold - Kennedy theorem of three centers, Velocity analysis by instantaneous centers. The line-of-centers method, Velocity analysis by components, Velocity images, Velocity diagrams.	11	20%
3.	**Acceleration Analysis** Definition of acceleration, Angular acceleration, A general case of acceleration, Radial and transverse components of acceleration, The coriolis component of acceleration, Examples of acceleration analysis, Acceleration diagrams	13	20%

Section I			
Module	**Content**	**Hours**	**Weightage**
4.	**Kinematics Of Belts, Ropes And Chain Drives** Introduction, Belt and rope drives, Open and crossed belt drives, Velocity ratio, Slip, Materials for belt and ropes, Law of belting, Length of belt, Ratio of friction tensions, Power transmitted, Centrifugal effect on belts, Maximum power transmitted by a belt, Initial tension, Creep, Chains, Chain length, Angular speed ratio, Classification of chains.	06	10%
5.	**Kinematics Of Gears** Introduction, Classification of gears, Gear terminology, Law of gearing, Velocity of sliding, Forms of teeth, Cycloidal profile teeth, Involute profile Teeth, Comparison of Cycloidal and involute tooth forms, Path of contact, Arc of contact, number of pairs of teeth in contact, Interference in involute gears, Minimum number of teeth, Interference between rack and pinion, Undercutting, Introduction to helical, Spiral, Worm, Worm gear and bevel gears.	13	20%
6.	**Kinematics Of Cams** Introduction, Types of cams, Types of followers, Cam terminology, Displacement diagrams, Motions of the follower, Graphical construction of cam profile.	11	20%

List of Tutorials:

Sr No	Name of Practical/Tutorial	Hours
1.	Velocity diagram using Instantaneous center method	03
2.	Velocity and acceleration analysis of simple mechanism	02
3.	Velocity and acceleration analysis of mechanism involving coriolis component	02
4.	Layout of cam profile for reciprocating knife edge follower	02
5.	Layout of cam profile for offset reciprocating roller follower	02
6.	Layout of cam profile for flat faced reciprocating follower	02

Text Books:

Title	Author/s	Publication
Theory of Machines	S. S. Rattan	Tata McGraw Hill Education
Theory of Machines and Mech-anisms	John J. Uicker, Gordon R. Pennock, Jo-seph E. Shigley	Oxford University Press

Reference Books:

Title	Author/s	Publication
Mechanism and Machine Theory	J.S Rao, R.V Dukkipati	Wiley Eastern Ltd.
Theory of Mechanism and Machine	Ghosh A., Malick A.K	East-West Pvt. Ltd.

Web Material Links:

http://nptel.ac.in/courses/112104121/1

Course Evaluation:

Theory:

- Continuous Evaluation Consist of Two Tests Each of 15 Marks and 1 Hour of duration.
- Submission of assignment which consists of 5 Questions to be answered under each module and it carries 10 Marks of Evaluation and model preparation for different mechanism.
- End Semester Examination will consist of 60 Marks Exam.

Practical/Tutorial:

- Continuous Evaluation Consist of Performance of Practical/Tutorial which should be evaluated out of 10 for each practical/Tutorial and average of the same will be converted to 10 Marks.
- Internal Viva component of 20 Marks.
- Model of any mechanism having weightage of 10 marks.
- Problem Solution/Quiz of 10 Marks during End Semester Exam.

Course Outcomes:

- After learning the course, the students should be able to
- demonstrate an understanding of the concepts of various mechanisms and pairs.
- do velocity and acceleration analysis of different mechanism.
- design a layout of cam and follower for specific motion.
- demonstrate an understanding of principle of gears.

P P Savani University
School of Engineering

Department of Applied Sciences & Humanities

Course Code: SESH2211
Course Name: Basics of Electrical & Electronics
Prerequisite Course: Basic of electronics/Physics (SESH1210)

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
				Theory		Practical		Tutorial		
Theory	Practical	Tutorial	Credit	CE	ESE	CE	ESE	CE	ESE	Total
0	2	0	1	00	00	50	00	00	00	50

CE: Continuous Evaluation, ESE: End Semester Exam

Objectives of the Course:

To help learners to

- understand basic fundamental electronic circuit.
- learn to use common electronic instrumentation.
- explain the construction and application of standard circuit configurations and identify the component types and connections used to build functioning electronic circuits.
- understand components of instruments, terminology and applications.

Course Content:

Section I

Module	Content	Hours	Weightage
1.	**Introduction to Electrical Instrument** Multimeter-Application, Sensitivity, Merits And Demerits. Cathode Ray Oscilloscope-Working, Application, Understanding Different Type Of Waveforms Formed On Cro. Understanding The Bread Board Connection. Electrical Component, Lamped Circuit Element-Classification Of Resistors, Carbon Color Coded Resistance, Capacitor, Inductor Kirchhoff's Laws	10	15%
2.	**Three phase ac circuit** Advantage, generation, phase sequence, balance load, relationship between line and phase value, power measurement in balanced three phase circuit.	10	20%
3.	**Electrical safety** Electrical wiring, Different type of wiring system, Safety precaution in handling electrical appliances, Cause of electric shock, Types of earthing, Circuit protection device, Earthing, Difference between Fuse and MCB.	10	15%

Section II			
Module	**Content**	**Hours**	**Weightage**
1.	**Logic Gates & Family** Classification of logic gates and ICs (74XX), symbols and truth table verification of basic logic gates, multiple input basic logic gates, Universal gates, Implementation of different Boolean functions using various gates.	15	25%
2.	**PCB Designing** Drawing and printing layout on board, photo etching process, masking process, PCB manufacturing techniques, Software	15	25%

List of Practical/Exercise:

