PAAVAI ENGINEERING COLLEGE, NAMAKKAL – 637 018
M.E. ENGINEERING DESIGN
CURRICULUM

SEMESTER III

Course Code	Course Title	L	T	P	C
PEDE153**	Elective-IV	3	0	0	3
PEDE153**	Elective-V	3	0	0	3
PEDE153**	Elective-VI	3	0	0	3
PED15301	Project Work Phase -I	0	0	12	6

SEMESTER IV

Course Code	Course Title	L	T	P	C
PED15401	Project Work Phase -II	0	0	24	12

LIST OF ELECTIVES

SEMESTER III

Course Code	Course Title	L	T	P	C
PEDE15301	Productivity Management and Re-Engineering	3	0	0	3
PEDE15302	Design of Hydraulic and Pneumatic systems	3	0	0	3
PEDE15303	Reverse Engineering	3	0	0	3
PEDE15304	Design of Material Handling Equipments	3	0	0	3
PEDE15305	Plasticity and Metal Forming	3	0	0	3
PEDE15306	Theory of Plates and Shells	3	0	0	3
PEDE15307	Design of Pressure Vessel and Piping	3	0	0	3
PEDE15308	Modal Analysis of Mechanical Systems	3	0	0	3
PEDE15309	Experimental Stress Analysis	3	0	0	3
PEDE15310	Maintenance Engineering	3	0	0	3
PEDE15311	Micro Electro Mechanical Systems	3	0	0	3
PEDE15312	Creativity in Design	3	0	0	3

PEDE15301 PRODUCTIVITY MANAGEMENT AND RE-ENGINEERING 3 0 0 3

COURSE OBJECTIVES

- To understand the concepts of productivity and analyze its factors and models.
- To learn the concepts of management by objectives (MBO) and performance objective Productivity (POP).
- To study the elements of organizational transformation, reengineering principles and models.
- To familiarize the reengineering process improvement and its models like LMICIP and NPRDC.
- To gain the knowledge about reengineering tools, techniques and implementation.

UNIT I PRODUCTIVITY 9

Productivity Concepts – Macro and Micro factors of productivity – Dynamics of Productivity - Productivity Cycle Productivity Measurement at International, National and Organization level - Productivity measurement models

UNIT II SYSTEMS APPROACH TO PRODUCTIVITY MEASUREMENT 9

Conceptual frame work, Management by Objectives (MBO), Performance Objectivities Productivity (POP) – Methodology and application to manufacturing and service sector.

UNIT III ORGANIZATIONAL TRANSFORMATION 9

Elements of Organizational Transformation and Reengineering-Principles of organizational transformation and re-engineering, fundamentals of process reengineering, preparing the workforce for transformation and re-engineering, methodology, guidelines, LMI CIP Model – DSMC Q & PMP model.

UNIT IV RE-ENGINEERING PROCESS IMPROVEMENT MODELS 9

PMI models, PASIM Model, Moen and Nolan Strategy for process improvement, LMICIP Model, NPRDC Model.

UNIT V RE-ENGINEERING TOOLS AND IMPLEMENTATION 9

Analytical and process tools and techniques – Information and Communication Technology – Implementation of Reengineering Projects – Success Factors and common implementation Problem – Cases.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After completion of the course the students will be able to

- gain knowledge on macro and micro factors of productivity and measurement models.
- understand the system approach to productivity measurement.
- familiarise the process of organizational transformations .
- become knowledgeable about re-engineering process improvement models.
- learn re-engineering tools ,implementation techniques and analyze the problems involved.

REFERENCES

1. Sumanth, D.J., 'Productivity Engineering and Management', TMH, New Delhi,1990.
2. Edosomwan, J.A., "Organisational Transformation and Process Re-engineering",Library Cataloging in Pub. Data, 1996.
3. Rastogi, P.N., "Re-engineering and Re-inventing the Enterprise", Wheeler Pub.New Delhi, 1995.
4. Premvrat, Sardana, G.D. and Sahay, B.S., "Productivity Management – ASystems Approach", Narosa Publishing House. New Delhi, 1998.
5. David J.Sumanth.,"Total Productivity Management",ST.Lucie Press, New York Washington D.C, 1998

WEB LINKS

1. http://ebookdig.biz/ebook/q/pdf/productivity-management-and-re-engineering.html
2. http://books.google.co.in/books?id=Pa2DpNkJIEwC&pg

PEDE15302 DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS 3 0 0 3

COURSE OBJECTIVES

- To familiarize the students to know the various hydraulic systems and hydraulic actuators.
- To understand the control valve and actuation systems.
- To learn to design Hydraulic circuits effectively.
- To acquire knowledge to design the pneumatic systems and circuits.
- To know about pneumatic equipments, design calculation and use of microprocessors.

