



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	UMEC0701	L	T	P	Credit
Course Name:	Finite Element Analysis	3	1	0	4
Course Pre-Requisites:	1. Applied Mechanics 2. Strength of Materials				
Course Description:	This subject enables the student to understand the important concepts of FEA, its evolution and applications. Students will learn the mathematical formulation of FEA problems. The Knowledge gained through this subject will be helpful in solving the real life problems.				

Course Objectives:	
1	Introduce students to Finite Element Analysis fundamentals.
2	Introduce students to steps involved in FEA, domain discretization, polynomial interpolation, application of boundary conditions, assembly of global arrays, and solution of the resulting algebraic systems.
3	To enable the students to formulate the design problems into FEA
4	Understand the practical (modeling and analysis) aspects of the FEA
5	Apply this theory and practical knowledge to solve 1-d, 2-d structural and thermal Problems manually and with using computers.

Course Outcomes:	After the completion of the course the student will be able to		
COs	CO Statement	Blooms Level	Descriptor
CO1	Explain the mathematical modeling and Finite Element Analysis .	II	Understand
CO2	Make use of advanced software for solving the problems and interpreting the results	III	Apply
CO3	Develop solutions of some mechanical real time problems.	III	Apply
CO4	Estimate the deformation, stresses, strains and reactions	V	Evaluate

CO-PO Mapping:	
	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12 PSO1 PSO2 PSO3
CO1	3 2
CO2	3 2 2
CO3	2 2 3 2
CO4	2 2 3 2 2

Assessment Scheme:			
SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:		
Unit No.	Unit Content	No. of Lectures
1	Unit 1: Introduction: Introduction, An overview of engineering problems and methods for solving them, demonstration by an example – Physical system – Physical model – Mathematical model – Methods for solution – Solution. Need for using numerical method to solve engineering problems-Types of Engineering Analysis.	5 Hrs
2	Unit 2: Introduction to 1D bar element problems: Introduction to steps of FEM for the problem of finding elongation of an axially loaded bar as an example of a 1-D problem. Step- by-step development of the procedure of Galerkin weighted residual FEM for the bar problem - residual error, weighting function, discretization, elements and nodes, local variables, approximation functions (or shape functions), need for numerical integration and co-ordinate transformation, Gauss Legendre integration scheme. Process of assembly of local matrix equations into global, solution to the equations, equation solvers.	7 Hrs
3	Unit 3: Introduction to 2D truss element problems: FE formulation for truss, FEM procedure followed for the truss problems. Computation of derived quantities like strains and stresses from the nodal values of the field variables, Result post processing. Finite element formulation using variational and virtual work methods, demonstration for bar and truss problems.	6 Hrs

4	Unit 4: 2-D Problem from structural mechanics: Introduction to 2-dimensional problem from structural mechanics static analysis, Triangular and quadrilateral elements, Basic concepts of Plain stress and Plain strain. Constant strain triangular element Stiffness Matrix and Equation. Finite element Solution of a plane stress Problem. Higher order elements, iso-parametric elements.	8 Hrs
5	Unit 5: Potential field problems: Introduction to potential field problems, examples from structural mechanics - of torsion of noncircular prismatic bars, 2-D steady state heat transfer with convection from surface. Sources of errors, error analysis, remedies to minimize the errors. Application of FEM to Axisymmetric problems, Axisymmetric solids under rotation.	8 Hrs
6	Unit 6: Non-linear Static elasticity, Buckling, Modal, Transient Response, Harmonic Response, Shock Spectrum Analysis. Translators, types and use, importance of traslatotrs.	6 Hrs

Text Books:

Sr. No.	
1	M. J. Fagan, Finite element analysis, Longman Scientific and Technical
2	D. L. Logan, A first course in finite element method, 4 ed. Cengage learning
3	J. N. Reddy, An introduction to the finite element method, 2 ed. McGraw Hill
4	Introduction to Finite Elements in Engineering, 4th edition, ISBN 978-0-13-216274-6 by Tirupathi R. Chandrupatla

Reference Books:

Sr. No.	
1	S. S. Rao, the finite element method in engineering, 4 ed. Elsevier Science & Technology Books
2	T. A. Stolarski, Engineering analysis with ANSYS Software, Elsevier
3	Erdogan Madenci, Ibrahim Guven, The Finite Element Method And Applications In Engineering Using Ansys, Springer
4	N.S. Gokhale, S.S. Deshpande, S.V. Bedekar, A.N. Thite, Practical Finite Element Analysis, Finite to Infinite Publication



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	UMEC0702	L	T	P	Credit
Course Name:	Manufacturing and Process Engineering	3			3
Course Pre-Requisites:	Machine drawing, Manufacturing processes, Limits, fits and tolerances, Engineering Metrology, Machine Tools				
Course Description:	This course gives the process planning sequence and how to create any part when design is ready with available manufacturing resources, with given part accuracy requirements.				

Course Objectives:

1	To understand the fundamentals of process engineering in a manufacturing industry
2	To understand the information on drawing related to manufacturing process
3	To select the stated tolerances on drawing and select bestsuitable manufacturing processes.
4	To study the feasibility of the component.
5	To select the standard tooling for creation of part as per requirement on drawing.

Course Outcomes: After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
CO1	Select the manufacturing process and machines for generating required tolerances	III	Apply
CO2	Interpret the given part drawing	II	Understand
CO3	Select proper tooling's for production	III	Apply
CO4	Inspect the feasibility of the component	IV	Analyz
CO5	Show process of industrial component with help of process pictures	I	Remember
CO6	Estimate the cycle times and production rates for different operations in the formulated process plan.	V	Evaluating

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2		1						1	1	3	2	1
CO2	2	3	2							2		1	2	3	
CO3	2	2	2		2						1	1	3	2	
CO4	2	2	2	3							1		1	1	1
CO5	2	2	1		2					2	1	1			
CO6	2	2									2		1	1	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:

Unit No.	Unit Content	No. of Lectures
1	Unit 1:--- Introduction: Process planning function and activities-drawing interpretation, material evaluation and process selection, selection of machines and tooling, setting process parameters, workholding devices, selecting quality assurance methods, costing and documentation, Inputs and outputs for process planning, Position of product and process engineering department in the organization, functions of product and process engineers.	7
2	12.1 PartPrintInterpretation: IdentifyingOriginating process,major andminoroperations, identifying useful supplementary information, material specification and treatments, interchangeability and standardization, identifying critical processing factors (4) 2.2 Study of Machining Accuracies: Factors affecting accuracies, work piece control theories, product tolerances, process tolerances, tolerance stack -types and effects. (3)	8

3	Unit 3:--- 3.1 Technical Feasibility Study: Raw material, basic originating process, accuracy level, processes required, machine tools and accessories required Manufacturing feasibility study with illustrations(4) 3.2 Selection of Process: General guidelines for and factors in process selection, process selection method, process and operation sequencing – guidelines;Combining and eliminating operations, economic aspects of processing (A case should be discussed), (4)	8
4	Unit 4:--- 4.1 Selection of Equipment: Various sources of information, technical, economical and managerial considerations, selection criteria for GPMs, SPMs and CNCs for processing in job, batch and massmode.(4) 4.2 Selection of Tooling: Technical specifications of standard cutting tools and gauges required for various machining operations, selection criteria for cutting tools and gauges, study of special tools, gauges and work holding devices, selection of machining parameters.(4)	8
5	Unit 5:--- ProcessPlanning: Preparation of processsheetformachining of a componentfor job,batch andmass production using conventional andCNCmachines, Selection ofquality assurance method and tools, in process gauging. Process Picture sheet including process symbols. Process sheet design.	7
6	Unit 6:--- Time Estimation: Calculation of standard time and production rates for various operations by consideration of various allowances.(Numerical exercises expected)Takt-time concept.(2)	7

Text Books:

Sr. No.	
1	Eary D. F., Johnson G. E., —Process Engineering for manufacturel Prentice Hall of India Pvt. Ltd.
2	Narayana K. L., Kannaiah P., Vankata Reddy K., —Production Drawingl, New age international Publishers.
3	Groover Mikell P., Automation, Production Systems, and Computer-Integrated Manufacturing, Third Edition, PHI Learning Private Limited.

Reference Books:

Sr. No.	
1	Process Engineering for Manufacturing – Eary & Johnson (Prentice Hall
2	Principles of Machine Tools- Sen, Bhattacharya
3	Automation, Production Systems, and C.I.M. – Groover, M.P. 3/e, (PHI)
4	Manufacturing Technology: Principles for Optimisation – Daniel
5	Manufacturing Processes for Engineering Materials by Serope Kalpakjian and Steven R. Schmid: This text provides comprehensive coverage



Kolhapur Institute of Technology's College of Engineering, Kolhapur (Empowered Autonomous)

Department of Mechanical Engineering

Course Code:	UMEC0703	L	T	P	Credit
Course Name:	Artificial Intelligence and Machine Learning	3			3
Course Pre-Requisites:	Probability, Statistics, Logical Reasoning, machine tools				
Course Description:	This course aims to impart knowledge of artificial intelligence and machine learning with respect to various algorithms and its applications in mechanical engineering and in other sectors				

Course Objectives:

1	Acquaint with fundamentals of artificial intelligence and machine learning.
2	Learn feature extraction and selection techniques for processing data set.
3	Understand basic algorithms used in classification and regression problems.
4	Outline steps involved in development of machine learning model.
5	To provide graduates of mechanical- design engineering with fundamental knowledge in the fourth revolution terminologies and technologies
6	Implement and analyze machine learning model in mechanical engineering problems

Course Outcomes: After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
CO1	Explain the elements of Industry 4.0 and smart machines and manufacturing systems.	II	Understand
CO2	Explain the basics concepts in AIML and types of AIML systems.	II	Understand
CO3	Apply machine learning algorithms for classification and regression problems.	III	Apply
CO4	Explain the steps in development of ML model and types of ANN	II	Understand
CO5	Explain applications of AIML in mechanical engineering	II	Understand

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2										2	2		
CO2	2	2										2	2		
CO3	2	2										2	2		
CO4	2	2	2									2	2	2	2
CO5	2											2	2	2	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:

Unit No.	Unit Content	No. of Lectures
1	Introduction to Industry 4.0 Concept of Industry 4.0, The Fourth Revolution, LEAN manufacturing, Smart factories, Potential manufacturing for Industry 4.0, smart manufacturing system for Industry 4.0, Time line of Industry 1.0–4.0, Demand dimensions for Industry 4.0, Design prerequisites for Industry 4.0, Benefits of Industry 4.0, Limitations of Industry 4.0	7
2	Smart factories and smart machines The Smart Factory of the Industry 4.0: Cyber-Physical Systems, Internet of Services, Steps to implement industry 4.0 in manufacturing industry. Concept of smart machines, sensors and transducers used in smart machines, Selection of parameters on the manufacturing machines to be monitored for monitoring-machine health, quality of output of the machine, machine data collections, storing, retrieving and analyzing, time intervals for these measurements, applications, benefits.	7
3	Introduction to AI & ML History of AI, Comparison of AI with Data Science, Need of AI in Mechanical Engineering, Introduction to Machine Learning. Basics of artificial intelligence: Reasoning, problem solving, Knowledge representation, Planning, Learning, Perception, Motion and manipulation. Types of AI: Cybernetics and brain simulation, Symbolic, Sub-symbolic, Statistical. Types of ML: Supervised learning, Unsupervised learning, Reinforcement learning,	7

4	Classification & Regression algorithms in Machine Learning Difference between feature extraction and feature selection Classification: Decision tree, Random forest, Naive Bayes, Support vector machine. Regression: Logistic Regression, Support Vector Regression. Regression trees: Decision tree, random forest, K-Means, K-Nearest Neighbor (KNN). Applications of classification and regression algorithms in Mechanical Engineering	8
5	Development of ML Model and Artificial neural network Problem identification: classification, clustering, regression, ranking. Steps in ML modeling, Data Collection, Data pre-processing, Model Selection, Model training (Training, Testing, K-fold Cross Validation), Model evaluation (understanding and interpretation of confusion matrix, Accuracy, Precision, Recall, True positive, false positive etc.), Hyper parameter Tuning, Predictions. Characteristics of Deep Learning, Artificial Neural Network types	8
6	Applications of AIML in Mechanical Manufacturing Industries Human Machine Interaction, Predictive Maintenance and Health Management, Fault Detection, Image based part classification, Process Optimization, Material Inspection, Tuning of control algorithms, Fault diagnosis- Quality inspection- Improving the safety of working places, Machine learning in Machine Tools and Manufacturing Industries	6

Text Books:

Sr. No.	
1	Deisenroth, Faisal, Ong, Mathematics for Machine Learning, Cambridge University Press, 2020.
2	B Joshi, Machine Learning and Artificial Intelligence, Springer, 2020.
3	Parag Kulkarni and Prachi Joshi, "Artificial Intelligence – Building Intelligent Systems", PHI learning Pvt. Ltd., ISBN – 978-81-203-5046-5, 2015
4	Stuart Russell and Peter Norvig (1995), "Artificial Intelligence: A Modern Approach," Third edition, Pearson, 2003.
5	Industry 4.0: Managing The Digital Transformation by Alp Ustundag, Springer

Reference Books:

Sr. No.	
1	Solanki, Kumar, Nayyar, Emerging Trends and Applications of Machine Learning, IGI Global, 2018.
2	Mohri, Rostamizadeh, Talwalkar, Foundations of Machine Learning, MIT Press, 2018.
3	Kumar, Zindani, Davim, Artificial Intelligence in Mechanical and Industrial Engineering, CRC Press, 2021.
4	Zsolt Nagy - Artificial Intelligence and Machine Learning Fundamentals-Apress (2018)
5	Artificial Intelligence by Elaine Rich, Kevin Knight and Nair, TMH



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	IndustrialAutomation&Robotics	L	T	P	Credit
Course Name:	UMEC0704	3			3

Course Pre-Requisites:	:ManufacturingProcesses,Basicelectronics &electrical,Basic Sciences
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Course Description:	This course gives knowledge about the automation and Robotics. It also describesthe merging trends in Automation and robotics
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Course Learning Objectives:

1	To understand basic terminologies and concepts associated with Robotics and Automation
2	To study various Robotic sub-systems and Automation systems
3	To study kinematics and dynamics to understand exact working pattern of robots
4	To studyt he associated recent updates in Robotics and Automation

Course Outcomes:	After the completion of the course the student will be able to
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COs	CO Statement	Blooms Level	Descriptor
CO1	Demonstrate knowledge of automation tools and other Equipment's by taking into account the fundamental principles manufacturing processes and assembly components.	II	Understand
CO2	Identify parameters of designing different grippers for various operations.	III	Apply
CO3	Illustrate different programming methods for robots	II	Understand
CO4	Explain the various kinematics behind robots	II	Understand

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2							1		1		2	2		
CO2	2	1		2					2				2	2	
CO3	2	2	2	2	2				2				2	2	
CO4	2	2	1		1								2		

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:

Unit No.	Unit Content	No. of Lectures
1	Unit1: -Introduction Automated manufacturing systems, Fixed /programmable/ flexible, Automation, Need of automation, Basic elements of automated systems- Power, program and control. Low-cost automation, Economic and social aspects of automation, Advanced automation functions, Levels of automation.	7
2	Unit 2: -Industrial Control and Transfer Line Industrial control systems in process and discrete manufacturing industries, Continuous and discrete control; Computer process control.Fundamentals of transfer lines, Configurations, Transfer mechanisms, Storage buffers, Control, Applications; Analysis of transfer lines with and without storage buffers.	7
3	Unit 3: -Assembly Automation Assembly Automation: Types and configurations, Parts delivery at workstations, Various vibratory and non-vibratory devices for feeding and orientation, Product design for automated assembly,	7
4	Unit 4: - Fundamentals of Industrial Robots Basic Concepts such as Definition, three laws, DOF,Specifications and Characteristics, Criteria for selection, Dynamic propertiesof robots-stability, Control resolution, Spatial resolution, Accuracy, Repeatability, Compliance, Introduction to mobile Robots, Path Planning and Machine Vision systems Artificial Intelligence: - Introduction to Artificial Intelligence, AI techniques, Need and application of AI, Other Topics in Robotics: - Socio-Economic aspect	7
5	Unit 5: - Robotic End Effectors & Manipulator Kinematics End Effectors- Types, grippers, Various process tools as end effectors; Robot End effector interface, Active and passive compliance, Gripper selection and design,Introduction to Transformation, Relative transformation, DH representation and displacement matrices for standard configuration (theoretical treatment).	6
6	Unit 6: -Robot Teaching Introduction, Various teaching method, Task programming, Survey of Robot level programming languages, A Robot program as a Path in space, Motion interpolation, WAIT, SIGNAL and DELAY commands, Branching, Robot language structure, Various textual robot, Languages such as VAL II, RAIL, AML and their features, Typical programming examples such as palletizing, Loading a machine etc., Application of Robot.	6

Text Books:	
Sr. No.	
1	John J. Craig, Introduction to Robotics (Mechanics and Control), Pearson Education, ISBN 978-81-317-1836-0 3rd Edition, 2009
2	Mikell P. Groover Industrial Robotics: Technology, Programming and Applications, Tata McGraw-Hill International, 3rd reprint 2008. ISBN 13-978-0-07 026509-7
3	Shimon Y. Nof, Handbook of Industrial Robotics, John Wiley Co, 2001. ISBN 0-471 17783-0
4	Automation, Production Systems and Computer Integrated Manufacturing, M.P. Groover, Pearson Education. ISBN: 81-7808-511-9 2nd Edition (2004).
5	Introduction to Robotics, Analysis, Control and Applications Niku, Saeed B., Wiley Publication, ISBN 9788126533121, 2nd Edition.
Reference Books:	
Sr. No.	
1	Richard D. Klafter, Thomas A. Chmielewski, Michael Negin, Robotic Engineering: An Integrated Approach, Prentice Hall India, 2002.
2	Hand book of design, manufacturing & Automation: R.C. Dorf, John Wiley and Sons
3	Fundamentals of Robotics- David Ardayfio, CRC Press (1987)
4	Robotics-Control, Sensing, Vision and Intelligence Fu, K.S.; Gonzalez, R.C. and Lee, C.S.G., McGraw Hill Intl. Ed., ISBN: 0-07-100421-1.
5	A Mathematical Introduction to Robotic Manipulation by Richard M. Murray, Zexiang Li, and S. Shankar Sastry c 1994, CRC Press



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	UMEC0705	L	T	P	Credit
Course Name:	Finite Element Analysis Lab	-	-	2	1
Course Pre-Requisites:	1. Applied Mechanics 2. Strength of Materials				
Course Description:	The course aims at solving the structural and thermal problems by FEA by hand calculations as well as by using Software.				

Course Objectives:

1	To provide the students the methodology of solving FEA problems by using hand Calculations
2	To train students in using the FEA software for solving FEA problems

Course Outcomes: After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
CO1	Explain structural and thermal problems by using analytical and engineering softwares	II	Understand
CO2	Analyze structural and thermal problems using FEA software	IV	Analyze

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	3								2	2	2
CO2	2	2	2	3	3								2	2	2

Assessment Scheme:

One component of In Semester Evaluation (ISE)

SN	Assessment	Marks
1	In Semester Evaluation	25

ISE are based on practical performed/ Quiz/ Mini-Projectassigned/ Presentation/ Group Discussion/Internal oral etc.

Course Contents:

Unit No.	Unit Content	No. of Sessions
1	Experiment No 1:Introduction :Assignment on past, present and future of FEA, steps involved in FEA .	1
2	Experiment No. 2: One dimensional structural problems to be solved by hand calculations.	2
3	Experiment No. 3: One dimensional structural problems to be solved by hand calculations.	2
4	Experiment No. 4: Analysis of truss problems to be solved by hand calculations.	2
5	Experiment No. 5: Torsion problems to be solved by hand calculations.	2
6	Experiment No. 6: Solution of all above problems by using FEA software and comparing results.	2
7	Experiment No.7: Modal Analysis of Mechanical element by using software.	2
8	Experiment No.8: Plane Stress and plane Strain problems by hand calculations and using software.	2

Text Books:

Sr. No.	
1	Finite Element Analysis using Ansys 11.0 by Paleti Shrinivas,Krishna Chaitnay Sambana, Rajesh Kuma Datti.
2	Finite Element Analysis Theory and Applications with ANSYS by Saeed Moaveni
3	Engineering Analysis with ANSYS Software by Y. Nakasone and S. Yoshimoto
4	The finite element method And applications in Engineering using Ansys® byErdogan Madenci, Ibrahim Guven
5	PracticalFinite Element Analysis by NitinGokhale of M/S Finite to Infinite.
6	Reference Manual of Hypermesh Software
7	Online TutorialHyperMesh Software.
8	Tutorial of Ansys Software.



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	UMEC0706	L	T	P	Credit
Course Name:	Digital Manufacturing Lab			2	1
Course Pre-Requisites:	Knowledge of 3D Modeling and surface modeling is essential				
Course Description:	With explosive growth of AM along with consumer interests, so many unique and interesting application areas are being developed. The objective of the course is to develop an understanding of the principles of the current additive manufacturing processes that produce parts by a layer at a time from solid 3D computer model so that optimal geometry, machine, and material can be selected to satisfy the functional requirement of the designed shape along with 3D scanning using professional 3D scanner. The course will conclude with a perspective in pushing the current envelope of AM spanning many technical domains such as biomedical, aerospace, biotechnology industries.				

Course Objectives:

1	To generate Solid / Surface model And converting it into .STL format
2	To generate the layer of .stl file and applying various printing parameters in Slicer Software and generate its program . Study the working of 3D Printer and print the object on machine
3	Scan the object using 3D scanner.

Course Outcomes: After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
CO1	Construct basic and advanced 3D solid Models and surface models of parts using CAD software.	III	Apply
CO2	Construct the layer of .stl file and applying various printing parameters in Slicer Software and generate its program and Build the part by printing it on 3d printer	III	Apply
CO3	Construct the CAD model of part using 3D scanner	III	Apply

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1		3							1	2	1	1
CO2	2	2	1		3							1	2	2	1
CO3	2	2	1		3							1	2	2	1

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	ISE	100%	ISE are based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group
2	ESE (POE)	100%	ESE Assessment is based on External practical oral examination

Course Contents:

S.N.	Experiment Name	No. of Hours
1	Generation of Solid/Surface model of industrial component using any commercially available high end CAD software and Converting the Solid/Surface model into .stl format.(STereoLithography =.stl) Definition of STereoLithography.	4 Hrs
2	Importing .stl file into slicer software like CURA. Applying various 3D printing parameters like nozzle diameter, Nozzle temperature, Bed temperature, Layer thickness, Shell thickness, Top and Bottom layer height, Fill density, Support, Support density etc., Generation of program to print object on 3D printer.	8 Hrs
3	Process overviews, Process Strength & limitations, of Fused Deposition Modeling construction and working of 3D Printer available in the lab, Inserting Filament in nozzle. Transferring the program to machine and carry out 3D printing on actual machine in the lab. Part cleaning.	8 Hrs
4	Introduction to reverse engineering. Scanning the physical prototype and converting into digital CAD model using 3D scanner.	4 Hrs

Text Books:

Sr. No.

1	Rapid Manufacturing: An Industrial Revolution for the Digital Age – Editors N. Hopkinson, R.J.M. Hague and P.M. Dickens, (2006) John Wiley & Sons, Ltd., ISBN-10 0-470-01613-2 Pereira, J.A. Pérez, J.L. Diéguez, G. Peláez and J.E. Ares,
2	“Design and manufacture of casting pattern plates”, by rapid tooling, Archives of Materials Science, Vol. 29, No. 1-2, 2008 63
3	Rafiq Noorani, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons, 2006.
Reference Books:	
Sr. No.	
1	Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 2nd Ed. (2015), Ian Gibson, David W. Rosen, Brent Stucker.
2	Laser Additive Manufacturing of High-Performance Materials, Dongdong Gu, Springer Publ. 2014
3	Understanding Additive Manufacturing, Andreas Gebhardt, Hanser Publishers, 2011.
4	Chua Chee Kai., Leong Kah Fai., Chu Sing Lim, Rapid Prototyping: Principles and Applications in Manufacturing,
5	Ian Gibson., David W Rosen., Brent Stucker., Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer, 2010.



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	UMEC0707	L	T	P	Credit
Course Name:	Project Phase-I			4	2
Course Pre-Requisites:	Knowledge up to pre-final year Mechanical Engineering Program.				
Course Description:	It covers problem identification, Activity planning for the time frame and division of project responsibility to each student, literature survey, designing methodology, synopsis preparation and data collection				

Course Objectives:

1	The student should be able implement their ideas/real time industrial problem/ current application of their engineering branch which they have studied in the curriculum
2	The student will learn to apply the state of the art topics in a broad area of his/her specialization
3	The student will learn to plan and carry work as per plan.

Course Outcomes: After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
CO1	Apply acquired knowledge and skills to identify problems or needs faced by industry or society.	III	Apply
CO2	Analyze the problem domain through an extensive review of relevant literature.	IV	Analyze
CO3	Analyze the problem to determine an appropriate methodology for addressing it.	IV	Analyze
CO4	Apply communication, teamwork, and leadership skills to effectively present the problem, methodology, and outcomes.	III	Apply

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO1	3	2	2	2			1		2	1	2	1	3	2	1	
CO2	2	2	2	3			1	2	2	1	2	2	2	1	1	
CO3	3	3	3	3	2	2	2		2	1	3	2	3	3	2	
CO4	1							2	3	2			1	1	2	

Assessment Scheme:

SN	Assessment	Weightage	Mark	Remark
1	In Semester Evaluation 1 (ISE1)	50%	50	Presentation
2	In Semester Evaluation 2 (ISE2)	50%	50	Presentation
	The In-Semester Exam (ISE-1) will be carried tentatively after one and half month of commencement of VII-Semester. The group should submit the synopsis in following format i. Title of Project ii. Names of Students iii. Name of Guide iv. Relevance v. Present Theory and Practices vi. Proposed work vii. Expenditure viii. References. The synopsis shall be signed by the each student in the group, approved by the guide and endorsed by the Head of the Department. The In-Semester Exam (ISE-2) will be carried towards the end of VII-Semester.			
	Course Content			

The students in a group of minimum FOUR will work under the guidance of the faculty member on the project work undertaken by them. The work started in Semester VII will be continued in the Semester VIII and the final submission of the report will be at the end of the Semester VIII.

The project work may consist of-

1. A comprehensive and up-to-date survey of literature related to study of a phenomenon or product.

2. Problem Identification

3. Methodology / Design Documents

4. A synopsis of the selected project work (two to three pages typed on A4 size sheets) will be submitted and assessed by the Project Guide and one more faculty member appointed by the Department / concerned responsible official of the sponsoring industry/Co-guide.

5. Data collection for manufacturing, fabrication and assembly.

Activity planning for the time frame and division of project responsibility to each student. An interim report of the work completed in Semester VII along with project diary and other relevant documents shall be submitted for the term work.

The term work shall be assessed by the Guide and one more faculty member appointed by the Head of the Department.

The assessment shall be based on a presentation of the work completed and submission of interim report.

A project report should preferably contain at least following details:

Abstract

Introduction

Literature Survey

Survey of Existing systems

Limitations of Existing systems or research gaps

Motivation (Challenges that are encouraging to choose the problem)

Problem Statement and Proposed Solution

Scope of the system

Proposed System

General Workflow/Block diagram

Analysis and Modeling (only applicable diagrams)

Design steps

Implementation Plan for Next Semester

Timeline Chart for Phase-I and Phase-II Summary

References



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	UMEE0731	L	T	P	Credit
Course Name:	Automobile & EV Technology	3	-	-	3
Course Pre-Requisites:	Basic Mechanical Engineering, I. C Engine, Basic knowledge about electric motors.				
Course Description:	This course discusses the fundamental concepts, principles and analysis of hybrid and electric vehicles. This course discusses the various EV subsystems such as electric motors, motor controllers, energy storage devices, battery management system, charging technology etc.				

Course Objectives:

1	To make students familiar with various basic systems of a modern automobile.
2	To introduce the mathematical treatments required for vehicle performance
3	To make students aware about latest trends in transportation towards a safe, pollution free and fully automatic vehicle.
4	To empower students to face the real life automotive usage with greater confidence.

Course Outcomes: After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
CO1	Explain different automobile systems and components.	II	Understand
CO2	Show the impact of EV on environment and sustainability	II	Understand
CO3	Demonstrate the structure of electric vehicle.	II	Understand
CO4	Compute design parameters of Electric vehicles for a given requirement.	III	Apply

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2											1	2	1	1
CO2	1					3	3					1	1	1	1
CO3	2											1	2	2	2
CO4	2	2	1									1	2	1	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:

Unit No.	Unit Content	No. of Lectures
1	Introduction to Electric Vehicle History of electric vehicles, Development towards 21st century, Automobile history and development, Classification, vehicle layouts- engine location and drive arrangement, specifications of vehicles, Type of vehicle bodies, Environmental impact, Social and environmental importance of hybrid and electric vehicles, Fuel Cell EV.	6
2	Transmission System Clutch – Function and requirements, Classification, Construction and working of Single-plate, Multi-plate, Diaphragm spring and centrifugal clutches, Fluid flywheel. Gear Box – Necessity, classification, construction of manual gear boxes like Sliding mesh, constant mesh, Synchromesh, Epicyclic gear train, Automatic transmission, Overdrive. Propeller shaft, Differential and final drive.	6
3	Vehicle Systems Steering system - function, principle of steering, Types of steering gearbox, power steering. Suspension system - Functions, Types of suspension systems, types of springs. Braking system - Need, principle, types, Mechanical, hydraulic and pneumatic brakes, disc and drum types, air brakes, Anti-lock braking system. Electrical Systems - Automotive batteries, battery charging system, alternators, lighting and electrical accessories, automobile air conditioning	6
4	Vehicle Performance Resistance to vehicle motion, Air, Rolling and Gradient resistance, Acceleration, Gradeability and draw bar pull, Traction and Tractive effort, Distribution of weight, Power required for vehicle propulsion, Selection of gear ratio, Rear axle ratio. (Numerical)	8

5	Electric vehicles – technology and design Configuration of EVs, Electric motor characteristics, design process and issue, modelling and performance estimation, energy consumption, regenerative breaking.	7
6	Hybrid electric vehicle technology Concepts, modes and operation patterns, architectures of hybrid drive trains, series hybrid drive train, parallel hybrid drive train	7
Text Books:		
Sr. No.		
1	“Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives”, C. Mi, M. A. Masrur and D. W. Gao, John Wiley & Sons, 2011	
2	“Hybrid Electric Vehicles: Energy Management Strategies”, S. Onori, L. Serrao and G. Rizzoni , Springer, 2015	
3	Kripal Singh, Automobile Engineering Vol II, Standard Publishers Distributors, Tenth Edition , 2007	
4	P S Gill, Automobile Engineering II, S K Kataria and Sons, Second Edition, 2012	
5	R K Rajput, Automobile Engineering, Laxmi Publications, First Edition, 2007	
Reference Books:		
Sr. No.		
1	James Larminie, J. Lowry, “Electric Vehicle Technology Explained”, John Wiley & Sons Ltd. 2003.	
2	M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design”, CRC Press, 2004.	
3	S. Onori, L. Serrao and G. Rizzoni, “Hybrid Electric Vehicles: Energy Management Strategies”,Springer, 2015.	
4	Iqbal Hussein, “Electric and Hybrid Vehicles: Design Fundamentals”, CRC Press, 2003.	
5	Newton, Steeds and Garrett, The Motor Vehicle, Butterworths International Edition, 11th Edition, 1989	

Title of the Course: Fracture Mechanics												L	T	P	Credit
												3	-	-	3
Course Code: UMEE0732															
Course Pre-Requisites: Analysis mechanical elements, Metallurgy, Machine Deign,															
Course Description: The focus of engineering fracture mechanics is to develop an understanding of the mechanics of fracture of engineering materials and structure under static and dynamic loading students will be taught the principles of linear elastic and elastic plastic fracture mechanics and their applications to engineering design. This course will be also introducing key applications of fracture mechanics in industry including damage detection failure analysis and experimental technique.															
Course Objectives: 1. To understand the design principle of materials and structures using fracture mechanics approaches 2. To introduce the mathematical and physical principles of fracture mechanics and their applications to engineering design. 3. To prepare the students for broader applications of fracture mechanics in material testing, evaluation, characterization, and material selection															
Course Learning Outcomes:															
CO	After the completion of the course the student should be able to												Bloom's Cognitive		
													level	Descriptor	
CO1	Explain basics of Fracture Mechanics												2	Understand	
CO2	Analyze Fracture behavior of materials under different conditions.												4	Analyze	
CO3	Estimate life of component considering crack tip opening and J integral												5	Evaluate	
CO4	Apply the principle of fracture mechanics to practical problems												3	Apply	
CO-PO Mapping:															
CO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3	2	1									2	3	1	
CO2	2	3	2									2	2	1	
CO3	2	3	3			1						1	2	1	
CO4	2	2	3	1	1	1						2	2		
Assessments:															
Teacher Assessment:															
Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.															
Assessment												Marks			
ISE 1												10			
MSE												30			
ISE 2												10			
ESE												50			
ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc. MSE: Assessment is based on 50% of course content (Normally first three modules) ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.															

