Syllabus Book

4th Year B. Tech.
Mechanical Engineering

P P Savani University

School of Engineering

Department of Mechanical Engineering

Effective From: 2020-21

Authored by: P P Savani University

P P SAVANI UNIVERSITY																
SCHOOL OF ENGINEERING																
TEACHING & EXAMINATION SCHEME FOR FOURTH YEAR B.TECH. MECHANICAL ENGINEERING PROGRAMME																
Sem	Course Code	Course Name	Offered By	Teaching Scheme					Examination Scheme							
				Contact Hours				Credit	Theory		Practical		Tutorial		Total	
				Theory	Practical	Tutorial	Total		CE	ESE	CE	ESE	CE	ESE		
7	SEME4011	Control Engineering	ME	3	2	0	5	4	40	60	20	30	0	0	150	
	SEME4021	Renewable Energy Sources & Systems	ME	3	2	0	5	4	40	60	20	30	0	0	150	
	SEME4031	Design of Power Transmission Elements	ME	4	0	1	5	5	40	60	0	0	20	30	150	
	SEME4040	Operation Research	ME	4	0	1	5	5	40	60	0	0	50	0	150	
	SEPD4010	Creativity, Problem Solving & Innovation	SEPD	3	0	0	3	3	40	60	0	0	0	0	100	
	SEME4910	Industrial Training	ME	5			0	5	0	0	100	100	0	0	200	
		Elective-III by Industry Expert		2	2	0	4	3	40	60	20	30	0	0	150	
8	SEME4920	Major Project	ME	18			18	18	0	0	100	100	0	0	200	
TEACHING & EXAMINATION SCHEME FOR FOURTH YEAR B.TECH. MECHANICAL ENGINEERING PROGRAMME (ELECTIVE COURSES)																
7	SEME4511	Design of Heat Exchangers	ME	3	0	0	3	3	40	60	0	0	0	0	100	
	SEME4521	Tools Design	ME	3	0	0	3	3	40	60	0	0	0	0	100	
	SEME3631	Automobile Engineering	ME	3	0	0	3	3	40	60	0	0	0	0	100	
	SEME3602	Gas Dynamics	ME	3	0	0	3	3	40	60	0	0	0	0	100	

CONTENT

Semester 7

Electives

P P Savani University
School of Engineering

Department of Mechanical Engineering

Course Code: SEME4011
Course Name: Control Engineering
Prerequisite Course(s): SESH2211- Basics of Electrical & Electronics

Teaching & Examination Scheme:

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

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learners to

- develop the mathematical model of the physical systems.
- analyze the response of the closed and open loop systems.
- analyze the stability of the closed and open loop systems.
- design the various kinds of compensator.

Course Content:

Section I			
Module No.	Content	Hours	Weightage in %
1.	**Fundamentals of Control System** Basic Concepts of Control System, Classification, System Modeling, Transfer Function, Block Diagram Representation, Signal Flow Graph, Concept of Superposition for Linear Systems with Examples	08	20
2.	**System Modelling** Translational and Rotational Mechanical, Electrical, Thermal, Hydraulic and Pneumatic Systems, Force Voltage and Force Current Analogy, Position Servo Mechanism. Block Diagram and Signal Flow Graph Representation of Physical Systems along with Rules, Properties, Comparison and Limitation, Mason's Gain Formula	08	15
3.	**Time Response and Stability Analysis** Concept of Stability, Types of Stability, Routh's Stability Criterion, Special Cases with Numerical Examples, Stability of Closed Loop System, Concept of Root Locus, Open Loop and Closed Loop Transfer Poles, Step by Step Procedure for Root Loci, Numerical Examples	07	15

Section II			
Module No.	Content	Hours	Weightage in %
1.	**Frequency Response Analysis** Need of Frequency Response Analysis, Sinusoidal Response of Linear System, Methods Used in Frequency Response, Frequency Domain Specifications	08	20
2.	**Hydraulic Control System** Basic Elements of Hydraulic Circuit, Principle Used in Hydraulic Circuit, Sources of Hydraulic Power, Integral, Derivative, PD & PID Controller With its Transfer Function, Comparison Between Hydraulic and Electrical Control System	07	15
3.	**Pneumatic Control System** Basic Elements of Pneumatic Circuit, Difference Between Pneumatic and Hydraulic Control Systems, Force Balance and Force Distance Type Controllers, Nozzle-Flapper Amplifier, PD, PI and PID Control System along with its Transfer Function.	07	15

List of Practical:

Sr. No.	Name of Practical	Hours
1.	Introduction to simulation software like MATLAB/LABVIEW	2
2	Modelling of physical system using simulation software	4
3.	Simulation of linear system to different inputs	2
4.	Given a system transfer function, plot the location of the system zeros and poles using simulation software	2
5.	Simulation of root locus plot using simulation software	4
6.	Introduction to hydraulic trainer system/software	2
7.	Development & performance of given hydraulic circuit	4
8.	Introduction to pneumatic trainer system/software	4
9.	Development & performance of given pneumatic circuit	4
10.	Introduction of programmable logic controller and ladder diagram	2

