Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Curriculum for
Final Year B. Tech
(Mechanical Engineering)
2020 Pattern

Department of
Mechanical Engineering

VISION

Excellence in Mechanical Engineering for Global Acceptance

MISSION

- Make spirited mechanical engineers with morals, values and principles for sustainable development of society.
- Strive continuously to impart knowledge and skills of the highest standards.
- Our engineers will respond to the current and future needs of the industry, higher studies as well as research.

Program Educational Objectives:

1. Graduates of the program will become competent engineers suitable for the mechanical engineering based industry and higher education.
2. Graduates of the program will acquire the necessary foundation in fundamental mechanical engineering subjects for development of mathematical and analytical abilities.
3. Graduates of the program will acquire the knowledge and skills in mechanical engineering to provide technological solutions.
4. Graduates of the program will learn managerial, financial and ethical practices such as, project and financial management skills, multidisciplinary approach and soft skills.
5. Graduates of the program will respond to growing demands of society through lifelong learning.

Program Outcomes:

At the end of the program, a student will be able to

1. **Engineering knowledge-** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis-** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. **Design/development of solutions-** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
4. **Conduct investigations of complex problems-** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage-** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society-** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability-** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics-** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work-** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication-** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance-** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning-** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Program Specific Outcomes-

At the end of the mechanical engineering program, a student will be able to-

1. Identify, automate and apply manufacturing processes for production of mechanical components considering effective use of man, machines, and material resources.
2. Design, formulate, develop and analyze mechanical components and systems using design engineering principles and modern CAD/CAE tools
3. Specify, analyze, evaluate, audit, design and build thermal and fluid systems using modern engineering tools

FINAL YEAR B. TECH (MECHANICAL ENGINEERING), SEMESTER VII (PATTERN 2020) MODULE I/V

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/OR/TW		
MEUA40201	Professional Elective-IV	TH	2	-	-	20	30	20	30	25	125	2
MEUA40202	Professional Elective-V	TH	2	-	-	20	30	20	30	25	125	2
IOEUA40203	Open Elective-II	TH	2	-	-	20	30	20	30	--	100	2
IOEUA40204	Open Elective-III	TH	2	-	-	20	30	20	30	--	100	2
MEUA40205	Research Methodology and IPR	CE	2	-	-	-	-	50	-	-	50	2
MEUA40206	Major Project	CE-PR/OR	-	-	20	100	-	-	-	50	150	10
M4	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
	Total	-	10	-	20	180	120	130	120	100	650	20

CIE: Continuous Internal Evaluation **SCE:** Skill and Competency Examination
ISE: In-Semester Examination **ESE:** End Semester Examination

Professional Elective-IV		**Professional Elective-V**	
Course Code	Course Title	Course Code	Course Title
MEUA40201A	Finite Element Analysis	MEUA40202A	Noise Measurement and Control
MEUA40201B	Computer Integrated Manufacturing	MEUA40202B	Reliability Engineering
MEUA40201C	Design of Heat Exchangers	MEUA40202C	Automobile Engineering

Open Elective -II		**Open Elective -III**	
Course Code	Course Title	Course Code	Course Title
IOEUA40203A	Introduction to Industry 4.0 and Industrial IOT	IOEUA40204A	Social Media Analytics
IOEUA40203B	Software Testing and Quality Assurance	IOEUA40204B	Organizational Behavior
IOEUA40203C	Data Centric AI	IOEUA40204C	Data Ethics
IOEUA40203D	Computer Vision	IOEUA40204E	Business Analytics
IOEUA40203E	Project planning ,management, planning, execution, evaluation and control	IOEUA40204F	Project Management and Economics
IOEUA40203F	Solar and Wind Energy		

FINAL YEAR B. TECH (MECHANICAL ENGINEERING), SEMESTER VII (PATTERN 2020) MODULE II/IV

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/ OR/ TW		
MEUA40207	Semester Internship	CE-PR/OR	-	-	20	100	-	-	-	50	150	10
M4	Mandatory Course	AU	-	-	-	-	-	-	-	--	-	-
	Total		-	-	20	100	-	-	-	50	150	10

BoS Chairman **Dean Academics** **Director**

FINAL YEAR B. TECH (COMMON TO ALL PROGRAMS), SEMESTER VIII (PATTERN 2020) MODULE III (FROM A.Y. 2023-24)

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/OR/ TW		
MEUA42201	Elective – IV*	TH	3	-	2	20	30	20	30	25	125	4
IOEUA42202	Open Elective – I	TH	3	-	-	20	30	20	30	25	125	3
IOEUA42203	Open Elective – II	TH	3	-	-	20	30	20	30	25	125	3
M4	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
	Total	-	9	-	2	60	90	60	90	75	375	10

Elective-IV		**Open Elective-I**		**Open Elective-II**	
MEUA42201A	Computational Fluid Dynamics	IOEUA42202A	Gamification	IOEUA42203A	Financial Technology
MEUA42201B	Composite Materials*	IOEUA42202B	Inferential Statistics for Data Science	IOEUA42203B	Agriculture Electronics
		IOEUA42202C	Energy Engineering*	IOEUA42203C	Operation Research
MEUA42201C	Mechanical System Design	IOEUA42202D	Numerical Methods in Engineering	IOEUA42203D	Total Quality Management
		IOEUA42202E	Social Media Analytics	IOEUA42203E	Blockchain Technology

BoS Chairman **Dean Academics** **Director**

NOTE:

- **Students who will register for Module-I in Semester VII have to register either of Module-III or Module IV in Semester VIII.**
- **Students who will register for Module-II in Semester VII have to register for Module-V in Semester VIII.**

List of Mandatory Courses:

Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge

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MODULE-I

SEMESTER-VII/VIII

Professional Elective-IV
Finite Element Analysis (MEUA40201A)

Teaching Scheme	Examination Scheme						
Credits : 2	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L) : 2 hrs./week Tutorial (T): -- hr. Practical (P): -- hrs./week	20	30	20	30	25	-	125

Prerequisite:
Engineering Mechanics, Strength of Materials, Design of Machine elements, Engineering Mathematics, Heat Transfer, Dynamics of Machinery, Fundamentals of Programming Language

Course objectives:

- To understand the general procedure and philosophy of Finite Element Method as applied to solid mechanics and thermal analysis problems.
- To familiarize students with the displacement-based finite element method for displacement and stress analysis and to introduce related analytical and computer tools.It provides a bridge between hand calculations based on mechanics of materials and machine design and numerical solutions for more complex geometries and loading states.
- To study approximate nature of the finite element method and convergence of results are examined

Course Outcomes:

Upon completion of this course, the student will be able to:

1. Understand the concept of finite element method and formulate element stiffness matrix for 1D bar element.
2. Analyze truss and beam element to solve for displacements and stresses.
3. Obtain finite element formulation for two-dimensional plane stress and plane strain problems using constant strain triangle (CST) elements.
4. Use concepts of isoparametric quadrilateral and higher order elements in finite element formulation for 2D problems and solve numerical integration using Gaussian quadrature.
5. Solve finite element equations for 1D steady state heat conduction and convection problems in heat transfer using Galerkin weighted residual method
6. Formulate and solve dynamics problem using finite element method

UNIT 1: Fundamentals Concepts of FEA

Introduction to FEA, 1D Bar Element: Finite element formulation of 1D linear bar element using Direct Stiffness Approach - shape functions, element stiffness matrix, force terms, assembly of global stiffness matrix and load vector, treatment of boundary conditions- elimination approach, calculation of nodal displacement, strain and element stresses, properties of stiffness matrix, Numerical Examples.

UNIT 2: Plane Truss and Beam Elements

Analysis of Truss Element: Element Stiffness Matrix, Direction cosine, assembly of global stiffness matrix, element strains and stresses, Numerical Examples.
Analysis of Beam Element: Hermite Shape function, element stiffness matrix, element load vector, Numerical Examples.

UNIT 3: 2D Elements

Two-Dimensional Stress Analysis: Plane Stress/Strain problems in 2D elasticity, constitutive relations Constant Strain Triangle (CST), Displacement function, Pascal's triangle, compatibility and completeness requirement, geometric isotropy, solving for primary variables (displacement), stress calculations

UNIT 4: Isoparametric Elements & Numerical Integration
Concept of isoparametric elements, Terms Isoparametric, super parametric and subparametric, Coordinate mapping - Natural coordinates, higher order triangular and quadrilateral elements (Lagrangean and serendipity elements), Uniqueness of mapping - Jacobian matrix. Numerical integration –Gauss Quadrature in 1 & 2 dimension, Order of Gauss integration
UNIT 5: 1D Steady State Heat Transfer Problems
Introduction to Galerkin weighted residual method, One dimensional steady-state heat transfer problem- Governing differential equation, Finite Element formulation using Galerkin's approach for composite wall and thin Fin , Essential and natural boundary conditions and solving for temperature distribution
UNIT 6: Dynamic Analysis
Types of dynamic analysis, General dynamic equation of motion, lumped and consistent mass, Mass matrices formulation of bar, truss and beam element. Undamped-free vibration- Eigenvalue problem, Evaluation of eigenvalues and eigenvectors (characteristic polynomial technique),
Text Books: 1. Chandrupatla T. R. and Belegunda A. D., Introduction to Finite Elements in Engineering, Prentice Hall India, 2002 2. Finite Element Analysis, G Lakshmi Narasaiah, B S Publications, 2008. 3. Text book of Finite Element Analysis, P., Seshu, PHI Learning Private Ltd., New Delhi
Reference Books : 1. Finite Element Procedures, Bathe K. J., Prentice-Hall of India (P) Ltd., New Delhi. 2. Concepts and Applications of Finite Element Analysis, R. D. Cook, et al. Wiley, India 3. Finite Element Method using MATLAB, Kwon Y. W., Bang H., CRC Press, 1997 4. MATLAB Guides to Finite Elements- An Interactive Approach, Peter Kattan, Springer, 2008. 5. Finite element analysis, theory and application with Ansys, S. Moaveni, Prentice Hall 6. The Finite Element Method and Applications in Engineering Using Ansys, Erdogan Madenci and Ibrahim Guven, Springer, 2006. 7. Fundamental of Finite Element Analysis, David V. Hutton, Tata McGraw-Hill 8. Practical Finite Element Analysis‖, Gokhale N. S., et al., Finite to Infinite, Pune, 2008. Finite Element Method with Applications in Engineering, Y. M. Desai, T. I. Eldho and H. Shah, Pearson Education, 2011 9. A First Course in the Finite Element Method, Daryl L. Logan, 2007.**on, Tata McGraw-Hill,**
Self-Assignments : 1. Computer program for stress analysis of 1D bar using linear elements. 2. Computer program for stress analysis of 2-D truss subjected to plane forces 3. Computer programs for modal for 1-D beam (simply supported or cantilever beams) 4. Computer program for 1-D temperature analysis 5. Static stress concentration factor calculation for a plate with center hole subjected to axial loading in tension using FEA software. 6. Modal analysis of any machine component using FEA software. 7. Stress and deflection analysis of any machine component consisting of 3-D elements using FEA software.