UNIT I OIL HYDRAULIC SYSTEMS AND HYDRAULIC ACTUATORS 5

Hydraulic Power Generators – Selection and specification of pumps, pump characteristics. Linear and Rotary Actuators – selection, specification and characteristics.

UNIT II CONTROL AND REGULATION ELEMENTS 12

Pressure - direction and flow control valves - relief valves, non-return and safety valves - actuation systems.

UNIT III HYDRAULIC CIRCUITS 5

Reciprocation, quick return, sequencing, synchronizing circuits - accumulator circuits - industrial circuits - press circuits - hydraulic milling machine - grinding, planning, copying, - forklift, earth mover circuits- design and selection of components – safety and emergency mandrels.

UNIT IV PNEUMATIC SYSTEMS AND CIRCUITS 16

Pneumatic fundamentals - control elements, position and pressure sensing – logic circuits - switching circuits - fringe conditions modules and these integration -sequential circuits - cascade methods - mapping methods - step counter method -compound circuit design - combination circuit design.

UNIT V INSTALLATION, MAINTENANCE AND SPECIAL CIRCUITS 7

Pneumatic equipments- selection of components - design calculations – application -fault finding - hydro pneumatic circuits - use of microprocessors for sequencing -PLC, Low cost automation - Robotic circuits.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After learning the course, the students will be able to

- have thorough knowledge of hydraulic power generator, pumps and various actuators.
- gain knowledge of control and regulation elements.
- design an appropriate hydraulic circuits for various Engineering applications.
- acquire knowledge on designing of pneumatic circuits.
- select the components for designing hydro pneumatic circuits.

REFERENCES

1. Antony Espossito, “Fluid Power with Applications”, Prentice Hall, 1980.
2. Dudleyt, A. Pease and John J. Pippenger, “Basic fluid power”, Prentice Hall, 1987.

3. Andrew Parr, “Hydraulic and Pneumatics” (HB), Jaico Publishing House, 1999.
4. Bolton. W., “Pneumatic and Hydraulic Systems “, Butterworth –Heinemann, 1997.
5. K.Shanmuga Sundaram, “Hydraulic and Pneumatic Controls: Understanding made Easy" S.Chand & Co Book publishers, New Delhi, 2006 (Reprint 2009)

WEB LINKS

1. nptel.ac.in/courses/112106175/Module%201/Lecture%201.pdf
2. https://books.google.co.in/books/about/Industrial_hydraulics.html?id=A-BSAAAAMAAJ

PEDE15303 REVERSE ENGINEERING 3 0 0 3

COURSE OBJECTIVES

- To introduce the basic concepts, tools, data management and integration process of re-engineering
- To know the different types of Reverse Engineering tools.
- To study the reverse engineering concepts and their implementations.
- To understand the strategies, software components and evaluation models of data management.
- To learn the reuse tools, coordinate measurement and feature capturing for integration of reverse engineering.

UNIT I INTRODUCTION 5

Scope and tasks of RE - Domain analysis- process of duplicating

UNIT II TOOLS FOR R E 8

Functionality- dimensional- developing technical data - digitizing techniques -construction of surface model - solid-part material- characteristics evaluation -software and application- prototyping – verification

UNIT III CONCEPTS 12

History of Reverse Engineering – Preserving and preparation for the four stage process – Evaluation and Verification- Technical Data Generation, Data Verification, Project Implementation

UNIT IV DATA MANAGEMENT 10

Data reverse engineering – Three data Reverse engineering strategies – Definition –organization data issues - Software application – Finding reusable software components – Recycling real-time embedded software – Design experiments to evaluate a Reverse Engineering tool – Rule based detection for reverse Engineering user interfaces – Reverse Engineering of assembly programs: A model based approach and its logical basics

UNIT V INTEGRATION 10

Cognitive approach to program understated – Integrating formal and structured methods in reverse engineering – Integrating reverse engineering, reuse and specification tool environments to reverse engineering –– coordinate measurement –feature capturing – surface and solid members

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- understand the scope and tasks of re-engineering
- gain thorough knowledge of tools used for RE digitization, surface modeling, prototyping and application of software
- evaluate the process of RE, data generation ,verification and project implementation.
- find suitable reusable software components.
- acquire knowledge of integrating methods of RE.

REFERENCES

1. Design Recovery for Maintenance and Reuse, T J Biggerstaff, IEEE Corpn. July1991
2. White paper on RE, S. Rugaban, Technical Report, Georgia Instt. of Technology,1994
3. Reverse Engineering, Katheryn, A. Ingle, McGraw-Hill, 1994
4. Data Reverse Engineering, Aiken, Peter, McGraw-Hill, 1996
5. Reverse Engineering, Linda Wills, Kluiver Academic Publishers, 1996

WEB LINKS

1. people.auc.ca/xu/present/reverse.ppt
2. https://www.classle.net/#!/classle/videolink/lec-52-reverse-engineering/

PEDE15304 DESIGN OF MATERIAL HANDLING EQUIPMENTS 3 0 0 3

COURSE OBJECTIVES

- To learn the types, selection and applications of materials handling equipment.
- To familiarize the applications of the chain drives, ropes and pulleys.
- To identify the handling mechanisms which are appropriate to different types of material handling.
- To acquire knowledge about the various types of conveyors and its application based on the purpose.
- To know the design details of elevators and safety while handling various types of materials.

