RAMAIAH
Institute of Technology

CURRICULUM

for the Academic year 2023 – 2024

MECHANICAL ENGINEERING

VII & VIII SEMESTER B.E

RAMAIAH INSTITUTE OF TECHNOLOGY
(Autonomous Institute, Affiliated to VTU)
Bangalore – 560054.

About the Institute

Dr. M. S. Ramaiah a philanthropist, founded 'Gokula Education Foundation' in 1962 with an objective of serving the society. M S Ramaiah Institute of Technology (MSRIT) was established under the aegis of this foundation in the same year, creating a landmark in technical education in India. MSRIT offers 17 UG programs and 15 PG programs. All these programs are approved by AICTE. All eligible UG and PG programs are accredited by National Board of Accreditation (NBA). The institute is accredited with **'A^+' grade by NAAC in March 2021** for 5 years. University Grants Commission (UGC) & Visvesvaraya Technological University (VTU) have conferred Autonomous Status to MSRIT for both UG and PG Programs since 2007. The institute is also been conferred autonomous status for Ph.D program since 2021. The institute is a participant to the Technical Education Quality Improvement Program (TEQIP), an initiative of the Government of India. The institute has 380 competent faculty out of which 65% are doctorates. Some of the distinguished features of MSRIT are: State of the art laboratories, individual computing facility for all faculty members, all research departments active with sponsored funded projects and more than 300 scholars pursuing Ph.D. To promote research culture, the institute has established Centre of Excellence for Imaging Technologies, Centre for Advanced Materials Technology, Centre for Antennas and Radio Frequency systems (CARFS), Center for Cyber Physical Systems, Schneider Centre of Excellence & Centre for Bio and Energy Materials Innovation. **M S Ramaiah Institute of Technology has obtained "Scimago Institutions Rankings" All India Rank 107 & world ranking 600 for the year 2022.**

The Entrepreneurship Development Cell (EDC) and Section 8 Company "Ramaiah Evolute" have been set up on campus to incubate startups. **M S Ramaiah Institute of Technology is recognized by Atal Ranking of Institutions on Innovation Achievements (ARIIA), MoE, Govt. of India.** MSRIT has a strong Placement and Training department with a committed team, a good Mentoring/Proctorial system, a fully equipped Sports department, large air-conditioned library with good collection of book volumes and subscription to International and National Journals. The Digital Library subscribes to online e-journals from Elsevier Science Direct, IEEE, Taylor & Francis, Springer Link, etc. MSRIT is a member of DELNET, CMTI and VTU E-Library Consortium. MSRIT has a modern auditorium and several hi-tech conference halls with video conferencing facilities. The institute has excellent hostel facilities for boys and girls. MSRIT Alumni have distinguished themselves by occupying high positions in India and abroad and are in touch with the institute through an active Alumni Association.

As per the National Institutional Ranking Framework (NIRF), MoE, Government of India, M S Ramaiah Institute of Technology has achieved 67th rank among 1249 top Engineering Institutions & 17th Rank for School of Architecture in India for the year 2022 and is 1st amongst the Engineering Colleges affiliated to VTU, Karnataka.

About the Department

The Department of Mechanical Engineering started in the year 1962 with an intake of 40 students. The department has grown strong over the last 60 years and today has an intake of 120 students and 37 teaching staff including Professor Emeritus. All the faculty members are well qualified and possess post graduate degree with 27 doctorates. The department offers four-year degree course and also offers one Master's Degree in Robotics and Artificial Intelligence, with an intake of 18. The Department also offers research program which includes MSc Engineering by research and PhD degree from Visvesvaraya Technological University and at present 22 researchers are pursuing PhD. The department received software grants from Autodesk a leading Computer Aided Design multinational company and has been using them in the curriculum. The faculty members have taken up number of research projects funded by external agencies like DRDO, DST, SERB, AICTE and Visvesvaraya Technological University and received funding to the tune of 1 Crore. In viewof the golden jubilee celebrations, the department has conducted a national level project exhibition and an International Conference on "Challenges and Opportunities in Mechanical Engineering, Industrial Engineering and Management Studies" – ICCOMIM. Faculty members from the department have published books on different domains of Mechanical Engineering and are recommended by Visvesvaraya Technological University Board of Studies as reference text books.

The students from the department participate both at the national and international competition throughout the year, in the year 2013 – AeRobusta – 4-member student team from the department participated in SAE Aero Design competition and stood 18th position out of 64 teams from all over the world. The team AeRobusta stood FIRST AMONG THE ASIAN COUNTRIES.

Another team from the department also participated in the "Unmanned Air Vehicle System "conducted by U.S. Navy at Maryland, USA. The team secured 5th Place in the technical session out of 36 participating teams from all over the world.

A team of two students also participated in the CAD Design Competition conducted by Autodesk, a CAD multinational company, in association with IIT Madras and secured FIRST PLACE among the teams from all over India with a cash prize of Rs1,20,000 and also received a free Trip to Autodesk University, held at Las Vegas, USA.

VISION OF THE INSTITUTE

To be an Institution of International Eminence, renowned for imparting quality technical education, cutting edge research and innovation to meet global socio-economic needs

MISSION OF THE INSTITUTE

MSRIT shall meet the global socio-economic needs through

- Imparting quality technical education by nurturing a conducive learning environment through continuous improvement and customization
- Establishing research clusters in emerging areas in collaboration with globally reputed organizations
- Establishing innovative skills development, techno-entrepreneurial activities and consultancy for socio-economic needs

QUALITY POLICY

We at Ramaiah Institute of Technology strive to deliver comprehensive,continually enhanced, global quality technical and management education through an established Quality Management System complemented by the synergistic interaction of the stake holders concerned

VISION OF THE DEPARTMENT

To be a centre of International repute in Mechanical Engineering and to create qualified human resources needed to meet the demanding challenges in different areas and emerging fields of Mechanical Engineering and allied sciences.

MISSION OF THE DEPARTMENT

To impart quality technical education to meet the growing needs of the profession through conducive and creative learning environment, to produce qualified and skilled human resources, create R&D environment, to be a centre of excellence and to offer post graduate programs in the emerging fields of Mechanical Engineering.

Program Educational Objectives (PEOs)

PEO1 To produce engineers with sound basic theoretical knowledge along with required practical skills in various specialized fields of Mechanical Engineering.

PEO2 To inculcate team work capabilities and communication skills among students through co-curricular activities.

PEO3 To motivate students for higher studies in specialized areas of Mechanical Engineering and explore possible profession in R & D, academic and self-employment opportunities.

PEO4 To bring in awareness on environmental issues and commitments towards Professional ethics, social responsibilities and need for lifelong learning

PROGRAM OUTCOMES (POs):

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: 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.

PO3: 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.

PO4: 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.

PO5: 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.

PO6: 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.

PO7: 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.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: 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.

PO11: 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.

PO12: 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.

PSOs of the program offered

Mechanical Engineering Graduates will be able to:

PSO1: Ability to apply their knowledge in engineering mechanics, materials science, design, thermal engineering, production, management, CAD/CAM, robotics - on an applied basis.

PSO2: Ability to apply the learned principles to the analysis, design, development and implementation to advanced mechanical systems and processes, be prepared to work professionally in Mechanical Engineering domain.