Course Contents:	
Unit 1: Fracture mechanics principles : Kinds of Failure, Historical Aspects, Brittle and Ductile Fracture, Modes of Fracture Failure, A crack in a structure, The stress at a crack tip The Griffith criterion, The crack opening displacement criterion, Crack propagation, Closure	8 Hrs.
Unit 2: - Energy Release Rate: Introduction, Griffith's Dilemma, Surface Energy, Griffith's Realization, Griffith's Analysis, Energy Release Anelastic Deformation at Crack-tip, Crack Resistance, Stable and Unstable Crack Growth, R-curve for Brittle Cracks, Thin Plate vs Thick Plate, Critical Energy Release Rate.	6 Hrs.
Unit 3: - Stress Intensity Factor: Introduction, Stress and Displacement Fields in Isotropic Elastic Materials, Stress Intensity Factor, Background for Mathematical Analysis, Field Equations, Elementary Properties of Complex Variables, Westergaard's Approach, Model (Opening Mode), Mode II (Sliding Mode), Mode III (Tearing Mode)	6 Hrs.
Unit 4: - Elastic-plastic fracture: Fracture beyond general yield, The crack tip opening displacement, The possible use of the CTOD criterion, Experimental determination of CTOD, Parameters affecting the critical CTOD, Limitations, fracture at general yield, Use of the J Integral, Limitations of the J integral.	7 Hrs.
Unit 5: - Fatigue Crack Propagation: Introduction, Crack growth and the stress intensity factor, Factors affecting crack propagation, Variable amplitude service loading, Retardation models, Similitude, Small cracks	6 Hrs.
Unit 6: - Crack Detection through Non-Destructive Testing: Introduction, Examination through Human Senses, Liquid Penetration Inspection, NDT and Various NDT methods used in fracture mechanics, Ultrasonic Testing, Radiographic Imaging, Magnetic Particle Inspection.	7 Hrs.
Textbooks: 1. David Broek, "Elementary Engineering Fracture Mechanics", Springer Netherlands, 2011 2. Anderson, "Fracture Mechanics-Fundamental and Application", T.L CRC press 1998. 3. Prashant Kumar, "Elements of Fracture Mechanics", McGraw Hill Education (India) Private Limited, New Delhi.	
References: 1. Karen Hellan, "Introduction to fracture mechanics", McGraw Hill, 2nd Edition 2. S.A. Meguid, "Engineering fracture mechanics" Elsevier Applied Science, 1989 3. Jayatilaka, "Fracture of Engineering Brittle Materials", Applied Science Publishers, 1979 4. Rolfe and Barsom, "Fracture and Fatigue Control in Structures", Prentice Hall, 1977 5. Knott, "Fundamentals of fracture mechanisms", Butterworths, 1973	
Unit wise Measurable students Learning Outcomes: 1. Explain the mechanism of fracture in ductile and brittle materials. 2. Explain the ERR mechanics of brittle and ductile fracture. 3. Find out the stress intensity factor in structure. 4. Estimate cracks tip operating displacement crack detection and J integral 5. Find Crack Propagation 6. Explain different NDT methods for Fracture Mechanics Crack Detection.	

Title of the Course: Metal Forming and Joining Technology		L	T	P	Credit							
Course Code: UMEE0733		3	-	-	3							
Course Pre-Requisite: strength of material, metallurgy and machine tool processes												
Course Description: Metal forming techniques are use create different sheet metal product for engineering and residential applications. Theories of forming processes are good application of theory of plasticity like yielding criteria, application of two and three dimensional problem. Metal joining processes are play very important role in joining of two similar or dissimilar metal.												
Course Objectives: 1. Gain the fundamental knowledge about metal forming and metal joining processes 2. Understand the analysis of flow of material and it's properties during the processes 3. Selection the process of metal forming as application. 4. To introduce the students to the theory and practices of metal forming and metal joining processes												
Course Learning Outcomes:												
CO	After the completion of the course the student should be able to		Bloom's Cognitive									
			level	Descriptor								
CO1	Explain theoretical concepts of metal forming and metal joining processes		1	Remember								
CO2	Interpret the analysis of flow of material and it's properties during forming and joining the processes		4	Analyze								
CO3	Select process parameter of different metal forming and metal joining process		3	Applying								
CO4	Select the process of metal forming and metal joining process as per the applications		3	Applying								
CO-PO Mapping:												
CO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	1	2	3									
CO2	1	2										
CO3	2	3	2	3								
CO4	2	2	2									
Assessments :												
Teacher Assessment:												
Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one EndSemester Examination (ESE) having 20%, 30% and 50% weights respectively.												
Assessment		Marks										
ISE 1		10										
MSE		30										
ISE 2		10										
ESE		50										
ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.												
MSE: Assessment is based on 50% of course content (Normally first three modules)												

ESE: Assessment is based on 100% course content with 60-70% weight age for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1:--- Theory of Plasticity & Workability Flow curve, Concepts of true stress and true strain, plane stress condition ,stress tensor, yield criteria and their comparison., plastic stress-strain relationships. Plain stress condition, Equilibrium condition. Introduction to Workability Overview at the workability, Strain tensor, strain hardening. Strain rate, Friction and Lubrication in metal forming	8 Hrs.
Unit 2:--- Introduction metal forming processes Rolling:-Classification of rolling processes, deformation of metal in rolling, roll bite, elongation, reduction, defects in rolling, Introduction to Extrusion-Equipment and principles, types of extrusion, direct, indirect, Introduction to Drawing-drawing die working.	5 Hrs.
Unit 3:--- Introduction to Forging and Advanced Metal forming Processes Forging : Basic operations, forging stress and die design considerations, forging defects, applications. Advanced Metal forming Processes: Explosive forming, Electromagnetic forming, Magnetic pulse forming, hydro forming, Rubber pad forming.	5 Hrs.
Unit 4:--- Introduction to ARC welding process Fundamentals of arc welding, principle, process parameters and performance of joints by welding processes: GMAW, GTAW, PAW, SAW and their variants like P-GTAW, A-GTAW.	6 Hrs.
Unit 5:--- Introduction to Resistance: Fundamentals of resistance welding, spot, seam, protection, HF induction and resistance welding, flash-butt, stud welding	6 Hrs.
Unit 6:--- Radiation base welding processes Fundamentals of radiation based welding processes, melt-in and key hole modes, principle, process parameters and performance of joints by LBW, EBW, selection of power density and scanning speed in LBW, vacuum for EBW	6 Hrs.

Textbooks:

1. Manufacturing Processes – Begman, Amstead etc.(John Wiley)
2. Rowe, Principles of Industrial Metal working Processes,
3. Forging and Forging Die Design - Sharan, Prasad, Saxena.
4. Rolling of Metals: Ivankove and Chaturvedi (Yantrik Publications, Mumbai)
5. Extrusion - Pearson (McGraw Hill)
6. Manufacturing Technology: Foundry, Forming and Welding by P.N. Rao (TMH)
7. Plastic Technology: Theory, Design & Manufacture – William J. Patton
8. Plastics-6/e, J. Harry DuBOIS, Frederick W. John, Van Nostrand Reinhold Co.
9. Manufacturing Engineering Technology by Kalpakjian (Addison Wesley)
10. Manufacturing Processes for Engineering Materials by Kalpakjian (Addison Wesley)
11. Injection Mold Design, R.G.W. Pye 4/e, Affiliated East West Press Pvt. Ltd. New Delhi.
12. J. Norrish: Advanced Welding Processes, Woodhead publishing

13. Lancaster J. F., "The Metallurgy of Welding", 6th Ed., William Andrew Publishing.
14. Welding Handbook, Volumes 1, 2 & 3, 9th Ed., American Welding Society.
15. ASM Metals Handbook", Vol. 6, ASM International Publication.
16. Larry J. and Jeffus L., "Welding Principles and Application", 5th Ed., Delmer Publication.
17. Messler R. W., "Principles of Welding (Processes, Physics, Chemistry and Metallurgy)", John Wiley & Sons
18. Richard L Little, Welding and welding technology, Mc Graw Hill, 2021.

References books:

- 1] ASM Handbook on Forming
 - 2] Mechanical Metallurgy (S.I. Units) - Dieter, McGraw Hill
- 1.

Title of the Course: ADVANCED MANUFACTURING PROCESSES		L 3	T -	P -	C 3
Course Code: UMEE0734					
Course Pre-Requisite: Basic Knowledge of conventional manufacturing Processes like sand casting, welding, metal forming And plastic processing techniques.					
Course Description: This course create awareness about essential advanced technologies and knowledge required in the engineering industry. It covers advanced machining processes, special casting processes, advanced welding processes and plastics processes. Orientation is all about getting an overview of the advances in the field of manufacturing processes.					
Course Objectives: 1. To understand importance of advanced machining processes. 2. To acquire knowledge of different types of nontraditional machining processes 3. To disseminate knowledge on various plastic processing techniques. 4. To Understand fundamental of advanced arc, and solid state welding processes 5. To create awareness about current trends in foundry practice.					
Course Learning Outcomes:					
CO	After the completion of the course	Bloom’s Cognitive			
		Level	Descriptor		
CO1	Compare traditional and non-traditional machining processes.	II	UNDERSTANDING		
CO2	Define the scope and importance of advanced machining process and their relative characteristics.	III	APPLYING		
CO3	Explain theoretical concepts of plastic processing methods and applications	III	UNDERSTANDING		
CO4	Apply advanced knowledge of casting for different range of materials.	III	APPLYING		
CO5	To Understand fundamental of MIG,TIG welding and solid state welding processes	II	UNDERSTANDING		
CO6	To summarize technologies allied with manufacturing	II	UNDERSTANDING		

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2			2						2	2	2	
CO2	2	3			3						2	2	3	
CO3	2	2			2						2	2	2	3
CO4	2	3			2						2	2	3	
CO5	2	2			2						2	2	2	
CO5	2	2			3		3				2	2	2	

Strength of Correlation: Key: 3: High, 2:Medium, 1:Low

Assessments :**Teacher Assessment:**

In Semester Examination (ISE1 and ISE 2) will be for 20 Marks

Assessment	Marks
ISE 1	10
MSE	30
ISE II	10
ESE	50
TOTAL	100

ISE1 & ISE 2 : Assessment is based on assignments, quiz, declared test, seminar etc;

Course Contents:	
Unit 1: - IMPORTANCE OF ADVANCED MACHINING PROCESSES Need for advanced material removal processes, Classification of advanced machining/ metal removal processes. Considerations in process selection and applications, comparison of conventional Vs. unconventional machining processes Mechanical Energy based processes : Abrasive jet machining, Water Jet machining, working principle, process parameters and applications.	06 Hrs.
Unit 2: - ADVANCED MACHINING PROCESSES Electrical Energy Based Processes: Electrical discharge machining(EDM) Wire Electrical Discharge Machining, working principle, process parameters, and applications. Thermal Energy Based processes: Laser Beam Machining, Electron beam Machining, plasma arc machining, Working principle, process parameters and applications Chemical and Electro-chemical based processes : CHM, ECM , working principle, process parametrs and applications.	08 Hrs.
Unit 3: - PROCESSING OF PLASTICS : Introduction to polymer materials, thermoplastics and thermosets: General characteristics and applications. Criterion to select process technique ,Forming techniques for thermoplasiiics-blow molding, Injection molding Thermos forming and vaccum forming. Forming techniques for thermosets Compression molding, injection molding GRP molding. .	06 Hrs.

Unit 4: ADVANCED CASTING PROCESSES: Introduction to advanced metal casting techniques, Expendable molding Processes such as vacuum molding, Evaporative molds, Investment molds Shell molding, principle, process capabilities, advantages and applications. Permanent Mold Castings: Centrifugal casting, Die casting- hot chamber die casting and cold chamber die casting squeeze casting and continuous casting. Principle, advantages and applications. Modernisation and Mechanisation of foundries.	10 Hrs.
Unit 5: - ADVANCED WELDING PROCESSES • Advanced Arc Welding Processes Tungsten inert gas welding, Metal inert gas welding, Electroslag welding Electro gas welding, principle of operation, process characteristics, applications. • Solid State Welding Processes Principle of operation, process characteristics and applications of 1. Ultrasonic welding 2. Friction welding	07 Hrs.
Unit 6: SMART MANUFACTURING Introduction, Benefits, Limitations and applications. How does it differ from conventional/legacy manufacturing, computer integrated manufacturing systems. Functional areas of CIM systems.	03 Hrs.

TEXT/REFERENCE BOOKS

1. "Nontraditional Manufacturing Processes", G.F. Benedict, Marcel Dekker, Inc. New York.
2. "Advanced Machining Processes" Vijay.K. Jain, Allied Publishers Pvt. Ltd., New Delhi.
3. "Manufacturing Engineering & Technology", Kalpakjian. S., Pearson Education Asia.
4. "Materials and Processes in Manufacturing", E. P. DeGarmo, J. T Black, R. A. Kohser, Prentice Hall of India, New Delhi
5. "Material and Processes in manufacturing" Paul De Garmo, J.T.Black, and
6. Ronald.A.Kohser, Prentice Hall of India Pvt. Ltd., New Delhi
7. Tim A. Osswald Georg Menges "Material Science of Polymers for Engineers", Hanser ,Publications, 2012.
8. Plastics Engineering, Crawford R.J. Butterworth - Heinemann, 3rd Edition, 2005.
9. Plastics Extrusion Technology, Friedhelm Hansen, 2nd Edition, Hanser Publishers, 1997.
10. Modern welding technology: - Carry H. B. (Pearson; 2004)
11. Welding and welding technology: - Richard Little (TMH;2017)
12. AWS- welding handbook (AWS;2019)
13. Manufacturing Processes for Engineering Materials, S. Kalpakjian and S.Schmid 6th Edition, Pearson.
14. Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, M.P. Groover 7th edition, Wiley. Manufacturing Science, A. Ghosh, A. K. Mallik East-West Press Pvt Ltd, Second edition
15. Manufacturing Technology P.N. Rao Vol 2, Mc Graw Hill India.
16. G.K. Lal, Introduction To Machining Science,. G.K. Lal ,New Age International.
17. E. J. A. Armarego, R. H. Brown, The machining of metals, E. J. A. Armarego, R. H. Brown Prentice-Hall
18. Welding Hand Book, Volume I and IV , 8th Edition , American Welding Society,
19. Nasir Ahmed 'New Development in Advance Welding', Wood head publishing Limited, England, 2007
20. John Norrish, 'Advance Welding Processes- Technologies and Process Control' Wood



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	UMEE0741	L	T	P	Credit
Course Name:	Automobile & EV Technology Lab	-	-	2	1
Course Pre-Requisites:	Basic Mechanical Engineering, I. C Engine, Basic knowledge about electric motors.				
Course Description:	This course discusses the fundamental concepts, principles and analysis of hybrid and electric vehicles. This course discusses the various EV subsystems such as electric motors, motor controllers, energy storage devices, battery management system, charging technology etc.				