UNIT I MATERIALS HANDLING EQUIPMENT 5

Types, selection and applications

UNIT II DESIGN OF HOISTS 10

Design of hoisting elements: Welded and roller chains - Hemp and wire ropes Design of ropes, pulleys, and pulley systems, sprockets and drums, Load handling attachments. Design of forged hooks and eye hooks – crane grabs - lifting magnets -Grabbing attachments - Design of arresting gear - Brakes: shoe, band and cone types.

UNIT III DRIVES OF HOISTING GEAR 10

Hand and power drives - Traveling gear - Rail traveling mechanism - cantilever and monorail cranes - slewing, jib and luffing gear - cogwheel drive - selecting the motor ratings.

UNIT IV CONVEYORS 10

Types - description - design and applications of Belt conveyors, apron conveyors and escalators Pneumatic conveyors, Screw conveyors and vibratory conveyors.

UNIT V ELEVATORS 10

Bucket elevators: design - loading and bucket arrangements - Cage elevators – shaft way, guides, counter weights, hoisting machine, safety devices - Design of fork lift trucks.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After completion of the course, the students will be able

- to understand the various types of materials handling equipment, their selection and applications.
- to design the various hoisting elements like chain drive, ropes and pulley.
- to learn about the hand and power drives of hoisting gear and their mechanisms.
- to understand the different types of conveyors and their applications.
- to gain knowledge on different types of elevators and design of fork lift.

REFERENCES

1. Alexandrov, M., Materials Handling Equipments, MIR Publishers, 1981.

2. Boltzharol, A., Materials Handling Handbook, the Ronald Press Company, 1958.
3. P.S.G. Tech., “Design Data Book”, Kalaikathir Achchagam, Coimbatore, 2003.
4. Lingaiah. K. and Narayana Iyengar, “Machine Design Data Hand Book”, Vol.1 & 2, Suma Publishers, Bangalore, 1983.
5. ASME, “Materials Handling Handbook”, Wiley-Interscience, 1985.

WEBLINKS

1. nptel.ac.in/courses/112107142/part2/material%20handling/lecture1.htm
2. www.managementstudyguide.com/material-handling.htm

PEDE15305 PLASTICITY AND METAL FORMING 3 0 0 3

COURSE OBJECTIVES

- To study the theory of plasticity and its behavior.
- To familiarize the concepts of constitutive relationships and plastic instability.
- To learn to analyse problems of metal forming.
- To learn sheet metal forming process and the theories involved.
- To acquire knowledge of various advancements in metal forming processes.

UNIT I THEORY OF PLASTICITY 9

Theory of plastic deformation - Engineering stress and strain relationship – Stress tensor - Strain tensor - Yield criteria's - Plastic stress strain relationship – Plastic work - Equilibrium conditions - Incremental plastic strain

UNIT II CONSTITUTIVE RELATIONSHIPS AND INSTABILITY 7

Uniaxial tension test - Mechanical properties - Work hardening, Compression test, bulge test, plane strain compression stress, plastic instability in uniaxial tension stress, plastic instability in biaxial tension stress

UNIT III ANALYSIS OF METAL FORMING PROBLEMS 12

Slab analysis - Slip line method, upper bound solutions, statistically admissible stress field, numerical methods, contact problems, effect of friction, thermo elastic Elasto plasticity, Elasto visco plasticity - Thermo mechanical coupling – Analysis of forging, rolling, extrusion and wire drawing processes - Experimental techniques of the evaluation of metal forming

UNIT IV ANALYSIS OF SHEET METAL FORMING 8

Bending theory - Cold rolling theory - Hill's anisotropic theory, Hill's general yield theory - Sheet metal forming - Elements used - Mesh generation and formulation -Equilibrium equations - Consistent full set algorithm - Numerical solutions procedures - examples of simulation of simple parts - Bench mark tests – Forming limit diagrams

UNIT V ADVANCES IN METAL FORMING 9

Orbital forging, Isothermal forging, Warm forging, Hot and Cold isotropic pressing, high speed extrusion, rubber pad forming, micro blanking –Super plastic forming -Overview of Powder Metal techniques - Powder rolling - Tooling and process parameters

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course students will be able to

- learn the concepts of plasticity and its behavior.
- understand the mechanical properties of plastics and their instability.
- solve the metal forming problems for different shapes using different methods.