Prepared by: Dr. A .R. Mache

BOS Member:

BOS Chairman:

Professional Elective-IV
Computer Integrated Manufacturing (MEUA40201B)

Teaching Scheme	**Examination Scheme**						
Credits : 2	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L) :2hrs./week Tutorial (T): -- Practical (P): --	20	30	20	30	25	-	125

Prerequisite: Solid Modeling and Drafting, Computer Aided Engineering, Industrial Engineering

Course objectives:

1. Justify the need for CIM and factory automation.
2. Integrate hardware and software elements for CIM.
3. Integrate processes planning, quality, and MRP with computers.
4. Compare flexible, cellular manufacturing, and group technology.
5. Summarize IOT, Industry-4.0, and cloud base manufacturing.
6. Summarize Digital and cloud base manufacturing.

Course Outcomes:

On completion of the course the learner will be able to;
CO1. Explain CIM and factory automation.
CO2. Analyze processes planning, quality and MRP integrated with computers.
CO3. Recognize the need of automation and RP in industry.
CO4. Interpret flexible, cellular manufacturing and group technology.
CO5. Analyze the effect of IOT, Industry-4.0
CO6. Interpret Digital and cloud base manufacturing.

Unit 1: Introduction to CIM

Need of CIM, Introduction, Evolution of CIM,CIM Hardware and software, Role of CIM System, Definition of CIM, automation and types of automation, Reasons for automation, Types of Production, Functions in Manufacturing, CIM wheel, Computerized element of CIM, Advantages of CIM

Unit 2: Computer Aided Process Planning and Quality Control

Process Planning: Computer Aided Process Planning (CAPP), Benefits of CAPP, Approaches to CAPP, Material Requirement Planning, Capacity Planning, Manufacturing Resource Planning (MRP) - Input, working, outputs and benefits, structure of MRP system, planning & implementation issues, MRP-II & Enterprise Resource Planning (ERP), Computer Aided Production Scheduling, Control Systems: Shop Floor Control, Inventory Control, Computer Aided Inspection and Quality Control, Manufacturing Execution System(MES).

Unit 3: Rapid prototyping

Rapid Prototyping - Introduction, classification of RP Processes (Stereolithography, Laminated Object Manufacturing, Selective Laser Sintering, Fused Deposition Method, 3D(printing), Working principle.

Unit 4: FMS & Cellular Manufacturing

Introduction Flexible Manufacturing Systems, FMS components, Material handling and storage system, computer control systems, types of FMS Layout, FMS planning and design issues, Automated Storage and Retrieval Systems, AS/RS. Group Technology (GT), Cellular Manufacturing – Composite part concept – Machine cell design and layout, Arranging Machines in a GT cell – Hollier Method – Simple Problems.

Unit 5: Future Smart Factories

Industry 4.0: Functions, Applications and Benefits. Components of Industry 4.0, Industry 5.0, Internet of Things (IoT): IoT applications in manufacturing, Big-Data and Cloud Computing for IoT, IoT for smart manufacturing, Supply-Chain Optimization, Supply-Chain & logistics.

Unit 6: Digital Manufacturing

Digital Manufacturing: Industrial Automation, Cyber-Physical Manufacturing Systems, Digital Twin Driven Smart Manufacturing, Digital Manufacturing, Assembly and Automation Systems, Scheduling and Cloud Manufacturing, Knowledge Management, Digital Supply Chains, Web based Application in Manufacturing

Textbooks:

1. Automation, Production system & Computer Integrated manufacturing, M. P. Groover Person India, 2007 2nd edition.
2. Principles of Computer Integrated Manufacturing, S. Kant Vajpayee, Prentice Hall India

Reference books:

1. Chang, T.C. and Wysk, R.A., 1997. Computer-aided manufacturing. Prentice Hall PTR.
2. Xu, X., 2009. Integrating Advanced Computer-Aided Design, Manufacturing, and Numerical Control. Information Science Reference.
3. Weatherall, A., 2013. Computer integrated manufacturing: from fundamentals to implementation. Butterworth-Heinemann.
4. Nanua Singh, Systems Approach to Computer Integrated Design and Manufacturing, John Wiley Publications. 5. Harrington J, Computer Integrated Manufacturing Krieger Publications 1979.
6. Zeid, CAD/CAM, Tata McGraw Hill.
7. Jha, N.K. "Handbook of Flexible Manufacturing Systems ", Academic Press Inc., 1991.

Guidelines for Laboratory Conduction

- Minimum 08 numbers of Experiments/Assignments shall be completed.
- Open-source software, simulation tools may be used wherever required.

List of experiments:

The student shall complete the following activity as a Term Work:

1. Tool path generation and simulation for Turning, and drilling using suitable software
2. Tool path generation and simulation for Grooving and Threading with help of software
3. Tool path generation and simulation for Milling Facing, Pocketing. with help of software.
4. Tool path generation and simulation for Milling Contouring and drilling, etc. with help of suitable software
5. Generate Bill of Material (BOM) from Assembly and other data using CAD Software.
6. Prepare Computer Aided Process Plan for selected part using variant type of CAPP Software.
7. Use MRP (Material Resource Planning) Software for CIM and Assembly.
8. Generate Part Family Code for a machine component using OPITZ Method
9. Study FMS system from Video clip and identify various elements of FMS and its controlling by computer.
10. Modeling and Simulation of Computer Integrated Manufacturing System. (VLab IIT, Kharagpur OR comparable sources)
11. Machine vision based quality control. (VLab IIT, Kharagpur OR comparable sources)
12. Remote Monitoring and Operation of a Computer Integrated Manufacturing System. (VLab IIT, Kharagpur OR comparable sources
13. Industrial visit based on Industry 4.0/Digital Manufacturing/CIM.

Prepared by: Prof.A. A. Somatkar

BOS Member:

BOS Chairman:

Professional Elective-IV
Design of Heat Exchangers (MEUA40201C)

Teaching Scheme	**Examination Scheme**						
Credits:4 Lecture (L): 3hrs./week Tutorial (T): -- hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	25	-	125

Prerequisite: Readers/students are expected to know all topics of basic engineering science courses in thermodynamics, fluid mechanics and heat transfer.

Course Objectives:

- To understand different kinds of heat exchangers, their working and applications
- To familiarize with different standards of heat exchangers design
- Students will able to understand different methods of heat exchanger design

Course Outcomes:

After successful completion of the course Student will be able,

1. To classify different types of heat exchangers and select as per the applications
2. To analyze sizing and rating of heat exchangers with different methods
3. Understand the different shell and tube heat exchanger design standards and apply the knowledge for the design of shell and tube heat exchanger
4. To analysis different heat transfer enhancement techniques and calculate the heat transfer arte and pressure drop
5. To formulate the sizing and rating of exiting Plate Fin Heat Exchanger
6. To understand physics of multiphase heat transfer and apply it for different applications

Unit I: Basics Heat Exchangers

Heat exchange mechanism, Classification of Heat Exchangers, Construction and working of tubular, Plate and Compact heat exchangers. Selection of heat exchangers, Applications of heat exchangers in different areas. Introduction to cryogenics heat exchanger.

Unit II: Design of Heat Exchangers

Introduction to thermal and hydraulic aspects, Pressure drop and heat transfer considerations, Sizing and rating of heat exchangers. F-LMTD and NTU method.

Unit III: Shell and Tube Heat Exchangers

Basic components, Types of shell and tube heat exchangers, TEMA standards, Basic design methodology, Heat transfer and pressure drop calculations, Shell side calculations-KERN,s and Bell Delaware method.

Unit IV: Compact Heat Exchangers

Heat transfer enhancement, extended surfaces, Plate fin and tube fin heat exchangers- Applications and construction. Heat transfer and pressure drop calculations.

Unit V: Plate Fin Heat Exchangers

Plate fine heat exchangers- Types and applications, Construction and fabrication, Flow arrangement and design of PFHE.

Unit VI: Phase Change Heat Exchangers

Introduction to evaporators and condensers, construction, working, design and operational considerations and thermal analysis.

List of Practical:

1. Basic design methods and tube heat exchangers
2. TEMA standards and applications to STHEX
3. Analysis of shell & tube heat exchanger using different methods
4. Thermal Analysis of compact heat exchangers
5. Analysis of plate fin type heat exchangers
6. Fouling analysis of heat exchangers
7. Trial on heat pipe to determine performance parameters
8. Industrial visit to heat exchanger manufacturing company

Text Books:

1. Heat Transfer by F. Incropera and D. DeWitt or other basic undergraduate heat transfer textbook.
2. Kakac, Sadik, Hongtan Liu, and Anchasa Pramuanjaroenkij. *Heat exchangers: selection, rating, and thermal design*. CRC press, 2012.R K Shah, Fundamental of Heat Exchanger Design
3. Kay Kays and London, *Compact heat exchanger*, Krieger Pub Co,., 1998

Reference Books :

1. Fundamentals of Heat Exchanger Design -Ramesh K. Shah, Dusan P. Sekulic,Wiley-India
2. Heat exchanger, Design, rating and Selection, Sadik Kakac, CRC Press
3. Process Heat Transfer/D. Q. Kern/ TMH
4. Heat Exchanger Design/ A. P. Fraas and M. N. Ozisick/ John Wiely& sons, New York.
5. Heat Exchangers Thermal Hydraulic Fundamentals and Design by S. Kakac, A. , Bergles, F. Mayinger, McGraw-Hill Book Company.

Prepared by: Dr. S. S. Kore

BOS Member:

BOS Chairman:

Professional Elective-V

Noise Measurement and Control (MEUA40202A)

Teaching Scheme	**Examination Scheme**						
Credits:3 Lecture (L): 3hrs./week Tutorial (T): -- hr. Practical (P): -- hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Prerequisite: Applied Mathematics, Theory of Machines ,Dynamics of Machinery, Mechanical Vibrations.

Course Objectives:

1. To know the fundamentals of acoustics and Indian standards of Noise
2. To know the sound absorbing materials and its practical applications.
3. To know the measurement and control techniques of vibration and noise.
4. To understand the effect of noise on human comfort and environment.

Course Outcomes:

Upon completion of the course, students will be able to

1. Illustrate the fundamentals of sound propagation and effect of noise.
2. Classification of various sound measurement instruments.
3. Analyze the important techniques used for noise measurement.
4. Categorize the different source of noise.
5. Analyze the performance of muffler and acoustic material.
6. Interpret the importance of noise regulations.

Unit I : Fundamental of sound

Introduction to Sound, Sound propagation, Quantification of sound- frequency and wave length ,Sound levels and decibels, sound power level sound pressure level, Sound intensity level, Octave & 1/3 octave bands, A weighting, Sound field, Sound reflection ,absorption and transmission - concept & governing equation with correlation of each other, Loudness. Introduction to noise, Noise induced hearing losses.