Course Objectives:

1	To make students familiar with various basic systems of a modern automobile technology.
2	To introduce the mathematical treatments required for vehicle performance
3	To make students aware about latest trends in transportation towards a safe, pollution free and fully automatic vehicle.
4	To empower students to face the real life automotive usage with greater confidence.

Course Outcomes: After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
CO1	Demonstrate the basic concepts of electric vehicles.	II	Understand
CO2	Explain different vehicle systems and components.	II	Understand
CO3	Identify electric vehicle troubleshooting and remedies.	III	Apply

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2											1	2	2	2
CO2	2											1	2	2	2
CO3	2	2	1									1	2	1	1

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation (Lab ISE)	50%	25 Marks (based on experiments)
2	End Semester Examination (POE)	50%	25 Marks

Course Contents:

Unit No.	Course Contents:	No. of sessions
1	Experiment No. 1:--- Study and demonstration of four-wheeler chassis layout and vehicle body parts and its materials.	1
2	Experiment No. 2:--- Study and Demonstration of working of single plate automobile clutch and synchromesh gearbox.	1
3	Experiment No. 3:--- Study and demonstration of final drive and differential.	1
4	Experiment No. 4:--- Study and Demonstration of Control systems – Braking system, steering system.	1
5	Experiment No. 5:--- Study and Demonstration of automobile systems –Suspension system, Electrical System.	1
6	Experiment No. 6:--- Demonstration of typical hybrid vehicle construction and operation.	1
7	Experiment No. 7:--- Regenerative braking with BLDC motor using bidirectional converter.	1
8	Experiment No. 8:--- Study of AC charger for electric vehicle.	1
9	Experiment No. 9:-- Experiment on wheel balancing and front wheel alignment.	1
10	Experiment No. 10:-- Visit to EV servicing station for study of vehicle maintenance, repairs and report.	1

Text Books:

Sr. No.	
1	Kripal Singh, Automobile Engineering Vol II, Standard Publishers Distributors, Tenth Edition , 2007
2	“Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives”, C. Mi, M. A. Masrur and D. W. Gao, John Wiley & Sons, 2011
3	“Hybrid Electric Vehicles: Energy Management Strategies”, S. Onori, L. Serrao and G. Rizzoni , Springer, 2015
4	P S Gill, Automobile Engineering II, S K Kataria and Sons, Second Edition, 2012

5	R K Rajput, Automobile Engineering, Laxmi Publications, First Edition, 2007
Reference Books:	
Sr. No.	
1	James Larminie, J. Lowry, “Electric Vehicle Technology Explained”, John Wiley & Sons Ltd. 2003.
2	M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design”, CRC Press, 2004.
3	S. Onori, L. Serrao and G. Rizzoni, “Hybrid Electric Vehicles: Energy Management Strategies”, Springer, 2015.
4	Iqbal Hussein, “Electric and Hybrid Vehicles: Design Fundamentals”, CRC Press, 2003.
5	Newton, Steeds and Garrett, The Motor Vehicle, Butterworths International Edition, 11th Edition, 1989

Title of the Course: Fracture Mechanics Lab												L	T	P	Credit
												-	-	2	1
Course Code: UMEE0742															
Course Pre-Requisites: Analysis mechanical elements, Metallurgy, Machine Deign,															
Course Description: The focus of engineering fracture mechanics is to develop an understanding of the mechanics of fracture of engineering materials and structure under static and dynamic loading students will be taught the principles of linear elastic and elastic plastic fracture mechanics and their applications to engineering design. This course will be also introducing key applications of fracture mechanics in industry including damage detection failure analysis and experimental technique.															
Course Objectives: 1. To understand the design principle of materials and structures using fracture mechanics approaches 2. To introduce the mathematical and physical principles of fracture mechanics and their applications to engineering design. 3. To prepare the students for broader applications of fracture mechanics in material testing, evaluation, characterization, and material selection															
Course Learning Outcomes:															
CO	After the completion of the course the student should be able to												Bloom's Cognitive		
													level	Descriptor	
CO1	Explain basics of Fracture Mechanics												2	Understand	
CO2	Analyze Fracture behavior of materials under different conditions.												4	Analyze	
CO3	Estimate life of component considering crack tip opening and J integral												5	Evaluate	
CO4	Apply the principle of fracture mechanics to practical problems												3	Apply	
CO-PO Mapping:															
CO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3	2							2	1		2	3	1	
CO2	2	3	2	2					2	1		2	2	1	
CO3	2	3	3	2	1				2	1		1	2	2	
CO4	2	2	3	2	1				2	1			2	2	
Assessments:															
Teacher Assessment:															
Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.															
Assessment										Marks					
ISE										25					
ISE is based on assignment/experiments completed by students on regular basis.															
Course Contents:															
Expt. No. 1 Study of standard procedure for testing material for fracture mechanics.														2 Hrs.	
Expt. No. 2 – Experiment on linear elastic fracture behaviour of M.S.														2 Hrs.	

Expt. No. 3 – Experiment on fracture behaviour of polymers	2 Hrs.
Expt. No. 4 – Experiment on effect of temperature on fracture behaviour of polymers.	2 Hrs.
Expt. No. 5 – Experiment on fatigue testing of MS	2 Hrs.
Expt. No. 6 – Experiment on fatigue testing of polymers	2 Hrs.
Expt. No. 7 – Experiment on crack detection using magnetic particle inspection.	2 Hrs.
Textbooks: 1. David Broek, “Elementary Engineering Fracture Mechanics”, Springer Netherlands, 2011 2. Anderson, “Fracture Mechanics-Fundamental and Application”, T.L CRC press 1998. 3. Prashant Kumar, “Elements of Fracture Mechanics”, McGraw Hill Education (India) Private Limited, New Delhi.	
References: 1. Karen Hellan , “Introduction to fracture mechanics”, McGraw Hill, 2nd Edition 2. S.A. Meguid , “Engineering fracture mechanics” Elsevier Applied Science, 1989 3. Jayatilaka, “Fracture of Engineering Brittle Materials”, Applied Science Publishers, 1979 4. Rolfe and Barsom , “Fracture and Fatigue Control in Structures” , Prentice Hall, 1977 5. Knott , “Fundamentals of fracture mechanisms”, Butter worths, 1973	

Title of the Course: Metal Forming and Joining Technology Lab Course Code: UMEE0743		L	T	P	Credit						
		2	0		2						
Course Pre-Requisite: strength of material, metallurgy and machine tool processes											
Course Description: Metal forming techniques are use create different sheet metal product for engineering and residential applications. Theories of forming processes are good application of theory of plasticity like yielding criteria, application of two and three dimensional problem. Metal joining processes are play very important role in joining of two similar or dissimilar metal.											
Course Objectives: 1. Gain the fundamental knowledge about metal forming and metal joining processes 2. Understand the analysis of flow of material and it's properties during the processes 3. Selection the process of metal forming as application. 4. To introduce the students to the theory and practices of metal forming and metal joining processes											
Course Learning Outcomes:											
CO	After the completion of the course the student should be able to				Bloom's Cognitive						
					level						
					Descriptor						
CO1	Explain theoretical concepts of metal forming and metal joining processes				1						
CO2	Interpret the analysis of flow of material and it's properties during forming and joining the processes				4						
CO3	Select process parameter of different metal forming and metal joining process				3						
CO4	Select the process of metal forming and metal joining process as per the applications				3						
CO-PO Mapping:											
CO	a	b	c	d	e	f	g	h	i	j	K
CO1	1	2	3								
CO2	1	2									
CO3	2	3	2	3							
CO4	2	2	2								
Assessments : Teacher Assessment: End Semester Examination (ESE) having wattages depend on file submission and continues assessment during semester.											
Assessment											
Marks											

ESE	25
ISE are based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc. ESE: Assessment is based on oral examination	
Course Contents:	
Experiment No. 1:--- Assignments based on the Fundamentals of MFT topics including exercises of practical application Aim and Objectives: Gain the fundamental knowledge of metal working and formability Outcomes: Explain concepts of deformation in forming process	2 Hrs.
Experiment No. 2:--- Die design for a simple forged component including 4Hrs. KIT's College of Engineering (Autonomous) ,Kolhapur 6 calculations and drawing Aim and Objectives: Selection the process of metal forming as per the applications such as forging	2Hrs.
Experiment No. 3:-- Industrial visits in Forging and Rolling industry for studying the metal forming- Aim and Objectives: Selection the process of metal forming as per the applications such as forging and rolling. Outcomes: Select process parameter of different metal forming process	4 Hrs.
Experiment No. 4:-- Making simple components of suitable material using the following processes a) Hot Forging ,b) Wire Drawing. c) Extrusion,d) Rolling,e)CO2 welding Aim and Objectives: Select the process of metal forming as per the applications Outcomes: Select process parameter of different metal forming process	4Hrs.
Experiment No. 5:-- Making simple components of suitable material using laser cutting Aim and Objectives: Selection the process of metal forming as per the applications such as laser welding Outcomes: Select process parameter of different metal forming process Aim and Objectives: Select the process of metal forming as per the applications	2 Hrs.
Textbooks: 1] George E. Dieter - Mechanical Metallurgy, McGraw Hill, London, 1988 2] R. Sharan, S.N. Prasad - Forging Design and Practice 3] Forging Equipment, Material and Processes, J. Altan, F. W. Boulger - Metals Ceramic Information Center, Columbus 1973. 4] Metal Forming Fundamentals & Applications – Alan T, American Society of Metals, Metal Park 1983	

5] Metal Forming Mechanics & Metallurgy, Hosford WF and Cadell R.M. , Prentice Hall, Englewood Cliffs, 1993

References:

1] G. E. Dieter - Workability Testing Techniques, American Society for Metals, Metals Park, 1984

2] Metal Forming Handbook, -Schuler, Springer-Verlag Berlin Heidelberg New York, (2008) ISBN 3- 540-61185-1

3] Roll Forming Handbook, - George T. Halmos, (CRC Press, Taylor & Francis), (2006) ISBN 0-8247- 9563-6

4] ASM Hand Book - Forming and Forging, 9/e, Volume 14, (1998)

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Title of the Course: ADVANCED MANUFACTURING PROCESSES		L	T	P	C
Course Code: UMEE0744		2	-	-	1
Course Pre-Requisite: Basic Knowledge of conventional manufacturing Processes like sand casting, welding, metal forming And plastic processing techniques.					
Course Description: This course creates awareness about essential advanced technologies and knowledge required in the engineering industry. It covers advanced machining processes, special casting processes, advanced welding processes and plastics processes. Orientation is all about getting an overview of the advances in the field of manufacturing processes. The objective is to get acquainted with all the processes and specialize in some key processes with a view to develop an aptitude towards emerging technologies or processes. The laboratory exercises are aimed at developing the necessary skills and knowledge pertaining to welding , forming and plastic processes.					
Course Objectives: 1. To understand importance of advanced machining processes. 2. To acquire knowledge of different types of nontraditional machining processes 3. To disseminate knowledge on various plastic processing techniques. 4. To Understand fundamental of advanced arc, and solid state welding processes 5. To create awareness about current trends in foundry practice.					
Course Learning Outcomes:					
CO	After the completion of the course	Bloom's Cognitive			
		Level	Descriptor		
CO1	To study advanced TIG welding process	II	UNDERSTANDING		
CO2	To create a butt joint applying TIG WELING PROCESS.	V	CREATING		
CO3	Explain theoretical concepts MIG welding process	III	UNDERSTANDING		
CO4	Apply advanced knowledge of MIG welding for creating lap joint.	V	CREATING		
CO5	To Understand fundamental of plastics processing	II	UNDERSTANDING		
CO6	To summarize technologies allied with advanced manufacturing processes	II	UNDERSTANDING		

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2			2						2	2	2	
CO2	3	3			3						5	5	5	
CO3	2	2			2						2	2	2	
CO4	3	3			3						5	5	5	
CO5	2	2			2						2	2	2	
CO5	2	2			2		2				2	2	2	

Strength of Correlation: Key: 3: High, 2:Medium, 1:Low

Assessments :

Teacher Assessment:

In Semester Evaluation (ISE) will be for 25 Marks

Assessment	Marks
ISE	25
In Semester Evaluation (ISE) : Based on Job Performed during Practical Session and Seminar given on Latest Trends in Manufacturing Processes.	
TOTAL	25
ESE --- (POE)	25
POE Evaluation will be based on Oral Examination of Course	25

Course Contents:

Session No..	Session Activity	No. of Hours.
01	TIG WELDING DEMONSTRATION	02
02	JOB ON TIG WELDING BUTT JOINT-ALUMINIUM	02
03	MIG WELDING DEMONSTRATION	02
04	JOB ON MIG WELDING LAP JOINT. STAINLESS STEEL WELDING	02
05	DEMONSTRATION OF PLASTIC PROCESSING	02
06	JOB ON INJECTION MOLDING	02
07	DEMONSTRATION OF LASER CUTTING	02
08	JOB ON LASER CUTTING	02
09	INDUSTRY VISIT TO STUDY ADVANCED MACHINING PROCESSES	02
10	INDUSTRY VISIT TO STUDY ADVANCED MACHINING PROCESSES	02
11	INDUSTRY VISIT TO STUDY ADVANCED CASTING PROCESSES	02
12	SEMINAR ON ADVANCES IN MANUFACTURING PROCESSES	02
13	SEMINAR ON ADVANCES IN MANUFACTURING PROCESSES	02

TEXT BOOKS

1. "Nontraditional Manufacturing Processes", G.F. Benedict, Marcel Dekker, Inc. New York.
2. "Advanced Machining Processes" Vijay.K. Jain, Allied Publishers Pvt. Ltd., New Delhi.
3. "Manufacturing Engineering & Technology", Kalpakjian. S., Pearson Education Asia.
4. "Materials and Processes in Manufacturing", E. P. DeGarmo, J. T Black, R. A. Kohser, Prentice Hall of India, New Delhi
5. "Material and Processes in manufacturing" Paul De Garmo, J.T.Black, and
6. Ronald.A.Kohser, Prentice Hall of India Pvt. Ltd., New Delhi
7. Tim A. Osswald Georg Menges "Material Science of Polymers for Engineers", Hanser ,Publications, 2012.
8. Plastics Engineering, Crawford R.J. Butterworth - Heinemann, 3rd Edition, 2005.
9. Plastics Extrusion Technology, Friedhelm Hansen, 2nd Edition, Hanser Publishers, 1997.
10. Modern welding technology: - Carry H. B. (Pearson; 2004)
11. Welding and welding technology: - Richard Little (TMH;2017)
12. AWS- welding handbook (AWS;2019)
13. Manufacturing Processes for Engineering Materials, S. Kalpakjian and S.Schmid 6th Edition, Pearson.
14. Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, M.P. Groover 7th edition, Willey. Manufacturing Science, A. Ghosh, A. K. Mallik East-West Press Pvt Ltd, Second edition
15. Manufacturing Technology P.N. Rao Vol 2, Mc Graw Hill India.
16. G.K. Lal, Introduction To Machining Science,. G.K. Lal ,New Age International.
17. E. J. A. Armarego, R. H. Brown, The machining of metals, E. J. A. Armarego, R. H. Brown Prentice-Hall
18. Welding Hand Book, Volume I and IV , 8th Edition , American Welding Society,
19. Nasir Ahmed 'New Development in Advance Welding', Wood head publishing Limited, England, 2007

REFERENCE BOOKS

1. John Norrish, 'Advance Welding Processes- Technologies and Process Control' Wood head publishing Limited, England, 2006
2. Modern Arc Welding technology: - Nadkarni S. V. (Ador Welding;2008)
3. Welding Metallurgy :- Sindo Kou (Wiley;2003
4. Text Books:- 1. "Nontraditional Manufacturing Processes", G.F. Benedict, Marcel Dekker, Inc. New York.
5. 2. "Advanced Machining Processes" Vijay.K.Jain, Allied Publishers Pvt. Ltd., New Delhi.



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	FINANCIAL MANAGEMENT	L	T	P	Credit
Course Name:	UMEA0701	2			0
Course Pre-Requisites:	This course requires the basic knowledge of the following: 1. Basics of Mechanical Engineering. 2. Basics of Mathematics.				
Course Description:	Engineering management relies on the knowledge of Engineering economics to be able to evaluate projects from a financial perspective. Optimizing financial performance of a project is a key responsibility of an Engineer in the decision-making process. This course is designed to present Engineering students the major concepts and techniques of costing that are needed in the decision-making process. The emphasis of this course is on the analytical analysis of cost calculation of component.				

Course Objectives:

1	To understand the basics of Costing and Finance Management
2	To apply analytical formulae to determine the cost of a component.
3	To emphasizes the strong correlation between engineering design and manufacturing of products/systems and the economic issues they involve.

Course Outcomes:

COs	CO Statement	Blooms Level	Descriptor
CO1	Explain basic elements of the Costing System.	II	Understand
CO2	Make use of Mathematical formulae to calculate the Depreciation and the Material cost.	III	Apply
CO3	Apply Engineering knowledge to calculate the weight and Machining time for a component	III	Apply
CO4	Explain the concept of Overheads and Solve Overhead Accounting problems.	III	Apply

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	
CO1	2											2			
CO2	3											2			
CO3	2	1										2	2		
CO4	2											2	2		

Assessment Scheme:

SN	Assessment	Weightage	Remark
4	End Semester Examination (ESE)	100%	100% course contents

Course Contents:

Unit No.	Unit Content	No. of Lectures
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1	Unit 1: ---Introduction Concept of cost, cost unit, cost center, classification of cost, Definition of costing, desirable conditions for a costing system. Cost Estimating: Definition, purpose and functions of Cost Estimation, estimating procedures, Depreciation, Causes of depreciation of assets, Depreciation numerical, Review of purchasing procedure, recording of stock and consumption of material by LIFO, FIFO, Weighted average method. (Numerical Treatment expected)	6
2	Unit 2: ---Estimation of Machining Cost Constitutes, direct cost, indirect cost, Estimation Process for each Operation Process of breaking down product drawing in to simpler elements or shapes, estimating the volume, weight and cost. Operation time calculation for turning, knurling, facing, drilling, boring, reaming, threading, milling, tapping, shaping, cutting, various grinding operations, planning etc. Machine Hour Rate Calculation. (Numerical Treatment expected)	7
3	Unit 3: ---Overheads and Cost Accounting Methods of Overhead Allocation, apportionment, absorption of overheads. (Numerical) Cost Accounting Methods: Job costing, Batch costing, Unit costing, Process costing, Contract costing, Activity based costing. (numerical)	6
4	Unit 4: ---Finance Management Objectives of Finance Management, Finance Functions, Internal and External, Short, medium and long-term finance, Sources of funds for business organization, Concepts of wants, scarcity, choice, opportunity cost, demand and supply curves, price determination. Minimum Attractive Rate of Returns, Internal Rate of Returns (IRR), Budgetary control, Budget objectives, classification of budgeting, Zero Base Budgeting, ZED Concept.	5

Text Books:

Sr. No.	Name of Textbooks
1	Mechanical Estimating and Costing By B.P. Sinha. Tata McGraw Hill Publishing Co. Ltd. N. Delhi
2	Mechanical Estimating and Costing T.R. Banga and S.C. Sharma, Khanna Publishers, Delhi-6
3	Principles & Practice of Cost Accounting – N. K. Prasad (Book Syndicate Pvt. Ltd.)
4	Cost Accounting: B. Jawaharlal (TMH)
5	Cost Accounting: R.R. Gupta.
6	Financial Management- I.M. Pande, Vikas Publishing House Pvt Ltd.

Reference Books:

Sr. No.	Name of Reference Books
1	Theory & Problems of Management & Cost Accounting – M.Y. Khan, P. K. Jain (TMH)
2	Mechanical Estimation and Costing – TTTI, Chennai (TMH)
3	Cost Accounting: Jain, Narang (Kalyani Publishers)
4	Cost Accounting, 13/e - B. K. Bhar, (Academic Publishers, Kolkata)
5	A Text Book of Estimating and Costing Mechanical – J.S. Charaya & G. S. Narang (Satya Prakashan)



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	UMEC0801	L	T	P	Credit
Course Name:	Project Phase-II			8	4
Course Pre-Requisites:	Domain knowledge from Mechanical Engineering				
Course Description:	Project Phase-II covers problem data analysis, design calculations, manufacturing/ simulation, results and discussion and documentation of project report.				

Course Objectives:

1	Practical implementation of theoretical knowledge gained during study.
2	Implement ideas/real time industrial problem/ current application
3	Evaluate better solution for selected problem using state of the art topics in a broad area of his/her specialization.

Course Outcomes: After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
CO1	Analyze the given problem and find safest suitable solution on the basis of Engineering knowledge background.	IV	Analyze
CO2	Develop a prototype solution using the methodology / numerical or simulation model for performance assessment of the solution under the variety of working	VI	Create
CO3	Analyze the outcome of the problem and validate findings on the basis of experimentation and testing.	IV	Analyze
CO4	Develop clarity of presentation based on communication, teamwork and leadership skills.	III	Apply

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO1	3	3	2	3	3	2	2	2	3		2	2	3	3	3	
CO2	3	3	2	3	3	2	2	2	3		2	2	3	2	3	
CO3	2	2	2	2	2	2		2	3	2	2	2	2	2	2	
CO4								2	3	2						

Assessment Scheme:

SN	Assessment	Weightage	Mark	Remarks
1	In Semester Evaluation 1 (ISE1)	25%	50	Progress report and Presentation
2	In Semester Evaluation 2 (ISE2)	25%	50	Progress report and Presentation
3	End Semester Examination (ESE)	50%	100	Submission of Dissertation report and Viva-voce of Project

Course Contents:

	Course Content
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Project Phase-II

The work started in Semester VII will be continued in the Semester VIII and the final submission of the report will be at the end of the Semester VIII.

ESE(O.E) :a) Submission of dissertation report

b) Viva-voce of Project Phase-II

The project work may consist of-

1. Design of equipment /idea
2. Manufacturing / simulation and testing.
3. Critical Analysis of any design or process for optimizing it.
4. Experimental verification of principles used in applications
5. Project report preparation

The report of the work completed in Semester VIII along with project diary and other relevant documents shall be submitted for the term work. The term work shall be assessed by the Guide and one more faculty member appointed by the Head of the Department. The assessment shall be based on a presentation of the work completed and submission of final report.

The oral examination shall be based on the final reports of project



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	UMEC0802	L	T	P	Credit
Course Name:	INTERNSHIP			4	2
Course Pre-Requisites:	Students should be able to communicate effectively and work well in a team. She/he should be able to demonstrate professional, reliable and a strong work ethic, this includes being punctual, taking initiative and being able to manage time effectively.				
Course Description:	The Industry Internship Program offers students the opportunity to gain practical experience and insight into the professional world within their chosen field. Throughout the internship experience, students will engage in meaningful projects, tasks, and assignments designed to develop industry-specific skills, enhance professional competencies, and foster personal growth. Under the guidance of experienced mentors and supervisors, students will have the opportunity to explore various aspects of the industry, gain exposure to industry trends and practices, and contribute to organizational goals.				

Course Objectives:

1	To apply theoretical knowledge gained in the classroom to real – world industry (Hands on experience.)
2	To develop professional skills such as communication, teamwork, time management, problem-solving and adaptability (Professional Development).
3	To expose students to the operations, practices and culture of a specific industry.
4	To engage students to work on real projects, this will develop problem solving skills, creativity, and the ability to deliver tangible results.
5	To encourage students to analyze problems, evaluate options and make decisions in real world.

Course Outcomes: After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
CO1	Apply theoretical concepts and academic knowledge gained in the classroom to practical.	III	Apply
CO2	Develop industry specific skills such as technical skills, research skills, analytical skills, or communication skills.	III	Apply
CO3	Develop the ability to identify, analyze and solve problems encountered in the workplace.	VI	Create
CO4	Interpret effectively through various channels, such as written reports, oral presentation, emails or meetings	II	Understand
CO5	Demonstrate overall growth and development as a professional integrating academic knowledge, practical skills, and personal qualities to succeed in future career endeavors within the industry	II	Understand

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2	2	1	1							3	2	
CO2	3	3	3		2								3	3	
CO3	3	3	3	3	3	1			2				3	3	
CO4					1			2		3	2				2
CO5	2	2	2			3		2	2	2	2	3	2	2	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	50%	presentation, industry review and project/ case study report evaluation etc.
2	In Semester Evaluation 2 (ISE2)	50%	presentation, industry review and project/ case study report evaluation etc.

Course Contents:

	Guidelines for Internship	No. of Lectures
1	As per the approved academic structure and internship policy defined by college, students will be allowed to take internships during the 8th semester of B.Tech program. Students must have to complete all the ISE activities of 8th Semester using LMS (Learning Management System). It will be mandatory to all students (including internship students) to appear for the Mid Semester Exam (MSE) and End Semester Exams (ESE). Failing to do so, you will not be considered for the award of B. Tech degree. There will not be any extension/exemption from MSE and ESE exams. The rest of the rules and regulations related to academics and exam are all applied as it is.	
2	The department holds the final authority to accept or reject the internship offered to students. Department will check the credibility of the organization offering the internship to students. If the department finds the internship is unworthy, then students will not be allowed to join the organization.	

3	Orientation and company Introduction • Introduction to the host company, its mission, values, and organizational structure. • Overview of the departments relevant to mechanical engineering. Familiarization with safety protocols, facilities, and resources.	
4	Departmental Rotation • Rotations through different departments or teams within the company. • Exposure to various functions such as marketing, operations, research and development, finance, etc. • Observe daily tasks, workflows, and project management processes.	
5	Project Assignments: Assignments aligned with the intern's field of study or interests. • Real-world projects with defined objectives, deliverables, and timelines. • Opportunities to work independently or collaborate with teams on cross-functional projects.	
6	Mentorship and Guidance: • Assignment of a mentor or supervisor to provide guidance, support, and feedback. • Regular check-ins and one-on-one meetings to discuss progress, challenges, and learning goals. • Opportunities for skill development, and professional networking.	
7	Performance Evaluation: • Regular performance evaluations based on predefined criteria and objectives. • Feedback from supervisors, mentors, and peers on technical skills, teamwork, and professionalism.	
8	Final Presentation and Report: • Culminating presentation and report showcasing the intern's accomplishments, projects, and key learnings. • Presentation to company executives, department heads, and/or internship college mentor. • Recommendations for improvements or insights gained during the internship.	

Text Books:

Sr. No.	
1	
2	
3	
4	
5	
6	

Reference Books:

Sr. No.	
1	
2	
3	
4	
5	



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	UMEE0841	L	T	P	Credit
Course Name:	CRYOGENICS	3			3
Course Pre-Requisites:	Basics of thermodynamics and Refrigeration system				
Course Description:	This subject introduce cryogenic engineering to the students, student will understand basic concepts of refrigeration, cryogenic and liquefaction process along with storage and transportation of cryogenic liquids.				

Course Objectives:

1	To learn basic concepts about cryogenics
2	To learn about refrigeration and liquefaction process
3	To Relate the principles of ultra-low temperature systems and their applications
4	To analyze handling and storage of cryogenic liquids and its application

Course Outcomes: After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
CO1	Explain the basic principles of cryogenic systems	II	Understand
CO2	Illustrate refrigeration and liquefaction processes	II	Understand
CO3	Apply principles of ultra-low temperature and their applications	III	Apply
CO4	Analyze storage systems used in cryogenic applications	IV	Analyze

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3					2	1					1	1		
CO2						2	1					1	1		
CO3		2					1							2	2
CO4	2	2		1								2		2	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:

Unit No.	Unit Content	No. of Lectures
1	Insight of Cryogenics: Basic definition and Principle of cryogenics, Properties of Cryogenic fluids, Material properties at Cryogenic.	7
2	Refrigeration and Liquefaction: Simple Linde cycle, Carnot Liquefaction Cycle, Joule Thomson Effect, Pre-cooled Joule Thomson cycle, dual- pressure cycle, Simon helium liquefier, classical cascade cycle, mixed refrigerant cascade cycle.	8
3	Ultra-low-temperature refrigerators: Definition and Fundamentals regarding ultra-lowtemperature refrigerators, Equipment associated with low-temperature systems, Various Advantages and Disadvantages.	7
4	Different refrigeration cycle and cryocoolers: Stirling cycle refrigerators, pulse tube Refrigerators, regenerators used in cryogenic refrigerators, magnetic refrigerators and cryocoolers.	7
5	Storage and Handling of Cryogenic Refrigerants: Cryogenic dewar, Storage and transfer systems, Insulation, Various types of insulation typically employed, Polyurethane Foams (PUFs) and Polystyrene Foams (PSFs), Vacuum insulation etc.,	8
6	Application of Cryogenic System: Broad Applications of Cryogenic Refrigerants in various engineering systems, Like Space Programs – Superconductivity - Cryo Metallurgy – Medical Applications.	8

Text Books:

Sr. No.	
1	Fundamentals of Cryogenic Engineering, Mamata Mukhopadhyay, PHI, 2010

2	Cryogenic Engineering, Thomas Flynn, CRC, 2004
3	Arora and Domkundwar, Refrigeration and Air-conditioning, Dhanpat Roy & Co., 2018.
4	Cryogenic Technology and Applications, A. R. Jha, Butterworth-Heinemann, 2005
5	Cryogenic Engineering - Fifty Years of Progress, Timmerhaus et. al., Springer, 2007
Reference Books:	
Sr. No.	
1	The book of Cryogenic Engineering, J. G. Weisend, CRC Press, 1998.
2	Cryogenic Engineering, R. B Scott., Van Nostrand and Company Inc., 1985.
3	Randall F. Barron, Cryogenic Systems, Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi, 1985.
4	Cryogenics: A Textbook, S. S. Thipse, Narosa Publishing House, 2013 (Reprinted/Distributed by Alpha Science International), New Delhi, India
5	Fundamentals of Cryogenic Engineering, Rohit Manglik, EduGorilla Publication, 2023, Lucknow, India.

Title of the Course: THERMAL MANAGEMENT AND PACKAGING OF ELECTRONICS Course Code: UMEE0842										L	T	P	Credit		
										3	-	-	3		
Course Pre-Requisite: Fluid Mechanics, Heat Transfer															
Course Description: The continuing trend toward miniaturization and high power density electronics results in a growing interdependency between different fields of engineering. In particular, thermal management has become essential to the design and manufacturing of most electronic systems. The course details how engineers can use intelligent thermal design to prevent heat-related failures, increase the life expectancy of the system, and reduce emitted noise, energy consumption, cost, and time to market. Appropriate thermal management can also create a significant market differentiation, compared to similar systems. Since there are more design flexibilities in the earlier stages of product design, it would be productive to keep the thermal design in mind as early as the concept and feasibility phase. The course provides the basic knowledge necessary to understand and solve simple electronic cooling problems. Also experimental and numerical techniques and tools that are used in a typical thermal design process. This course can help all engineers to develop the necessary expertise in thermal management of electronics and move a step closer to being a multidisciplinary engineer.															
Course Objectives: 1. To prepare students of Mechanical Engineering to excel in thermal management and packaging of electronics so as to succeed in careers in industry, technical professions or entrepreneurship. 2. To provide students with a solid foundation in mathematics, science and engineering fundamentals required to solve engineering problems in thermal management and packaging of electronics and also to pursue higher studies. 3. To train students with good scientific and engineering breadth in the areas of thermal management and packaging of electronics so as to comprehend, analyze, design and create novel products and solutions for the real life problems.															
Course Learning Outcomes:															
CO	After the completion of the course the student should be able to										Bloom's Cognitive				
											level	Descriptor			
CO1	Explain fundamentals of thermal management and packaging of electronics										2	Understanding			
CO2	Analyze the performance of thermal management of electronic devices										3	Analyzing			
CO3	Estimate the rate of heat transfer at specified thermal conditions.										4	Evaluating			
CO-PO,PSO Mapping:															
CO	PO1	PO2	PO3	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2	-	1
CO2	-	3	-	-	2	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	2	2	-	-	-	3	2	-

Assessments :**Teacher Assessment:**

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one EndSemester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

UNIT 1: Introduction: Semiconductor Technology Trends, Temperature-Dependent Failures, Importance of Heat Transfer in Electronics, Thermal Design Process	06 Hrs.
UNIT 2: Thermal Resistance Network: Thermal Resistance Concept, Series Thermal Layers, Parallel Thermal Layers, General Resistance Network, Thermal Contact Resistance, Thermal Interface Materials, Spreading Thermal Resistance, Thermal Resistance of Printed Circuit Boards (PCBs).	07 Hrs.
UNIT 3: Thermal Packages: Importance of Packaging, Packaging Types, Thermal Specifications of Microelectronic Packages, Package Thermal Resistance Network, Parameters Affecting Thermal Characteristics of a Package.	07 Hrs.
UNIT 4: Fundamentals of Heat Transfer: Fin theory: Heat Sink Thermal Resistance, Effectiveness, and Efficiency, Heat Sink Manufacturing Processes. Convection: Normalized Boundary Layer Equations. Forced and natural convection for flow over and across different geometrical configurations, Fans and Pumps, Plate-Fin Heat Sinks. Radiation: Fundamental laws and definition, Radiation Heat Transfer from a Plate-Fin Heat Sinks.	07 Hrs.
UNIT 5: Experimental Techniques and Thermal Design: Flow Rate Measurement Techniques, System Impedance Measurement, Fan and Pump Curve Measurements, Velocity Measurement Methods, Temperature Measurement Techniques, Acoustic Noise Measurements, Importance of Experimental Measurements in Thermal Design.	07 Hrs.
UNIT 6: Advanced Cooling Techniques: Heat Pipes, Liquid Cooling, Thermoelectric Coolers, Electro-hydrodynamic Flow, Synthetic Jet.	06Hrs.

Textbooks:

1. Heat Transfer- Thermal Management of Electronics, Younes Shabany, CRC Press, Indian Edition
2. Heat Transfer: A Practical Approach, Yunus A. Cengel , McGraw-Hill Higher Education; 2edition
3. Fundamentals of Heat & Mass Transfer ,7th Edition, Frank P. Incropera, Wiley.

References:

1. Fundamentals of Engineering Heat and mass transfer, R C Sachdeva, NEW AGE; Fourthedition
2. Heat And Mass Transfer, Data Book, C.P. Kothandaraman, New Age International PrivateLimited; Ninth edition.
3. Thermal Management in Electronic Component using Jet Impingement, Anwarullah

Mohammed, Mohammed Asadullah Thakur, LAP Lambert Academic Publishing.

Unit wise Measurable students Learning Outcomes:

1. Graduates will be able to explain fundamentals of importance of Heat Transfer in Electronics, failure process.
2. Graduates will be able to explain thermal resistance network, resistance calculation in PCBs
3. Graduates will be able to identify the parameters of thermal packages.
4. Graduates will be able to demonstrate fundamental knowledge heat transfer mechanisms relevant to electronic packaging.
5. Graduates will be able to demonstrate the understanding of experimental techniques used in Thermal management of electronics packaging.
6. Graduates will be able to explain the fundamentals of electronic cooling techniques.



Kolhapur Institute of Technology's College of Engineering, Kolhapur (Empowered Autonomous)

Department of Mechanical Engineering

Course Code:	UMEE0843	L	T	P	Credit
Course Name:	Design of Mechanical Systems	3			3
Course Pre-Requisites:	Applied Mechanics, Kinematics of Machines, Design of Machine elements.				
Course Description:	Design of Mechanical Systems is offered as Professional Elective III at the 8th semester of Mechanical Engineering undergraduate programme; consists of six units. The first unit consists of aesthetic and ergonomics consideration in design. Second unit deals with pressure vessel design. Third units discusses various Automobile transmission systems. The Fourth unit focuses on Design of Gear boxes or speed drives for machine tool applications and Fifth unit deals with I.C.Engine component design and sixth unit is of optimum design. This course intends to build the competency in the students to design complete mechanical system as compared to Design of component alone, Analyze the problem and implement solutions to enhance the efficiency of Systems in terms of cost, Strength, Rigidity, reliability, etc				

Course Objectives:

1	Classify different design parameters and evaluate optimum design.
2	Elaborate the significance of stepped regulation in Design of machine tool speed box and Design gear box.
3	Elaborate the significance of speed regulation in Design of Automobile gear box.
4	Select clutch and brake on the basis of Functional requirements of Automobile transmission systems.
5	Design I.C.Engine components.
6	Identify various design parameters of Crane..

Course Outcomes:

After the completion of the course the student will be able to			
COs	CO Statement	Blooms Level	Descriptor
CO1	Select various mechanical components on basis of functional requirements of system.	II	Understand
CO2	Identify various design parameters of mechanical Systems.	III	Apply
CO3	Apply analytical formulae to various mechanical systems to estimate design parameters.	III	Apply
CO4	Analyze static and dynamic behavior of mechanical systems.	IV	Analyze

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2											1	2	1	1
CO2	1	3				1						1	1		
CO3	2	2	2	1	1	1						2	2	2	
CO4	2	2	2	1	2							2	2		3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:

Unit No.	Unit Content	No. of Lectures
1	Optimum Design : Objectives of optimum design- Johnsons Method of Optimum Design (MOD), Adequate and optimum design. Primary, Subsidiary and Limit equations Optimum design with normal specifications of simple machine elements like tension bar, transmission shaft, helical spring. Introduction to optimum design with Langrange Multiplier.	6
2	Design of Speed Drives for machine tool applications : Determination of variable speed range- Graphical representation of speeds Structure diagram Deviation diagram- Ray diagram- Selection of optimum ray diagram- Difference between number of teeth of successive gears in a change gear box- Analysis of twelve speed gear box.	7
3	Design of Automobile Gear box: Automobile Gearbox - General engine operation and transmission types, Saw tooth diagram and design procedure for gearbox. Basic transmission types and kinematic diagram, Gear failures and material selection, module calculation concept, shaft design, lubrication selection and method, bearing selection and gearbox losses.	7

4	Design of Automobile transmission Systems : Design consideration in brakes, Band, Internal expanding shoe, External contracting shoe. Thermal consideration and rating of brakes. Design requirement of friction clutches, Selection criteria. Torque transmitting capacity of single plate, Multidisc clutch, Cone clutch and Centrifugal clutch.	8
5	Design of I. C. Engine Components Introduction to selection of material for I. C. engine components, Design of cylinder and cylinder head, Design of cylinder liners, Design of piston and piston pins, Piston rings, Design of connecting rod.	7
6	Design of Cranes: Classification, Criteria for selection, Types of cranes and their Layouts, Hoisting Mechanism, Traveling Mechanism – Trolley and Bridge, Design of Bridge Girder: Box type, Truss type, Design of Jib crane.	5

Text Books:

Sr. No.	
1	“Design of machine element”, V.B.Bhandari, Tata Mc- Graw Hill Publication, 3rd Edition.
2	“Mechanical Engineering Design”, Shigley and C.R.Misce, Tata Mc- Graw Hill Publication.
3	“Mechanical Design Analysis”, M.F.Spotts, Prentice Hall Publication.
4	“Design of Machine Tools”, S.k. Basu and D.K. Pal Oxford and IBH Publication, 6th Edition.
5	“Machine Tools Design”, N.K. Mehta, Tata Mc- Graw Hill Publication, 5th Edition.

Reference Books:

Sr. No.	
1	“Handbook of Gear Design”,Jitin Maitra,Tata Mc-Graw Hill Publication.
2	“Machine Design”, Black P.H.and O.Eugene Adams, Tata Mc- Graw Hill Publication.
3	“Process Equipment Design”, M.V.Joshi , Macmillal Publication, 3rd Edition.
4	“Mechanical System Design”, S.P.Patil, Jaico Publication House,New Delhi,2nd Edition.
5	“Principles of Machine Tool”, Sen. Bhattacharya, New Central Book Agency.



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:		UMEE0844										L		T		P		Credit	
Course Name:		Operations Research (Program Elective-IV)										3				-		3	
Course Pre-Requisites:		Preliminary knowledge of Linear Algebra (matrices, vectors, linear equations) and Engineering Mathematics																	
Course Description:		Course Description: Operations Research explores mathematical techniques for optimizing processes and making informed decisions. Topics include mathematical modeling, optimization techniques (such as linear programming), decision analysis under uncertainty, simulation, queuing theory, inventory management, and supply chain optimization. Emphasis is on practical applications through case studies and hands-on exercises. Students develop problem-solving skills applicable across various domains.																	
Course Objectives:																			
1		Understand and apply fundamental concepts of Operations Research																	
2		Analyze and solve optimization and scheduling problems																	
3		Evaluate strategic decisions through game theory, decision theory,																	
4		Develop and interpret project networks using CPM and PERT techniques, calculate critical paths, estimate project durations, and optimize project timelines.																	
Course Outcomes:		After the completion of the course the student will be able to																	
COs		CO Statement										Blooms Level			Descriptor				
CO1		Demonstrate the applicability of LPP techniques such as Graphical method, Simplex , Transportation and Assignment to the Industrial problems										II			Undersatnd				
CO2		Apply OR techniques such as Project management, Sequencing Theory for Decision making in Manufacturing industry										III			Apply				
CO3		Construct mathematical models for real life cases using game theory and replacement model										III			Apply				
CO-PO Mapping:																			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3				
CO1	2											2	2	2					
CO2	2	1									2	2	2	2					
CO3	2											2	1	1					
Assessment Scheme:																			
SN	Assessment					Weightage		Remark											
1	In Semester Evaluation 1 (ISE1)					10%		Assignment, Test, Quiz, Seminar, Presentation, etc.											
2	Mid Semester Examination (MSE)					30%		50% of course contents											
3	In Semester Evaluation 2 (ISE2)					10%		Assignment, Test, Quiz, Seminar, Presentation, etc.											
4	End Semester Examination (ESE)					50%		100% course contents											
Course Contents:																			
Unit No.	Unit Content															No of lectures			
1	Introduction to Operations Research (OR): History and development of Operations Research, Modeling in OR, Scope, Application of Operations Research, Linear Programming Problem: Formulation of problem, graphical solution, simplex procedure for maximization and minimization, Big M method and duality concern															6 Hrs			
2	Transportation, assignment and sequencing model: Transportation Problem (TP): Mathematical formulation of TP, methods to obtain initial basic feasible solution, TP without degeneracy and with degeneracy Assignment Problem (AP): Mathematical formulation of AP, variations of AP, Travelling salesman problem: Sequencing Problem: Assumptions in sequencing, processing of n jobs on two machines, processing of n jobs on three machines and processing of n jobs on m machines.															7 Hrs			
3	Replacement model: Introduction, replacement of items that deteriorates replacement of items whose maintenance and repair cost increases with time ignoring value of money and replacement of items whose maintenance and repair cost increases with time considering value of money, replacement of items that fail suddenly group replacement															6 Hrs			
4	Games theory: Minimax (Maxmin) criterion for optimality, characteristics of game, dominance principles, 2X2 game-arithmetic and algebraic method, 2Xn and mX2 game-graphical method and method of sub-games, 3X3 game-method of matrices, iteration method and applications of games theory															7 Hrs			
5	Decision Theory: Introduction, Pay off table, Opportunity loss or regret table, Decisions under uncertainty, Laplace criterion, Maximin or Minmax principle, Maximax or Minimin principle, Hurculeilcz principle, Decisions under risk–maximum likelihood criteria, Expectation principle, Expected opportunity loss or expected regret decision trees.															7 Hrs			
6	Network Model: CPM – Construction of networks, critical path, Forward and backward path, Floats and their significance, PERT – Time estimates, Construction of networks, Probability of completing projects by given date, Crashing.															7 Hrs			
Text Books:																			
Sr. No.																			
1		S. D. Sharma, Himanshu Sharma, “Operations research: Theory, Methods and Applications”, Fifteenth edition, Kedar Nath Ram Nath, Meerut																	
2		Premkumar Gupta, D. S. Hira, “Operations research”, revised edition, S. Chand & Company Pvt. Ltd																	
Reference Books:																			
Sr. No.																			
1		Hamdy A Taha, “Operations research-An introduction”, Ninth edition;2011, Pearson																	
2		Maurice Saseini, Arhur Yaspan and Lawrence Friedman, “Operations research: methods and problems”, Literary Licensing																	
3		Encyclopedia of Operations Research and Management Science, Saul I. Gass & Michael C. Fu, Springer (Springer New York, NY)																	
4		Introduction to Operations Research, Frederick S. Hillier & Gerald J. Lieberman, McGraw-Hill																	
5		Operations Research: Principles and Practice – Ravindran, Phillips & Solberg (John Wiley & Sons)																	



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	UMEE0845	L	T	P	Credit
Course Name:	Industrial Engineering	3	0	0	3
Course Pre-Requisites:	Knowledge of machines and processes used in manufacturing organizations.				
Course Description:	Industrial engineering is one of the fastest growing areas of engineering. It looks at what makes organizations work best. An industrial engineer tries to find the right combination of human and natural resources, technology, equipment, information and finance to do the work best. This course is important to finding the answers for many important problems in manufacturing. Industrial engineers design and change how things are done to increase quality, safety and productivity.				

Course Objectives:

1	To introduce students to the concept of Productivity.
2	To acquaint the students with tools and technique of industrial engineering.
3	To analyze and design new method of performing job.
4	To understand work measurement techniques

Course Outcomes: After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
CO1	Illustrate various tools and techniques for utilization of resources.	II	Understand
CO2	Identify various non-value adding activities.	III	Apply
CO3	Select optimum arrangement of facilities.	III	Apply

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		3	2		2						2	3	3	1
CO2	3	2	3	2		2	3	1	2		1		3	1	2
CO3	3					2				2			3	3	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:

Unit No.	Unit Content	No. of Lectures
1	Introduction to Industrial Engineering and Productivity:- Introduction to Industrial Engineering – Definition, Scope, Responsibilities, Important contributors to I.E., Tools and techniques of industrial engineering. Productivity: Definition, Types of Productivity, measurement of Productivity, Productivity improvement techniques. Productivity improvement programme.	7
2	Method Study:- Historical background, Role of work study in improving productivity, Steps, Tools and Techniques used in the Method Study, outline Process Chart, Flow process Chart, Symbols, Flow Diagrams, Two Handed Chart, String diagram, Multiple Activity Chart, 5W and 1 H.	7
3	Motion Study :- Principles of motion economy, Micromotion study, SIMO chart, MEMO motion study, Cycle graph, Chronocycle graph Production Planning and Control: Introduction: Types of production systems, Need and functions of PPC, Aggregate production planning, Capacity Planning.	6
4	Work Measurement (TimeStudy):- Aim & Objectives, Terminology & Tools, Use of stopwatch procedure in making Time Study. Time Study Forms, Performance rating, allowances and its types. Calculation of Standard Time. Work Sampling: Introduction to work sampling. Determinations of Standard time using work Sampling. Synthetic & Standard data Methods: Concepts, Introduction to PMTS, MTM1, WFS, and Basic Motion Time Study. MTM2 & Other second Generation Methods, MOST and other advanced work measurement techniques.	9
5	Facility Design:- Plant site selection, Factors influencing the selection, Optimum decision on choice of site and analysis, Types of plant layout, Advantages and disadvantages of layout, Principles and objectives of plant layout, Tools and techniques of layout planning, Material handling.	7
6	Value Engineering:- Value Analysis: Definition, Concept of approaches of value analysis and engineering, steps, Evaluation, and applications of value analysis.	4

Text Books:

Sr. No.	
1	M. Telsang, “Industrial Engineering and Production Management”, S. Chand Publication, ISBN 81 219 1773 5.

2	O. P. Khanna, "WorkStudy", Dhanpat Rai Publications, New Delhi.
3	Banga & Sharma, "Industrial Organisation & Engg. Economics", Khanna Publishers, 2001, ISBN 81-7409-078-9
4	Chabra T. N., "Principles & Practices of Management", Dhanpat lal & compony
5	MahajanM., "Industrial Engineering and Production Management" Dhanpat Rai and Sons Publishers, 2005, ISBN-81-7700-047-0
Reference Books:	
Sr. No.	
1	H. B. Maynard and others, "Industrial Engineering Handbook", IVth edition McGraw Hill Publications, ISBN 0-07-041084-4.
2	"Introduction to Work Study", ILO Universal Pub. Co, B'bay, ISBN 818502706
3	Ralph M. Barnes, "Motion and Time Study : Design and Measurement of Work" J. Wiley & Sons.
4	Koontz Harold and Weihrich Heinz, "Essentials of management", 7ed, Tata McGraw Hill publishing, 2008, ISBN 0-07-0623030-x.
5	Luthansf., "OrganizationalBehaviour", McGraw-HillCompany, 2008, ISBN 81-317-05021.
6	CynthiaL. Greene, "Entrepreneurship: Ideas in Action", Thomson, ISBN-981-243-257-1.

Title of the Course: Internet of Things (IoT)												L	T	P	Credit
Course Code: UMEE0846												3	-	-	3
Course Pre-Requisites: C programming basics, Understanding of sensors and actuators. Study of microcontrollers, IP protocol. Arduino programming.															
Course Description: Internet of Things (IoT) is one of the upcoming technologies worldwide. IoT encompass different application domain like agriculture, space, healthcare, manufacturing, construction, water irrigation and mining. IoT hardware collect data, upload data on cloud using different protocols. Cloud is making things possible for pervasive connectivity, storage, and computation, which, in turn, creates immense opportunities for building different IoT solutions															
Course Objectives: 1. Introduce architecture of IoT. 2. Analyze protocols for implementation of IoT 3. Sensor technology for IoT. 4. Prototyping and Designing Software for IoT Applications 5. Overview of security aspects of IoT and cloud 6. Discuss Applications and Case study of IoT															
Course Learning Outcomes:															
CO	After the completion of the course the student should be able to												Bloom's Cognitive		
													level	Descriptor	
CO1	Understand basics concept of IoT and its applications												2	Understand	
CO2	Make use of Sensors and Protocols for IoT												3	Applying	
CO3	Selection of software's for IoT and security threats and solution												3	Applying	
CO-PO Mapping:															
CO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
Assessments:															
Teacher Assessment:															
Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.															
Assessment										Marks					
ISE 1										10					
MSE										30					
ISE 2										10					
ESE										50					
ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc. MSE: Assessment is based on 50% of course content (Normally first three modules) ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.															
Course Contents:															
Unit 1: - Overview of Internet of Things: IoT Conceptual Framework, IoT Architectural View, Technology Behind IoT, Sources of IoT, M2M communication, Modified OSI Model for the IoT/M2M Systems, enrichment, Examples of IoT.														8 Hrs.	
Unit 2: - Internet Connectivity Principles: Introduction, Internet															

Connectivity, Internet based communication, IP addressing in the IoT, Media access control, Application Layer Protocols: HTTP, HTTPS, FTP, Telnet and others.	6 Hrs.
Unit 3: - Sensors, Participatory Sensing, RFIDs, and Wireless Sensor Networks: Introduction, Sensor Technology, Participatory sensing, Industrial IoT and automotive IoT, Actuator, Sensor data communication Protocols,	6 Hrs.
Unit 4: - Prototyping and Designing Software for IoT Applications: Introduction, Prototyping Embedded device software, Programming Embedded Device Arduino Platform using IDE, Reading data from sensors and devices, Devices, Gateways, Internet and Web/Cloud services software development. Programming MQTT clients and MQTT server	7 Hrs.
Unit 5: -. IoT Security: Introduction to IoT privacy and security. Vulnerabilities, security requirements and threat analysis, IoT Security Tomography and layered attacker model, Radio Frequency Identification Technology (RFID), Wireless Sensor Networks Technology.	6 Hrs.
Unit 6: - IoT Applications and Case Studies: Introduction, IoT Applications in the Premises, Supply-Chain and customer monitoring, Connected cars and its applications and services, IoT Applications for Smart Homes, Cities, Environment monitoring and Agriculture, Case Study: Smart city streetlights Control and Monitoring.	7 Hrs.
Textbooks: 1. Internet of Things: Architecture And Design Principles, Raj Kamal, McGraw Hill 2017 2. Internet of Things (A Hands-on-Approach) , Vijay Madiseti , Arshdeep Bahga 3. Cloud Computing Black Book- Jayaswal, Kallakurchi, Houde, Shah, Dreamtech Press	
References: 1. 6LoWPAN: The Wireless Embedded Internet, Zach Shelby, Carsten Bormann, Wiley 2. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publishers 3. The Internet of Things: From RFID to the Next-Generation Pervasive Networked Lu Yan, Yan Zhang, Laurence T. Yang, Huansheng Ning 4. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010 5. Designing the Internet of Things , Adrian McEwen (Author), Hakim Cassimally	
Unit wise Measurable students Learning Outcomes: 1. Discuss the basics concepts of IoT. 2. Discuss and analyze protocols used in IoT implementation 3. Discuss sensor technology used for IoT. 4. Discuss design software for IoT application 5. Discuss analyze security concerns of IoT. 6. Discuss IoT applications and case studies	

Title of the Course: GAS TURBINES AND JET PROPULSION	L	T	P	Credit
Course Code: UMEE0851	3	-	-	3

Course Pre-Requisite: Engineering thermodynamics and Heat transfer engineering

Course Description:

This course equips student with the fundamentals of propulsion systems, fundamentals of gas turbine, exploring their workings and performance. Student will also gain a solid understanding of compressible and incompressible flow, critical concepts in propulsion. Finally, the course explores the principles and operation of both aircraft and rocket propulsion systems.

Course Objectives:

The course aims to

To gain the understanding about working and performance of gas turbine.

To understand fundamentals and operation of compressible and in-compressible flow

To understand the phenomenon of shock waves and its effect on flow.

To gain knowledge about jet propulsion and Rocket Propulsion.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Understand the working and performance of gas turbine	II	Understand
CO2	Analyze compressible and in-compressible flow and its effects.	IV	Analyse
CO3	Understand the principle and operation of aircraft propulsion	II & III	Understand and Apply
CO4	Understand the principle and operation of rocket propulsion	II & III	Understand and Apply

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3												2		
CO2		2	2									1		3	
CO3						2						1			2
CO4	2			2			1								2

Assessments :

Teacher Assessment:

Two components of in Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one EndSemester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/case study/group discussion etc.

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with 60-70% weightage for course content(normally last three modules) covered after MSE.

Course Contents:	
Unit 1: Introduction Development of gas turbine, Classification of gas turbines, Basic cycle of Gas turbine operation, Gas turbine vs. reciprocating IC engine, Gas turbine v.s. steam turbine Applications of gas turbine.	06 Hrs.
Unit 2: Analysis of gas turbine cycles: Analysis of simple and constant pressure GT cycle, analysis with heat exchanger, Reheater and inter-cooler, combination of different cycles, Ericsson cycle. Thermodynamic analysis of actual gas Turbine cycle	08 Hrs.
Unit 3: Gas turbine power generation: Different types of turbine, Open cycle Gas turbine with single shaft power generation and separate power turbine, closed cycle system and semi-closed gas turbine system. Optimum pressure ratio for maximum output. Velocity ratio and torque, advantage and limitation of velocity compounding, Cooling of gas turbine blades.	06Hrs.
Unit 4: Gas dynamics Introduction, velocity of sound in ideal gas and Mach number, compressibility and its effects, One-dimensional steady flow, Energy and momentum equations for compressible fluid flows- various regions of flows, stagnation state, propagation of sound waves, critical states, Mach number, critical Mach number and effect of Mach number on compressibility. Governing equations - variation of flow parameters like static pressure, static temperature, density, stagnation pressure and entropy across the normal shock, flow in convergent and divergent nozzle with shock - normal shock in Fanno and Rayleigh flows - flow with oblique shock (elementary treatment only).	08Hrs.
Unit 5: Aircraft propulsion – Types of jet engines – energy flow through jet engines - study of turbojet engine components – diffuser, compressor, combustion chamber, turbine and exhaust systems.	07 Hrs.
Unit 6: Rocket propulsion – Classification of rocket engines – Propellants: solid and liquid propellants, rocket engines thrust equation – effective jet velocity specific impulse – rocket engine performance – Flow through rocket nozzles, Vertical flight of a rocket: powered flight and coasting flight – Rocket applications	07 Hrs.
Textbooks: 1. V. M. Domkundwar, Gas Turbines and Jet Rocket Propulsion, Dhanpat Rai & Co. (Pvt.) Ltd.,2012. 2. P. Balachandran, Fundamental of Compressible Fluid Dynamics, Prentice Hall of India, New Delhi, 2009. 3. Anderson, J.D., "Modern Compressibleflow", 3rd Edition, McGraw Hill,2012 4. Yahya, S.M. "Fundamentals of Compressible Flow", New Age International (P) Limited,New Delhi,2002	
References: 1. Patrich.H. Oosthvizen, William E. Carscallen, Compressible fluid flow, Tata McGraw 2. HillPublishing Company Pvt Ltd., New Delhi,2004 3. Rathakrishnan, Gas Dynamics, Prentice Hall of India, New Delhi, 2008. 4. H. Cohen, GFC. Rogers and HIH Saravanamuttoo, Gas Turbine 5. Theory, Longman House, Burnt Mill, Harlow, 1996.	
Unit wise Measurable students Learning Outcomes: 1) Acquire the knowledge of gas turbine and its working 2) Analyse the performance of gas turbine 3) Inculcate the operation of gas turbine power generation 4) Understand the fundamentals of compressible and incompressible flow 5) Study the working and operating of air craft propulsion 6) Study the working and operation of rocket propulsion	



Kolhapur Institute of Technology's College of Engineering Kolhapur (Autonomous)

Department of Mechanical Engineering

Course Code:	UMEE0852	L	T	P	Credit
Course Name:	DESIGN OF THERMAL SYSTEMS	3			3
Course Pre-Requisites:	Applied Thermodynamics, Fluid Mechanics, Heat & Mass Transfer, Refrigeration and Air-conditioning.				
Course Description:	This subject enables the student to understand the different components, accessories and controls used in refrigeration systems. The students will be able to understand mathematical formulation of components as well as a whole thermal system. The students will be able to estimate the heat load calculations for refrigeration applications and will be able select or design appropriate components.				

Course Objectives:

1	Learn thermal system design methodology
2	Learn mathematical formulation of components as well as a whole thermal system
3	Learn estimation of heat load calculations for refrigeration applications.
4	Design simple thermal systems

Course Outcomes:

After the completion of the course the student will be able to			
COs	Upon completion of the course, students shall have ability to	Blooms Level	Descriptor
CO1	Apply knowledge of mathematics, science, and engineering for mathematical formulation of components as well as a whole thermal system.	III	Apply
CO2	Analyze the heat load calculations for refrigeration applications	IV	Analyze
CO3	Design the thermal systems.	V	Design

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3		
CO2	3	2												2	2
CO3		2		3	3										

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:

Unit No.	Unit Content	No. of Lectures
1	Introduction to Thermal System Design: Thermal systems used in practice, Classification of design, Optimal and nearly optimal design, Methodology of design, Aspects of thermal system design, Assessment concept and creation, mathematical formulation component level and system level by first law of thermodynamics [energy balance basis].	6
2	Design of Refrigeration System: Types of components used in VCRC, controls, accessories, their functions, salient features, applications, heat load calculations and design of basic components of refrigeration systems, Design of refrigeration systems - Household refrigerator, Ice plant, Cold storage, refrigerated vehicle, Vapour absorption systems.	9
3	Design Analysis of Air Conditioning System: Design of Air conditioning systems: Design considerations, Load calculations, Single unit room air-conditioner, Central air conditioning plant, Industrial drying systems, Component selection.	5
4	Design of Solar System Design of solar assisted water heating systems, applications of solar energy, types of solar collectors, Preliminary specifications, Concepts development, Component design.	6

5	Heat Exchanger Networking & Advanced Cooling Systems: Design of advanced heat exchanger networks, Design of electronic miniature cooling systems, Utilization of Nano-Fluids for cooling systems, Design of waste heat recovery systems.	6
6	Exergy Analysis: Concept of exergy, Physical exergy and Chemical exergy, Exergy analysis for control region, Exergy concepts for closed systems, Exergy efficiency, Grassmann diagram .	8
Text Books:		
Sr. No.		
1	“Thermal Design & optimization”, Adrian Bejan, George Tsatsaronis, Michael Moran, JOHN WILEY & SONS INC .	
2	“The Exergy Method of Thermal Plant Analysis”, T. J. Kotas, British Library Cataloguing in Publication Data.	
3	“Exergy, Energy, Environment and Sustainable Development “, Ibrahim Dincer, Marc A. Rosen	
4	“Handbook of Process Heat Transfer”, Hewitt	
Reference Books:		
Sr. No.		
1	“HVAC System Design Handbook” ASHRAE.	
2	“Design and Optimisation of Thermal Systems”, Yogesh Jalurkar, CRC Press.	
3	“Design and Simulation of Thermal Systems”, N.V. Suryanarayana, Oner Arici, Tata Mc Graw Hill Inc.	
4	“Thermal System Design”,Stoecker, Tata McGrew Hill Publication, 3rd Edition.	



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	UMEE0853	L	T	P	Credit
Course Name:	Process Equipment Design	3	-	-	3
Course Pre-Requisites:	Knowledge of Analysis of Mechanical elements and Machine Design				
Course Description:	Process equipment design is a course designed to learn the design procedures of process equipment design like pressure vessels, pressure vessel supports, heat exchangers etc and to get familiar with standards related with process equipments.				