Text Book(s):

Title	Author/s	Publication
Control System Engineering	J.Nagrath and M.Gopal	New Age International Publishers, 5th Edition, 2007
Automatic Control Systems	Farid Golnaraghi, Benjamin C Kuo,	John Wiley & Sons, Inc., 9th Edition

Reference Book(s):

Title	Author/s	Publication
Modern Control Engineering	Ogata K.	Prentice Hall India, 2003
Modern Control Systems	Richard C. Dorf, Robert H Bishop	Pearson Education International, 12th Edition.
Control System Engineering	Norman S Nise	John Wiley & Sons, Inc., 6th Edition

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests each of 30 marks and 1 Hour of duration.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the course coordinator.
- End Semester Examination will consist of 60 marks.

Practical:

- Continuous Evaluation consists of Performance of Practical which should be evaluated out of 10 for each practical in the next turn 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 Outcome(s):

After the completion of the course, the student will be able to

- develop the mathematical model of the physical systems.
- analyze the response of the closed and open loop systems.
- analyze the stability of the closed and open loop systems.
- design the various kinds of compensator.

P P Savani University
School of Engineering

Department of Mechanical Engineering

Course Code: SEME4021
Course Name: Renewable Energy Sources & Systems
Prerequisite Course(s): SEME3011-Heat Transfer

Teaching & Examination Scheme:

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

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learners to

- identify which are the different renewable energy sources available and their national scenario.
- interpret Solar energy and related terminology along with their possible applications and conversions.
- Understand wind energy and related terminology along with their conversion to produce electricity.
- explore the geothermal and ocean energy with their possible conversions.

Course Content:

Section I			
Module No.	Content	Hours	Weightage in %
1.	**Renewable Energy Scenario** Scope for Renewable Energy, Advantages and Limitations of Renewable Resources, Present Energy Scenario of Conventional and Non- Conventional Resources, Government Policies, National Missions	04	10
2.	**Solar Energy** Energy Available from the Sun, Spectral Distribution, Sun-Earth Angles and their Relations, Measuring Techniques and Estimation of Solar Radiation Outside and the Earth's Atmosphere, Radiation on Tilted Surface **Solar Power Generation** Photovoltaic System for Power Generation, Types of Solar Cell Modules and Arrays, Solar Cell Types, Grid Connection, Payback Period Calculation, Advantages and Disadvantages, Site Selection and other Parameters.	19	40

	Solar Applications Conversion of Solar Energy In to Heat, Solar Thermal Collectors, Solar Concentrators Analysis and Performance Evaluation, Solar Energy Thermal Storage, Solar Based Devices like: Solar Pumping, Solar Cooker, Solar Still, Solar Drier, Solar Refrigeration and Air Conditioning, Solar Pond, Heliostat, Solar Furnace		
Section II			
Module No.	Content	Hours	Weightage in %
1.	**Wind Energy** Principle and Basics of Wind Energy Conversion, Energy Available from Wind, Basics of Lift and Drag, Effect of Density, Angle of Attack and Wind Speed **Wind Power Conversion** Wind Turbine Rotors, Horizontal and Vertical Axes Rotors, Drag, Lift, Torque and Power Coefficients, Tip Speed Ratio, Solidity of Turbine, Site Selection and Basics of Wind Farm, Solar-Wind Hybrid System	09	20
2.	**Bio Energy** Energy from Biomass, Sources of Biomass, Different Species, Conversion Process, Advantages and Disadvantages, Properties of Biomass, Biomass Energy **Biogas Generation** Conversion of Biomass into Fuels, Gasification and Combustion, Aerobic and Anaerobic Bio-Conversion, Types of Biogas Plants, Design and Operation, Factors Affecting Biogas Generation, Gasification, Types and Applications of Gasifiers	07	15
3.	**Geothermal energy** Availability, Vapor and Liquid Dominated Systems, Binary Cycle, Hot Dry Rock Resources, Magma Resources, Advantages and Disadvantages, Applications **Ocean Energy** Ocean Thermal Energy Conversion, Availability, Advantages and Limitations; Open, Closed and Hybrid Cycle Otec System, Wave and Tidal Energy, Estimation of Tidal Power, Tidal Power Plants, Single and Double Basin Plants, Site Requirements	06	15

List of Practical:

Sr. No.	Name of Practical	Hours
1.	To Prepare one mathematical model using the Sun angles relations for particular any one solar application.	06
2.	Demonstration of Solar air heater, solar cooker, Solar pyranometer, Solar collector, biogas plant, gasifier.	06
3.	To estimate the solar day time with the help of sunshine recorder.	02