Unit II: Noise measurement and instrumentation

Noise measuring instruments- microphones, types of microphones Sound pressure measurement, Sound power measurement, Sound intensity measurement , Measurement of sound transmission loss ,sound level meter, sound frequency analyser, noise dosimeter, recorder, calibrators. Sound intensity probes, Acoustic exciters, Data acquisition system, Digital signal processing, sampling, aliasing and resolution.

Unit III: Noise Source Identification and Analysis

Introduction to anechoic chamber and reverberation chamber, , Frequency and order domain analysis, Sound intensity and sound power mapping ,Introduction to array techniques - Acoustic holography & beam forming.

Unit IV: Major source of noise- Automotive and non-Automotive

Major Sources of noise, noise due to construction equipment and domestic applications, Interior Noise of Automobiles - Interior noise sources, Structure borne noise, airborne noise. Industrial noise, industrial noise control- strategies, noise control at the source, noise control at the path, Acoustic barriers, noise control at the receiver. Active noise control techniques.

Unit V: Passive Noise Treatments

Ducts & Mufflers – Types of mufflers, performance parameters – acoustics and backpressure, Reactive and absorptive silencers and Overall design considerations.
Acoustic Material Characterization – Sound transmission, absorption and damping, Behaviour of acoustic material with respect to sound absorption and transmission, Standard methods for evaluating sound absorption coefficient and transmission loss, Types of sound absorbers, Prediction of transmission loss and flanking transmission, Damping materials and their applications.

Unit VI: Noise Regulations

Non auditory and auditory effect noise on human beings, Noise standards and limits in India, Ambient emission noise standards in India, Hazardous noise exposure – legal aspects, Day night sound level ,Noise specifications for automotive vehicles – pass-by & stationary and Noise specifications for generator sets, fire crackers and household articles, warning devices.

List of Practical:

1. Measurement of noise parameters like frequency, sound pressure level (dB) of any system by using microphone.
2. Noise Measurement & analysis using appropriate instrument. Analysis of SPLsignature using any analysis software package
3. Determination of Airflow resistivity of foam material using Airflow resistivity instrument
4. Determination of sound absorption coefficient of acoustic material by using impedance tube
5. Determination of transmission loss of reactive silencer by using impedance tube.

Assignments:
1) Determination of gear noise- numerical
2) Determination of fan noise- numerical

Text Books:

1. Rao S. S. ―Mechanical Vibrations‖, Pearson Education Inc. New Delhi. (ISBN 978-0-13-212819-3)
2. Grover G. K. ―Mechanical Vibrations‖, New Chand and Bros.,Roorkee (ISBN-10: 9788185240565)
3. Clarence W. de Silva , "Vibration Monitoring, Testing, and Instrumentation ",CRC Press, 2007(ISBN 9781420053197)
4. David A.Bies and Colin H.Hansen "Engineering Noise Control: Theory and Practice "Spon Press, London, 2009 (ISBN 0-203-16330-3)
5. C.Sujatha " Vibration and Acoustics : MaGrawhill Publication 2010(ISBN 10: 0070148783)
6. M.L.Munjal –" Acoustics of Ducts and Mufflers" Willy publications(ISBN 9780471847380)
7. A.G.Ambekar – "Mechanical Vibration and Noise Engineering" PHI publications.(ISBN. 9788120329003)

Professional Elective-IV
Reliability Engineering (MEUA40202B)

Teaching Scheme	Examination Scheme						
Credits : 4	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L) : 2 hrs./week Tutorial (T): -- Practical (P): ---	20	30	20	30	25	-	125

Prerequisite: Engineering Mathematics, Manufacturing Processes and Design Engineering

Course Objectives:

Understanding of basic principles of Reliability for ensuring sustainable product design. Application to system requirements, design, manufacturing and testing, with real-world examples. Understand in detail Asset Management, Maintenance, Quality and Productiveness.

Course Outcomes:

Upon completion of the course, students will be able to

- Calculate MTTF, MTBF, failure rate and hazard rate for life characteristic phases of system
- Analyze series, parallel, mixed configuration systems using probability concepts.
- Apply different reliability apportionment techniques to improve reliability of system.
- Calculate inherent, achieved, and operational availability of system.
- Perform FEMA, FMECA and Design of Experiments
- Apply different methods to test reliability.

Unit I: Fundamentals Concepts of Reliability

Reliability terminologies, Interrelationship of safety, quality and reliability, life characteristic phases, Introduction to maintainability, availability. Concepts of Failure, failure density, failure Rate, hazard rate, pdf, cdf. Modes of failure, Mean Time To Failure (MTTF), Mean Time Between Failure (MTBF), Numericals based on calculation of failure rate, hazard rate. Warranty Management and Life cycle cost.

Unit II: Probability Concepts and System Reliability

Basic probability concepts, Discrete and continuous probability distributions, Analysis of series, parallel, mixed configuration systems, Concept of k-out of n structure, Conditional probability method, delta-star method for conditional probability analysis, Tie-set, and Cut-Set method (Concepts and Numericals).

Unit III: System Reliability Analysis

Reliability Improvement- Redundancy, element redundancy, unit redundancy, standby redundancy (Numericals), Introduction to Reliability allocation or apportionment, reliability apportionment techniques: Equal apportionment, AGREE, ARINC, Minimum effort method (Numericals).

Unit IV: Reliability Management

Objectives and types of maintenance, Maintainability, system down time, availability - inherent, achieved, and operational availability (Numerical treatment). Introduction to Reliability Centered Maintenance. Design for maintainability and its considerations, Reliability and costs, Costs of Unreliability, Technology aspects in Reliability Management, BIT (Built in testing).

Unit V: Reliability in Design and Development

Reliability techniques- Failure mode, effects analysis (FMEA), Failure mode, effects, and criticality analysis (FMECA)- Case Studies, Basic symbols, Fault Tree construction and analysis, Introduction to Design of Experiments (DOE).

Unit VI: Reliability Testing
Introduction to reliability testing, Stress strength interaction, Testing for Reliability and Durability- Accelerated Life Testing and Highly Accelerated Life Testing (HALT), highly accelerated stress Screening (HASS). Reliability in manufacturing- Production FRACAS.
Textbooks:
1. Kapur — Reliability in engineering Design‖, Wiley India 2. L. S. Srinath, Reliability Engineering, EWP, 4th Edition 2011
Reference Books:
1. Alessandro Birolini, Reliability Engineering Theory and Practice, Springer 2. S S. Rao, Reliability Based Design, McGraw Hill Inc. 1992

Prepared by: Dr. S. S. Chinchanikar

BOS Member:

BOS Chairman:

Professional Elective-V
Automobile Engineering (MEUA40202C)

Teaching Scheme	**Examination Scheme**						
Credits:2 Lecture (L): 2 hrs./week Tutorial (T): -- hr. Practical (P): -- hr	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	25	-	125

Prerequisite: Strength of Materials, Theory of Machines, Machine Design, Workshop Practice I.

Course Objectives:

- To make the student conversant with fundamentals of automobile systems.
- To develop competencies in performance analysis of vehicles.
- To make the student conversant with automobile safety, and vehicle Standard.

Course Outcomes:

- Discuss the function of each automobile component.
- Compare different types of suspension and baking system.
- Estimation of steering kinematics of four-wheel vehicle.
- Analyze the tire ride properties for better vehicle performance.
- Identify the equation of motion used in vehicle to know the forces acting on it.
- Illustrate the safety parameters and emission standard of a vehicle.

Unit 1- Introduction automobile Engineering

Automobile history and development, Classification, vehicle layout- engine location and drive arrangement, specifications of vehicles, Type of vehicle bodies, Chassis types, constructional details, Frames, sub frames, frameless vehicles, vehicle dimensions), details of chassis material.

Unit II - Suspension System and Brakes

Sprung and unsprung mass, Types of suspension linkages, Type of springs- leaf, coil, air springs, hydro gas suspension, rubber suspension, interconnected suspension, self-leveling suspension (active suspension), damping and shock absorbers Types of brake systems - drum, disc, Operation- mechanical, hydraulic, air brakes, servo and power braking, ABS.

Unit III - Steering Kinematics

Terminology, definitions – reference frame, toe-in, toe-out, wheel camber, caster and kingpin angle, steering offset, Steering geometry and types of gear box, power steering, equivalent mechanisms (front view / side view), anti-dive and squat geometry, steering geometry, steering force and moments.

Unit IV- Tire Characteristics

Tire – types, axis system, mechanics of pneumatic tires - tire forces and moments, rolling resistance of tires, tractive (braking) effort and longitudinal slip (skid), cornering properties of tires, ride properties of tires.

Unit V- Vehicle Performance

Equation of motion and maximum tractive effort, aerodynamic forces and moments, vehicle body moments, roll over, road performance curves, acceleration time and distance, gradability, Parameters, vehicle resistances.

Unit VI- Advancement in Automobile

Types of active and passive safety, vehicle interior and ergonomics, Types of vehicle maintenance, Electronic Stability Control (ESC), autonomous vehicle, autotronics, vehicle to vehicle communication, pre-collision technology.

List of Practical:

1. Vehicle layout of four-wheeler to study the different components.
2. Design of chassis of FSAE using any design software.
3. Demonstration of suspension system of a vehicle.
4. Assembly and disassembly of gear box.
5. Design and study of steering system of any four-wheeler.
6. Calculation of tire forces and moments.
7. Testing of vehicle parameter using any virtual software.
8. Study of front and rear axle of a vehicle.
9. Study of vehicle emission standards.
10. Industrial Visit.

Text Books:

1. Hans Hermann Braess, Ulrich Seiffen, handbook of Automotive Engineering, SAE Publications ISBN-10: 0768007836 ISBN-13: 978-0768007831.
2. A Textbook of Automobile Engineering by R.K. Rajput ISBN : 8170089913,978-8170089919
3. Joseph Heitner, Automotive Mechanics 2013 -C.B.S Publishers and Distributors ISBN-13: 9788176710152.
4. SAE Manuals and Standard.
5. Internal Combustion Engines by v Ganeshan ISBN : 1259006190, 978-1259006197
6. Automobile Mechanics -.N. K. Giri ISBN-10: 81-7409-216-1 ISBN-13: 978-81-7409-216-1.
7. Automobile Electrical Equipment -P. S. Kohali ISBN-10: 0074602160 ISBN-13: 9780074602164.
8. Narang G. B. S. Automobile Engineering - S. Chand and Company Ltd.
9. Singh Kripal - Automobile Engineering -Volume 2 New Chand Jain. EAN: 9788180141775.