- gain knowledge of sheet metal forming and various theories associated with it.
- update with various advancements in metal forming processes and their techniques.

REFERENCES

1. Wagoner. R H., and Chenot. J.J., Metal Forming analysis,Cambridge University Press, 2002.
2. Slater. R A. C., Engineering Plasticity - Theory & Applications to Metal Forming,John Wiely and Sons, 1987.
3. Shiro Kobayashi, Altan. T, Metal Forming and Finite Element Method, Oxford University Press, 1989.
4. Narayanaswamy. R, Theory of Metal Forming Plasticity, Narosa Publishers, 1999.
5. Hosford. W. F and Caddell. RM., Metal Forming Mechanics and Metallurgy, Prentice Hall Eaglewood Cliffs, 1993.

WEBLINKS

1. www.vgu.edu.vn/fileadmin/pictures/studies/master/.../tp/plastice.pdf
2. web.itu.edu.tr/~livatyali/dersler/mak645e/ICTP08_history.pdf

PEDE15306 THEORY OF PLATES AND SHELLS 3 0 0 3

COURSE OBJECTIVES

- To acquire thorough knowledge in structural mechanics, approximations of membranes, plates and shells and principals of elasticity.
- To become familiar with the concepts of classical theories, equilibrium in different coordinates, bending in various shapes of plates.
- To focus on buckling analysis of plates under different compressive and boundary conditions.
- To know about the various vibrating conditions of plates under different loads conditions.
- To analyse the shells of revolution and various aspects of cylindrical and spherical shells.

UNIT I GENERAL INTRODUCTION 7

Review of equations of elasticity- kinematics, compatibility equations, stress measures- equations of motions- constitutive relations- transformation of stresses, strains and stiffness-energy principles and variation methods in elasticity- virtual work-external and internal virtual work- variation operator- functional- Euler Lagrange equations- energy principles- Hamilton's principle- principle of minimum total potential- applications

UNIT II CLASSICAL THEORY OF PLATES 10

Plates as structural elements- stress and moment resultants- assumptions made in the classical theory- displacement fields and strains- equations of equilibrium in Cartesian coordinates and in polar coordinates- boundary conditions – bending of rectangular plates with various boundary conditions and loading- symmetrical and asymmetrical bending of circular plates-limitations of classical theory- finite element analysis(elementary treatment only; discussion of various elements used and their capabilities- not for examination)

UNIT III BUCKLING ANALYSIS OF RECTANGULAR PLATES 10

Buckling of simply supported plates under compressive forces- governing equations the Navier solution- biaxial compression of a plate- uniaxial compression of a plate buckling of plates simply supported on two opposite edges- Levy's solution- buckling of plates with various boundary conditions- general formulation- finite element analysis(elementary treatment only; discussion of various elements used and their capabilities- not for examination)

UNIT IV VIBRATION OF PLATES 9

Governing equations for natural flexural vibrations of rectangular plates- natural vibrations of plates simply supported on all edges- vibration of plates with two parallel sides simply supported- Levy's solution- vibration of plates with different boundary conditions- Rayleigh-Ritz method- Natural vibration of plates with general boundary conditions- transient analysis of rectangular plates- finite element analysis (elementary treatment only; discussion of various elements used and their Capabilities- not for examination)

UNIT V ANALYSIS OF THIN ELASTIC SHELLS OF REVOLUTION 9

Classification of shell surfaces- geometric properties of shells of revolution- general strain displacement relations for shells of revolution- stress resultants- equations of motion of thin shells- analytical solution for thin cylindrical shells- membrane theory flexure under ax symmetric loads- shells with double curvature- geometric considerations- equations of equilibrium- bending of spherical shells- vibration of cylindrical shells- finite element analysis(elementary treatment only; discussion of various elements used and their capabilities- not for examination)

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course students will be able to

- compute structural mechanic approximations of membrane, plates and shells.
- derive equations of membrane plate and shell for analysis.
- gain knowledge of demonstrating the consistent derivation of approximate boundary conditions and edge effects.
- analyse and determine the static, dynamic, non-linear motion of membrane, plate and shell structures.
- perform numerical approximations of all types of shells.

REFERENCES

1. Reddy,J.N., “Theory and Analysis of Elastic Plates & Shells”,C.R.C.Press,NY,USA, 2nd Edition
2. Szilard, R., Theory and Analysis of Plates, Prentice Hall Inc., 1995
3. S.Timoshenko.,”Theory of plates and shells” McGraw Hill company.
4. Eduard Ventsel Theodor Krauthammer.,” Thin Plates and Shells Theory, Analysis, and Applications”. Marcel Dekker, 2001.
5. S.S.Bhavikatti.,”Structural analysis” Vikas publication.2007.