4.	To perform efficiency test of solar water heater with its different parameters.	04
5.	To evaluate distilled water output under solar desalination system considering different water depth and day-night performance and calculation of payback period.	04
6.	To estimate the solar power generation using PV panel and estimation of Payback period.	04
7.	To calculate the wind power generation using the small wind mill.	04

Text Book (s):

Title	Author/s	Publication
Solar Energy-Fundamentals, Design, Modelling and Applications.	G.N. Tiwari	Narosa Publishers
Non-conventional energy resources.	Shobh Nath Singh	Pearson India
Solar Energy	S P Sukhatme, J K Nayak	McGraw Hill

Reference Book(s):

Title	Author/s	Publication
Principles of Solar Engineering	F. Kreith and J.F. Kreider	McGraw Hill
Solar Energy thermal processes	J.A. Duffie and W.A. Beckman	J. Wiley
Wind energy Theory and Practice	Ahmed	PHI, Eastern Economy Edition
Renewable Energy Sources and Emerging Technologies	Kothari	PHI, Eastern Economy Edition

Web Material Links:

- https://nptel.ac.in/courses/112107216/ (Review of Thermodynamics)
- https://nptel.ac.in/courses/108105058/8 (Thermal Power Plants)
- https://nptel.ac.in/courses/112106133/15 (Capacity of Steam Power Plant)

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests each of 30 marks and 1 Hour of duration, which will be converted to 30 marks.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the course coordinator.
- End Semester Examination will consist of 60 marks.

Practical:

- Continuous Evaluation consists of performance of practical which will be evaluated out of 10 marks for each practical and average of the same will be converted to 10 marks.
- Internal viva consists of 10 marks.
- Practical performance/quiz/drawing/test consists of 15 marks during End Semester Exam.
- Viva/ Oral performance consists of 15 marks during End Semester Exam.

Course Outcome(s):

After the completion of the course, the student will be able to

- interpret national energy scenario and its possible utilization to become self-reliant in the field of renewable energy.
- define the availability of bio energy and its utilization in rural as well urban areas to use natural wastes and their conversion in biogas along with power generation.
- identify the types of renewable energies with their eco-friendly applications.

P P Savani University
School of Engineering

Department of Mechanical Engineering

Course Code: SEME4031
Course Name: Design of Power Transmission Elements
Prerequisite Course(s): SEME3060-Design of Basic Machine Elements

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
04	00	01	05	40	60	00	00	20	30	150

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learners to

- learn the basics of various transmission elements involved in mechanical power transmission.
- identify various forces and its effect on power transmission.
- impart the ability for selection of proper power transmission system as per requirement.
- understand the standard data catalogue for various power transmission drives.

Course Content:

Section I			
Module No.	Content	Hours	Weightage in %
1.	**Introduction to Design** Terminologies, Stress, Strain, Types of Forces, Various Transmission Drives, Design	03	5
2.	**Design of Flexible Elements** Design of Flat Belts and Pulleys, Selection of V Belts and Pulleys, Selection of Hoisting Wire Ropes, Design of Transmission Chains and Sprockets	09	15
3.	**Bearings** Sliding Contact Bearings- Types of Journal Bearing, Load Carrying Capacity, Methods of Lubrication, Hydrodynamic Bearing, Performance of Bearing, Mckee's Equation, Heat Dissipation and Power Loss, Summerfield Number. Rolling Contact Bearing- Types, Bearing Designation (SKF and BIS), Static Load carrying Capacity, Life of Bearing, Basic Load Rating.	09	15
4.	**Cams, Clutches and Brakes** Cam Design: Types, Pressure Angle and Under Cutting Base Circle Determination, Design of Plate Clutches, Axial Clutches,	09	15

	Cone Clutches, Band and Block Brakes, External Shoe Brakes, Internal Expanding Shoe Brake		
Section II			
Module No.	Content	Hours	Weightage in %
1.	**Spur Gears and Parallel Axis Helical Gears** Gear Terminology, Speed Ratios and Number of Teeth, Force Analysis Tooth Stresses, Dynamic Effects, Fatigue Strength, Factor of Safety, Gear Materials, Module and Face Width, Power Rating Calculations Based on Strength and Wear Considerations Parallel Axis Helical Gears – Pressure Angle in the Normal and Transverse Plane - Equivalent Number of Teeth, Forces and Stresses	12	20
2.	**Bevel, Worm and Cross Helical Gears** Straight Bevel Gear: Tooth Terminology, Tooth Forces and Stresses, Equivalent Number of Teeth, Estimating the Dimensions of Pair of Straight Bevel Gears. Worm Gear: Merits and Demerits, Terminology. Thermal Capacity, Materials, Forces and Stresses, Efficiency, Estimating the Size of the Worm Gear Pair. Cross Helical: Terminology - Helix Angles -Estimating the Size of the Pair of Cross Helical Gears	09	15
3.	**Geartrains** Geometric Progression, Standard Step Ratio, Design of Sliding Mesh Gear Box, Design of Multi Speed Gear Box, Types of Gear Trains, Simple Gear Trains, Compound Gear Train, Reverted Gear Train, Epicyclic Gear Train	09	15