Reference Books :

1. Road Vehicle Dynamics – Problems & Solutions, Rao & Dukkipati, SAE ISBN: 0768020514, 9780768020519.
2. Theory of Ground Vehicles, J.Y. Wong, John Wiley & Sons ISBN: 978-0-470-17038-0.
3. Fundamentals of Vehicle Dynamics, T.D. Gillespie, SAE ISBN-13: 978-1560911999.Kalpakjian and Schmid - Manufacturing Engineering and Technology, Prentice Hall, New Jersey, 2013

Prepared by: Prof.P.P.Rathod

BOS Member:

BOS Chairman:

Open Elective II
Solar and Wind Energy (Course code: IOEUA40183E)

Teaching Scheme	**Examination Scheme**						
Credits:2 Lecture (L): 2 hrs./week Tutorial (T): 0 hr. Practical (P): 0 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	100

Prerequisite: Basic Mechanical Engineering, Basic Electrical and Electronics Engineering and Heat Transfer

Course Objectives:

- To understand fundamentals of solar and wind energies.
- To understand constructions, working principle and design procedure of solar and wind power plants.
- To apply basic engineering principle to design a simple solar and wind power system.

Course Outcomes:

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

1. Understand and apply solar radiation and geometry principles.
2. Apply specifications of Solar Cell for different applications.
3. Recognize design process of solar pv system for domestic purpose.
4. Acknowledge Wind Data for site selection.
5. Identify and Design types of Wind Plant for a given application.
6. Classify the Wind Turbine Generators for Power Transmission.

Unit I : Solar Energy Basics

Renewable Energy Scenario in India, Benefits and Limitations on Use of Renewable Energy, Present solar energy scenario in India, governing bodies (self-study), solar radiations and its measurements, (Instruments) Issues and Challenges for Growth of Renewable Energy at in India, Concept of Solar Parks, Recent Solar Applications

Unit II: Solar Cell Operation

Solar Spectrum, Solar Radiation Spectrum, Worked Problem - Total Irradiance,
Solar Cell Fundamentals, Worked Problem - The I-V Characteristic, Solar Cell Types and Technologies, Multi-junctions. Conversion Efficiency Limitations, Worked Problem, From Cell to Module, **Energy Audit of Home/Residence**

Unit III: Design of Solar PV Systems

PV Sizing and Output, Orientation and Tilt, Temperature Dependent Output, Module and array conditions, Shading calculations using PV Watts, PV Sizing and output under different conditions, Inverter Sizing and Selection, Case Studies

Unit IV: Wind Energy and its assessment

Principle of wind energy conversion; wind data and site selection considerations, wind energy potential and installation in India., Basic components of wind energy conversion systems; Analysis of aerodynamic forces acting on wind mill blades **and estimation of power output;**

Unit V: Wind Power Plants

Different Components in Wind Turbine Power Plant, Types of Wind Power Plants (WPPs): Small and large wind turbines; Horizontal and Vertical axis; Upwind and Downwind, One, Two and Three blades , Market **Survey and Specifications, Performance Analysis and Numerical,** Case study on designing miniature wind mill for domestic purpose referring existing system.
Unit VI: Wind Turbine Generators and Power Transmission
Types of Wind Turbine Generators, DC Generator, AC Synchronous Generator, AC Asynchronous Generators, Switched Reluctance Wind Turbine Generator, Issues occur while integrating wind energy with power grids, reactive power compensation, HVDC and HVAC Transmission, onshore and offshore wind power and benefits of Wind Energy
List of Practical:
1: Design of solar food drier for domestic purpose referring existing systems. 2: Measurement of Solar Insolation at Residence. (Instruments) 3: Design of Solar Pump for Farm Irrigation. 4: Design of solar photovoltaic system for domestic/ commercial building purpose. 5. Design of Solar Operated home appliance. 6. Case study on designing miniature wind mill for domestic purpose referring existing system. 7. Visit to Solar PV System/wind power system used in commercial building. 8. Mini Project on Solar/Wind Energy.
Text Books:
1. S. P. Sukhatme, 'Solar Energy: Principles of thermal collections and storage', McGraw Hill 2. G. D. Rai, 'Non-Conventional Energy Sources', Khanna Publisher 3. Tiwari G N. 'Solar Energy: Fundamentals, design, modeling and Applications', Narosa, 2002
Reference Books :
1. Mukund R. Patel, 'Wind And Solar Power Systems: Design, Analysis and Operation, Second Edition', CRC Press 2. Kreith And Kreider, Solar Energy Handbook, McGraw Hill 3. Ray Hunter, 'Wind Energy Conversion: From Theory to Practice', John Wiley and Son Ltd 4. Gary L Johnson, 'Wind Energy Systems', Prentice-Hall Inc., New Jersey 5. Martin O L Hansen, 'Aerodynamics of Wind Turbines', James & James/Earthscan. 6. Goswami D Y, Kreith F, Kreider J F, 'Principles of Solar Engineering', Taylor & Francis 7. Robert Gasch, 'Wind Power Plant Fundamentals, Design, Construction And Operations', Springer 8. C S Solanki, 'Solar Photovoltaic: Fundamentals, Technology And Applications', PHI Learning

Prepared by: Dr. Ajay D.Kale
BOS Member:
BOS Chairman:

Open Elective -III
Project Management & Eonomics (IOEUA40204F)

Teaching Scheme	**Examination Scheme**						
Credits:2 Lecture (L): 2 hrs./week Tutorial (T): -- hr. Practical (P): – hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	--	100

Prerequisite: Basic Concepts of Statistics and Probability

Course Objectives:

- To provide students a strong foundation in engineering projects for entry-level to mid-level professionals.

To learn the basics of economics and cost analysis relevant to engineering so as to take economically sound decisions.

Course Outcomes:

Upon completion of the course, students will be able to

1. Demonstrate the understanding of project management and project evaluation techniques
2. Allocate project resources considering risk management.
3. Identify HRM issues in project procurement and material management
4. Calculate rate of return, interest rate and tax.
5. Perform cost analysis.
6. Critically examine present worth and future worth.

Unit I: Introduction to Engineering Projects

Project Fundamentals, Project overview, Project Feasibility Analysis, Project identification, Sources of Project ideas, Project Evaluation Techniques, Monitoring and control of projects.

Unit II: Project Resource Allocation

Project scheduling with unlimited Resources, Project scheduling with limited Resources, Risk Identification, Enterprise Resource planning.

Unit III: Project Human Resource Management

Project Organization Structure, Leadership Style, Managing Conflicts, Human Resource Management issues, Project Total Quality Management, Project Contract Management.

Unit IV: Introduction to Economics

Engineering Decision-Makers, Engineering Economics, Intuition and Analysis, Tactics and Strategy. Law of demand and supply, Law of returns,
Interest and Interest factors: Interest rate, Simple interest, Compound interest,
Personal loans and EMI Payment, Tax concepts, Income tax.

Unit V: Fundamentals of Finance and Costing

Components of costs such as Direct Material Costs, Direct Labor Costs, Fixed Over-Heads, Factory cost, Administrative Over-Heads, Marginal cost, Selling price. Statements of Financial Information: Introduction, Source of financial information, Financial statements, Balance sheet, Profit and Loss account.

Unit VI: Net Worth Comparisons
Present-Worth Comparisons: Conditions, Basic Present worth comparisons, Present-worth equivalence, Net Present worth, Future-worth comparison, Pay-back comparison, Equivalent Annual-Worth Comparison methods, Situations for Equivalent Annual-Worth Comparisons, Consideration of asset life.
Text Books:
1. Total Project Management – The Indian Context by P. K. Joy, Macmillan Publishers India Ltd., ISBN No.: 0333-92624-2 2. Chan S. Park "Contemporary Engineering Economics", 3rd Edition,PHI Publications.
Reference Books :
1. Chandra, P., Projects, Planning, Analysis, Financing, Implementation and control, Tata McGraw Hill, Fifth Edition 2. Maylor, H., Project Management, Pitman Publication, Second Edition. 3. Ghattas, R.G. &McKee, S.L., Practical Prokject Management, Pearson Education Asia. 4. Pinto, P.K., Project Management, Pearson Education, First Edition 5. Wyzocki, R.K. &Mc Gary R., Effective Project Management, Wiley. First Edition 6. Leland T. Blank and Anthony J. Tarquin , "Engineering Economy" 4th Edition ,McGraw Hill Publication . Dr.K.K.Dewett and M. H. Navalur ," Modern Economic Theory"Revised Edition,S Chand Publication.

Prepared by: Prof. Naren B. Kate

BOS Member:

BOS Chairman:

Intellectual Property Rights (MEUA40205)

Teaching Scheme	Examination Scheme						
Credits: 2 Lecture (L): 2 hrs./week Tutorial (T): hr. Practical (P): - hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	-	-	50	-	-	-	50

Course objectives:

- The course is designed to introduce fundamental aspects of Intellectual property Rights.
- The course introduces all aspects of the IPR Acts.
- It also includes case studies to demonstrate the application

Course outcomes:

Upon completion of course, students will be able to

1. Demonstrate and develop awareness and impact of patent law on their academics and professional life.
2. Understand the procedure of patent filing.
3. Understand and aware importance of trade mark in industry.
4. Apply knowledge to read the patent document.

Unit 1: Overview of Intellectual Property

Introduction and the need for intellectual property right (IPR) IPR in India – Genesis and Development IPR in abroad Some important examples of IPR

Unit II : Patents

Macro economic impact of the patent system, Patentability, Types of IP tools, Copyright, trademarks, Patent databases, Patent document and its search, Rights of a patent,

Unit III : Patent Search

Searching a patent, Patent database, Patent free database. Patent structure, Patent grants Procedure in India, Different layers of the international patent system (National, Regional and international options). Copyright- Definition of copyright, Content of copyright, What are related rights, Rights covered by copy right.

Unit IV : Trademark

Definition of trademark, Rights of trademark, Kind of signs can be used as trademarks, Types of trademark function, Protection of trademark, Trademark registration.

Text Books :

1. Resisting Intellectual Property by Halbert ,Taylor & Francis Ltd ,2007
2. Industrial Design by Mayall, McGraw Hill
3. Intellectual Property Rights Under WTO by T. Ramappa, S. Chand

4. Encyclopedia of Ethical, Legal and policy issue in Biotechnology by T. M. Murray and M. J. Mehlman, John Wiley and Sons 2000.

Reference Books :

1. Nanotechnology Intellectual Property Rights: Research, Design, and Commercialization by Dr. S. K. Jabade, CRC Press
2. Product Design by Niebel, McGraw Hill
3. Introduction to Design by Asimov, Prentice Hall
4. Intellectual Property in New Technological Age by Robert P. Merges, Peter S. Menell, Mark A. Lemley

Prepared by: Dr.S.S.Kore

BoS Member:

BoS Chairman:

Project Work or Project III (MEUA40206)

Teaching Scheme	**Examination Scheme**						
Credits: 5	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L): - hrs./week Tutorial (T): - hr. Practical (P): 10 hrs./week	100	-	-	-	50	-	150

Prerequisite: All Mechanical Engineering Subjects till semester VI

Course objectives:

To train the students to apply their engineering knowledge to real life problem solving. And to plan. implement and execute project work to satisfy the stated objectives of the project

Course Outcomes:

By the end of the course, students will be able to

1. Identify and formulate the problem related to mechanical engineering based on literature survey.
2. Apply concepts and modern engineering tools to design the solution for identified problem.
3. Develop a system, component, or process to meet desired needs considering the standards and codes.
4. Prepare a plan of activities according to the time frame and budget.
5. Prepare and present technical report.
6. Work in a group as a part of multidisciplinary team with professional responsibility.