WEBLINKS

1. nptel.ac.in/courses/105105041/module%206.pd
2. www.math.uci.edu/~fwan/pdf/65_theoryofthinelasticshellsnotes.pdf

PEDE15307 DESIGN OF PRESSURE VESSELS AND PIPING 3 0 0 3

COURSE OBJECTIVES

- To give exposure to engineering problems involved in the design of pressure vessel.
- To learn about the tests and analysis for various components of pressure vessels.
- To know the procedure to design pressure vessels.
- To familiarize the buckling and fracture analysis of pressure vessel under various load conditions
- To acquire knowledge of piping, piping layout and designing of pipes

UNIT I INTRODUCTION 3

Methods for determining stresses – Terminology and Ligament Efficiency –Applications.

UNIT II STRESSES IN PRESSURE VESSELS 15

Introduction – Stresses in a circular ring, cylinder – Membrane stress Analysis of Vessel Shell components – Cylindrical shells, spherical Heads, conical heads –Thermal Stresses – Discontinuity stresses in pressure vessels.

UNIT III DESIGN OF VESSELS 15

Design of Tall cylindrical self supporting process columns – supports for short vertical vessels – stress concentration – at a variable Thickness transition section in a cylindrical vessel, about a circular hole, elliptical openings. Theory of Reinforcement – pressure vessel Design.

UNIT IV BUCKLING AND FRACTURE ANALYSIS IN VESSELS 8

Buckling phenomenon – Elastic Buckling of circular ring and cylinders under external pressure – collapse of thick walled cylinders or tubes under external pressure –Effect of supports on Elastic Buckling of Cylinders – Buckling under combined External pressure and axial loading.

UNIT V PIPING 4

Introduction – Flow diagram – piping layout and piping stress Analysis.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- understood the concepts of various types of pressure vessels and their applications
- identify various stresses in different components of pressure vessels.
- design different types of pressure vessels.
- be thorough with bucking and fracture analysis of pressure vessels and their components
- gain knowledge on the concepts of piping and stress analysis of piping.

REFERENCES

1. John F. Harvey, “Theory and Design of Pressure Vessels”, CBS Publishers and Distributors, 1987.
2. Henry H. Bedner, “Pressure Vessels, Design Hand Book, CBS publishers and Distributors, 1987.

3. Stanley, M. Wales, “Chemical process equipment, selection and Design.Buterworths series in Chemical Engineering, 1988.
4. William. J., Bees, “Approximate Methods in the Design and Analysis of Pressure Vessels and Piping”, Pre ASME Pressure Vessels and Piping Conference, 1997.
5. Dennis K. Williams, James F. McCabe, Dominique Moinereau, “Pressure Vessels and Piping Division” ,American Society of Mechanical Engineers ,2003

WEBLINKS

1. https://www.mersen.com/uploads/tx_mersen/brochure-pressure-vessels_1_.pdf
2. http://strathprints.strath.ac.uk/7495/

PEDE15308 MODAL ANALYSIS OF MECHANICAL SYSTEMS 3 0 0 3

COURSE OBJECTIVES

- To impart knowledge on modal testing to perform model analysis and their applications.
- To apply the DOF in single and Multi systems and to study various dampings, vibrations and property analysis.
- To understand the concepts behind the mobility measurement techniques, selection and mounting of transducers, amplifiers.
- To know the concept of peak amplitude details and get an idea to draw the time domain curve.
- To gain the analytical knowledge of different modal models for display, response, spatial and system.

UNIT I OVERVIEW 6

Introduction to Modal Testing – Applications of Modal Testing – Philosophy of Modal Testing – Summary of Theory – Summary of Measurement Methods – Summary of Analysis – Review of Test Procedure.

UNIT II THEORETICAL BASIS 12

Introduction – Single Degree of Freedom (SDOF) System Theory – Presentation and Properties of FRF Data for SDOP System – Undamped Multi-degree of freedom (MDOF) system – Proportional Damping – Hysteretic Damping – General Case – Viscous Damping – General Case – Characteristics and presentation of MDOF – FRF Data – Complete and incomplete models - Non-sinusoidal vibration and FRF Properties – Analysis of Weakly Nonlinear Structures.

UNIT III MOBILITY MEASUREMENT TECHNIQUES 10

Introduction – Basic Measurement System – Structure preparation – Excitation of the Structure – Transducers and Amplifiers – Analyzers – Digital Signal Processing –Use of Different Excitation types – Calibration – Mass Cancellation – Rotational Mobility Measurement – Measurement on Non linear structures – Multi point excitation methods.

UNIT IV MODAL PARAMETER EXTRACTION METHODS 11

Introduction – Preliminary checks of FRF Data – SDOF Modal Analysis-I – Peak amplitude – SDOF Modal Analysis-II – Circle Fit Method – SDOF Modal Analysis III –Inverse Method – Residuals – MDOF curve-fitting procedures – MDOF curve fitting in the Time Domain – Global or Multi-Curve fitting – Non linear systems.