List of Tutorials:

Sr. No.	Name of Tutorial	Hours
1.	Design of Flat belt and selection of V belt	02
2.	Standard Catalogue related to belt, Chain and Spocket	01
3.	Design of sliding and rolling contact bearing	01
4.	Design of single plate clutch	01
5.	Design of brakes and cams	01
6.	Design of spur gears	02
7.	Design of helical gears	02
8.	Design of bevel and worm wheel	02
9.	Standard catalogue for spur, helical and worm gears	01
10.	Design of Gear Trains	02

Text Book(s):

Title	Author/s	Publication
Design of Machine Elements	V B Bhandari	McGraw Hill Eduction
Mechanical Engineering Design	Joseph Shigley	McGraw Hill Eduction

Reference Book(s):

Title	Author/s	Publication
Machine Design	Sundararajamoorthy T. V	Anuradha Publications
Machine Design	R S Khurmi	S Chand Publication
Hand book of Mechanical Design	Gitin Maitra	McGraw Hill Eduction

Web Material Links:

- https://nptel.ac.in/courses/112/106/112106137/

Course Evaluation:

Theory:

- Continuous Evaluation consists of Two Tests Each of 30 Marks and 1 Hour of duration.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the course coordinator.
- End Semester Examination will consist of 60 marks.

Tutorial:

- Continuous Evaluation consists of solution of Practical which should be evaluated out of 10 for each Tutorial and average of the same will be converted to 20 Marks.
- Performance/Problem solution/quiz/test of 15 Marks during End Semester Exam.
- Viva/Oral performance of 15 Marks during End Semester Exam.

Course Outcome(s):

After the completion of the course, the student will be able to

- select the materials for mechanical transmission system.
- apply the design knowledge to design the various flexible drives.
- apply the design concepts to design the parallel axis mating gear.
- apply the basic design steps to design the perpendicular and oblique axis mating gear.
- apply the design procedure to design the gear box.
- apply the design principles to design the various friction drives.

P P Savani University
School of Engineering

Department of Mechanical Engineering

Course Code: SEME4040
Course Name: Operation Research
Prerequisite Course(s): --

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
04	00	01	05	40	60	00	00	50	00	150

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learners to

- provide students the knowledge of optimization techniques and approaches.
- enable the students apply mathematical, computational and communication skills needed for the practical utility of Operations Research.
- teach students about networking, inventory, queuing, decision and replacement models.
- introduce students to research methods and current trends in Operations Research.

Course Content:

Section I			
Module No.	Content	Hours	Weightage in %
1.	**Linear Models** Introduction to Operations Research - Linear Programming - Mathematical Formulation, Solution Techniques of LP: Graphical Methods, Analytical Methods: Simplex, Big M and Two Phase, Sensitivity Analysis, Primal and Dual Problems, Economic Interpretation	14	24
2.	**Transportation and Assignment** Transportation Problems Definition, Linear Form, Solution Methods: North West Corner Method, Least Cost Method, Vogel's Approximation Method, Degeneracy in Transportation, Modified Distribution Method, Unbalanced Problems and Profit Maximization Problems, Transshipment Problems, Assignment Problems and Travelling Sales Man Problem	08	13
3.	**Queuing Theory** Basis of Queuing Theory, Elements of Queuing Theory, Kendall's Notation, Operating Characteristics of a Queuing	08	13

	System, Classification of Queuing Models, Preliminary Examples of M/M/1:∞/FCFA		
Section II			
Module No.	Content	Hours	Weightage in %
1.	**Inventory Control** Inventory Models, Various Costs and Concepts EOQ, Deterministic Inventory Models, Production Models, Stochastic Inventory Models, Buffer Stock	06	10
2.	**Decision Models** Game theory – Two-person Zero Sum Game, Graphic Solution - Property of Dominance, Algebraic solution Replacement Models - Items that deteriorate with Time, when Money Value Changes, Items that failed completely — Individual Replacement and Group Replacement	12	20
3.	**Sequencing and Networks** Sequencing — Problem with N jobs and 2 machines - 3 machines and 'M' machines Network Models — Basic Concepts, Construction of Networks, Project Network, CPM and PERT - Critical Path Scheduling, Crashing of Network	12	20

List of Tutorial:

Sr No	Name of Practical	Hours
1.	Exercise on definition, formulation of linear programing problems.	02
2.	Exercise on Graphical solution of linear programing problems	02
3.	Exercise and case problems on Simplex, Big M and Two-phase LP Problems	01
4.	Exercise and case problems on Dual and Primal LP Problems	01
5.	Exercise and case problems on Sensitivity Analysis	01
6.	Exercise and case problems on Transportation and Transhipment Problems.	01
7.	Exercise and case problems on Assignment and Travelling sales man Problems	02
8.	Exercise and case problems on Queuing theory	01
9.	Exercise and case problems on Game theory	01
10.	Exercise on Inventory model	01
11.	Exercise on Replacement theory	01
12.	Exercise and case problems on PERT/CPM	01

Text Book(s):

Title	Author/s	Publication
Operations Research	Kanti Swarup, Gupta PK, and Manmohan	S. Chand & Sons
Operations Research: An Introduction	Hamdy Taha	Pearson

Reference Book(s):

Title	Author/s	Publication
Operations Research	P Mariappan	Pearson
Operations Research	H N wagner	Prentice hall
Optimization in Operations Research	Ronald Rardin	Pearson Education Inc
Quantitative Techniques in Management	N D Vohra	Tata McGraw-Hill

Web Material Links:

- www.nptel.ac.in/

Course Evaluation:

Theory:

- Continuous Evaluation consists of Two Test Each of 30 Marks and 1 Hour of duration.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the course coordinator.
- End Semester Examination will consist of 60 Marks.

Tutorial:

- Continuous Evaluation consists of Performance of Tutorial which should be evaluated out of 10 for each Tutorial and average of the same will be converted to 20 Marks.
- Internal Viva component of 30 Marks.

Course Outcome(s):

After the completion of the course, the student will be able to

- describe characteristics and scope of OR.
- to define and formulate mathematical problems.
- to select optimal problems solving techniques for a given problem using LP.
- formulate and solve transportation, travelling sales man and transshipment problems.
- formulate and solve optimization problems related to job/ work assignments.
- demonstrate and solve simple models of Game theory.
- evaluate optimum solution using dynamic programming for different applications.
- choose / devise appropriate queuing model for practical application.
- solve different problems related to Network.

P P Savani University
School of Engineering

Center for Skill Enhancement and Professional Development

Course Code: SEPD4010
Course Name: Creativity, Problem Solving & Innovation
Prerequisite Course(s): --

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
03	00	00	03	100	00	00	00	00	00	100

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learners to

- achieve expertise with the technicalities of creativity and problem solving.
- advance an assertiveness for innovation.
- advance creative thinking skills using shaft of learning components leading to understanding of plans of creativity, problem solving and innovation
- discuss uses of the concepts of creativity and problem-solving skills in personal, social, academic, and profession life.

Course Content:

Section I			
Module No.	Content	Hours	Weightage in %
1.	**Introduction to Creativity, Problem Solving and Innovation** • Definitions of Problem Solving, Creativity and Innovation • Need for Problem Solving and Innovation & Scope of Creativity • Types and Styles of Thinking • Strategies to Develop Creativity, Problem Solving and Innovation Skills	08	17
2.	**Questioning and Learning** • Introduction to Questioning, Learning and Visualization and its Strategies • Sources and Methods of Questioning and Learning • Finding Perspective, Visualizing thinking • Mind Mapping	07	16
3.	**Creative Thinking and Problem Solving** • Need of Creative Thinking	08	17

	• Cracking Creativity - Reversals, Reversing Perspective, seeing all sides, Looking in other world, • Finding what you are not looking for and following up • Fishbone Diagram • SCAMPER Technique		
Section II			
Module No.	Content	Hours	Weightage in %
1.	**Logic and Reasoning** • Basic Concept of Logic • Divergent Vs Convergent Thinking, Inductive Vs Deductive Thinking • Fusion of Ideas for Problem Solving • Moral Reasoning • Improvisation	08	17
2.	**Practices of Playing** • Collaboration and Brainstorming • The Spirit of Koinonia • QFT Model • Connecting the Unconnected • Making Novel Combinations	07	16
3.	**Review Strategies for Creative problem-solving methods** • A Heuristic Technique • Problem-Solving Strategies: Why Bother? • Five Building Blocks as per Fogler & LeBlanc • Strategy for Critical Thinking for Choosing • Lateral Thinking • Six Thinking Hats by Edward De Bono • Design Thinking	07	17

Text Book(s):

Title	Author/s	Publication
Thinker Toys	Michael Michalko	Random House Publication 2006
Crackling Creativity, The Secrets of Creative Genus	Michael Michalko	Ten Speed Press 2001

Reference Book(s):