Individual project may have different POs based on the nature of project

The students in a group of not more than FOUR will work under the guidance of the faculty member on the project work undertaken by them. The completion of work, the submission of the report and assessment should be done at the end of semester VII/VIII.

The project work could be of the following nature:

- Design/development and Fabrication of models. Machines and prototypes based on new ideas, robotic and automation systems, Experimental set ups. Test rigs equipment.
- Thermal Systems, Energy audit, conservation studies
- Extensive computational analysis of problems relevant to mechanical engineering.
- CAD/CAM/CAE
- Modeling/simulation of product(s). mechanism(s) or system(s) and its validation or comparison with available bench mark results

A report containing minimum of 30 pages shall be submitted based on the project. Report point are;

- Background, need and scope of the project,
- Project specifications,
- Activities involved in the project and activity plan.
- Study of literature and basic theory.
- Design calculation, standards & codes used, analysis, simulation, experimentation, testing, manufacturing,
- Results, discussion, conclusion, and future work.

- References

Prepared by: Prof. P.R. Anerao
BoS Member:
BoS Chairman:

MODULE-II

SEMESTER- VII/VIII

Semester Internship (MEUA40201)

Teaching Scheme	**Examination Scheme**						
Credits : 12	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L) : -- hrs./week Tutorial (T): -- hr. Practical (P): 12 hrs./week	100	-	-	-	50	-	150

Course Objectives:

 To Provide possible opportunities to learn, understand and sharpen the real time technical/managerial skills required at the job.
 To Familiarize with various materials, processes, products, and their applications along with relevant aspects of quality control
 To Understand the social, economic, and administrative considerations that influence the working environment of industrial organizations.
 To Understand the psychology of the workers and their habits, attitudes, ethics, and approach to problem-solving

Course Outcomes:
At the end of this course, a student will be able to -
1. Understand the industrial requirement in terms of ethics, skillsets for future employees/entrepreneurs
2. Apply knowledge gained in academics to the industrial applications
3. Function effectively as an individual and as a member of the multidisciplinary team
4. Get a good opportunity as a potential employer

MODULE-III

Elective-IV: Computational Fluid Dynamics (MEUA42201A)

Teaching Scheme	**Examination Scheme**						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): -- hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	25	-	125

Perquisite: Engineering Mathematics, Manufacturing Processes and Design Engineering

CourseObjectives:

- Students should be able to model fluid / heat transfer problems and apply fundamental
- Conservation principles.
- Students should be able to do discretize the governing equations by Finite Difference Method
- and Finite volume Method.
- Studentsshouldbeabletosolvebasicconvectionanddiffusionequationsandunderstandsthe role in fluid flow and heat transfer.

To prepare the students for research leading to higher studies.

Course Outcomes:

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

1. Analyze and model fluid flow and heat transfer problems.
2. Generate high quality grids and interpret the correctness of numerical results with physics.
3. Solve two dimensional steady and unsteady heat conduction equation using finite volume method
4. Analyse different boundary conditions.
5. Formulate two dimensional steady and unsteady heat convection-diffusion equation
6. Apply proper turbulence model to solve fluid flow problems.

Unit I: Introduction

Introduction to Computational Fluid Dynamics, How CFD Code work, Applications of CFD, Steps for problem solving with CFD

Unit II: Governing equations of CFD

Derivation and physical interpretation of governing equations (conservation of mass, momentum and energy) in differential form, Concept of substantial derivative, divergence and curl of velocity, Mathematical behavior of Governing Equations and boundary conditions.

Unit III: Solution to Conduction Equation

Introduction to FEA, FDM and FVM, Solution of two dimensional steady and unsteady heat conduction equation using finite volume method (Implicit and Explicit) with Dirichlet, Neumann, Robbin boundary conditions, Stability Criteria.

Unit IV: Solution to Advection Equation

Solution of two dimensional steady and unsteady heat advection equation using finite volume method (Implicit and Explicit) with Dirichlet BC, Stability Criteria, Introduction to first order upwind, CD,

Unit V: Solution to Convection-Diffusion Equation

Solution of two dimensional steady and unsteady heat convection-diffusion equation for slug flow, using finite volume method (Implicit and Explicit), Stability Criteria, 1-D transient convection- diffusion system, Peclet Number
Unit VI: Introduction to Turbulence Modeling
Introduction to turbulence models, Reynolds Averaged Navier-Stokes equations (RANS), One equation model (Derivation) and two equation model.
List of Practical:
1. One-dimensional steady state conduction meshing using finite volumemethod 2. Two-dimensional steady state conduction using finite volumemethod 3. Two-dimensional unsteady state conduction using finite volumemethod 4. Two-dimensional advection using finite volumemethod 5. One-dimensional conduction convection problem using finite volumemethod 6. Solution of Navier Stokes equation using SIMPLE algorithm for LidDriven Cavity flowproblem Mini-project based on above practical's.
Reference Books : 1. H. Tennekes and J. L. Lumley, A First Course in Turbulence, MITPress. **2.** David C. Wilcox, Turbulence Modeling for CFD, DCWIndustries

Course Coordinator: Dr. S.S. Kore

BoS Member:

BoS Chairman:

Elective-IV: Composite Material (MEUA42201B)

Teaching Scheme	Examination Scheme						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): -- hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	25	-	125

Prerequisite: Strength of Material, Design of Machine Elements, Material Science

Course Objectives :

- To understand importance of composite materials in various applications such as aerospace, automotive
- To understand various fabrication methods of composite material
- To know various composite testing methods and standards of testing
- To develop an understanding of the micro and macro mechanical analysis of composite materials

Course Outcomes :

By the end of the course, students will able to

1. Identify different types of composite materials and its constituents and list its applications in various fields
2. Explain the various manufacturing methods of composite materials
3. Apply various ASTM testing standards for characterizing composite materials
4. Apply strength of material approach to analyze a lamina at micromechanical level
5. Analyze composite lamina at macromechanical level
6. Apply Classical Lamination Theory for the analysis of composite laminates

Unit I : Introduction to Composite Material

Introduction to Composite Materials, classification of composite materials, Matrices and Reinforcement, Types of Fiber Reinforcement, Types of matrix materials - Thermoset and Thermoplastic, Advantages and Disadvantages, Applications of composite materials, Mechanics Terminology

Unit II : Manufacturing of Composite Material

Composite Manufacturing Processes, Hand Lay-up process, Compression molding process, Vacuum Impregnation Methods, Resin Transfer molding, Filament winding , Pultrusion , Prepregs, Stacking of reinforcements

Unit III : Composite Material Characterization

Composite testing, Need for testing ,Major types of testing, Physical testing, Mechanical testing as per ASTM standards- Tensile, compression, shear, flexural, impact, fatigue and creep test, Chemical testing , Thermal testing Volume and Mass Fractions, Density, and Void Content

Unit IV : Micromechanical Analysis of a Lamina

Evaluation of the Elastic Moduli- Strength of material approach: Representative Volume Element (RVE), Rule of Mixtures, Inverse Rule of Mixtures. Ultimate Strengths of a Unidirectional Lamina, Coefficient of thermal expansion , Coefficient of moisture expansion

Unit V : Macromechanical Analysis of Lamina

Hooke's Law for Different Types of Materials- Anisotropic Material, Orthotropic/Specially Orthotropic, Hooke's Law for a Two-Dimensional Unidirectional Lamina, Plane Stress Assumption, Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of a Lamina, Two-Dimensional Angle Lamina, Strength Failure Theories of an Angle Lamina- Tsai–Wu Failure Theory

Unit VI : Macromechanical Analysis of Laminates

Laminate Code, Classical Lamination Theory - Stress–Strain and Strain-Displacement Equations, Strain and Stress in a Laminate, Force and Moment resultants related to Midplane Strains and Curvatures, extensional, coupling, and bending stiffness matrices, analyzing a laminated composite. Special Cases of Laminates- Symmetric Laminates, Cross-Ply Laminates, Angle Ply Laminates, Antisymmetric Laminates, Balanced Laminate, Quasi-Isotropic Laminates

Text Books :

1. Autar K. Kaw, Mechanics of Composite Materials, , CRC, Taylor and Francis 2006, ISBN:10:0-8493-1343-0.
2. Robert M. Jones, Mechanics of Composite Materials, Taylor and Francis 2010, ISBN:10:1-56032-712-X.
3. Madhujit Mukhopodhyay , Mechanics of Composite Materials and Structures , University Press (India) PVT Ltd, 2009, ISBN: 9788173714771
4. Mallick PK, Fiber-reinforced composites: materials, manufacturing, and design. CRC press, Taylor and Francis Group 2007; ISBN: 13: 978-0-8493-4205-9.

Reference Books :

1. Isaac M. Daniels, Ori Ishai, "Engineering Mechaincs of Composite Materials", Oxford University Press, 1994.
2. Bhagwan D. Agarwal, Lawrence J. Broutman, "Analysis and Performance of fiber composites", John Wiley and Sons, Inc. 1990.
3. Mathews, F. L. and Rawlings, R. D., "Composite Materials: Engineering and Science", CRC Press, Boca Raton, 03.
4. Mazumdar S. K., "Composaite Manufacturing – Materials, Product and Processing Engineering", CRC Press, Boca Raton, 02.

Assignments:

1. Demonstration on manufacturing of synthetic fiber reinforced composite laminate using compression molding machine.
2. Demonstration on manufacturing of synthetic fiber reinforced composite laminate using vacuum bagging technique
3. Tensile testing of composite coupon specimen
4. Micromechanical Analysis of lamina using MATLAB;
5. Macromechanical Analysis of lamina using MATLAB;
6. Macromechanical Analysis of laminate using MATLAB
7.

Course Coordinator: Dr. A.R.Mache

BoS Member:

BoS Chairman:

Elective-IV: Mechanical System Design (MEUA42201C)

Teaching Scheme	Examination Scheme						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): -- hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	25	-	125

Prerequisite: Engineering Mechanics, Manufacturing Process, Engineering Mathematics, SOM, TOM, DME, IC Engines.

Course objectives:

1. To develop competency for system visualization anddesign.
2. To enable student to design machine toolgearbox.
3. To enable student to design material handlingsystems.
4. Ability to apply the statistical considerations in design and analyze the defects and failure modesin components
5. To enable student to design cylinders, pressure vessels and internal engine components and to use IScode.
6. To enable student to study and understand automobile suspensionsystem

Course Outcomes:

By the end of the course, students will be able

1. To design machine tool gearbox for varioussystem.
2. To design belt conveyer system for material handlingsystem.
3. To study different statistical methods/ techniques/ principles and apply it tomechanical components.
4. To Design various types of cylinders and pressurevessels.
5. To Understand the design concept and procedure for IC enginecomponents.
6. To Understand the concept for automobile suspensionsystem.