UNIT V DERIVATION OF MATHEMATICAL MODELS 6

Introduction – Modal Models – Display of Modal Model – Response Models – Spatial Models – Mobility Skeletons and System Models.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- learn modal testing to perform modal analysis and their applications.
- know about DOF in single and multi systems and to study various dampings, vibrations and property analysis.
- have thorough knowledge on the concepts of mobility measurement techniques.,
- understand the concept of modal parameter extraction methods.
- drive mathematical models of modal analysis for display, response, spatial and system models.

REFERENCES

1. Ewins D J, "Modal Testing: Theory and Practice ", John Wiley & Sons Inc., 1988.
2. Nuno Manuel Mendes Maia et al," Theoretical and Experimental Modal Analysis",Wiley John & sons, 1997.
3. Gaetan.Kerchen, "Modal analysis of non linear mechanical system", CISM International system,2014
4. Singiresu S.RAO, "Vibration of Continuous System",2007
5. S.K.Dwivedy, "Analysis of mechanical System", 2008

WEBLINK

1. nptel.ac.in/syllabus/syllabus.php?subjectId=112105055.

PEDE15309 EXPERIMENTAL STRESS ANALYSIS 3 0 0 3

COURSE OBJECTIVES

- To know about force and strain measuring devices and their performance.
- To understand the working principles and operations of various vibration measuring instruments.
- To study the various pressure and wind flow measuring equipment.
- To diagnose the distress, cracks and corrosion problems in structures.
- To learn different non-destructive testing methods for structures, buildings and towers.

UNIT I FORCES AND STRAIN MEASUREMENT 9

Strain gauge, principle, types, performance and uses. Photo elasticity – Principle and applications - Moire Fringe - Hydraulic jacks and pressure gauges – Electronic load cells – Proving Rings – Calibration of Testing Machines.

UNIT II VIBRATION MEASUREMENTS 9

Characteristics of Structural Vibrations – Linear Variable Differential Transformer (LVDT) – Transducers for velocity and acceleration measurements. Vibration meter – Seismographs – Vibration Analyzer – Display and recording of signals – Cathode Ray Oscilloscope – XY Plotter – Chart Plotters – Digital data Acquisition systems.

UNIT III ACOUSTICS AND WIND FLOW MEASURES 9

Principles of Pressure and flow measurements – pressure transducers – sound level meter – venturimeter and flow meters – wind tunnel and its use in structural analysis – structural modeling – direct and indirect model analysis

UNIT IV DISTRESS MEASUREMENTS 9

Diagnosis of distress in structures – crack observation and measurements – corrosion of reinforcement in concrete – Half-cell, construction and use – damage assessment – controlled blasting for demolition.

UNIT V NON DESTRUCTIVE TESTING METHODS 9

Load testing on structures, buildings, bridges and towers – Rebound Hammer –acoustic emission – ultrasonic testing principles and application – Holography – use of laser for structural testing – Brittle coating.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- demonstrate a basic understanding of experimental methods commonly used in solid mechanics.
- understand the basics of vibration measurement and its importance in engineering field.

- learn the principles of measurements of static and dynamic response of structures and carryout the analysis of results.
- acquire depth logical knowledge in conclusions based theoretical results and other experimental evidence.
- Gain knowledge on different non-destructive testing methods for bridges, buildings and towers.

REFERENCES

1. Sadhu Singh – Experimental Stress Analysis, Khanna Publishers, New Delhi, 1996.
2. JW Dalley and WF Riley, Experimental Stress Analysis, McGraw Hill Book Company, N.Y. 1991
3. L.S.Srinath et al, Experimental Stress Analysis, Tata McGraw Hill Company, New Delhi, 1984
4. R.S.Sirohi, HC Radhakrishna, Mechanical Measurements, New Age International (P) Ltd. 1997
5. F.K Garas, J.L. Clarke and GST Armer, Structural assessment, Butterworths,London, 1987

WEBLINK

1. www.aimforhigh.in/2011/12/ae2352-experimental-stress-analysis.html

PEDE15310 MAINTENANCE ENGINEERING 3 0 0 3

COURSE OBJECTIVES

- To understand the concepts of maintenance, safety and their importance in industry.
- To learn the concepts of planning and control of various maintenance engineering.
- To know about the safety aspects that will enable the students to deal effectively with various types of hazards in industry.
- To gain knowledge on bar codes, mobile computer and wireless data transmission for monitoring.
- To study different types of analysis and its rules and guidelines in safety.

UNIT I INTRODUCTION TO MAINTENANCE SYSTEMS 8

Introduction to repair and Maintenance -Maintenance as business – Maintenance systems such as reactive, preventive, predictive or proactive systems – Human resources management in Maintenance management - maintainability- Inherent and overall availability. - Mean time between failures, mean time to repairs and mean down time - Testability and supportability - "Design for Maintenance" – Poor maintainability aspects - Design for reliability.