Sr No	Name of Practical/Tutorial	Hours
1.	Identify various tools used for wiring	04
2.	Identify the symbols used in electrical circuit diagrams	04
3.	Verification of truth tables of all logic gates	04
4.	Verification of De Morgan's theorem, the postulates of Boolean algebra and Realiza-tion of Sum of Product and Product of Sum expression using universal gates	08
5.	Implementation of the given Boolean function using logic gates	04
6.	Understanding Electricity lab	04
7.	Understanding the breadboard connection.	04
8.	Understanding seven segment led using bread board	04
9.	Understanding Network Theorem	04
10.	Study full wave & Half wave rectifier	04
11.	To Study and calculate Ripple factor and efficiency of various Rectifier	06
12.	PCB design of a small circuit with its layout using tapes & etching in the lab	10

Text Books:

Title	Author/s	Publication
Making Printed Circuit Boards	Jan Axelsen	Mc GrawHill
Fundamentals of Digital Circuits	A.Anand Kumar	Prentice-hall of India Pvt. Ltd
Electronics Instrumentation	H S Kalsi	TMH

Reference Books:

Title	Author/s	Publication
Digital Electronics and Circuit design	Malvino & Leach	TMN
Everyday Electronics Data Book	Mike Tooley	B P B
Electrical Technology	B.L.Theraja	S.Chand

Web Material Links:

- https://nptel.ac.in/courses/108108076/
- http://www.nptelvideos.in/2012/11/basic-electronics-prof-tsnatarajan.html
- http://vlab.co.in/

Course Evaluation:

Theory:

- Continuous evaluation consists of two tests each of 15 marks and 1 hour of duration.
- Submission of assignment which consists of 5 questions from each module and it carries 10 marks of evaluation.
- End semester examination will consist of 60 marks.

Practical/Tutorial:

- Continuous evaluation consist of performance of practical and noted the same in manual and record book which should be evaluated out of 10 for each practical and average of the same will be converted to 10 marks.
- Internal viva component of 10 marks.
- Practical performance/quiz/drawing/test of 15marks during end semester exam.
- Viva/Oral performance of 15marks during end semester exam.

Course Outcomes:

After learning the course, the students should be able to

- to use the techniques, skills and modern engineering tools necessary for engineering practice
- identify and understand importance of various electrical and electronics components.
- acquire knowledge about analog and digital communication.
- develop the idea of identifying, analyzing and designing combinational circuits.

P P Savani University
School of Engineering

Centre for Skill Enhancement & Professional Development

Course Code: SEPD2020
Course Name: Values and Ethics

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
				Theory		Practical		Tutorial		
Theory	Practical	Tutorial	Credit	CE	ESE	CE	ESE	CE	ESE	Total
02	00	00	02	40	60	--	--	--	--	100

CE: Continuous Evaluation, ESE: End Semester Exam

Objectives of the Course:

To help learners to

- develop a familiarity with the mechanics of values and ethics.
- understand basic concepts of values and ethics.
- explore and understand values, ethics in context of professional, social and persona spectrum.
- explore an understand values, ethics in context of globalization and global issues.
- explore an application of values and ethics in personal, social, academic, global and professional life.
- facilitate the learners to understand harmony at all the levels of human living and live accordingly.

Course Content:

Section I

Module	Content	Hours	Weightage
1.	**Introduction to Values** • Definition and Concept • Types of Values • Values and its Application	06	20 %
2.	**Elements and Principles of Values** • Universal & Personal Values • Social, Civic & Democratic Values • Adaptation Models & Methods of Values	06	20 %
3.	**Values and Contemporary Society** • Levels of Value Crisis • Value Crisis Management • Values in Indian Scriptures	06	20 %

Section II			
Module	**Content**	**Hours**	**Weightage**
1.	**Ethics an Ethical Values** • Definition and Concept • Acceptance and Application of Ethics • Ethical Issues and Dilemma • Universal Code of Ethics: Consequences of Violation	06	20 %
2.	**Applied Ethics** • Professional Ethics • Organizational Ethics • Ethical Leadership • Ethics in Indian Scriptures	06	20 %

Text Books:

Title	Author/s	Publication
Values and Ethics in Business and Profes-sion	By Samita Manna, Suparna Chakraborti	PHI Learning Pvt. Ltd., New Delhi, 2010

Reference Books:

Title	Author/s	Publication
Just a Job?: Communication, Ethics, and Professional life	George Cheney	Oxford University Press, 2010
Professional Ethics and Human Values	M. Govindarajan, S. Natarajan, V. S. Senthilkumar	PHI Learning Pvt. Ltd, 2013
Creating Values In Life: Personal, Mor-al, Spiritual, Family and Social Values	By Ashok Gulla	Author House, Bloomington, 2010

E-Books:

- Ethics for Everyone, Arthur Dorbin, 2009. (http://arthurdobrin.files.wordpress.com/2008/08/ethics-for-everyone.pdf)
- Values and Ethics for 21st Century, BBVA. (https://www.bbvaopenmind.com/wp-content/uploads/2013/10/Values-and-Ethics-for-the-21st-Century_BBVA.pdf)

Course Evaluation:

Theory:

- Continuous Evaluation Consist of Two Tests Each of 15 Marks and 1 Hour of duration.
- Submission of assignment which consists of 5 Questions to be answered under each module and it carries 10 Marks of Evaluation.
- End Semester Examination will consist of 60 Marks Exam.

Course Outcomes:

After learning the course, the students should be able to

- Understand and relate the concepts and mechanics of values and ethics in their life.
- Correlate the significance of value and ethical inputs in and get motivated to apply them in their life and profession.
- Realize the significance of value and ethical inputs in and get motivated to apply them in social, global and civic issues.
- Learn to apply such principles with reference to Indian Scriptures

P P SAVANI
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