Unit I - Design of Machine Tool Gearbox

Introduction to machine tool gearboxes, design and its applications, basic considerations in design of drives, determination of variable speed range, graphical representation of speed and structure diagram, ray diagram, selection of optimum ray diagram

Unit II - Design of Belt conveyer system for material handling

System concept, basic principles, objectives of material handling system, unit load and containerization. Belt conveyors, Flat belt and troughed belt conveyors, capacity of conveyor, rubber covered and fabric ply belts, belt tensions, conveyor pulleys, belt idlers, tension take-up systems, power requirement of horizontal belt conveyors for frictional resistance of idler and pulleys.

Unit III – Design of Cylinder

Design of Cylinders:
Thin and thick cylinders, Lame's equation, Clavarino,,s and Bernie's equations, design of hydraulic and pneumaticcylinders,auto-frettageandcompoundcylinders,(NoDerivation)gasketedjointsincylindrical vessels

Unit IV- Design of Pressure Vessel

Design of pressure Vessel:

Modes of failures in pressure vessels, unfired pressure vessels, classification of pressure vessels as per I. S.2825-categoriesandtypesofweldedjoints,weldjointefficiency,stressesinducedinpressurevessels, materialsforpressurevessel,thicknessofcylindricalshellsanddesignofendclosuresaspercode,nozzles andopeningsinpressurevessels,reinforcementofopeningsinshellandendclosures-areacompensation method

Unit V- Design of I. C. Engine components

Introduction to selection of material for I. C. engine components, Design of cylinder and cylinder head, construction of cylinder liners, design of piston and piston-pins, piston rings, design of connecting rod. Design of crank-shaft and crank-pin, (Theoretical treatment only).

Unit VI– Automobile Suspension System

Suspensions: Types of suspension linkages, types of suspension springs- leaf, coil, air springs, hydrogas, rubber suspension, interconnected suspension, self levelling suspension (active suspension), shock absorbers (hydraulic andair)

Text Books:

1. Bhandari V.B. ―Design of Machine Elements‖, Tata McGraw Hill Pub. Co.Ltd.
2. Juvinal R.C, Fundamentals of Machine Components Design, Wiley,India

Reference Books:

1. Shigley J. E. and Mischke C.R., ―Mechanical Engineering Design‖, McGraw Hill Pub.Co
2. M. F. Spotts, ―Mechanical Design Analysis‖, Prentice HallInc.
3. Black P.H. and O. Eugene Adams, ―Machine Design‖ McGraw Hill Book Co.Inc.
4. JohnsonR.C.,―MechanicalDesignSynthesiswithOptimizationApplications‖,VonNostrandReynoldPub.
5. S.K. Basu and D. K. Pal, ―Design of Machine Tools,,, Oxford and IBH PubCo.
6. Rudenko,‖MaterialHandling Equipment‖, M.I.R. publishers, Moscow
7. P.Kannaiah,‖DesignofTransmissionsystems‖,SCIETCHPublicationsPvtLtd.
8. Pandy, N. C. and Shah, C. S., ―Elements of Machine Design―, Charotar PublishingHouse.
9. Mulani, I. G., ―BeltConveyors‖
10. Singiresu S. Rao, Engineering Optimization: Theory and Practice, , John Wiley &Sons.
11. M.V. Joshi, Process Equipment Design,Mc-Millan.
12. Design Data―, P.S.G. College of Technology,Coimbatore.
13. Bhandari, V. B. Machine Design data book, Tata McGraw Hill Publication Co.Ltd.
14. I.S. 2825: Code for unfired pressurevessels.

Course Coordinator: Mr. A.V.salve

BoS Member:

BoS Chairman:

Open Elective-I: Introduction to Gaming (IOEUA42202A)

Teaching Scheme	Examination Scheme						
Credits: 3 Lecture (L): 2 hrs./week Tutorial (T): -- hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Prerequisite: Readers/students are expected to know the following concepts:

1. Basics of Probability

Course Objectives:

- To learn about the video game art principles, Video Game production, Design Process and the Industry
- To understand and distinguish Video game elements, genres, types ad hardware
- To Study various video game production practices, terminology, Industry roles and responsibilities
- To know the application and use of a game engine across various verticals and develop and learn how to work with the game engine as a tool for production
- To examine and game engine interface, coding, game objects, asset Store, services, etc

Course Outcomes:

1. Use terminology related to Games and Interactive Media Industry
2. identify industry demands and structure project as per required specifications
3. Define Specifications for the execution of the project
4. Demonstrate game engine tools usage across art, animation, asset management, Interface, Audio, Lighting, Materials, Physics and Programming systems.
5. Select gaming services related to project structure
6. Develop basic interactive games

Unit- I : Introduction to Games Industry

Video game production techniques, hardware, production roles and responsibilities, Video game design elements, game genres, game types, examples of gaming platforms, gaming services, video game controls, video game industry terms, model asset optimization, asset store, video game art principles, video game industry practices, video game industry terminology

Unit-II : Game Engine Fundamentals

Gaming engine user interface, hierarchy, editor, game Window, navigation, inspector, scene, project, game object, prefab, models, tags, sounds, assets, project management, materials, textures, effects, lights, modelling practices and optimization practices, Import system, managing materials, managing textures

Unit III: World Building and Animation

Environment, Static Meshes, Rigid Body, Colliders, Preparing for lighting, Light tools, light types, User Interface, Art principles, Sprite editor, Lighting process, Baking process, Animated objects, Importing animation, Setting up animation states, Animation controllers, Transition, Animation refinement.

Unit IV: Scripting a Game Development

Script types, Variables, Methods, C# fundamentals, Game mechanics, Ray casting, Program Debugging, Various Error states, Navigation, Nav Mesh, Building NPC, Simple AI, Enemy System, Particle system, Adding Game audio, Audio types, Audio formats, Audio clips and properties, Camera System, Building camera system, Player Behaviors, User Interface system, User Interface Implementation, Properties of UI, Build tools, Cloud Services, Console, Build Settings, Platforms, Publishing tools, Mobile Publishing

Text Books :

1. Tom Meigs, Ultimate Game Design: Building Game Worlds 1st Edition, McGraw-Hill Education, 2003
2. Sam R. Kennedy, How to Become a Video Game Artist: The Insider's Guide to Landing a Job in the Gaming World, Watson-Guptill, 2013

Reference Books :

1. Penny de Byl, Holistic Game Development with Unity: An All-in-One Guide to Implementing Game Mechanics, Art, Design and Programming, 2nd Edition, A K Peters/CRC Press, 2017
2. Mike Geig, Unity 2018 Game Development in 24 Hours, Sams Teach Yourself, 3rd Edition, Sams Publishing, 2018

List of Assignments

Develop a game "Roller Madness" in Unity environment as following assignments

1. Implement the Setting Up the Scene, Camera Setup
2. Implement the Physics system
3. Configure the Player Control and Appearance
4. Health and Damage, Pickups,
5. UI Basics and Game Manager,
6. Create the Enemies
7. Implement the Particle System
8. Implement Animations to the game avatar
9. Spawners to create multiple objects of same type

Note : Do any 6 assignments based on syllabus

Course Coordinator:

BoS Member:

BoS Chairman:

Open Elective-I: Inferential Statistics for Data Science (IOEUA42202B)

Teaching Scheme	**Examination Scheme**						
Credits: 3 Lecture (L): 2 hrs./week Tutorial (T): -- hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Prerequisite: Readers/students are expected to know the following concepts:

2. Basics of Probability

Course Objectives:

- To equip students with the basic understanding of the fundamental concept of data and the nature of data sets
- To understand the fundamentals of probability distributions and their application for data analysis
- To derive the conclusions from the data sets with Bayesian and Inferential statistics

Course Outcomes:

1. Explain the nature and central tendency of given data sets using appropriate probability distribution for the given data set.
2. Estimate probability of unknown parameters of statistical model using the fundamentals of Bayesian statistics.
3. Analyze and conclude the hypothesis using inferential statistical tests
4. Evaluate the prominent characteristics of data sets with exploratory data analysis methods

Unit- I : Understanding Data and probability distributions

Understanding Data, Frequency Tables, Distributional Shapes, Central Tendency Describing Spread: Range, Interquartile Ranges and Standard Deviation , Measuring Data ,Measurements of Central Tendency, Measurements of Dispersion, Bi-variate Data and

Covariance ,Pearson Correlation Coefficient, Uniform Distribution, Binomial Distribution, Poisson Distribution, Normal Distribution, Normal Distribution - Formulas and Z Scores

Unit-II : Bayesian Statistics

Likelihood function and maximum likelihood, The minimaxity, Computing the MLE, Computing the MLE: examples ,Continuous version of Bayes' theorem, Priors and prior predictive distributions

Prior predictive: binomial example, Posterior predictive distribution, Bernoulli/binomial likelihood with uniform prior, Conjugate priors

Unit III: Inferential analysis

Central limit theorem and Hypothesis Testing , t-tests, Sensitivity Analysis ,chi square test, Correlation-values and confidence intervals, Use Analysis of Variance (ANOVA) or Analysis of Covariance (ANCOVA),Regression analysis

Unit IV: Exploratory Data Analysis

Univar ate data: measures of center and spread, transformations, visualization. – Bivariate data: Simple regression, curve fitting, – Trivariate/Hypervariate data: Multiple regression, model selection, principal components. – Binary responses: Logistic regression, residuals. – Categorical data: Contingency tables, correspondence analysis. – Distance data: Multi-dimensional scaling, non-linear dimensionality reduction. – Graph data: Descriptive statistics, spectral methods, visualization.

Text Books :

1. Sahu, Pradip Kumar, Pal, Santi Ranjan, Das, Ajit Kumar, "Estimation and Inferential Statistics", Springer
2. S.C. Gupta and V. K. Kapoor : Fundamentals of Mathematical Statistics, Sultan Chand and Sons, 88, Daryaganj, New Delhi, 2.
3. Manoj Kumar Srivastava, Abdul Hamid Khan, Namrata Srivastava, "Statistical Inference, Theory of estimation", PHI

Reference Books :

1. George Casella, Roger Berger," Statistical Inference ",CENGAGE Learning, Second Edition
2. Malcom O, Asadoorian, Demetri Kantarelis, "Essentials of Inferential Statistics", University Press of America

Practicals: Practicals can be done using Python/R

Study of Hypothesis testing(One sample t test, z test)

1. Analysis of variance (ANOVA)
2. To study Linear regression to predict the outcome of a variable
3. 4.Study of outlier in Predictive analysis
4. Finding the most important predictor variable in a dataset for feature Selection
5. 6.Model selection and analysis for a real world dataset

6. 7.Study of Logistic Regression
7. 8.To build an application: Time series forecasting

Course Coordinator:

BoS Member:

BoS Chairman:

Elective-IV: Energy Engineering (MEUA42201C)

Teaching Scheme	**Examination Scheme**						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): -- hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	25	-	125

Prerequisite: Applied Thermodynamics, Turbo-machines

Course objectives:

- To study the power generation scenario, the components of thermal power plant, improved Rankin cycle, Cogeneration cycle
- To understand details of steam condensing plant, analysis of condenser, the an environmental impacts of thermal power plant, method to reduce various pollution from thermal power plant
- To study layout, component details of hydroelectric power plant, hydrology and elements , types of nuclear power plant
- To understand components; layout of diesel power plant , components; different cycles ; methods to improve thermal efficiency of gas power plant
- To study the working principle , construction of power generation from non-conventional sources of energy
- To learn the different instrumentation in power plant and basics of economics of power generation.