UNIT II CONDITION BASED MAINTENANCE 7

Condition based monitoring of equipment and systems -condition monitoring techniques such as a) Vibration analysis, b) Ultrasonic detection techniques, c) Thermograph, d) Oil and lubricant analysis, e) Motor condition monitoring (MCM) - Shaft alignments through laser - Vibration instruments -Outline on Thermograph

UNIT III MAINTENANCE TECHNIQUES SUCH AS RELIABILITY CENTERED MAINTENANCE (RCM), TOTAL PRODUCTIVE MAINTENANCE (TPM)& CMMS) 10

Reliability centered Maintenance-Failure Mode and Effect Analysis-Root cause Analysis- logic tree analysis-Criticality matrix - Total Productive Maintenance, Overall Equipment Effectiveness-Lean manufacturing-TPM and TPO- Relationship between OEE and world-class Maintenance- Ladder of Maintenance improvement-Computerized Maintenance management system in a business scenario- data acquisition for effective management of CMMS.

UNIT IV ASSET PLANNING AND SCHEDULING OF ACTIVITIES IN MAINTENANCE 10

Asset and spare part management, - Conventional spare Parts management techniques such as Economic Order Quantity, two bin systems - Latest trends in monitoring through bar codes, mobile computer and wireless data transmissions -Different aspects of planning and scheduling of Maintenance, such as shutdowns-Critical aspects of both routine and shut down Maintenance -. bar charts – PERTnetwork during shut down -Man power Training and utilization of skilled manpower -

Sequencing of activities.

UNIT V SAFETY AND OTHER ASPECTS OF MAINTENANCE FUNCTIONS 10

Safety Engineering- Hazard analysis -General rules and guidelines in safety and hazard prevention –

Analytical tools - Hazard analysis- Fault Tree Analysis – Sneak Circuit analysis - Integrated approach to Maintenance- Statistical distributions such as normal, gamma and "Weibull" in Maintenance- Maintenance effectiveness.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of this course, student will be able to

- understand the meaning of maintenance, objective and function of maintenance departments and importance of maintenance and organization for maintenance.
- attain good understanding of the basic technologies related to maintenance engineering.
- gain knowledge of maintenance strategies and the process of achieving them in various industrial sectors.
- learn the principles of lubrication and the prevention of machinery degradation by periodic and predictive maintenance.
- get awareness of machinery measurements, and develop skills of maintenance from the perspective of safety.

REFERENCES

1. Kelly. A and Harris, M. J, "Management of Industrial maintenance", Butter worth &Co., 1978
2. David J. Smith, "Reliability and Maintainability in Perspective", McMillan,2nd Edition, 1985.
3. Gwidon W Stachowiak and Andrew W. Batchelor, "Engineering Tribology", Butterwork-Heinmann, 2001.
4. Mishra R.C. "Reliability and Maintenance engineering", New Age International limited, 2006.
5. K.Venkataraman "Maintenance Engineering and Management": -PHI Learning-2007

WEBLINKS

1. www.auupdates.com/.../me2037-maintenance-engineering-syllabus.html
2. www.swlearning.com/quant/gaither/ninth-edition/powerpoint/ch19.ppt.

PEDE15311 MICRO ELECTRO MECHANICAL SYSTEMS 3 0 0 3

COURSE OBJECTIVES

- To know the principles of micro fabrication for the development of micromechanical devices.
- To understand the principles of energy transduction, sensing and actuation on a microscopic scale.
- To analyze the behavior of micro electro mechanical devices through models and systems.
- To learn the fundamentals of pressure sensors used in MEMS.
- To evaluate and choose transduction principles (e.g., electrostatic or magnetic) for actuation.

UNIT I INTRODUCTION 8

Introduction, Materials-substrates, Additive materials. Fabrication techniques-Deposition, Lithography, etching, Surface micro machining, Thick film screen-printing and electroplating

UNIT II MECHANICAL SENSOR PACKAGING 8

Introduction, Standard IC packages-ceramic, plastic and metal packages. Packaging process-Electrical interconnects, Methods of die attachment, sealing techniques. MEMS mechanical sensor packaging

UNIT III MECHANICAL TRANSDUCTION TECHNIQUES 9

Piezo resistivity, Piezoelectricity, Capacitive Techniques, Optical techniques, Resonant techniques. Actuation techniques, Smart Sensors. MEMS Simulation and Design tools-Behavioral model ling simulation tools and Finite element simulation tools.

UNIT IV PRESSURE SENSORS 12

Introduction. Techniques for sensing. Physics of pressure sensing-Pressure sensor specifications. Dynamic pressure sensing. Pressure sensor types. MEMS technology pressure sensors-Micro machined silicon diaphragms,

UNIT V FORCE, TORQUE AND INERTIAL SENSORS 8

Introduction-Silicon based devises-Optical devises-capacitive devises-Magnetic devices-Atomic force microscope and scanning probes- micro machined accelerometer-Micro machined Gyroscope-Future inertial micro machined sensors

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- understand working principle of currently available micro sensors, actuators, and motors and fluidics used in micro systems.
- think in a unified way about interdisciplinary microsystems.
- choose micro fabrication methods suited for the fabrication of a given micro system.
- select proper micro machining techniques to develop miniaturised micro-mechanical components.
- have an experience on micro systems to deal with photonics and optical applications.

REFERENCES

1. Stephen Beeby, Graham Ensell, Michael Kraft and Neil White,' MEMS Mechanical sensors' Artech House, Inc. Boston 2003.
2. Mohamed Gad-el-Hak , "The MEMS Handbook" , CRC Press
3. G.K.AnanthaSuresh , "Micro and Smart Systems.", Wiley India
4. James J.Allen, Micro Electro Mechanical System Design, CRC Press published in 2005
5. M-H. Bao, Elsevier, Micromechanical Transducers: Pressure sensors, accelerometers, and gyroscopes, NewYork, 2000.

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1. www.mae.ucla.edu/.../syllabus/REVISED%20MEMS%20Syllabus.pdf
2. http://www.csa.com/discoveryguides/mems/overview.php

PEDE15312 CREATIVITY IN DESIGN 3 0 0 3

COURSE OBJECTIVES

- To know about the need and significance of creativity in design and quality concepts.
- To understand the different components of creative thinking and principles of animation and visualization.
- To study the various methods and tools available for generating new ideas in creativity pertaining to customer needs.
- To gain knowledge in the elements of process design, emotional design and levels of design.
- To familiarize with the different innovation methodologies, models and its essential factors.

UNIT I INTRODUCTION 4

Need for design creativity – creative thinking for quality – essential theory about directed creativity

UNIT II MECHANISM OF THINKING AND VISUALIZATION 11

Definitions and theory of mechanisms of mind heuristics and models: attitudes, Approaches and Actions that support creative thinking - Advanced study of visual elements and principles- line, plane, shape, form, pattern, texture gradation, color symmmetry. Spatial relationships and compositions in 2 and 3 dimensional space - procedure for genuine graphical computer animation – Animation aerodynamics –virtual environments in scientific Visualization – Unifying principle of data Management for scientific visualization – Unifying principle of data management for scientific visualization - Visualization benchmarking

UNIT III CREATIVITY 11

Methods and tools for Directed Creativity – Basic Principles – Tools of Directed Creativity – Tools that prepare the mind for creative thought – stimulation of new ideas – Development and Actions: - Processes in creativity ICEDIP – Inspiration, Clarification, Distillation, Perspiration, Evaluation and Incubation – Creativity and Motivation The Bridge between man creativity and the rewards of innovativeness –Applying Directed Creativity to the challenge of quality management

UNIT IV DESIGN 9

Process Design, Emotional Design – Three levels of Design – Viceral, Behavioral and Reflective- Recycling and availability-Creativity and customer needs analysis –Innovative product and service designs, future directions in this application of creativity thinking in quality management

UNIT V INNOVATION 10

Achieving Creativity – Introduction to TRIZ methodology of Inventive Problem Solving - the essential factors – Innovator's solution – creating and sustaining successful growth – Disruptive Innovation model – Segmentive Models – New market disruption - Commoditation and DE-commoditation – Managing the Strategy Development Process – The Role of Senior Executive in Leading New Growth – Passing the Baton.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After completion of the course the student will be able to

- have the ability to analyze and evaluate the information critically from multiple sources and diverse perspectives.
- access information through traditional and new technologies, and synthesize this information for problem solving activities.
- design the thinking strategies in an iterative design process to achieve innovativeness.
- assess, predict and articulate the importance of graphic design issues within the human environment from social responsibility, sustainability and interdisciplinary perspectives.
- learn the existing new design by studying various levels of theories and methods for innovation.

REFERENCES

1. Rousing Creativity: Think New Now Floyd Hurr, ISBN 1560525479, Crisp Publications Inc. 1999
2. Geoffrey Petty," how to be better at Creativity", The Industrial Society 1999
3. Donald A. Norman," Emotional Design", Perseus Books Group New York , 2004.
4. Clayton M. Christensen Michael E. Raynor," The Innovator's Solution", Harvard Business School Press Boston, USA, 2003.
5. Semyon D. Savransky," Engineering of Creativity – TRIZ", CRC Press New YorkUSA," 2000.

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1. bae.uncg.edu/ecdp/files/2012/05/ENT321_Syllabus.pdf
2. http://nptel.ac.in/courses/107108010/