Breakup of Credits for BE Degree Curriculum (I to VIII Semester)

BATCH 2020-2024

Sem	HSS	BS	ES	PCC	Professional Electives PC-E	Open Elective OE	Project / Seminar/ Internship PW/IN	Total Credits
I	04	17	21		-	-	-	**42**
II					-	-	-	
III	-	04	-	21	-	-	-	**25**
IV	-	04	-	21	-	-	-	**25**
V	03	-	-	15	03	03	-	**24**
VI	-	-	-	11	06	03	04	**24**
VII	03	-	-	10	06	-	01	**20**
VIII	-	-	-	-	-	-	15	**15**
Total	**10**	**25**	**21**	**78**	**15**	**06**	**20**	**175**

SCHEME OF TEACHING – VII SEM FOR THE ACADEMIC YEAR 2023 – 2024

Sl.No	Subject Code	Subject	Category	Credits			
				L	T	P	Total
1	ME71	CAD/CAM	PCC	4	0	0	4
2	ME72	Mechanical Vibration		3	1	0	4
3	ME73	Entrepreneurship/Economics & Management-HSS	HSS	3	0	0	3
4	MEE74X	Professional Elective -3	PC-E	3	0	0	3
5	MEE75X	Professional Elective -4	PC-E	3	0	0	3
6	MEL77	Non-conventional Energy Lab	PCC	0	0	1	1
7	MEL78	CAD/CAM lab		0	0	1	1
8	MESE1	Seminar		0	0	1	1
Total				**16**	**1**	**3**	**20**

L-Lecture T-Tutorial P- Practical’s

LIST OF COURSES OFFERED UNDER PROFESSIONAL ELECTIVE-3

CREDITS: 3:0:0

Sl. No.	SubjectCode	Subject
1	MEE741	Control Engineering
2	MEE742	Artificial Intelligence
3	MEE743	Automotive Engineering
4	MEE744	Operation Management

LIST OF COURSES OFFERED UNDER PROFESSIONAL ELECTIVE-4

CREDITS: 3:0:0

Sl. No.	SubjectCode	Subject
1	MEE751	Product Design and Manufacturing
2	MEE752	Foundry Technology
3	MEE753	Wind Energy
4	MEE754	Experimental Stress Analysis

VII SEMESTER B.E. MECHANICAL ENGINEERING

CAD/CAM

Course Code: ME71 **Course Credits: 4:0:0**
Prerequisite: Nil **Contact Hours: 56**
Course Coordinator: Dr. SUNITH BABU L

Course Learning Objectives

1. Enable students to learn the concepts of CAD/CAM
2. To create an awareness related to different methods of solving geometric entities
3. Educate students on different technologies related to CAD/CAM
4. To provide guidance on solving different milling and turning programs in CNC Technology
5. To Broaden the student understanding of CAD/CAM technology

UNIT I

Introduction: Definitions, meanings and components of CAD/CAM and other allied computer aided design/manufacturing strategies/techniques.
Hardware for CAD/CAM: Basic configuration of a typical Modern hardware for CAD/CAM – Vector stroke and raster scan output devices for CAD. RFID and bar-code readers for CAD/CAM application.
Software for CAD/CAM: A typical CAD/CAM database, use of cloud computing techniques for CAD/CAM, cloud based CAD tools, SaaS, PaaS, advantages.

UNIT II

Computer Graphics: Raster Scan Graphics, Coordinate Systems, Database Structure for Graphic Modeling, functions of graphics package, Transformation of geometry, 2D transformations – Simple problems
Geometric Modelling: Requirements for geometric modeling, Geometric Models, Geometric Based Modelling, Constrain Based Modelling, Curve Representation, Surface Representation methods.

UNIT III

Introduction to NC technology: Basic components of NC system. NC Coordinate system, types of NC systems, advantages and applications of NC, influence of computers in manufacturing environment.
DNC, CNC Systems: Types, advantages of adaptive control systems, types of CNC turning centers and machining centers,

UNIT IV

Computer Aided Manufacturing – Programming

Programming of CNC lathe and machining centre for real-time components on 3 axis lathe and machining centers for a typical CNC controller.

UNIT V

Flexible manufacturing system: FMS Equipment, FMS layouts, Analysis methods of FMS, Benefits of FMS. Computer aided quality control& Manufacturing: Automated inspection offline online, Material resource planning, benefits of MRP, Enterprise resource planning, capacity requirements planning.

Robotics: Definition, History, Classification, Terminologies, Configuration, System Integration, End-Effector, Grippers, Programming on Pick and Place and Applications.

TEXT BOOKS:

1. CAD/CAM principles and applications by P.N. Rao, Tata MC Graw Hill 2002.
2. CAD/CAM by Groover, Tata MC Graw Hill 1st July 2017, ISBN 978-0070681934.

REFERENCE BOOKS:

1. Mastering CAD/CAM, Ibrahim Zeid, Tata McGraw Hill Publishing Co.
2. Introduction to CAD/CAM Rao P.N, Tata McGraw Hill Publishing Co.
3. Automation, production systems and computer integrated manufacturing, Groover M.P., Prentice Hall of India
4. CAD/CAM/CIM, Radhakrishnan P, ISBN-8122422365 New Age Int Publishers.
5. James G. Keramas, Robot Technology Fundamentals, Delmar Publishers.

Course Outcomes (COs):

At the end of the course student will:

1. Understand the different CAD Hardware and software modules. [PO1,PO3,PO5,PO12,PSO1,PSO2]
2. Apply the CAD data base and transformation functions for computing different types of geometric entities. [PO1,PO2,PO3,PO5,PO11,PO12,PSO1,PSO2]
3. Demonstrate NC technology and adaptive control machining in computer aided manufacturing environment [PO1,PO2,PO3,PO5,PO11,PO12,PSO1,PSO2]
4. Develop NC programs based on sketches using G & M Codes. [PO1,PO2,PO3, PO11,PO12,PSO1,PSO2]
5. Analyze different technologies supporting CAD/CAM [PO1,PO2,PO3,PO5,PO11, PO12,PSO1,PSO2]

MECHANICAL VIBRATIONS

Course Code: ME72 **Course Credits: 3:1:0**
Prerequisite: Nil **Contact Hours: 42 L+14T = 56**
Course Coordinator: Dr. BALASUBRAMANYA H S

Course Learning Objectives

1. Impart the knowledge of fundamentals of vibrations for various applications.
2. Understand the concepts of vibrations of damped and un-damped systems under free and forced vibrations.
3. Develop skill to solve simple problems on single degree of freedom and multi degree of freedom systems.
4. Develop competence in applying the numerical methods in solving multi degree of freedom systems.
5. Develop an understanding of working of various automotive components based on vibrations.

UNIT I

Introduction: Types of vibrations, S.H.M, principle of super position applied to Simple Harmonic Motions. Beats, Fourier theorem and simple problems.
Undamped free vibrations: Single degree of freedom systems. Undamped free vibration-natural frequency of free vibration. Effect of mass of spring, Compound Pendulum.

UNIT II

Damped free vibrations: Single degree freedom systems, different types of damping, concept of critical damping and its importance, study of response of viscous damped systems for cases of under damping, critical and over damping, Logarithmic decrement.

UNIT III

Forced Vibration: ***Solution by force vector polygon (graphical analysis)*,** Reciprocating and rotating unbalance, vibration isolation-transmissibility ratio, due to harmonic excitation and support motion.
Vibration measuring instruments & Whirling of Shafts: Vibrometer and accelerometer. Whirling of shafts with and without air damping. Discussion of speeds above and below critical speeds.

UNIT IV

Systems with two degrees of freedom: Introduction, principle modes and Normal modes of vibration, co-ordinate coupling, generalized and principal co-ordinates, free vibration in terms of initial conditions. Geared systems. Forced Oscillations-Harmonic excitation. Applications: Vehicle suspension. Dynamic vibration absorber. Dynamics of reciprocating Engines.

UNIT V

Numerical methods for Multi degree Freedom systems: Introduction, Influence coefficients, Maxwell reciprocal theorem, Dunkerley's equation ***and Raleigh's method***. Orthogonality principle, Method of matrix iteration - Method of determination of all the natural frequencies using sweeping matrix and Orthogonality principle. Holzer's method, Stodola method.

TEXT BOOKS:

1. Theory of Vibration with Applications: W.T. Thomson and Marie Dillon Dahleh, Pearson Education 5th edition, 2007.
2. Mechanical Vibrations: V.P. Singh, Dhanpat Rai & Company Pvt. Ltd., 3rd edition, 2006.

REFERENCE BOOKS:

1. Mechanical Vibrations: S.S. Rao, Pearson Education Inc, 4th Edition, 2003.
2. Mechanical Vibrations: S. Graham Kelly, Schaum's Outline Series, Tata McGraw Hill, Special Indian edition, 2007.
3. Theory & Practice of Mechanical vibrations: J.S. Rao & K. Gupta, New Age International Publications, New Delhi, 2001.
4. Elements of Vibrations Analysis: Leonanrd Meirovitch, Tata McGraw Hill, Special Indian edition, 2007.

Course Outcomes (COs):

The students will be able to

1. Develop an understanding of concept of Vibrations and undamped free vibrations. [PO1,PO2,PO5,PO12,PSO1,PSO2]
2. Develop competence and skills to solve the problems of damped free vibrations. [PO1,PO2,PO12,PSO1,PSO2]
3. Demonstrate the ability and skill to solve forced vibration problems and gain knowledge of vibration measuring instruments. [PO1,PO2,PO5,PO12,PSO1,PSO2]
4. Demonstrate the ability to solve problems of related to two degree freedom system. [PO1,PO2,PO5,PO12,PSO1,PSO2]
5. Develop competence to solve multi degree freedom systems using numerical methods. [PO1,PO2,PO5,PO12,PSO1,PSO2]

ENTREPRENEURSHIP/ECONOMICS & MANAGEMENT

Course Code: ME73 **Course Credits : 3:0:0**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator: Dr. Jyothilakshmi R

Course Learning Objectives

1. To introduce students to the world of management and the theories associated with it. To delve into management theory through its functions such as planning, organizing, staffing, coordinating etc.
2. To help them understand the importance of recruitment, training, leadership styles, coordinating and controlling. To introduce students to the world of entrepreneurship and instill a desire in students to become entrepreneurs in future.
3. To familiarize students with the concepts of small scale industry, govt. policies and protection, institutional support, etc. To help students understand the basics of report writing and the common errors committed while writing project reports and to learn how project appraisals are carried out.
4. To help the students realize the importance of decision making based on financial reasoning, demand and supply concepts and familiarization with interest and interest factors. To make the student realize that the manufacturing world is all about demand and supply.
5. To appreciate the need for Present worth, future worth and Annual Worth analysis while comparing projects with different financial outlays. To help students especially budding entrepreneurs understand the basic concepts of rate of return and its importance in starting new ventures.

UNIT I

Management- Introduction, Meaning, nature and characteristics of management. Scope & functions of management. Planning - Nature, Importance and purpose of planning process, Steps in planning, planning premises.

Organizing and Staffing - Nature and purpose of organization, Principles of organization, Types of organization – Line and staff, Departmentation, Committees, Nature and importance of staffing, Process of selection and recruitment.

UNIT II

Directing & Controlling-Meaning and nature of directing, leadership styles, Motivation theories (only Maslow's and McGregor's theories), Communication- meaning and importance, Co-ordination, meaning and importance, techniques of co-ordination, Meaning and steps in controlling, Essentials of a sound control system, methods of establishing control

Entrepreneurship-Meaning of entrepreneur, function of an entrepreneur, types of entrepreneurs, Development of entrepreneurship, Stages in entrepreneurial process, Role of entrepreneurs in economic development. Entrepreneurship - its barriers, limitations of entrepreneurs

UNIT III

Small Scale Industry: Definition, characteristics, types, role of SSI in economic development. Steps to start an SSI – Govt. policy towards SSI. Institutional Support - TECKSOK, KIADB, KSSIDC, KSIMC, DIC, SISI, NSIC, SIDBI, KSFC.

Project - Meaning of Project; Project Identification, Project Selection, Guidelines by Planning Commission for Project report, Errors in Project Report. Project Appraisal, Identification of Business Opportunities, market Feasibility Study, Technical Feasibility study, Financial Feasibility Study & Social Feasibility study.

UNIT IV

Engineering Economics: Introduction, Laws of demand and supply, Difference between Microeconomics & Macroeconomics, Equilibrium between demand & supply, elasticity of demand, price elasticity, income elasticity. Law of Returns.

Interest and interest factors, Simple and Compound interest, Cash flow diagrams, personal loans and EMI payment calculation with flexible interest rates, Discussion and problems.

UNIT V

Present, Future and Annual worth Comparisons: Basic present worth comparisons, Assets with unequal lives and infinites lives, future worth comparisons, Equivalent annual worth comparisons, Advantages of annual worth comparisons.

Rate of return: Concept, minimum acceptable rate of return, IRR anomalies and misconceptions, Cost of capital, comparisons of present, future and annual worth with IRR, Discussions and problems.

REFERENCE BOOKS

1. Principals of Management by Koontz O. Donnell, McGraw Hill, 2005.
2. Entrepreneurship Development–small Business Enterprises, Poornima M Charanthmath, Pearson Education –3rd edition 2005
3. Engineering Economy, Riggs J. L, McGraw Hill Company, 2002.

TEXT BOOKS:

1. Principles of Management, P C Tripati, P N Reddy, Tata Mc Graw Hill, 3rd edition 2005Engineering economics by K. R. Phaneesh, Sudha Publications, Bangalore.
2. Entrepreneurship Development, S S Khanka, S Chand & Co, 4th edition, 2005
3. Engineering Economics, R. Panneerselvam, PHI Pvt Ltd, New Delhi, 2001.

Course Outcomes (COs):

1. Students are able to appreciate the nature of management and its fundamentals. They should realize the importance of planning in achieving management objectives. Students should understand the basics of different types of organization and the applications of each type.
2. They should also realize the importance of recruitment, training, leadership styles, coordinating and controlling. Students, especially those who wish to become entrepreneurs, get an introduction to the world of entrepreneurship.
3. Students are able to understand the concepts of small scale industry, govt. policies and protection, institutional support, etc. Students should realize the importance of good report writing and understand the basics.
4. Students should be able to realize the importance of decision making based on financial reasoning. They should be able to clearly understand demand and supply concepts and familiarize themselves with interest and interest factors.
5. Students should understand how to calculate present worth, future worth and Annual Worth of business projects and should be able to compare them while selecting the best based on results. They should understand the basic concepts of rate of return and its importance in starting new ventures.

CONTROL ENGINEERING

Course Code: MEE741 **Course Credits : 3:0:0**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator: Dr. VISHWANATH KOTI

Course Learning Objectives

1. To understand the basic fundamentals related to automatic control system and to obtain mathematical models using differential equations describing the behavior of engineering systems
2. To use the block diagram reduction techniques and signal flow graphs, to determine system transfer functions (input-output relations)
3. To determine the time domain response for wide range of inputs and to gain the in-depth knowledge of the transient and steady state response analysis of first and second order systems.
4. To analyze the performance of the control systems using polar plots, Nyquist plots and Bode plots.
5. To analyze the performance of the control systems using Root locus technique, to study different types of controllers in the design and analysis of closed loop control, state variable analysis of linear control system.

UNIT I

Introduction: Concept of automatic controls, open and closed loop systems, requirements of an ideal control system.

Mathematical Models: Transfer function models, models of mechanical system, model of electrical circuits, DC and AC motors in control systems, models of thermal system, models of hydraulic system, Pneumatic system, (Analogous systems, Force voltage, Force current).

UNIT II

Block Diagrams and Signal Flow Graphs: Block representation of system elements, reduction of block diagrams, Signal flow graphs: Mason's gain formula.

UNIT III

Steady state operation: Steady state analysis of for a control system, steady state characteristics and equilibrium in a system.

Transient Response: Transient response and steady state analysis of unit, step input, general operational representation for a differential equation of control system, distinct, repeated and complex conjugate zeros, general form of transient response, Routh's stability criterion for a control system. Numericals on transient response and RH criteria

Root locus method: Significance of Root locus, angle and magnitude conditions, breakaway points, angles of departure and arrival, construction of Root locus using general rules and steps, Numericals on root locus plots

UNIT IV

Frequency Response Analysis: Polar plots, Nyquist Stability Criterion, Stability Analysis, Relative stability concepts, phase and gain margin, M & N circles.

Frequency Response Analysis using Bode Plots: Bode attenuation diagrams, Stability Analysis using Bode plots, Simplified Bode Diagrams.

UNIT V

System Compensation & Control actions: Series and feedback compensation, Types of controllers-Proportional, Integral, Differential, Proportional & Integral, Proportional Differential and Proportional Integral Differential controllers.

State Variable Characteristics of Linear Systems: Introduction to state concepts, state equation of linear continuous data system. Matrix representation of state equations, controllability and observability, Kalman test. Numericals on controllability and observability

TEXT BOOKS:

1. Modern Control Engineering: Katsuhiko Ogata, Pearson Education, 2008.
2. Control Systems Principles and Design: M. Gopal, TMH, 2010
3. Control Engineering: U.A.Bakshi & V.U. Bakshi, Technical publications, Pune,2009
4. Control Systems Engineering: Nise, Wiley, Fourth edition

REFERENCE BOOKS:

1. Feedback Control Systems: Schaum's series 2010.
2. Control systems: I.J. Nagarath & M. Gopal, New age International publishers 2012.
3. Automatic Control Systems – B.C. Kuo, F. Golnaraghi, John Wiley & Sons, 2008.
4. Modern control Engineering: Dorf Bishop, Pearson, Eleventh edition

Course Outcomes (COs):

1. Develop skill to identify the basic elements and structures of feedback control systems anddevelop mathematical models. [PO1,PO2,PO5,PO10,PO11,PO12,PSO1,PSO2]
2. Use efficiently signal flow graphs and block diagrams to study the input-output relations ofvarious control systems. [PO1,PO2,PO5,PO10,PO11,PO12,PSO1,PSO2]
3. Obtain competence in Transient response analysis of control systems subjected to standard test signals and stability analysis, root locus plots [PO1,PO2,PO5,PO10,PO11,PO12,PSO1,PSO2]
4. Obtain competence in Frequency analysis of control system using various plots such asPolar, Nyquist and Bode plots. [PO1,PO2,PO5,PO10,PO11,PO12,PSO1,PSO2]
5. Obtain the competence in various system compensation techniques, compensators and control actions. Test for controllability and observability. [PO1,PO2,PO5,PO10,PO11,PO12, PSO1,PSO2]

ARTIFICIAL INTELLIGENCE

Course Code: MEE742 **Course Credits: 3:0:0**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator: Dr. LOKESHA

Course Learning Objectives

1. Examine the different ways of approaching AI & example systems that use AI.
2. Students should be able to understand and implement the forward & backward chaining reasoning algorithm.
3. Students should understand the representing predicate logic and syntax and semantics for prepositional logic.
4. Students should learn about different aspects of a statistics and probabilistic reasoning and expert system.
5. Students will understand the examples of expert system and machine learning system.

UNIT I

Introduction to AI and production systems: Introduction to AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics - Heuristic Search Techniques.

UNIT II

Knowledge Representation Issues: Representations and Mappings, Approaches to knowledge representation. Issues in knowledge representation.

Use of Predicate Logic: Representing simple facts, Instance and ISA relationships, Computable Functions and Predicates, Resolution, Natural deduction.

UNIT III

Knowledge Representation Using Rules: Procedural Vs Declarative knowledge, Logic programming. Forward Vs Backward reasoning, matching.

Symbolic reasoning under uncertainty: No monotonic reasoning. Implementation Depth First Search and Breadth First Search.

UNIT IV

Statistical And Probabilistic Reasoning: Probability and Bayes' theorem, Certainity factors and Rule based systems, Bayesian Networks, Shafer Theory, Fuzzy Logic and simple exercises.

UNIT V

Expert systems: Expert systems - Architecture of expert systems, Roles of expert systems - Knowledge Acquisition –Meta knowledge, Heuristics. Typical expert systems - MYCIN, DART, XOON, Expert systems shells.

TEXT BOOKS:

1. Artificial Intelligence, Elaine Rich & Kevin Knight, 3rd Ed., M/H 2009.
2. Introduction to AI & ES, Dan W. Patterson, Prentice Hall of India, 1999.

REFERENCE BOOKS:

1. Principles of Artificial Intelligence, Springer Verlag, Berlin, 1981.
2. Artificial Intelligence in business, Science & Industry, Wendy B. Ranch 179
3. A guide to expert systems, Waterman, D.A., Addison – Wesley inc. 1986
4. Building expert systems, Hayes, Roth, Waterman, D.A. Addison – Wesley, 1983

Course Outcomes (COs):

At the end of the course the student will be able to

1. Understand a AI-Problem formulation and production system concepts. [PO1,PO2,PO3,PO5,PSO1,PSO2]
2. Solve the concept of knowledge representation issues and the forward, backward reasoning. [PO1,PO2,PO3,PO5,PSO1,PSO2]
3. Ability to use of predicate logic to represent simple facts and Instances. [PO1,PO2,PO3,PO5,PSO2]
4. Identify a problem in statistical and probabilistic reasoning. [PO1,PO2,PO3,PSO2]
5. Demonstrate the various learning typical expert system. [PO1,PO2,PO3,PSO2]

AUTOMOTIVE ENGINEERING

Course Code: MEE743 **Course Credits: 3:0:0**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator: Mr. NAVEEN KUMAR B K

Course Learning Objectives

The students shall be able to:

1. Understand IC engine, its components and different types of fuels.
2. Develop skills in fuel supply super charger& ignition systems for SI and CI engines.
3. Develop skills in power trains.
4. Understand basic types of automotive chassis, springs and brakes.
5. Develop skills in automotive control system, electric propulsion & MEMS.

UNIT I

I C Engine Components, Cooling & Lubrication systems: SI & CI engines, cylinder – arrangements and their relatives merits, Liners, Piston, connecting rod, crankshaft, valves, valve actuating mechanisms, valve and port timing diagrams, Compression ratio, choice of materials for different engine components, engine positioning, cooling requirements, methods of cooling, different lubrication arrangements.

Fuels: Conventional fuels, LPG and Natural gas operation of SI engines; Operation of SI engines with alternate fuels like ethanol and ethanol blends, introduction to new fuels for Automotive Engines like hydrogen, hybrid fuels and fuel cells.

UNIT II

Fuel supply systems for SI and CI engines: Properties of air-fuel mixtures - Mixture requirements for steady state and transient operation, Mixture formation studies of volatile fuels, design of elementary carburetor, simple carburetor systems, mono point, multi-point and direct injection systems - Principles and Features, Bosch injection systems. Fuel feed systems, Mechanical and electrical pumps. Normal and abnormal combustion.

Superchargers and Turbochargers: Introduction. Construction and operation, Intercooler, Turbocharger lag.

Ignition systems: Battery Ignition systems, magneto Ignition system, Electronic Ignition, Automatic Ignition advance systems.

UNIT III

Power Trains: - Clutch: Principle of friction clutches and constructional details, Single plate, multi-plate and centrifugal clutches.

Gear box: Types of transmission, synchromesh gear box. Freewheeling mechanism, planetary gears systems, over drives, fluid coupling and torque converters, Epi-cyclic gear box, principles of automatic transmission, Dual Clutch Transmission (DCT), Continuously Variable Transmission (CVT), Automatic Manual Transmission (AMT).

Drive to wheels: Propeller shaft and universal joints, Hotchkiss and torque tube drives, differential, rear axle, different arrangements of fixing the wheels to rear axle, steering geometry, camber, king pin inclination, included angle, castor, toe in & toe out, condition for exact steering, steering gears, power steering- hydraulic and electric power assisted, over steer, under steer and neutral steer (No numerical).

UNIT IV

Automotive Chassis: Types of chassis layout with reference to power plant locations and drive, Vehicle frames. Various types of frames. Constructional details, Materials. Testing of vehicle frames. Unitized frame body construction: Loads acting on vehicle frame.

Suspension and springs: Requirements, Torsion bar suspension systems, leaf spring, coil spring, independent suspension for front wheel and rear wheel. Air suspension system, Telescopic shock absorber.

Brakes: Types of brakes, mechanical, air, vacuum and hydraulic braking systems, construction and working of master and wheel cylinder, brake shoe arrangements, Disk brakes, drum brakes, Antilock –Braking systems, purpose and operation of antilock-braking system. (No numerical)

UNIT V

Automotive emission control system: Controlling crankcase emissions, Controlling evaporative emissions, Cleaning the exhaust gas, Controlling the air-fuel mixture, Controlling the combustion process, Exhaust gas recirculation, Treating the exhaust gas, Catalytic converter, Emission standards- Euro I, II, III and IV norms, Bharat Stage II, III norms.

Electrical Propulsion System: Automotive Vehicle application batteries and motors (Basic).

MEMS in Automotive: MEMS sensors for engine management (ECU), Tire pressure sensors, Electronic stability control of the vehicles, Rollover and Skidding detections.

TEXT BOOKS:

1. **Automotive Mechanics,** William H Crouse & Donald L Anglin, 10th Edition Tata McGraw Hill Publishing Company Ltd., 2007.
2. **Automobile engineering**, Kirpal Singh. Vol I and II 2002.
3. **Automotive Mechanics** by S. Srinivasan, Tata McGraw Hill 2003.
4. **Mechatronics Principles & Applications,** by Godfrey Onwubolu, 2006.
5. **Electric Vehicle Technology Explained**, by James Laminie and John Lowry, John Wiley and Sons ltd, 2nd edition 2012.

REFERENCE BOOKS:

1. **Automotive mechanics: Principles and Practices**, Joseph Heitner, D Van Nostrand Company, Inc.
2. **Automobile Engineering**, R.B. Gupta, Satya Prakashan, 4th edn. 1984.
3. **Electrical and Electronics Technology**, E. Hughes, Pearson-2010.

Scheme of Examination:

Two questions to be set from each unit. Students have to answer any five full questions choosing at least one question from each unit.

Course Outcomes (COs):

1. Understand IC engine, its components and selection of fuels. (PO1, PO2, PO3, PO6, PO7, PO12)
2. Analyze different types of carburetor, turbocharging, supercharging & ignition system to be suitable for CI and SI engines. (PO1, PO2, PO3, PO6, PO7, PO12)
3. Demonstrate different types of power trains and its structure. (PO1, PO2, PO3, PO4, PO6, PO12)
4. Familiarize with different types of automotive chassis, suspension system and brakes. (PO1, PO2, PO3, PO4, PO6, PO7, PO12)
5. Expose knowledge of automotive emission control system, Electrical propulsion system and MEMS. (PO1, PO2, PO3, PO4, PO6, PO7, PO12)

OPERATIONS MANAGEMENT

Course Code: MEE744 **Course Credits : 3:0:0**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator: Dr. D K VISHWAS

Course Learning Objectives:

1. Know the basics of operations management and productivity concepts.
2. Study the various aspects of decision making situation, probability rules, and breakeven analysis by solving problems.
3. Learn forecasting methods and errors in them and problems on the above topic, fundamentals of supply chain management.
4. Understand aggregate planning and production schedules and related problems.
5. Know the MRP & CRP basics, to solve problems on that. Understand scheduling methods using single/ multiple machines, Gantt charts.

UNIT I

Operations Management Concepts: Introduction, Historical Development, Operations Management Definition, Production and Manufacturing Systems, Products v/s Services, Productivity, Factors affecting Productivity, International Dimensions of Productivity.
Operations Decision Making: Introduction, Characteristics of decisions; framework for Decision Making, Decision methodology, Decision support systems; Economic models; Statistical models.

UNIT II

Forecasting: Forecasting Objectives and Uses, Forecasting Variables, Opinion and Judgmental methods, Time Series methods, Simple Exponential smoothing, Regression and Correlation methods, Application and Control of Forecasts.

Supply Chain Management: Introduction, components of supply chain, Process orientation, supply chain structure, Bullwhip effect in supply chains, Contracts and supply chain performance, Measures of supply chain performance.

UNIT III

Aggregate Planning and Master Scheduling: Introduction, Planning and Scheduling, Objectives of Aggregate Planning, Pure Strategies of Aggregate Planning. Master Scheduling - Objectives, Master Scheduling Methods.

UNIT IV

Material and Capacity Requirements Planning: Overview: MRP and CRP; MRP: Time phasing concepts, MRP inputs and outputs; Bill of Materials; MRP Logic; System refinements CRP inputs and outputs; CRP activities; Infinite and finite loading.

UNIT V

Scheduling and controlling production activities: Introduction, PAC objectives and data requirements; forward and backward scheduling; Gantt charts.

Single Machine Scheduling: concepts, measures of performance SPT Rule, Weighted SPT Rule; EDD Rule; minimizing number of tardy jobs.

Multi-Machine Scheduling: Johnson's algorithm, n-jobs to 2-machines, n-jobs to 3-machines, 2 jobs to n machines, Graphical solutions.

TEXT BOOKS:

1. Operations Management, B. Mahadevan. Theory and practice, Pearson, 2007
2. Operations Management, Monks, J.G., McGraw-Hill International Editions, 1987.
3. Operations Management, Monks, J.G., Schaum's Outline Series, Tata McGraw Hill Ed. (2004).

REFERENCE BOOKS:

1. Modern Production/Operations Management, Buffa and Sarin, Wiley Eastern Ltd.2001
2. Production and Operations Management, Pannerselvam. R., PHI. 2002
3. Productions & Operations Management, Adam & Ebert. 2002
4. Production and Operations Management, Chary, S. N., Tata-McGraw Hill. 2002

Course Outcomes (COs):

Students will be able to

1. Take a better decision for a given situation**.** [PO1,PO2,PO5,PO11,PO12,PSO1,PSO2]
2. Forecast the future demand from the history**.** [PO1,PO2,PO3,PO5,PO12,PSO1,PSO2]
3. Plan the production satisfying the demand, scheduling accordingly**.** [PO1,PO2,PO11, PO12,PSO1,PSO2]
4. Calculate material required, men and machines required**.** [PO1,PO2,PO3,PO11,PO12, PSO1,PSO2]
5. Schedule properly so that there will be full utilization of men and machines and time taken will be minimum [PO1,PO2,PO5,PO11,PO12,PSO1,PSO2]

PRODUCT DESIGN AND MANUFACTURING

Course Code: MEE751 **Course Credits : 3:0:0**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator: Dr. D K VISHWAS

Course Learning Objectives

1. To understand and simulate the different phases of product design with relevant flow charting and industrial practices in the area of product design concern to design considerations, problems faced and functional design practices
2. To understand, analyze the various material properties and loading conditions for the product design based on the manufacturing possibilities.
3. To understand the product design optimization by using different approaches such as differential Calculus, Lagrange Multipliers, safety, reliability, manufacturing and environmental aspects related to the economics of the product design
4. To understand the ergonomics of working environment and the role of computers in the area of product design.
5. To understand the value engineering by adopting the various steps in problem solving leading to the effective solution for the challenge and to understand the modern approaches like quality functional deployment (QFD) in product design

UNIT I

Introduction to Product Design- Asimow's model: Definition of product design, Design by Evolution, Design by Innovation, Essential Factors of Product design, Production-Consumption Cycle, Flow and Value Addition in the Production-Consumption Cycle, The Morphology of Design (The seven phases), Primary Design Phases and Flowcharting, Role of Allowance, Process Capability andTolerance in Detailed Design & Assembly.
Product design practice and industry: Introduction, Product Strategies, Time to Market, Analysis of the Product, The S's Standardization, Renard Series, Simplification, Role of Aesthetics in Product Design, Functional Design Practice**.**

UNIT II

Review of strength, stiffness and rigidity considerations in product design: Principal Stress Trajectories (Force-Flow Lines), Balanced Design, Criteria and Objectives of Design, Material Toughness: Resilience Designing for Uniform Strength, Tension vis-a-vis Compression. Review of Production Process: Introduction, Primary Processes, Machining Process, Non-traditional Machining Processes.

Design for production – metal parts: Producibility requirements in the Design of machine Components, Forging Design, Pressed components Design, Casting Design, and Design for Machining Ease, The Role of Process Engineer, Ease of Location Casting and Special Casting, Designing with Plastic, rubber, ceramics and wood: Approach to design with plastics, plastic bush bearings, gears in plastics, rubber parts, design recommendations for rubber parts, ceramic and glass parts.

UNIT III

Optimization in design: Introduction, Siddal's Classification of Design Approaches, Optimization by Differential Calculus, Lagrange Multipliers, Linear Programming (Simplex Method), Geometric Programming, Johnson's Method of Optimum Design.

Economic factor influencing design: Product Value, Design for Safety, Reliability and Environmental Considerations, Manufacturing Operations in relation to Design, Economic Analysis, Profit and Competitiveness, Break – even Analysis, Economic of a New Product Design.

UNIT IV

Human engineering considerations in product design: Introduction, Human being as Applicator of Forces, Anthropometry; Man as occupant of Space, the Design of Controls, the Design of Displays, Man/Machine Information Exchange.

UNIT V

Value engineering and product design: Introduction, Historical Perspective, What is Value? Nature and Measurement of Value,Normal Degree of Value, Importance of Value, The Value analysis Job Plan, Creativity, Steps to Problems-solving and Value Analysis, Value Analysis Test, Value Engineering Idea Generation Check-list, Reduction through value engineering case study on Tap Switch Control Assembly, Material and Process Selection in Value Engineering

Modern approaches to product design: Concurrent Design and Quality Function Deployment (QFD).

TEXT BOOKS:

1. **Product Design and Manufacturing** – A.K Chitale and R.C. Gupta, PHI 4th Edition, 2007
2. **Product Design & Development** - Karl T.Ulrich & Steven D, Epinger, Tata Mc. Graw Hill, 3rd Edition, 2003

REFERENCE BOOKS:

1. **New Product Development**- Tim Jones, Butterworth Heinmann, Oxford, mc1997
2. **New Product Development**- Design & Analysis by Roland Engene Kinetovicz, John Wiley and Sons Inc., N.Y.1990

Course Outcomes (COs):

1. The student will analyze the basic approaches in product design by following the standard design phases practiced in an industry. [PO1,PO2,PO3,PO4,PO5,PO12, PSO1,PSO2]
2. The student will understand the importance of consideration of various material properties and abilities of manufacturing aspects in product design. [PO1,PO2,PO4,PO5,PO12,PSO1,PSO2]
3. The students will be able to evaluate the economics and optimizations of the design for the best profit level by not compromising its utility. [PO1,PO2,PO4,PO5,PO12, PSO1,PSO2]
4. The students will apply the use of computers in design and other related areas of a manufacturing industry in consideration with safety, reliability and environmental aspects. [PO1,PO2,PO3,PO4,PO12,PSO1,PSO2]
5. The students will demonstrate the effective problem solving techniques and modern design approaches. [PO1,PO2,PO3,PO4,PO5,PO6,PSO1,PSO2]

FOUNDRY TECHNOLOGY

Course Code: MEE752 **Course Credits : 3:0:0**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator: Dr. SIDDARAJU C

Course Learning Objectives

1. Foundry metallurgy and concept of solidification of metals.
2. Design aspects of casting, Riser and gating system
3. Melting techniques
4. Mechanization and Modernization of foundry.
5. Ferrous and non ferrous foundry practice.

UNIT I

Foundry Metallurgy – Oxidation of Metals, Gas dissolution in liquid Metals, Methods of degassing, Fluidity, factors affecting Fluidity, hot tearing, Shrinkage of liquid metals.
Casting design – Introduction, Functional design Simplification of foundry practice, Metallurgical design, Economical design.

UNIT II

Solidification of Castings – Crystallization and development of cast structure, Nucleation and growth, Dendrite growth, Structure of castings, Significance and practical control of cast structure, Concept of progressive and directional solidification, Refinement and modification of cast structure, Solidification time and Chworinov rule
Risering - Needing for risering**,** Riser shape, size, Types of risers, Design and location of feeder heads, Design modifications, padding, chills and insulation.

UNIT III

Gating of Castings – Essential features of gaiting system, Design of gating system, General aspects of gating practice, Forces acting on the mould.
Special Casting Techniques :- Principle, material used , process details and application of Vaccum Process or V-Process Dissamatic moulding or Flaskless moulding
Cupola Melting:- Construction, Preparation and Operation of the cupola, Zones of Cupola Development of Cupola, Charge calculations.

UNIT IV

Ferrous foundry - Composition, Properties, applications of Gray Iron, Malleable Iron, SG Iron - Production, Magnesium recovery, Heat treatment and properties , application of SG Iron, ADI Production, Properties, , application.
Compostion, properties , application of Low , Medium , High Carbon Steel, Alloy steels

UNIT V

Nonferrous foundry - Introduction, Melting procedure, Casting characteristics of Aluminum based alloys, Copper based alloys, Magnesium based alloys.

Modernization and Mechanization - Introduction, Need for modernization, mechanization, Elements of Mechanization, Moulding line mechanization, Mechanization of Melting, Pouring and shakeout units. Material Handling equipments.

TEXT BOOKS:

1. Principles of metal casting by Heine, Loper & Rosenthal, Tata McGraw Hill 2001
2. Foundry technology by Beeley.P.R.(Buttersworth) 2000
3. Principles of Foundry Technology P L Jain TMH 2006

REFERENCE BOOKS:

1. Metal casting – ASME handbook 2002
2. Metal casting technology by P.C. Mukerji 2002
3. Principles of solidification by B. Chalmers, Tata McGraw Hill 2001

Course Outcomes (COs):

Students will be able to

1. Understand the concepts of foundry metallurgy, casting characteristics, the gating system and the concepts in casting design [PO1,PO2,PO8,PO12,PSO2]
2. Interpret the solidification of pure metal and alloys, special casting techniques, production of ferrous and nonferrous metals [PO1,PO2,PO8,PO12,PSO2]
3. Recognize the composition, properties and application of ferrous and nonferrous materials [PO1,PO2,PO8,PO12,PSO2]
4. Exercise the charge calculations for melting process and the designing the gating system [PO1,PO2,PO8,PO12,PSO2]
5. Organize the need for modernization and mechanization of foundries [PO1,PO2,PO5,PO8,PO12,PSO2]

WIND ENERGY

Course Code: MEE753 **Course Credits : 3:0:0**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator: Mr. VINAYAK TALUGERI

Course Learning Objectives

1. Study of modern wind turbines, components and various types of wind turbines.
2. Study of the methods and importance of wind resource assessment.
3. Study of aerodynamics and performance parameters of wind turbines.
4. Study of the wind turbine design and various aspects of siting and wind farm design.
5. Study of the economics and environmental impacts of wind energy generation.

UNIT I

Introduction: Origin of Winds, Nature of winds, Modern wind turbines; Wind resource; Technology achievements; Wind energy penetration level.
Wind Power in India: Introduction, Commercial Wind Power Development, wind turbine manufacturing Industry, Current wind power Scenario and Challenges and opportunities.

UNIT II

Types of Wind Turbine Plants: Introduction, Types axis, Upwind and Downwind WPPSs, Blade count, Power rating of WPPs Classification of wind turbines; turbine components Aerodynamics: Introduction; Aerofoil; Actuator disc; Axial moment theory; Momentum theory of rotating wake; Blade element theory; Strip theory; Tip losses; Tip loss correction; Wind machine parameters; C_p - λ characteristics, SERI blade sections; Wind machine mechanics; Numerical problems.

UNIT III

Wind turbine design: Rotor blade theory; Blade geometry; Variation of aerofoil characteristics with Reynolds number; cambered aerofoil's; Simplified methods for loss calculation; basis for design loads; Functions of control and safety systems; Turbulence and wakes; Non-operational load cases; Cost modeling; Relationship between rotational speed and solidity; Teetering; Power control; Braking systems; Blades.

UNIT IV

Siting and Wind farm design: Wind flow modeling, Power curve for wind turbine generator; Capacity factor; Planning of wind farms, Siting, wake models.

Wind energy economics: Annual energy output; Simple payback period; Capital recovery factor, Depreciation; Life cycle costing; Project appraisal.

UNIT V

Electrical and control systems: Classification of electrical machine; synchronous and induction generators; Variable speed generators; Control systems; Power collection systems; Earthing of wind farms; Embedded (Dispersed)wind generation.

Environmental Impact: Impact of wind power on environment, Benefit of wind power for environment, Land demand, Local impact: Physical impact, Sound propagation shadow and reflexes.

TEXT BOOK:

1. Wind Energy – Theory and Practice by Siraj Ahmed, PHI Learning Private Limited, Eastern Economy Edition, New Delhi, 2010.

REFERENCE BOOKS:

1. Freris, L.L., Wind Energy Conversion Systems, Prentice Hall.
2. Spera, D.A., Wind Turbine Technology: Fundamental Concepts of Wind Turbine Engineering, ASME Press.

Course Outcomes (COs):

At the end of course student have

1. Acquaint the modern wind turbines, components and various type of wind turbines. [PO1,PO2,PO10,PO11,PO12,PSO1]
2. Understand the methods and importance of wind resource assessment. [PO1,PO2,PO12,PSO1]
3. Apply the aerodynamic and performance parameters in wind turbines. [PO1,PO2,PO11,PO12,PSO1,PSO2]
4. Analyze the wind turbine design and various aspects of sitting and wind farm design. [PO1,PO2,PO10,PO11,PO12,PSO1,PSO2]
5. Evaluate the issues related to economics and environmental impacts of wind energy generation. [PO1,PO2,PO6,PO12,PSO1,PSO2]

EXPERIMENTAL STRESS ANALYSIS

Course Code: MEE754 **Course Credits : 3:0:0**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator: Dr. GIRISH V KULKARNI

Course Objectives

1. To understand and study the various types of strain gauges and their working principles.
2. Able to analyse and calibrate the strain gauge rosettes and strain measuring systems
3. Understanding the nature of light and two dimensional photoelasticity
4. Aplly the two dimensional photoelastic analysis and its applictions.
5. Study on the birefringent and brittle coatings techniques.

UNIT I

Strain Measurement: Introduction, Types of strain gauges: Mechanical, Optical, Pneumatic, Acoustic strain gauges, Electrical resistance strain gauges, Gauge factor for electrical resistance strain gauge, Properties of an ideal gauge material, Backing material, adhesive material, protective coating, Methods of bonding strain gauges, strain gauge load wire and connections, semiconductor, Strain gauge problems.

UNIT II

Stain gauge circuits: Whetstone's bridge, Error due to input impedance of measuring instrument, Temperature compensation and multiple gauge circuits, Calibration of strain measuring system, Load cells, problems, Strain gauge rosettes, Necessity, analysis, problems.

UNIT III

Nature of light: Harmonic wave, phase, amplitude, polarization, crystal optics, passage of light through crystalline media, Absolute and relative phase difference, Quarter wave plate, Half wave plate, Production of plane & circularly polarized light

Two dimensional photo elasticity: stress optic law, Plane polariscope, Circular polariscope, Isochromatic and Isoclinics, Dark & bright field arrangements, Methods of compensation, separation technique.

UNIT IV

Photoelastic Analysis: Calibration, properties, Casting, machining, Stress reliving and application, Two dimensional application, Problems

UNIT V

Birefringent coating: Theory, Reflection polariscope, Moire techniques, Moire fringe analysis, Introduction to holography, Brittle coating techniques, Computer techniques, Fringe analysis

TEXT BOOKS:

1. Experimental Stress Analysis, L S Srinath & others, Tata Mc Graw Hill Publication, 1984
2. Experimental Stress Analysis, Dally & Riley, Tata Mc Graw Hill Publication,2001.
3. Experimental Stress Analysis, Dr.Sadhu Singh, Khanna Publishers, 2010

REFERENCE BOOKS:

- Analysis of stress and strain,A J Duraelli,T, Tata Mc Graw Hill Publication,1958
- Moire Analysis of Strain, Durelli & Parks,1996

Course Outcomes (COs):

1. Apply concepts of strain measurements using the various types of strain gauges (PO1,PO2,PO3,PO4,PO12,PSO1,PSO2)
2. Understand the concept of strain gauge circuits, calibration and analysis of strain gauge rosettes. (PO1,PO2,PO3,PO4,PO12,PSO1,PSO2)
3. Apply fundamental concepts of nature of light and two dimesional photoelasticity. (PO1,PO2,PO3,PO4,PO12,PSO1,PSO2)
4. Demonstrate the ability to analyze the problems of practical interest. (PO1,PO2,PO3,PO4,PO12,PSO1,PSO2)
5. Develop competence to understand the different coating techniques such as birefringent, brittle and fringe analysis etc. (PO1,PO2,PO3,PO4,PO12,PSO1,PSO2)

NON-CONVENTIONAL ENERGY LAB

Course Code: MEL77 **Course Credits : 0:0:1**
Prerequisite: Nil **Contact Hours: 14**
Course Coordinator: Mrs. BIJAYALAKSHMI DAS

Course learning objectives:

During the course students will be learning the following.

1. Fundamentals of renewable energy.
2. Various types of renewable energy and their applications.
3. Experiments on wind energy.
4. Experiments on Thermal Energy storage system.
5. Concept of phase changing materials.

Part-A

1. Determine the performance (UL, FR, η) of the parabolic trough collector with fixed parameters and (i) Water and (ii) Oil as working fluid.
2. Evaluate the efficiency of charge controller.
3. Evaluate the RPM corresponding to cut-in speed of wind turbine experimentally.
4. Evaluate the Tip Speed ratio (TSR) at different wind speeds
5. Evaluate the coefficient of performance of wind turbine.
6. Draw the Turbine Power versus Wind Speed curve.
7. Draw the curve between TSR and coefficient of power.

Part-B

1. Evaluation of cut-off and cut-in speed of a wind turbine.
2. Experiment on PCM-1 (Organic Fatty Acid)
3. Experiment on PCM-2 (Paraffin Wax)
4. Experiment on PCM-1 & 2 in cascading (Paraffin plus Fatty acid, Unmixed)
5. Experiment on PCM-1 (Paraffin based) with different HTF flow rate
6. Experiment on PCM-2 with different HTF flow rate during charging and discharging

TEXT BOOKS:

1. Non-conventional energy sources by B.H.Khan Tata McGraw hill, 2002
2. Solar energy by S.P. Sukhatme, Tata McGraw hill, 2002

Course Outcomes (COs):

After the completion of course, students can do the following.

1. Students can install and conduct performance study of domestic water heating system [PO1,PO2,PO3,PO4,PO5,PO12,PSO1,PSO2]
2. Students can install and conduct performance study of wind energy system. [PO1,PO2,PO3,PO4,PO5,PO12,PSO1,PSO2]
3. Students can install and conduct performance study of Thermal Energy storage system. [PO1,PO2,PO3,PO4,PO5,PO12,PSO1,PSO2]

Scheme of Examination:

Students should do 2 experiments with one experiment each from pat-A and Part-B.

Each experiment carries 20 marks for both Part A and Part B

Max. Marks:	**50**
PART-A:	**20**
PART-B:	**20**
Viva-Voce:	**10**
Total:	**50**

CAD/ CAM LAB

Course Code: MEL78 **Course Credits : 0:0:1**
Prerequisite: Nil **Contact Hours: 14**
Course Coordinator: Dr. R KUMAR

Course Learning Objectives

During the course the students will be learning

1. The fundamentals of CAD/CAM process, use of data base, applications ofCAD/CAM.
2. Various types of turning and machining centers.
3. The manual part programming and computer aided part programming.
4. Programming for milling and turning operations using CAM PACKAGES.
5. Programming the Industrial Robots etc.

PART A

CAM: Simulation of machining process (Turning and Milling) using CAM PACKAGE.
CNC Machining: Demonstration of Manual Part programming for CNC Machines and execute simple machining operations in CNC Machining center.

PART B

Pneumatics and Hydraulics, Four typical experiments on the basis of these topics to be conducted.
Robot programming: Using Teach Pendent & Offline programming to perform pick and place, stacking of objects.

TEXT BOOKS:

1. CAD/CAM principles and applications by P.N. Rao, Tata MC Graw Hill 2002
2. CAD/CAM by Groover, Tata MC Graw Hill 2003

REFERENCE BOOKS:

1. CAD/CAM – Ibrahim Zeid- Tata MC Graw Hill 2nd edition
2. Computer aided manufacturing- P.N. Rao, Tiwar, Tata MC Graw Hill 3rd eidtion

Course Outcomes (COs):

At the end of the course the students are accustomed with:

1. Analyze the fundamentals of CAD/CAM process [PO1,PO2,PO3,PO4, PO5,PO12, PSO1,PSO2]
2. Demonstrate the Practical knowledge about turning and milling centers using CAM tool [PO1,PO2,PO3,PO4, PO5,PO12,PSO1,PSO2]

3. Formulate Manual part program for the machining process and Create CNC part program using commercial CAM package [PO1,PO2,PO3,PO4, PO5,PO12,PSO1, PSO2]

Scheme of Examination:

The student should solve 2 exercises. 1 should be from PART A and the other from PART B
Each exercise carries 20 marks.
Viva – Voce carries 10 Marks
Total Maximum Marks = 50

Max Marks:	**50**
PART A:	**20**
PART B:	**20**
Viva-voce:	**10**
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TOTAL:	**50**

SCHEME OF TEACHING – VIII SEM FOR THE ACADEMIC YEAR 2023 – 2024

Sl.No	Subject Code	Subject	Credits			
			L	T	P	Total
1	ME81N	Internship	0	0	3	3
2	ME82	Project Work	0	0	12	12
		Total	0	0	15	15
***CREDIT ADJUSTMENT SUBJECTS**						
1	*MEL81	Technical Seminar	0	0	1	1
2	*****MEL82	Technical Report Writing	0	0	1	1
3	*ME87	Processing of Materials	2	0	0	2

L-Lecture T-Tutorial P- Practical's

For 1 Credit Course:

Technical Seminar: Technical Seminar presentation on a new emerging topic is to be presented by the student. The committee constituted by the HOD will evaluate the presentation and the report submitted by the student, other norms regarding the technical seminar evaluation remains the same.

PROCESSING OF MATERIALS

Course Code: ME87 **Course Credits: 2:0:0**
Prerequisite: Nil **Contact Hours: 28**
Course Coordinator: Dr. C SIDDARAJU

Course Learning Objectives:

Students will be able to:

1. Understand the typical casting processes.
2. Explain various machining and forming processes.
3. Understand the methods of processing of ceramics.
4. Explain the techniques pertaining to processing of polymeric materials.
5. Understand different aspects of powder metallurgy process.

UNIT I

Introduction and Casting Processes:- Introduction of different manufacturing processes – Different approaches – conventional casting processes – Special casting processes, squeeze casting, foam casting, loam casting – advantages, disadvantages and applications.

UNIT II

Machining and Forming Process:- Abrasive flow machining abrasive jet machining, chemical machining, laser processing, high velocity forming of metals, explosive fabrication, electro hydraulic forming, electromagnetic forming.

UNIT III

Processing of Ceramics:- Forming – Pressing, Dry Pressing, Isostatic Pressing, hot Pressing, slip casting, extrusion, thermal treatment, vitrification, properties and applications.

UNIT IV

Processing of Polymeric Materials:- Thermoplastics, thermosetting plastics, industrial polymerization methods, processing of plastic materials, processes used for thermoplastic materials, injection molding, extrusion, blow molding and thermo – forming, properties and applications. Processes used for thermosetting materials – Compression molding, transfer molding, injection molding.

UNIT V

Powder Metallurgy Processes: Introduction to powder metallurgy, benefits of powder metallurgy, limitations and applications, production of powders, powder treatment, power characteristics, and compaction of powders, high temperature, pre sintering and post sintering operations.

TEXT BOOKS:

1. W.F. Smith, Principles of Materials Science and Engineering, Mc Graw Hill, New York (1994)
2. Rao P.N "Manufacturing Technology" Tata Mc Graw Hill. 1996

REFERENCES:

1. W.D Callister, An Introduction to Materials & Engineering, John Wiley & Sons (2007)

2. V. Raghavan, Material Science and Engineering, Prentice Hall of India, 2004.
3. R Sharma, Sharma, Heat Treatment: Principles and Techniques, Prentice Hall of India (2004)

Course Outcomes (COs):

At the end of the course, students would have:

1. Understood the typical casting processes and its advantages. [PO1,3,5,6,7,12 & PSO2]
2. Knowledge of explaining various machining and forming processes and its industrial applications. [PO1,2,4,5,6,7 & 12]
3. Understood different methods of processing of ceramics. [PO1,2,3,5,6,7,12, PSO1 & PSO2]
4. Knowledge of explaining techniques on processing of polymeric materials. [PO1,3,6,7,PO11,PO12 & PSO1]
5. Understood different aspects of powder metallurgy and its applications. [PO1,3,5,6,7,10 & PO12]