Title	Author/s	Publication
Zig Zag, The Surprising Path to Greater Creativity	R Keith Sawyer	Jossy-Bass Publication 2013
De Bono's Thinking Course	Edward De Bono	Penguin Publication 1994
Six Thinking Hats	Edward De Bono	Penguin Publication 1999
How to Mind Map	Tony Buzan	Thorsons Publication 2002
The Myths of Innovation	Scott Berkum	Berkun Publication 2010
Creative confidence: Unleashing	Tom Kelly and David	William Collins Publication

the creative Potential within Us all	Kelly	2013
The all Laughed	Ira Flatow	Harper Publication 1992
The Ultimate Lateral & Critical Thinking Puzzle book	Paul Sloane, Des MacHale & M.A. DiSpezio	Sterling Publication 2002

Course Evaluation:

Section	Module No.	Evaluation Criteria	Marks
1	1	Group Activity on Brainstorming	15
	2	Mind Mapping Activity	10
	3	Chart Preparation on 'Practicality of Fishbone Diagram'	15
		Group presentation on 'SCAMPER Technique & its applications'	10
2	1	Group Presentation on Critical Analysis of a Govt. scheme/ policy/ budget (merit/ demerit, pros/cons etc)	15
	2	Group Discussion/ Debate/ Elocution	10
	3	Problem Solving Activity (Individual)	10
		Presentation (Learning Outcomes)	15
		Grand Total	**100**

Course Outcome(s):

After completion of the course, the student will be able to

- establish creativity in their day to day actions and educational output.
- solve all types of problems with an optimistic and an impartial attitude.
- reflect innovatively and work towards problem solving in a tactical way.
- initiate different and advanced practices in their selected field of profession.

P P Savani University
School of Engineering

Department of Mechanical Engineering

Course Code: SEME4511
Course Name: Design of Heat Exchangers
Prerequisite Course(s): SEME3011-Heat Transfer

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
03	00	00	03	40	60	00	00	00	00	100

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learners to

- introduce and explain basics of Heat Exchanger
- calculate basis calculation applied in heat exchanger design.
- learn about analysis and design aspects in various heat exchangers.
- elaborate enhancement and performance evolution of heat exchanger.

Course Content:

Section I			
Module No.	Content	Hours	Weightage in %
1.	**Introduction** Classification and Selection of Heat Exchanger, Overall Heat Transfer Co-efficient, LMTD and e – NTU Analysis Methods, Fouling and its Control, Rating and Sizing Problems, Design Methodologies	08	17
2.	**Design of Double Pipe Heat Exchanger** Thermal and Hydraulic Design of Inner Tube and Annulus, Pressure Loss Calculations, Hair Pin Heat Exchanger with Bare and Finned Inner Tube	10	23
3.	**Design of Compact Heat Exchangers** Compact Heat Exchanger, Heat Transfer Enhancement, Plate Fin Heat Exchanger, Tube Fin Heat Exchanger, Heat Transfer and Pressure Drop Calculations	05	10
Section II			
Module No.	Content	Hours	Weightage In %
1.	**Enhancement and Performance Evolution**	08	20

	Enhancement of Heat Transfer, Performance Evaluation of Heat Transfer Enhancement Technique. Introduction to Inch Analysis		
2.	**Design of Shell & Tube Heat Exchanger** Construction and Basic Components, Basic Design procedure, TEMA standards, Conventional Design Methods, Bell Delaware Method, Application of Heat Exchanger	14	30

Text Book(s):

Title	Author/s	Publication
Heat Exchanger Selection, Rating and Thermal Design	Sadik Kakac Liu H.	CRC Press, Boston, 1998
Fundamentals of Heat Exchanger Design	Ramesh K Shah	John Wiley & Sons.

Reference Book(s):

Title	Author/s	Publication
Compact Heat Exchangers	Kays V A, London A L	McGraw Hill, New York, 1964
Process Heat Transfer	Donald Q Kern	McGraw Hill

Course Evaluation:

Theory:

- Continuous Evaluation consists of Two Test Each of 30 Marks and 1 Hour of duration.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the course coordinator.
- End Semester Examination will consist of 60 marks.

Course Outcome(s):

After the completion of the course, the student will be able to

- elaborate basic concepts and construction of various heat exchangers.
- do basic calculations applied in heat exchanger design.
- do detail calculations involved in various heat exchanger design.
- apply heat transfer principles to enhance heat transfer and performance of heat exchangers.

P P Savani University
School of Engineering

Department of Mechanical Engineering

Course Code: SEME4521
Course Name: Tools Design
Prerequisite Course(s): SEME3060-Design of Basic Machine Elements

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
03	00	00	03	40	60	00	00	00	00	100

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learners to

- learn the basics of various tools for different operations.
- learn the design procedure for various dies for punching, blanking etc.
- impart the ability for selection of proper jigs and fixtures for different manufacturing operations.
- understand the standard data catalogue for various tools.