Course Outcomes:

By the end of the course, students will

1. Describe the power generation scenario, the layout components of thermal power plant and analyze the improved Rankin cycle, Cogeneration cycle
2. Analyze the steam condensers, recognize the environmental impacts of thermal power plant and method to control the same
3. Describe the layout, component details of hydroelectric power plant and nuclear power plant
4. Explain the details of diesel power plant, gas power plant and analyze gas turbine power cycle
5. Describe the fundaments of non-conventional power plants.
6. Describe the different power plant electrical instruments.

Unit 1 - Thermal Power Plant

Introduction: General layout of modern power plant with different circuits, working of thermal power plant, coal classification and its CV, high pressure boilers (Latest three), Rankine cycle with reheat and regeneration (Separate Numerical with Mollier Diagram) , Cogeneration power plant (with numerical)

Unit 2 Steam Surface Condenser and Cooling Tower

Steam Condenser: Necessity of steam condenser, Classification, Cooling water requirements, Condenser efficiency, Vacuum efficiency,(Numerical) Cooling towers (Performance Parameters), air Leakage, Effects of Air Leakage on condenser performance, (Numerical Treatment)

Unit 3 – Hydroelectric Power Plant

Introduction, Site Selection, Advantages and Disadvantages of HEPP, Hydrograph, Flow duration curve, (Numerical) Mass Curve, Classification of HEPP with layout.

Nuclear Power Plants: Elements of NPP, Nuclear reactor & its types, fuels moderators, coolants, control rod, classification of NPP, N-waste disposal (No Numerical)

Unit 4 - Gas Turbine Power Plant

Layout of Gas Turbine Power Plant with Important Systems, Brayton Cycle analysis, Thermal Efficiency, Work ratio, maximum & optimum pressure ratio, Isentropic Efficiency of Compressor and Turbines, Inter-cooling, reheating, & regeneration cycle, (Separate Numerical) Combined power cycle plant.

Unit 5 - Non-Conventional Power Plants

Wind Power Plant: Introduction, wind availability measurement, types of wind machines, site selection, and wind power generation.

Solar Power Plant : Low & High Temperature Solar Power Plant, Photovoltaic Power System (Case Study), Heliostat, Challenges in commercialization of Non-Conventional Power Plants.

Unit 6 Power Plant Instrumentation

Generator, Transformers, Exciters, Switch Gear, Circuit breakers, Protective Devices and Control Systems, Boiler Instrumentation and Control

Term-Work

The Term-Work shall consist of any eight experiments

1) Study of High Pressure boilers.
2) Visit to thermal Power plant /Co-generation Power plant to understand layout and specifications of main components.
3) Visit to any Non-Conventional Power Plants.
4) Trial on steam power plant.
5) Simulated performance of Steam Power plant with suitable software.
6) Simulated performance of Gas Turbine Power plant.
7) Trial on Diesel Power Plant to understand performance parameters by Graphs.
8) Power plant Instrumentation.
9) Case study on Solar/Wind with numerical or suitable software.

Text Books

1) P.K.Nag, ―Power Plant Engineering‖, McGraw Hill Publications New Delhi.
2) Mahesh M Rathore, - Thermal Engineering, Tata McGraw Hill, New Delhi
3) S.P.Sukhatme, ―Solar Energy‖ Tata McGraw-Hill Publications, New Delhi (Latest Edition)

Reference Books :

1. Domkundwar & Arora, ―Power Plant Engineering‖, Dhanpat Rai & Sons, New Delhi.
2. R.K.Rajput, ―Power Plant Engineering‖, Laxmi Publications New Delhi.
3. R.Yadav , ―Steam and Gas Turbines‖ ,Central Publishing House, Allahabad.
4. Cengel Boles, Thermodynamics An Engineering approach, The Tata McGraw Hill, New Delhi
5. G.D.Rai, ― Non-Conventional Energy Sources‖ Khanna Publishers,Delhi

Course Coordinator: Dr. A.D. Kale

BoS Member:

BoS Chairman:

Open Elective-I: Social Media Analytics (IOEUA42202E)

Teaching Scheme	Examination Scheme						
Credits: 3 Lecture (L): 2 hrs./week Tutorial (T): --hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Prerequisites:

1.Basic knowledge of Graphs.
2. Data mining.
3. Data Analysis.

Course Objectives:

Upon successful completion of the course, students will be able to

1. Understand foundations of Social Media Analytics.
2. Visualize and understand the data mining aspects in social networks.
3. Solve mining problems by different algorithms.
4. Understand network measures for social data.
5. Understand behavioral part of web applications for Analysis.
6. Analyze the data available on any social media applications.

Course Outcomes:

By the end of the course, students should be able to

1. Explain the basics of Social Media Analytics.
2. State the visualization of social networks and the significance of Data mining in Social media.
3. Demonstrate the algorithms used for text mining.
4. Compare network measures for social media data.
5. Explain Behavior Analytics techniques used for social media data.
6. Apply social media analytics for Facebook, LinkedIn and Twitter kind of applications.

Unit I – Introduction To Social Media Analytics (Sma) And Types Of Analytics Tools

Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas,

The foundation for analytics, Social media data sources, Defining social media data, data sources in social media channels, Estimated Data sources and Factual Data Sources, Public and Private data, data gathering in social media analytics

UNIT II - The Social Networks Perspective And Its Visualization

The social networks perspective - nodes, ties and influencers, Social network and web data and methods. Graphs and Matrices- Basic measures for individuals and networks.

A Taxonomy of Visualization, The convergence of Visualization, Interaction and Analytics. Data mining in Social Media: Introduction, Motivations for Data mining in Social Media, Data mining methods for Social Media

Unit III – Text Mining In Social Networks

Introduction, Keyword search, Classification Algorithms, Clustering Algorithms-Greedy Clustering, Hierarchical clustering, k-means clustering, Transfer Learning in heterogeneous Networks, Sampling of online social networks, Comparison of different algorithms used for mining, tools for text mining.

Unit IV - Network Measures

Centrality: Degree Centrality , Eigenvector Centrality, Katz Centrality , PageRank, Betweenness Centrality, Closeness Centrality ,Group Centrality ,Transitivity and Reciprocity, Balance and Status, Similarity: Structural Equivalence, Regular Equivalence

Unit V – Behavior Analytics

Individual Behavior: Individual Behavior Analysis, Individual Behavior Modeling, Individual Behavior Prediction Collective Behavior: Collective Behavior Analysis, Collective Behavior Modeling, Collective Behavior Prediction

Unit VI - Case Study
Mining Twitter: Overview, Exploring Twitter's API, Analyzing 140 Characters Mining Facebook: Overview, Exploring Facebook's Social Graph API's, Analyzing Social Graph Connections. Mining Linked In: Overview, Exploring Linked In API

Text books :

1. Reza Zafarani Mohammad Ali Abbasi Huan Liu, Social Media Mining, Cambridge University Press, ISBN: 10: 1107018854.
2. Charu C. Aggarwal, Social Network Data Analytics, Springer, ISBN: 978-1-4419-8461-6.
3. Matthew Ganis, Avinash Kohirkar Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media,Pearson publications,2016

Reference Books :

1. Marshall Sponder, Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics, McGraw Hill Education, 978-0-07-176829-0. 2.
2. Matthew A. Russell, Mining the Social Web, O'Reilly, 2nd Edition, ISBN:10: 1449367615.
3. Jiawei Han University of Illinois at Urbana-Champaign Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann, 2nd Edition, ISBN: 13: 978-1-55860-901-3 ISBN: 10: 1-55860-901-6.
4. Bing Liu, Web Data Mining : Exploring Hyperlinks, Contents and Usage Data, Springer, 2nd Edition, ISBN: 978-3-642-19459-7

Course Coordinator:

BoS Member:

BoS Chairman:

Open Elective-II: Financial Technology

Teaching Scheme	**Examination Scheme**						
Credits: 3 Lecture (L): 3 hrs./week Tutorial (T): - hr. Practical (P): - hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	-	100

Prerequisite: Readers/students are expected to know the following concepts:
Basics of Probability

Course Objectives:

- To Introduce FinTech and it's sub sectors
- To Explain the classification of various models of FinTech.
- To Describe the innovation in FinTech
- To Introduce an innovative Fin Tech strategy
- To Study the development of FinTech Application and about future trends in Fin Tech

Course Outcomes:

After completion of the course, student will be able to

1. Describe what FinTech is and the sub sectors that comprise it.
2. Classify various models of the Fintech
3. Illustrate various innovations done using latest technology trends in FinTech
4. State the Critical Success Factors in Fin Tech
5. Practice an innovative Fin Tech strategy within their own organization to lead a digital transformation project.
6. Develop the application using the concepts of FinTech as a case stud

Unit- I : Unit I: Introduction to Fintech

Introduction, Financial Services and Fintech: Introduction, Changing Environment, Customer Centricity, Digital Transformation, Definition of Fintech, History of Fintech, Fintech stages, An Overview of Fintech Initiatives Around the World, Ecosystems, Ranking National Ecosystems, Downsides of Disruptive Fintech Initiatives.

Unit-II : Model and Classifications

Introduction, Classification, Five Ws and one H : 1. Why a fintech initiative was born? 2. For whom was it born? 3. Which are the services it aims to provide? 4. Where does it aim to perform its business? 5. When does it aim to operate, within the framework of the financial cycle? 6. How is fintech working? The organization and its elements, The V4 business model framework, A Business Model, A Business Model for Fintech, Revenue—Focus on Customer Lifetime Value, Components of an effective marketing plan.

Unit III: Fintech Innovation

Introduction, Innovation and Fintech, Digital Transformation and Fintech, A model for an integrated innovation strategy, Types of Innovation : Product (or services), Process, Organization, Business models, Examples of Innovation, Fintech business model canvas, Process Innovation : Big Data Analytics, Value Creation from Big Data Analytics, Kreditech's self-learning algorithm, Internet of Things, Blockchain Technology, Organizational Innovation: Social Networks, Business Model Innovation, Robots, The V4 business model framework for Kreditech, Virtual Currencies, Technology Acceptance Model.