Course Objectives:

1	To prepare the students to design the process equipment
2	To make students familiar with design procedures and various standards related with the design of process equipment

Course Outcomes: After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
CO1	Identify the different types of process equipment and general design procedure of Process equipment	2	Understand
CO2	Recommend the appropriate process for the design of process equipment	3	Apply
CO3	Design the process equipment as per standards	5	Evaluate

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3		
CO2	2	3												2	
CO3		2	3											2	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10% (10M)	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30% (30M)	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10% (10M)	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50% (50M)	100% course contents

Course Contents:

Unit No.	Unit Content	No. of Lectures
1	Unit 1: - Study of Pressure Vessels : Type of vessels and factors influencing the design of vessels. Classification of vessels such as tank, flat, bottomed and vertical cylinder tank, vertical cylindrical and horizontal vessels with formed ends. Introduction to IS and ASME pressure vessel codes and standards	8
2	Unit 2: - Design Considerations of Pressure: Vessels Stresses in pressure vessels, autofrettage, design of unfired pressure vessels, design of end closures, flanges, Nozzle reinforcement	6
3	Unit 3: Pressure vessel supports : Different types of pressure vessel support, types of tall vertical vessels, Design considerations of pressure vessel supports vertical and horizontal	6
4	Unit 4: - Study of Heat Exchangers : Introduction, types, Scope of the shell-and-tube heat exchanger, Components of shell and tube heat exchangers (shell, shell cover, tubes, tube sheet, baffles and nozzles), materials of construction, inspection and testing	6

5	Unit 5: - Introduction to TEMA Standards Tubular heat exchangers TEMA standard heat-exchanger nomenclature, selection criteria for different types of shells and front and rear head ends; geometrical characteristics of TEMA heat exchangers	6
6	Unit 6: - Mechanical Design of Heat Exchangers : Heat exchanger analysis for parallel, Counter, Multi-pass and cross-flow heat exchanger, e-NTU method for heat exchanger analysis. Introduction to Tinker's, .Design standards and codes, Key terms in heat exchanger design and thickness calculation for major components such as tube sheet, shell and tubes	8

Text Books:	
Sr. No.	
1	M.V. Joshi, V. V. Mahajani,Process Equipment Design, Macmillan India
2	Mahajani V.V. and Umbrani S.B., “Process Equipment Design”, Macmillan Publishing India Ltd., Fourth edition, 2009.
3	R. K. Shah and D. P. Sekulic, Fundamentals of Heat Exchangers Design, John Wiley & Sons, 2003
4	Lloyd E. Brownell & Edwin H. Young,Process Equipment Design,wiley
5	S B Thakore and B I Bhatt Introduction to Process Engineering and Design, Tata McGraw Hill, 1 I Edition,

Reference Books:	
Sr. No.	
1	Dennis Moss - Pressure Vessel Design Manual
2	R. K. Shah and D. P. Sekulic, Fundamentals of Heat Exchangers Design, John Wiley & Sons, 2003.
3	Saunders E.A.D., Heat Exchangers - Selection, Design and Construction, Longman Scientific & Technical, 1998
4	András Nagy, Fundamentals of Tank and Process Equipment Design,springer
5	Tubular Exchanger Manufacturer Association (TEMA), and other codes
6	Maan H. Jawad, Structural Analysis and Design of Process Equipment,Wiley



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	UMEE0854	L	T	P	Credit
Course Name:	Supply Chain Management	3	0	--	3
Course Pre-Requisites:	Fundamentals of Mechanical Engineering and Manufacturing				
Course Description:	This course will be valuable for someone pursuing a career in consulting or a position in the operations, marketing, or finance function in a manufacturing or distribution firm. The course focuses on the management and improvement of supply chain processes and performance.				

Course Objectives:

1	Introduce students to the basic principles and terminology of supply chain management.
2	Help students understand the role of supply chain management in mechanical engineering.
3	Provide an overview of key supply chain processes such as procurement, production, and distribution.
4	Familiarize students with basic tools and techniques used in supply chain analysis and optimization.

Course Outcomes:

After the completion of the course the student will be able to			
COs	CO Statement	Blooms Level	Descriptor
CO1	Define key concepts and terminology related to supply chain management.	I	Remember
CO2	Summarize the stages and components of a supply chain.	II	Understand
CO3	Apply basic supply chain management principles to solve procurement and inventory management problems.	III	Apply
CO4	Analyze supply chain performance metrics and propose improvements to enhance supply chain efficiency.	IV	Analyze

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1										1		1		1
CO2	1										1		1		1
CO3	2	2	2								2		2	2	2
CO4	1	2	1	2							2		1	1	1

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	10%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	30%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	10%	100% course contents

Course Contents:

Unit No.	Unit Content	No. of Lectures
1	Supply Chain Concepts What is a Supply Chain and Objectives of a Supply Chain, Stages of Supply Chain, Value Chain Process, Cycle view of Supply Chain Process. Examples of Supply Chains	5
2	Supply Chain Integration and Drivers Understanding the importance of integration in supply chain processes: Competitive and Supply Chain Strategies Achieving Strategic Fit. SCM drivers: Framework for Structuring Drivers Facilities, Inventory, Transportation Information, Sourcing, and Pricing. (Case studies), Supply Chain Performance: Bullwhip effect and reduction, Performance measurement: Dimension, Tools of performance measurement	8

3	Procurement and Inventory Management Procurement Management: Procurement process overview, Supplier selection criteria and strategic sourcing, Negotiation techniques, and contract management, Supplier relationship management Inventory Management: Basics of inventory management, Inventory control models (e.g., EOQ, safety stock), Estimating Cycle inventory costs, ABC analysis and inventory classification, Vendor-managed inventory (VMI), and Just-in-Time (JIT) inventory systems	7
4	Manufacturing and Production Planning Manufacturing Process Overview: Manufacturing process types and strategies, Production planning and scheduling fundamentals, Capacity planning and resource allocation Lean Manufacturing Principles: Introduction to lean manufacturing principles, Waste reduction techniques (e.g., 5S, Kanban, SMED), Value stream mapping and continuous improvement	7
5	Logistics and Transportation Logistics Management: Logistics and transportation overview, Warehouse design and management, Cross-docking and distribution center operations Transportation Management: Modes of transportation and selection criteria, Routing and scheduling optimization, Freight consolidation and network design	6
6	Supply Chain Technologies and Risk Management Supply Chain Technologies: Role of information technology in supply chain management, Enterprise Resource Planning (ERP) systems and their implementation, RFID, IoT, and blockchain applications in supply chain Risk Management: Basics of supply chain risk management, Identification, assessment, and mitigation strategies for supply chain risks, Business continuity planning, and resilience in supply chain operations.	7

Text Books:

Sr. No.	
1	"Supply Chain Management: Strategy, Planning, and Operation" by Sunil Chopra and Peter Meindl
2	Supply Chain Management For Dummies" by Daniel Stanton
3	"Operations Management: An Integrated Approach" by R. Dan Reid and Nada R. Sanders
4	Mohanty R.P, S.G Deshmukh "Supply Chain Management" Biztantra, New Delhi

Reference Books:

Sr. No.	
1	Altekar, Rahul V.; Supply Chain Management: Concepts and Cases;
2	Ballou, Ronald H.; Supply Chain Management; Pearson Education
3	Sahay, B.S.; Supply Chain Management; Macmillan
4	Ballou, R.H. Business Logistics Management. Prentice-Hall Inc.
5	Bowersox D.J. ,Closs D.J. , Logistical Management, McGraw-Hill, 1996



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	UMEE0855	L	T	P	Credit
Course Name:	Material Handling Systems	3			3
Course Pre-Requisites:	Fundamental knowledge of Materials and Manufacturing.				
Course Description:	Course comprises of introduction to material handling concepts. It also comprises of overview of various material handling equipments like Trucks, Conveyors, Hoisting equipment, Cranes, Storage & Sorting Systems. It also covers introduction to automation in material handling, safety and maintenance aspects of material handling.				

Course Objectives:

1	Introduce students with the concepts of Material handling systems
2	Acquaint the students with applications of material handling equipments.
3	Understand students the uses of material handling automation, safety and maintenance aspects of material handling equipments

Course Outcomes: After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
CO1	Explain the principles of different material handling systems	II	Understand
CO2	Choose tools and techniques to improve the material handling operation.	III	Apply
CO3	Analyze suitable material handling equipment used in industries as per the requirement.	IV	Analyze

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO1	1	2	1		1								1			
CO2	2	2	2		1							1	2	1	2	
CO3	2	2	2		1	2						2	2	2	2	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:

Unit No.	Unit Content	No. of Lectures
1	Unit 1: Introduction to Materials Handling Importance of Materials Handling, Systems Concept, Characteristics and Classification of Materials, Principles of Materials Handling, Unit Load concept, Classification of Material Handling Equipment, Load Unitization Process and Handling Methods, Plant Layout and its types	7
2	Unit 2: Trucks & Conveyors Hand trucks & types, Power Trucks & types, Fork Lift Trucks, Order Pickers, Tractors- Industrial Tractor, Trailer Conveyors, Belt Conveyors-various types, Calculation for size and speed of belt conveyor Chain Conveyors-types, Haulage Conveyors & types, Roller Conveyors- Unpowered, Powered, Screw conveyor	7
3	Unit 3: Hoisting Equipment & Cranes Hoists-Hand operated & Electric, Winches, Elevators-Bucket elevator & its capacity calculation, Cranes, Classification, parts of cranes, Basic motions, types of cranes	6
4	Unit 4: Storage Systems & Sorting Systems Objectives of storage systems, Pallets, Skids, Dolly, Containers, Crates, Trays, Bins, Bags, Jars Types of storage systems, Automatic Storage and Retrieval System (ASRS)& its types, Sorting system selection, Component of sorting system, Sortation conveyor & types,	7
5	Unit 5: Automation in Material handling Automated guided vehicles, types and uses, Basics of Robots, Main parts of robots, Types, Applications of Robots in material handling. Use of simulation software in material handling system. Concept of Warehouse, Ecommerce warehousing, Warehouse Packaging	7
6	Unit 6: Safety & Maintenance in Material Handling Material handling equipment safety, Safety norms, Crane safety, Conveyor safety, Fork lift truck safety, Maintenance Types- Planned & Unplanned, Condition based monitoring, Maintenance of Hoists & Cranes, Conveyors, Trucks, Lifts	6

Text Books:	
Sr. No.	
1	Introduction to Materials Handling-Siddhartha Ray-New Age International Publishers
2	Aspects of Materials Handling, K.C. Arora, Vikas Shinde-Laxmi Publications
3	Production Technology-R.K.Jain-Khanna Publishers
Reference Books:	
Sr. No.	
1	Material Handling Principles & Practice - Theodore H. Allegre Sr.-CBS Publishers & Distributors
2	Material Handling - Immer J. R.-McGraw Hill Publications
3	Plant Layout & Material Handling - James Apple -John Wiley Publications
4	Material Handling System Design- James Apple -John Wiley Publications
5	Materials Handling Handbook -Raymond A. Kulwiec-Wiley
6	Materials Handling Equipment -M.P.Alexandrov-MIR Publishers



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:		UMEE0856	L	T	P	Credit
Course Name:		Production Management	3			3
Course Pre-Requisites:		This course requires the basic knowledge of Manufacturing Processes, Machine Tools, Industrial management.				
Course Description:		The course deals with fundamental concepts of production systems, planning and controlling techniques, and modern manufacturing and maintenance techniques				
Course Objectives:						
1	To make students of Mechanical Engineering aware of production management concepts.					
2	To provide students detail information about planning and controlling techniques of Production management					
3	To train students to get acquainted with advanced manufacturing and maintenance concepts.					
Course Outcomes:		After the completion of the course the student will be able to				
COs	CO Statement		Blooms Level		Descriptor	
CO1	Explain fundamentals concepts of production management.		II		Understand	
CO2	Illustrate planning and controlling techniques in production management.		II		Understand	
CO3	Make use of advanced manufacturing and maintenance techniques.		III		Apply	

CO-PO Mapping:															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2												2		
CO2	2	2	2								2	1	2	1	
CO3	2	2	2								2	1	2	1	

Assessment Scheme:															
SN	Assessment					Weightage		Remark							
1	In Semester Evaluation 1 (ISE1)					10%		Assignment, Declared Test, Quiz, Seminar, Group Discussion, etc.							
2	Mid Semester Examination (MSE)					30%		50% of course contents (Normally First Three Modules)							
3	In Semester Evaluation 2 (ISE2)					10%		Assignment, Declared Test, Quiz, Seminar, Group Discussion, etc.							
4	End Semester Examination (ESE)					50%		100% course contents with 60-70% weightage for course content (normally last three modules) covered after MSE.							

Course Contents:															
Unit No.	Unit Content												No. of Lectures		
1	Unit 1: Introduction to Production Management Definition and concept of Productions management, Functions & scope of production management department, production management framework, types of production, classification of production system – job shop batch, continuous, cellular and mass production, organization structure for production function												8		
2	Unit 2: Production Planning and Control Objectives, production planning & production control, functions of PPC, production procedure, manufacturing methods and PPC, Strategy formulation process, Order qualifiers and order winners, Product portfolio, World Class Manufacturing												6		
3	Unit 3: Capacity planning, Aggregate Planning and Master Scheduling Defining and measuring capacity, Design and system capacity, Determinants of effective capacity, Capacity planning decisions, Tools for capacity planning, Over Capacity and Under Capacity. Aggregate planning, Aggregate planning strategies, Aggregate planning guidelines, Use of transportation model approach to Loading, scheduling and sequencing, Priority sequencing rules, n jobs 2 machines, n jobs 3 machines. Master scheduling objectives, Master scheduling methods with numerical, Numerical on Level production and chase demand, Master Production Schedule (MPS)												6		
4	Unit 4: Demand Forecasting Forecasting objectives and uses, Forecasting variables, Opinion and Judgmental methods, Delphi technique, Time series methods, Moving Average methods, Exponential smoothing, Trend adjusted Exponential Smoothing, Regression and correlation methods												8		
5	Unit 5: Total Productive maintenance Introduction, Six big losses, Stages of maintenance, pillars. Stages of TPM development, Concept of Overall Equipment Effectiveness (OEE), Replacement concept and need, Replacement of items whose maintenance cost increases with time, Replacement of items that fail suddenly.												8		

6	Unit 6: Supply chain Management and advanced manufacturing techniques Concept of supply chain and supply chain management, Manufacturing supply chain, Supply chain activities and strategies, Managing supply chain, Measuring supply chain performance. Just-in-time (JIT) manufacturing, Business Process Reengineering (BPR), Group Technology, Enterprise Resource Planning (ERP), Flexible Manufacturing System (FMS), Lean & Agile manufacturing, Manufacturing Excellence, Toyota Production System (TPS) etc.	7
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Text Books:

Sr. No.	
1	Telsang M., “Industrial Engineering and Production Management”, S.Chand & Co. , New
2	Paneerselvam R., “Production and Operations Management”, Prentice Hall India, 2005.
3	Mukhopadhyay S.K., “Production Planning and Control – Text and Cases”, Prentice Hall

Reference Books:

Sr. No.	
1	Tripathi, “Production and Operations Management”, Scitech Publications
2	S. N. Chary, “Production and Operations Management”, Tata McgGraw Hill, 5th Edition.
3	Elwood Buffa, “Modern Production and Operations Management”, Wiley India, 8th
4	Ashwathappa Bhat, “Production and Operations Management”, Himalaya Publishing
5	Everett E. Adam and Ebert, “Production and Operations Management”, PHI Publication, ISBN No. 9788120308381
6	Mahadevan B, “Operations Management Theory and Practice”, Pearson Education (2007)