Course Content:

Section I			
Module No.	Content	Hours	Weightage in %
1.	**Introduction to Tool Design** Introduction, Types of Tools, Various Manufacturing Operations, Jigs, Fixtures, Mechanics and Geometry of Chip Formation	02	5
2.	**Design of Single Point Cutting Tool** Various Angles Related to Cutting Tools, Tool Signature, Effect of Angles of Single Point Cutting Tool, Recommendation for Various Angle, Material Selection for Single Point Cutting Tool, Coated Carbide.	07	15
3.	**Design of Milling Cutter** Form Milling Cutter (Relieved) ,Types of Milling Cutter, Types of Milling, Forces in Milling, Nomenclature of Milling Cutter Elements, Selection of Cutter Geometry and Design	07	15
4.	**Design of Drills** Drilling operations, Nomenclature of Twist Drill Elements, Types of Drill, Recommendation Drill Point Geometry for Various Materials, Troubleshooting Drilling Problems Power Requirement for Drilling, Flat Drills	06	15

Section II			
Module No.	Content	Hours	Weightage in %
1.	**Design of Drill Jigs** Introduction, Types of Drill Jigs, Chip Formation in Drilling, General Consideration in Design of Drill Jigs, Methods of Construction, Design Problems	05	10
2.	**Design of Fixtures** Milling Fixtures, Boring Fixtures, Broaching Fixtures, Lathe Fixtures, Design Problems, Universal Fixture	05	10
3.	**Design of Sheet Metal Blanking and Piercing Dies** Introduction to Die cutting operations, Blanking and Piercing Die Construction, Pilots, Strippers and Pressure Pads, Strip Layout, Die Clearance, Design Problems	07	15
4.	**Design of Sheet Metal Bending, Forming and Drawing Dies** Introduction, Bending Dies, Forming Dies, Drawing Operations, Determination of Blank Size, Design Problems	06	15

Text Book(s):

Title	Author/s	Publication
Tool Design	Donaldson	McGRAW-HILL Publication

Reference Book(s):

Title	Author/s	Publication
Fundamentals of tool design with CD	Nee, John	SME Publication

Web Material Links:

https://nptel.ac.in/courses/112105233/

Course Evaluation:

Theory:

- Continuous Evaluation consists of Two Tests Each of 30 Marks and 1 Hour of duration.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the course coordinator.
- End Semester Examination will consist of 60 marks.

Course Outcome(s):

After the completion of the course, the students will able to

- select the materials for various tools.
- apply the design knowledge to design the piercing, blanking, forming, and bending dies.
- apply the design concepts to design the single point cutting tools.
- apply the basic design steps to design jigs and fixtures for drilling, milling, broaching etc.
- apply the design procedure to design milling cutter.

P P Savani University
School of Engineering

Department of Mechanical Engineering

Course Code: SEME3631
Course Name: Automobile Engineering
Prerequisite Course(s): -

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
03	00	00	03	40	60	00	00	00	00	100

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learners to

- make students understand the basic concepts, requirements and working of various Components of automobile.
- enable students to design basic systems like brakes, steering, and suspensions.
- make students understand construction and working of different systems like Transmission, steering and suspensions.
- make students understand automotive electronics.
- aware students about recent technologies in automobile engineering and its working.
- reduce the pace between basic vehicle technology and technologies in modern vehicles.

Course Content:

Section I			
Module No.	Content	Hours	Weightage in %
1.	**Introduction and Performance:** History and development of automobile, classification, layout, major components, Resistance to motion of vehicle, air rolling and gradient resistances. Power requirement for acceleration and gradability	04	10
2.	**Brakes:** Types of brakes – drum, disc, power and hydraulic; Brake efficiency and stopping distance, Weight transfer, skidding, antilock braking system.	05	10
3.	**Transmission System:** Constructional features and working of clutches, Gear Train: sliding mesh, constant mesh and synchromesh gear boxes with related components, Propeller and drive shaft, universal joints, Rear wheel drive arrangements, Rear axle	10	20

	final drive, the differential, rear axle, Simple problems in all mentioned topics, Automatic Transmission and CVT.		
4.	**Wheels and Tyres:** Types of wheels, Types of tyres, Tyre thread, Tyre selection.	03	10
Section II			
Module No.	Content	Hours	Weightage in %
1.	**Electrical and Electronics System:** Electrical and electronic components of vehicle, fundamentals of engine electricals, Lighting and Indicators: Features, Requirements and typical settings, Body electrical and electronic systems, Monitoring and Instrumentation.	05	10
2.	**Steering System:** Types of suspension systems, Functional requirements of suspension systems, Front suspension system and Steering: Types, Definitions for wheel orientation and its effect, Types and Constructional features of Front Suspension, Steering layout, types of steering gears, steering linkages, steering mechanism, definitions and significance of camber, caster and king pin inclination, toe in and toe out on turn, measurement and adjustment of various steering system layouts, steering ratio, under steering and over steering, steering geometry	12	25
3.	**Suspension System:** Principle, type of suspension system, conventional and independent front and rear axle, spring, rubber and air suspensions, automatic/hydro suspension system, shock absorbers.	06	15

Reference Book(s):

Title	**Author/s**	**Publication**
Automobile Engineering	Kirpal Singh	Standard Pub.& Dist.
Automobile Technology	N. K. Giri	Khanna Publication
Course in Automobile Engineering	R. P. Sharma	Dhanpat Rai & Sons.
Automobile Engineering	S. K. Saxena	Laxmi Publication Pvt. Ltd.

Course Evaluation:

Theory:

- Continuous Evaluation consists of Two Test Each of 30 Marks and 1 Hour of duration.
- Submission of assignment which consists of 5 Questions to be answered under each module and it carried of 10 Marks of Evaluation Banner or Presentation on modern measuring Instruments.
- End Semester Examination will consist of 60 Marks Exam.

Course Outcome(s):

After the successful completion of the course, the students will able to

- Understand needs and working of various systems in automobiles.
- Design various systems commonly used in automobiles.
- Develop a skill to work in multi-disciplinary streams.
- Illustrate the maintenance and repair of automobiles.
- Understand market and businesses of automobile industry.
- Outline about recent trends and research areas in Automobiles.

P P Savani University
School of Engineering

Department of Mechanical Engineering

Course Code: SEME3602
Course Name: Gas Dynamics
Prerequisite Course(s): -- Fluid Mechanics (SEME2060)
Power Plant Engineering(SEME3101)

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
03	00	00	03	40	60	00	00	00	00	100

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learners to
- learn about basic concepts of gas dynamics
- learn about how the gas behaves in different operating conditions
- learn about basics of compressible flow
- learn about application of gas dynamics in various mechanical systems

Course Content:

Section I			
Module No.	Content	Hours	Weightage in %
1.	**Fundamentals of compressible flow:** Ideal gas relationship, The adiabatic energy equation, Mach number and its significance, Mach waves, Mach cone and Mach angle, static and stagnation states, relationship between stagnation temperature, pressure, density and enthalpy in terms of Mach number, stagnation velocity of sound, reference speeds, various regions of flow, Effect of Mach number on compressibility, Area velocity relationship.	08	20
2.	**One Dimensional Isentropic flow:** General features of isentropic flow, performance curve, Comparison of adiabatic and isentropic process, One dimensional isentropic flow in ducts of varying cross-section- nozzles and diffusers, operation of nozzles under varying pressure ratio, mass flow rate in nozzles, critical properties and choking, area ratio as function of Mach number, Impulse function, non-dimensional mass flow rate in terms of pressure ratio, area ratio and Mach number, Working charts and gas tables, Application of Isentropic flow	10	20

3.	**Flow in constant area duct with heat transfer (Rayleigh flow):** Simple heating relation of a perfect gas, Rayleigh curve and Rayleigh flow equations, variations of flow properties, maximum heat transfer, tables and charts for Rayleigh flow.	07	10
Section II			
Module No.	Content	Hours	Weightage in %
1.	**Normal shock Waves:** Development of shock wave, Thickness of shock wave, governing equations, Strength of shock waves, Prandtl-Mayer relation, Rankine-Hugoniot relation, Mach number in the downstream of normal shock, variation of flow parameters across the normal shock, normal shock in Fanno and Rayleigh flows, impossibility of a rarefaction shock, supersonic diffusers, supersonic pitot tube.	10	25
2.	**Flow in constant area duct with friction (Fanno flow):** Fanno curve and Fanno flow equations, solution of Fanno flow equations, variation of flow properties, variation of Mach no. with duct length, isothermal flow in constant area duct with friction, tables and charts for Fanno flow, Experimental friction coefficients.	10	25

Text Book(s):

Title	Author/s	Publication
Fundamental of Compressible flow	S. M. Yahya	New Age International Publication
Fundamentals of compressible fluid dynamics	P. Balachandran	PHI Learning, New Delhi

Reference Book(s):

Title	Author/s	Publication
Gas Dynamics	E. Rathakrishnan	PHI Learning, New Delhi
Gas Dynamics and Jet Propulsion	P. Murugaperumal	Scitech Publication, Chennai.

Course Evaluation:

Theory:

- Continuous Evaluation consists of Two Test Each of 30 Marks and 1 Hour of duration.
- Submission of assignment which consists of 5 Questions to be answered under each module and it carried of 10 Marks of Evaluation Banner or Presentation on modern measuring Instruments.
- End Semester Examination will consist of 60 Marks Exam.

Course Outcome(s):

After the successful completion of the course, the students will able to

- understand the basic concepts of gas dynamics.
- understand the behavior of gas under different conditions.
- understand the basics of compressible flow.
- correlate fundamentals of Gas Dynamics with various mechanical systems