Unit IV: Critical Success Factors

The Model, Low-Profit Margin, Agility, Scalability, Security Management, Innovation, Ease of Compliance, Metrics, Fintech and Financial Services, Structure of fintech initiatives, The Challenges, Aspects to Consider, A Cooperation Model, Open Innovation

Unit-V: Regulations

The Role of the Regulators, Equal Treatment and Competition, The Risks to Consider, Regtech, A Business Model for Insurtech Initiatives, Drivers of Disruption, The Impact of Technology, Insurance and Technology: Insurtech, Application of the Model to the Insurance Industry, The Empowerment of Customers, Mobility in Support of Insurance Companies, Digital Wholesale Insurance,

Unit VI: A Case Study

Introduction, Robotica, Business Model Canvas, The Value Proposition, Customer Experience, Channels, Processes and Activities, Resources and Systems, Partnership and Collaborations, Revenues, Costs and Investments,

The Future: Financial Services as Platforms

Text Books :

1. B. Nicoletti, The Future of FinTech, 1st ed. Palgrave Macmillan, 2017
2. Kelvin Leong and Anna Sung "FinTech (Financial Technology): What is It and How to Use Technologies to Create Business Value in Fintech Way?" International Journal of Innovation, Management and Technology, Vol. 9, No. 2, April 2018.

Reference Books :

1. Accenture. (2015). The future of Fintech and banking: Digitally disrupted or reimagined? Accenture Research, 1–12
2. Dietz, M., Khanna, S., Olanrewaju, T., & Rajgopal, K. (2015). Cutting through the fintech noise: Markers of success, imperatives for banks. Practice, G. B. (Ed.), 1–18. McKinsey and Company. Retrieved from http://www.mckinsey.com/ industries/financial-services/our-insights/cutting-through-the-noise round financial -technology.
3. Nadar Naifar,"Impact of Financial Technology (FinTech) on Islamic Finance and Financial Stability" 2019.

Course Coordinator:

BoS Member:

BoS Chairman:

Open Elective-II: Agriculture Electronics (IOEUA42203B)

Teaching Scheme	Examination Scheme

Credits: 3 Lecture (L): 3 hrs./week Tutorial (T): - hr. Practical (P): - hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	-	100

Prerequisite: Readers/students are expected to know the following concepts:

b. Basic Electronics devices and their operations
c. Basic understanding of sensors and transducers.
d. Basic Farming Activities.

Course Objectives:

- To empower the learner to recognize environmental problems and to provide solutions to agricultural sector.
- An over view of technology of advanced topics like DAS , SCADA and IOT .
- The ability to select the essential elements and practices needed to develop and implement the Engineering Automation for Agricultural sector.

Course Outcomes:

After completion of this course, students will be able to -

1. Explain Role of Instrumentation & DAS.
2. State basics of Sensors and transducers .
3. Describe Instrument technology used in agriculture.
4. Apply knowledge of Electronics to achieve Precision Farming.
5. Select system components for different control Farming applications
6. Describe Smart Agriculture Technology & Role of Electronics Governance

Unit I : Introduction of Instrumentation system and Data acquisitions systems (DAS)

Introduction of Instrumentation system, Block diagram,
Data loggers, Data acquisitions systems (DAS), Basics of PLC , Supervisory control and data acquisition (SCADA),

Unit II : Sensors and Transducers

Basic of sensors and transducers, Type of sensors, Performance terminology - Displacement, Velocity and Motion sensors - Proximity sensors, Force, Pressure,–
Soil parameter measurement sensors - Flow, Level and Temperature sensors , Humidity, pH and Conductivity sensors, Specifications and selection criteria.

Unit III : Instrument technology for agriculture

Instruments for measurement of pH, Electrical conductivity, gas analysis, humidity, leaf area, chlorophyll content, and soil moisture & temperature.
Instrument for crop monitoring – moisture measurement – capacitive, infrared reflectance and resistance. Monitoring soil and weather – measurement of soil properties and meteorological parameters

Unit IV: Precision Farming

An introduction to precision farming. GIS/GPS positioning system for precision farming, Yield monitoring and mapping, soil sampling and analysis. Computers and Geographic information systems. Precision farming- Issues and conditions. Role of electronics in farm machinery for precision farming. Technology for precision farming.

Unit V: Control Applications in Farming :

Irrigation control systems. Instruments for crop establishment monitoring. Crop

spraying – selective crop spraying – flow control. Yield monitoring.
Instruments for protected cultivation – Green house environment control – transducers and control system. Instruments and systems for crop handling processing and storage.

Unit VI: SMART agriculture :
Introduction to IOT, IOT in Agriculture, Wireless sensor networks , IOT network using LoRaWAN.

Open Agriculture Initiative (OpenAg),

Agriculture & Electronics Governance: Technological Difficulties in Indian Context, Governance products & services in agriculture sector, Role of Electronics Governance in Agricultural sector.

Text Books :

1. **K. Krishna Swamy,** "Process Control"; New Age International Publishers.
2. C.S. Rangan, G.R. Sarma, V.S.V. Mani; " Instrumentation Devices and Systems "; Tata McGraw Hill; 2nd Edition
3. Curtis Johnson, "Process Control Instrumentation Technology"; 8th Edition, Pearson Education

Reference Books :

4. Shimon Y. Nof , "Springer Handbook of Automations", Springer.
5. Ernest O. Doebelin; " Measurement System Application and Design "; Mc-Graw Hill; 5th Edition
6. David G. Alciatore, Michael B Histand; " Introduction to Mechatronics and Measurement System "; Tata McGraw Hill
7. De Mess M. N. Fundamental of Geographic Information System. John Willy & sons, New York, Datta S.K.1987

Course Coordinator:

BoS Member:

BoS Chairman:

Open Elective-II: Total Quality Management (IOEUA42203D)

Teaching Scheme	Examination Scheme

Credits: 3 Lecture (L): 3 hrs./week Tutorial (T): - hr. Practical (P): - hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	-	100

Prerequisite:

Course Objectives:
To introduce the basic concepts of Quality management System and Management Information System

Course Outcomes:
Upon the completion of the course, students will be able to,

1. Explain the aspects of Quality in Construction activity
2. Explain the application of Six Sigma and Seven Quality tools in the Total Quality Management
3. Explain the role of Quality Manual to monitor Total Quality Management System
4. Describe the aspects of benchmarking and certifications
5. Explain the techniques of TQM implementation and awards
6. State the aspects of Management Information System

Unit I: Quality in Construction

Quality – Various definitions and interpretation. Importance of quality on a project in the context of global challenges, Factors affecting quality of construction, Reasons for poor quality and measures to overcome, Contribution of various Quality Gurus (Juran, Deming, Crossby, Ishikawa), Evolution of TQM- QC, TQC, QA, QMS, TQM.

Unit II: TQM & Six Sigma

TQM – Necessity, advantages , 7QC tools, Quality Function Deployment(QFD), Six sigma – Importance, levels, Defects & it's classification in construction. Measures to prevent and rectify defects.

Unit III: ISO & Quality Manual

Study of ISO 9001 principles. Quality manual – Importance, contents, documentation. Importance of check-lists in achieving quality. Typical checklist for concreting activity, formwork activity, steel reinforcement activity. Corrective and Preventive actions, Conformity and NC reports

Unit IV: Management Control & Certifications

Benchmarking in TQM, Kaizen in TQM. Quality Circle. Categories of cost of Quality. CONQAS, CIDC-CQRA certifications.

Unit V: Techniques in TQM Implementation and awards

5 _S' techniques. Kaizen. Failure Mode Effect Analysis (FMEA). Zero Defects. National & International quality awards- Rajeev Gandhi Award, Jamuna lal Bajaj Award, Golden Peacock Award, Deming Prize,

Malcolm Baldrize award.

Unit VI: Management Information System

Introduction to Management Information systems (MIS) Overview, Definition.
MIS and decision support systems, Information resources, Management subsystems of MIS, MIS based on management activity whether for operational control, management control, strategic control. Study of an MIS for a construction organization associated with building works.

Text books:

1. Total Quality Management-- Dr. Gunmala Suri and Dr. Puja Chhabra Sharma—Biztantra.
2. Quality Control and Total Quality Management by P.L.Jain- Tata McGraw Hill Publ. Company.
3. Total Quality Management - Dr. S.Rajaram and Dr. M. Sivakumar—Biztantra.
4. Total Engineering Quality Management – Sunil Sharma – Macmillan India Ltd.

Reference books:

1. Juran's Quality Handbook – Juran Publication. Importance of quality on a project in the context of global challenges. Importance of quality on a project in the context of global challenges.
2. Management –Principal, process and practices by Bhat – Oxford University Press.
3. Financial management by Shrivastava- Oxford University Press.
4. Management Information Systems – Gordon B. Davis, Margrethe H. Olson – Tata McGraw Hill Publ. Co.
5. Total Project Management – The Indian Context - P.K.Joy Macmillan India Ltd.

E- Sources:

www.nptel.ac.in , www.mobile.enterpriseappstoday.com

Course Coordinator:

BoS Member:

BoS Chairman:

Open Elective-II: Blockchain Technologies (IOEUA42203E)

Teaching Scheme	**Examination Scheme**						
Credits: 3 Lecture (L): 3 hrs./week Tutorial (T): - hr. Practical (P): - hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	-	100

Prerequisites:

- **Nil**

Course Objectives:

- To understand the basic fundamentals of Blockchain
- To introduce Bitcoin Blockchain
- To explain blockchain creation process
- To know the importance of Hyperledger
- To gain knowledge about the multichaining
- To discuss the emerging trends in Blockchain and Use cases

Course Outcomes:

After completion of the course, student will be able to

1. Demonstrate fundamental knowledge of Blockchain
2. Explain Bitcoin Blockchain
3. Describe blockchain creation process
4. Explain Hyperledger
5. Describe Emerging Trends in Blockchain

Unit I :	**Overview of Blockchain**
Basics of Blockchain, History of Blockchain, Network and protocols, Smart Contract and Consensus Algorithms, Blockchain users and adoption, Blockchain challenges	
Unit II :	**Bitcoin Blockchain**
Blockchain TOC Bitcoin/ Blockchain data structures, Keys as identity, Digital Signatures, Hashes, Hashes as Addresses, Hash Pointers and Data Structures, Blockchain transactions, Blockchain block structure	
Unit III :	**Creating the Blockchain: Mining**
Mining explained, The bitcoin network, The bitcoin Minning Process, Minning Developments	
Unit IV :	**Hyperledger**
Overview of Hyperledger, Hyperledger Projects, Hyperledger Architecture, Consensus model for permissioned Blockchains, Consensus and its interaction with architectural layers, Architecture of Enterprise level Blockchain applications.	
Unit V :	**Blockchain on Multichain**
Introduction to Multichain, Privacy and Permissions in Multichain, Features of Assets in Multichain, Multichain Streams, Mining in Multichain, Interactive mode commands, Round Robin Mining	
Unit VI :	**Emerging Trends in Blockchain and Use cases**
Transaction limitations, Additional blockchains, Hyperledger, Ethereum, Ripple, R3, Blockchain and cloud computing, Cloud -Based Blockchains, Blockchain Use cases, Blockchain and Artificial Intelligence.	

Text Books :

1	Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos
2	Blockchain by Melanie Swa, O'Reilly
3	Hyperledger Fabric - https://www.hyperledger.org/projects/fabric

Reference Books :

1	Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits - https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html

Course Coordinator:

BoS Member:

BoS Chairman: