SOLAPUR UNIVERSITY, SOLAPUR

M.E.(Mechanical Engg.)

Choice Based Credit System Syllabus (w.e.f. June 2015-16)

Part I

Sem I

Sr No.	Name of the subject	Teaching Scheme		Examination			Total Marks
		L	T/P	T/W	TP	ORAL	
1	Computational Techniques in Design Engg.	3	2	25	100	--	125
2	Industrial Instrumentation	3	2	25	100	--	125
3	Solid Mechanics	3	1	25	100	--	125
4	Design of Experiments and Research Methodology	3	1	25	100	--	125
5	Elective I	3	1	25	100	--	125
6	Seminar I	--	2	25	--	--	25
Total		15	9	150	500	--	650

L-Lecture T/P-Theory/PracticalT/W Term WorkTPTheory Examination

Sem II

Sr No.	Name of the subject	Teaching Scheme		Examination			Total Marks
		L	T/P	T/W	TP	ORAL	
1	Design Engineering	3	1	25	100	--	125
2	Theory & Analysis of Composite Materials	3	2	25	100	--	125
3	Mechatronics System Design	3	2	25	100	--	125
4	Industrial Product Design	3	1	25	100	--	125
5	Elective II	3	1	25	100	--	125
6	Seminar II	--	2	25	--	--	25
7	Mini Project	--	--	--	--	--	--
Total		15	9	150	500	--	650

*Miniproject should be completed during vacation after Semester II & report is to be submitted in Semester III

Elective I	Elective II
1. Reverse Engineering	1. Process Equipment Design
2. Engineering Design Optimization	2. Material Handling Equipment Design
3. Reliability Engineering	3. Machine Tool Design
4. FEM	4. Robotics
5. Synthesis & Analysis of Mechanisms &Machines	5. Tribology & Surface Engineering

Part II

Sem III

Sr No.	Name of the subject	Teaching Scheme		Examination			Total Marks
		L	T/P	T/W	TP	ORAL	
1.	Mini Project	--	--	50	--	--	50
2	Seminar III	--	1	--	--	50	50
3	Dissertation Phase I	--	4	50	--	--	50
Total		--	5	100	--	50	150

Sem IV

Sr No.	Name of the subject	Teaching Scheme		Examination			Total Marks
		L	T/P	T/W	TP	ORAL	
1	Dissertation	--	5	200	--	100	300
Total		--	5	200	--	100	300

Solapur University Solapur

M.E. MECHANICAL ENGG. – I

Part I (Sem I)

1.COMPUTATIONAL TECHNIQUES IN DESIGN ENGINEERING

Teaching -3 Periods (60 min.each) per week. Uni. Exam Marks -100 Marks

Practical -2 Periods (60 min.each) per week. Term work.- 25 Marks

1. Data analysis Errors in numerical, Interpolation by Central Differences, Sterling. Bessel & Everett Formulae, Interpolation Formula for Unequal Intervals, Spline Interpolation m Cubic Splines.
2. Curve Fitting: Least square method for linear & non-linear functions, weighted least square methods.
3. Solution of Linear System of Equations.
   Gauss Elimination with Pivoting, LU Decomposition method, Iterative methods, Eigen vectors-Jacobi Method.
4. Numercial Differentition & Integration:
5. Solution of Ordinary Differential Equation:
   Picard's Method, Euler's & Modified Euler's Method, Runge-kutta Method (upto fourth order) Predictor-corrector Methods, Milne Simpson, Adams Bashforth Moulten Methods.
6. Solution of partial Differential Equations Finite Difference Method, Solution of Laplace & Parabolic Equations.
7. Finite Element Method: History, Definition & Application of FEM, General Steps used in FEM, Types of 1 D & 2 D Elements, Types of Meshing, Types of Shape Functions, Principle of Minimization, Rayleigh-Ritz, Galerkin Least Square Methods, Softwares used in FEM.
8. Mathematical Modelling of Physical Problems Modelling Concept, Modelling of Linear Differential Eqautions of Second Order.

TERM WORK

Minimum ten computer programmes based on above syllabus should be developed and recorded n the journal.

BOOKS RECOMMENDED

1. S.S. Shastry, “Introductory Methods of Numerical Analysis”, Third Edition, Prentice Hall of India Publications Pvt. Ltd.
2. S.S. Rao, “Finite element Method” Wiley Eastern Ltd. II edition, New Delhi, Edition PHI Publication Pvt. Ltd.
3. Chandru Patla T. R & Belegundu A.D., “Finite Element Method”, Second Edition PHI Publication Pvt. Ltd.
4. Swami, Saran Singh, “Computer Programming and Numerical Methods”,
5. J.N. Kapoor, “Mathermatical Modelling”.

M.E. MECHANICAL ENGG. - I

2. INDUSTRIAL INSTRUMENTATION

Teaching Scheme:	Examination Scheme:
Teaching 3 Periods (60 min) per week	University Exam:100Marks
Practical: 2 Periods (60 min) per week	Term work : 25 Marks

1. Introduction to Instruments and their representation.
2. Static and Dynamic characteristics of Instruments.
3. Transducer Elements, Intermediate Elements, Indicating and recording Elements.
4. Mechanical Measurements.

a) Displacement Measurement, b) Force Measurement, c) Torque Measurement

5. Pressure and Vacuum Measurement, Flow Measurements.
6. Temperature Measurements.

   Industrial Thermocouples, Resistance thermometers, Radiation temperature Measurements.
7. Measurement of vibration, study of Vibrometer, Vibration analyser.
8. Measurement of Noise.

   Study of noise meter, noise analysis.
9. Signal and system Analysis.
10. Condition Monitoring and Signature Analysis, applications.
11. Data acquisition and Conversion.
12. Microprocessors and computer Application in Measurements.

TERM WORK

At least 10 Experiments based on above syllabus.

REFERENCE BOOKS

1.B.C. Nakra and K.K. Choudhary, “Instrumentation, Measurement and analysis”,Tata McGraw-Hill publication Pvt. Ltd.

2. Rangan and Sharma, “Instruments, devices and systems”, Tata Mc Graw-Hill Publication Pvt. Ltd. New Delhi.

1. Earnest O Doeblin,” Measurement systems. Application & Design,” McGraw Hill International.

2. Rangan C.S. Sharma Gasoline Rani USV, “Instrumentation devices and Systems”, Tata McGraw Hill, New Delhi.

M.E. MECHANICAL ENGG. - I

3. SOLID MECHANICS

Teaching Scheme:	Examination Scheme:
Teaching - 3 Periods (60 min) per week	University Exam:100Marks
Practical: 1 Periods (60 min) per week	Term work : 25 Marks

1. Plane stress and Plane strain: Differential equations of equation of equilibrium, Boundary conditions, Compatibility, Stress function and Bi harmonic equation.
2. Two dimensional problems in Rectangular co-ordinates. Applications to polynomials in rectangular co-ordinates, Saint Venant's Principle.
3. Two dimensional problems in Polar co-ordinates: General equations in polar co-ordinates, Pure bending of curved bars, Strain components in polar co-ordinates, Rotating disks, Stresses in a circular disks.
4. Shear center. Shear stress distribution and Shear center for thin walled open sections.
5. Torsion: Torsion of bars with elliptical, square & rectangular cross section. Membrane analogy, Hydro dynamical analogy, Torsion of hollow & thin tubes.
6. Membrane stresses in shell and storage vessels, Shells and vessels of uniform strength.
7. Contact stresses Problem, of determining contact stresses, Assumptions, Expressions for principle stresses, Examples.

TERM WORK

Term work: 10 to 12 study experiments / tutorials based on above topics.

BOOKS RECOMMENDED

1. S. Timoshenko & J.W. Goodeer,"Theory of Elasticity", MGH books co Ltd.
2. J.P.Den Hartog, "Advanced Strength of Materials." MGH books co Ltd.
3. F.B. Seely & Smlth, "Advanced mechanics of materials", John Wiley & Sons.

M.E. MECHANICAL ENGG. - I

4.DESIGN OF EXPERIMENTS AND RESEARCH METHODOLOGY

Teaching Scheme:	Examination Scheme:
Theory: 3 Periods (60 min) per week	Uni. Exam:100Marks
Practical: 1 Periods (60 min) per week	Term work : 25 Marks

1. Research concept: meaning objectives, motivation, types of research, approaches, research (Descriptive research, conceptual, theoretical, applied and experimental)
2. Formulation of research task: literature review. Importance and methods, sources quantification of cause-effect relations, discussions, field study, laboratory experiments, critical analysis of already generated facts, hypothetical proposal for future development and testing, selection of research task, prioritization of research.
3. Mathematical modeling and simulation: concept of modeling, classification of mathematical models, modeling with ordinary differential equations, difference equations, partial differential equations, graphs, Simulation: concept, types (quantitative, experimental, computer, fuzzy theory, statistical) process of formulation of model based on simulation.
4. Expeimental Modeling.
   a) Definition of experimental design, examples, single factor experiments, blocking and nuisance factors, guidelines for designing experiments.
   b) General model of process input factors / variables, O/P parameters / variables, controllable/uncontrollable variables, dependent/ independent variables, compounding variables, extraneous variables. Experimental validity.
   c) Process optimization and designed experiments methods for study of response surface. I order design, Determining optimum combination of factors, method of steepest ascent, Taguchi approach to parameter design.
5. Analysis of results (parametric and non parametric, descriptive and inferential data): types of data, collection of data (normal distribution, calculation of correlation coefficient) data processing, analysis, error analysis,meaning, different methods analysis of variance, significance of variance, analysis of co variance, multiple regression, testing linearity/ non linearity of model, testing adequacy of model / non linearity of model,/hypothesis, use of computational tools, software for research work.
6. Report writing: types of report, layout of research report, interpretation of results, style manuals, layout and format, style of writing, typing, references,

pagination, tables, figures, conclusions, appendices, Writing research paper for publication based on dissertation/research work.

7. Landscape of creativity: Convergent Vs. divergent thinking, creativity, creativity Vs. Intelligence, creativity abilities, creativity and madness, determination of creativity, increasing creativity, creative a achievement, techniques of creativity. Collective creativity.

TERM WORK

The tern work is expected to facilitate the student to identify a dissertation topic, to carry out literature review, plan and schedule the dissertation work, and prepare him/her for report writing. The term work be preferably based on following topics.

1. Study of research paper and literature review.
2. Assignments on data collection, processing, analysis, interpretation, inferences and conclusions.
3. Assignment on design of experiments.
4. Assignment on modeling and simulation of an engineering problem.
5. Designing and performing an experiment on any engineering problem.

REFERENCE BOOKS

1. Wlllkinsion K.P.L. Bhandarkar, " Formulation of Hypothesis", Himalaya Publishing Bombay.
2. Schank Fr, "Theories of Engg. Experiments", Tata McGraw Hill
3. Douglas Montgomary, "Design of experiments"
4. Introduction to SQC, John Willy and Sons
5. Cochram and Cocks, "Experimental Design", John Willy and Sons.
6. John W Besr and James V Kahn, "Research in Education", PHI Publication.
7. Adler and Granovky,"Optimization of Engg experiments" Meer publications.
8. S S Rao," Optimization theory and applications", Wiley Eastern Ltd. ND
9. C.R. Kothari,"Research Methodology", Wily Eastern, ND.

M.E. MECHANICAL ENGG. - I

5 ELECTIVE- I

FINITE ELEMENT METHOD

Teaching Scheme: Examination Scheme:
Theory: 3 Periods (60 min) per week Uni. Exam:100Marks
Practical: 1 Periods (60 min) per week Term work : 25 Marks

1. Introduction: Physical problem, Mathematical modeling and Finite Element Solutions, FEM as an integral part of Computer Aided Design.
2. General procedure used in FEM: Discretization, Formulation, Solving and post Processing.
3. Mathematical Formulation: Types of 2D and 3D Elements and their properties, types of shape functions (Langrange and Hermite) Principle of virtual work and principle of minimum potential energy', consistent mass and lumped mass formulation, principle of minimization weighted residual and variational Methods, imposing of boundary conditions, formulation for isoparametric elements.
4. Application of FEM –i) Static analysis-direct stiffness method, plan stress and strain elements, axisymmetric elements, nonlinear analysis, composite materials, time dependent loads, determination of temperature distribution and thermal stresses, ii) Dynamic analysis-spring and dashpot elements, Eigen value analysis, frequency analysis, transient analysis.
5. Computer implementation of FE procedures-various iterative methods used in static and dynamic analysis, inter-elemental continuity, convergence rate, refinement of FE solution, Validation of FE solutions, review of softwares in FEM.

TERM WORK

Minimum ten assignments based on above topics.

BOOKS RECOMMENDED

1) Klaus Jurgen Bathe, "Finite element Procedures", 1996 Edition, Prentice Hall of India Pvt. Ltd.
2) J N. Reddy,"An Introduction to finite Element Method", 1984 Edition, McGraw Hill book Pvt. Ltd.
3) O.C. Zienkiewicz, "The Finite Element Method" 1994 Edition, Tata McGraw Hill book Pvt. Ltd.
4) T.R. Chandrupatia and A.D. Belegundu, Introduction to finite Elements in Engineering" 2nd edition Prentice Hall of India Pvt. Ltd.
5) S.S. Rao, "The Finite Element Method in Engineering" 2nd Edition, Pergamon Press Oxford England.
6) RD. Cook, D.S. Malkas, M.E. Pleshan, 'Concept and applications of Finite Element analysis' 3rd Edition, John Wiley and Sons Publication.

M.E. MECHANICAL ENGG. - I

6. SEMINAR – I

Teaching Scheme:
Tutorial/Practical: 2Hr./week/student Term Work:25 Marks

Seminar I should be based on the literature survey on any topic relevant to Design Engineering (should be helpful for selecting a probable title of dissertation)

Each student has to prepare a write up of about 2.5 pages of "A4" size sheets and submit it in duplicate as the term work.

The student has to deliver a seminar talk in front of the teachers of the department and his classmates, the teachers, based on the quality of work and preparation and understanding of the candidate, shall do an assessment of the seminar internally jointly.

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ME- (MECHANICAL ENGG).-II

1. DESIGN ENGINEERING

Teaching Scheme:	Examination Scheme:
3 Lectures (60 min) per week	Uni. Exam:100Marks
1 Pract./Tut. (60 min) per week	Term work : 25 Marks

1. Design of High Speed Cams- Types of cams Kinematic design. Standard Contours, Combined motion and polynomial approadies, CSP and CPM cams and Importance of SVAJ diagrhms, Dynamic design of Cams-Rigid body Analysis, Elastic body analysis, polydyne Cams.

2. Design Based upon thermal stresses :- Definition of thermal stress. Applications, Form Constraint and Continuity Constraint, Thermal Stresses in flat walls and Cylindrical Shells, Addition of thermal and working stress, Methods of heat removal and decreasing thermal stress.

3. Form Design:- Principles effect of method of Production, material, space, size and weight on form design.

4. Power Transmission :- Design of Speed reducers and Variable Speed Drives, Electrical motor selection.

5. Fatigue in Materials:- Cumulative fatigue, Fracture mechanics approach to fatigue.

6. Creep in Materials:- Laws of Creep, Estimated time to rupture, Relaxation and creep in bending.

7. The Plastic flow process, shape factor, spring jack, Residual Stresses.

8. Pressure Vessel Design:- Discontinuity stresses, Theory of beams on elastic foundation, Infinite and semi-infinite beams, Concentrated load and moment, Design based on discontinuity stresses for cylinder with spherical head and cylinder with flat head.

9. Introduction to Reliability in Design:- Definitions of Reliability function, Terms used in Reliability, Failure Distribution Function, Hazard Rate, MTTR, MTBE, MTTR, Failure data analysis (discrete data), Reliability of systems-series. Parallel & combination system. Calculation of Reliability terms for Exponential, Rayleigh and Weibull-Failure Failure distribution function. Methods of improving Reliability, Example of design of an element using Reliability data.
   Term Work- Minimum 6 exercises based on above syllabus.

Reference Books:

1. Mechanical Design Analysis – M.S. Spotts Prentice Hall -------
2. Fundamentals of Machine Design – Vol-I P. Orlov MIR publications.
3. Pressure Vessel Design – J.F.Harvey.
4. Engineering Design – by Lehek
5. Theory of Machines & Mechanisms by Shigley McGraw Hill Book Co. 1981.
6. Dynamics of Machinery –Norton.

M.E. (MECHANICAL ENGG). -II

2. THEORY & ANALYSIS OF COMPOSITE MATERIALS

Teaching Scheme:	Examination Scheme:
3 Lectures (60 min) per week	Uni. Exam:100Marks
2 Pract./Tut. (60 min) per week	Term work : 25 Marks

1. Introduction to composite materials:
2. Basic Concepts , Definitions and applications:

   Classification and Characteristics of Composite Materials, Mechanical Behavior of Composite Materials, Basic Terminology of Laminated Fiber-Reinforced Composite materials, Applications of Composite Materials.

3. Macromechanical behavior of a lamina:

   Introduction, Stress-Strain Relations for Anisotropic Materials, Stress-Strain Relations for Plane Stress in an Orthotropic Material, Strengths of an Orthotropic Lamina.

4. Micromechanical behavior of a lamina:

   Introduction, Mechanics of Materials Approach to Stiffness, Elasticity Approach to Stiffness,Comparison of Approaches to Stiffness, Mechanics of Materials Approach to Strength.

5. Macromechanical Behavior of a Laminate:

   Introduction, Classical Lamination Theory, Special Cases of Laminate Stiffners, Strength of Laminates, Interlaminar Stresses.

6. Bending, Buckling and Vibration of Laminated Plates:

   Introduction, Governing Equations for Bending, Buckling, and Vibration of Laminated Plates.

7. Other Analysis and Behavior Topics
8. Introduction to Design of Composite Structures.

Term Work

Ten assignments based on above syllabus.

Reference Books:

1. Engineering Mechanics of Composite Materials, Second Edition, by I. M. Daniel and O. Ishai, Oxford University Press, 2005 .
2. Introduction to composite materials Derek Hull, T. W. Clyne, Cambridge University Press.
3. Composites design Stephen W. Tsai, Think Composites,Ohio,USA.
4. Mechanics of Composite Materials, Second Edition, R.M.Jones, Taylor & Francis.

M.E. MECHANICAL ENGG. - II

3. MECHATRONICS SYSTEM DESIGN

Teaching Scheme:	Examination Scheme:
3 Lectures (60 min) per week	Uni. Exam:100Marks
2 Pract./Tut. (60 min) per week	Term work : 25 Marks

1. Introduction:
   Introduction to mechatronic system, evolution, scope and components of mechatronic systems, mechatronics in product and measurement system, control system and modes of control, traditional design and mechatronic design (3)
2. Actuators, Sensors and Transducers:
   Hydraulic, pneumatic and electrical actuators and their system modeling, performance terminology, system modeling of sensors; displacement, position and proximity sensors, velocity and acceleration sensors, flow sensors, force sensors, temperature sensors, ultrasonic and fibre-optic sensors, selection of sensor, piezo-electric sensors. (6)
3. Hardware Components:
   Number systems in Mechatronics, binary logic, Karnaugh map minimization, transducer signal conditioning process, principals of analogue and digital signal conditioning, protection, filtering, operational and instrumentation amplifiers and their gains, analogue to digital and digital to analogue conversion, multiplexers, pulse modulation. (6)
4. Programmable Logic Controller:
   Review of logic gates, basic structure, features, input/output processing, programming, functional block diagram (FBD), ladder diagram, logic functions, latching, sequencing, jumps, internal relays, counters, shift registers, master and jump control, data handling, data movement, data comparison, arithmetic operations, code conversion, analog input and output, applications for automation, diagnostics and condition monitoring. (6)
5. Microcontroller:
   Comparison between microprocessor and microcontroller, organization of microcontroller system, architecture of MCS 51 controller, pin diagram of

8051, addressing modes, programming of 8051, interfacing input and output devices, interfacing D/A converters and A/D converters, Various applications for automation and control purpose. (6)

6. Real-Time Interfacing:
   Introduction, Elements of Data Acquisition and Control System,Overview of I/O Process, Installation of the I/O Card and Software, Installation of the application Software, Examples, Over framing. (4)
7. Advanced Applications in Mechatronics:
   Mechatronic control in automated manufacturing, Artificial Intelligence in mechatronics, Fuzzy Logic application in Mechatronics, Microsensors in Mechatronics, Case studies of Mechatronic systems. (5)

TERM WORK

1. Minimum Three exercises on analog-digital trainer to study fundamentals of digital electronics

2. Minimum three programs on PLC for system automation involving of interfacing of sensors and actuators,

3. One exercise on interfacing of sensors and actuators with microcontroller

4. At least two exercises on a total Mechatronic System Design for applications like packaging, loading/unloading, pick and place etc.

REFERENCE BOOKS

1) Mechatronics, 3/e --- W. Bolton (Pearson Education)

2) Mechatronics -Dan Necsulescu (Pearson Education)

3) The 8051 Microcontroller: Architecture, Programming and Applications, 2/e—Kenneth J.

Ayala (Penram International) 4) Mechatronics: Principles, Concepts and Applications - N.P.Mahalik (TMH)

5) Introduction to Mechatronics & Measurement Systems – David G. Alciatore & Michael B. Histand (TMH)

6) Process Control & Instrumentation Technology –Critis D. Johnson (Pearson Education)

7) Mechatronics System Design - Devdas Shetty, Richard A. Kolk (Thomson)

8) Computer Control of Manufacturing Systems - Yoram Koren (McGraw Hill)

9) Automated Manufacturing Systems: Sensors, Actuators - S. Brain Morriss (McGraw Hill)

10) Industrial Automation – David W. Pessen (John Wiley & Sons)

11) 99 Examples of Pneumatic Applications – FESTO Controls Pvt. Ltd. Bangalore.

12) Modular Pick and Place Device– FESTO Controls Pvt. Ltd. Bangalore.

13) Rationalization with Handling Technology– FESTO Controls Pvt. Ltd. Bangalore.

14) Rationalization with Small Workpiece Feeding- FESTO Controls Pvt. Ltd. Bangalore.

15) Sensors for Handling & Processing Pechnology- FESTO Controls Pvt. Ltd. Bangalore.

16) Sensors in Production Engg. - FESTO Controls Pvt. Ltd. Bangalore.

17) Handbook of Industrial Automation – Richard L. Shell & Ernest L. Hall (Marcel Decker Inc.) 18) Programmable Logic Controllers" Programming Methods and Applications (with CD Rom) – Jack R. Hackworth & Fredrick D. Hackworth,Jr.(Pearson Education).

M.E. (MECHANICAL ENGG). -II

5. INDUSTRIAL PRODUCT DESIGN

Teaching Scheme:	Examination Scheme:
3 Lectures (60 min) per week	Uni. Exam:100Marks
1 Pract./Tut. (60 min) per week	Term work : 25 Marks

I) Introduction: Approach to Industrial design. 1. Approach to industrial product based on idea generation and innovativeness (and inventiveness) to meet the needs of the developing society, Design and development process of industrial products, various steps as creative process involved in idea of marketing, Designers, mind-criticism, design process, creation. 2. Ergonomics and aesthetic requirement of product design, quality and maintenability consideration in product design, Use of modeling technique, prototype designs, conceptual (conceptional) design.

II) Industrial Product Design

1. General design situation, setting specifications, requirements and ratings, their importance in the design. Study of market requirements and manufacturing aspects of industrial designs.
2. Aspects of ergonomic design of machine tools, testing equipments, instruments, automobiles, process equipments etc. convention of style, form and color of industrial design.

III) Design of consumer Product.

1. Design concepts of consumer products, specification requirements and rating of their importance in design. Functions and use, standard and legal requirements. Body/dimensions.
2. Ergonomic considerations, interpretation of information conversions for style, forms, colors.

IV) Aesthetic Concepts.

1. Concept of unity and of order with variety, concept of purpose, style and environment, Aesthetic expressions of symmetry, balance, contrast, proportion, rhythm, radiance.
2. Form and style of products visual effect of line and form, mechanics of seeing, psychology of seeing, influence of line and form, Components of style, basic factors. House style. Effect of color on product

appearance color composition, conversion of colors of engineering products.

V) Economic Considerations: Selection of material, Design for Production, use of standardization, value analysis and cost reduction, maintenance aspects of product design.

VI) Design Organizations: Organizations structure, Designers position, Drawing office procedure, Standardization, record keeping, Legal Product of Design patents.

Term Work –

Case Studies :- Design analysis of existing products. ii) Design of new Products/ devices utility articles:- 2 eases. iii) Assignments based on above topics.

Reference Books :-

1. Industrial Design for Engineers – W.H. Mayall.. London Ilifle books Ltd.
2. Problems of Product Design and Development –Hearn Buck, Pergamon Press.
3. Industrial Designs in Engineering – Charles II. --------- Design council.
4. The Generation of Idea for New Products – Trevor Soweey, Kogan Page.
5. The Science of Engineering Design - --- II Hill.
6. Engineering Designs Conceptual Stage – M. J. French.Heinman Educational Books
7. Materials By Manxie

ME (MECHANICAL ENGG). -II

6. Elective – II

MATERIAL HANDLING EQUIPMENT DESIGN.

Teaching Scheme:	Examination Scheme:
3 Lectures (60 min) per week	Uni. Exam:100Marks
1 Pract./Tut. (60 min) per week	Term work : 25 Marks

Objectives of material handling systems and the basic principles, classification and selection of material handling equipment. Characteristics and applications. Discussion of various material handling equipments, functions and parameters effecting service. Packaging and storage of materials and their relations with material handing. Theory, construction and design of various comportment parts of mechanical handling devices. Wire ropes, chains, books, shackles, grabs, ladies and lifting electromagnets, pulleys, sheaves, sprockets and drums, winches brakes and ratchet stops, gears and power transmission systems, runner wheels and rails, buffers and controls of travel mechanisms.

Kinematic and dynamic analysis of various types of cranes and elevators. Stability and structural analysis. Discussion of principles and application of conveyors and related equipment. Design of various types of conveyors and their elements. Fault finding and failure analysis of material handling systems. System design and economics.

Term Work :- Eight assignments/study type exercises based on above syllabus.

Reference Books:-

1. Material Handling Equipments – N. Rudenko, Peace Publishers, Moscow.
2. Conveyor and Related Equipments – Spivakowasky and V. Dyachke, Peace Publishers, Mosow.
3. Material Handling – John Immer, McGraw Hill 1953
4. Ban-I and Band-II – B. Emst, Die Hebezeuge, Springer Verlag, 1978.

M.E.- (MECHANICAL ENGG). -II

5. Elective –II

MACHINE TOOL DESIGN

Teaching Scheme:	Examination Scheme:
3 Lectures (60 min) per week	Uni. Exam:100Marks
1 Pract./Tut. (60 min) per week	Term work : 25 Marks

1. Introduction to Machine Tool Drives and Mechanism: General requirements of machine tool design. "Design process as applied to machine tools. Layout of machine tool. Various motions introduced in machine tools., parameters defining limits of motions. Requirements of Machine Tool Drives,-mechanical and hydraulic transmission used in machine drives, their elements.
2. Regulation of Speed and Feed Rates: Aim of speed and fees regulation, Stepped regulation of Speed. Design of Speed Box. Design of Feed Box. Machine tool drives using multiple speed motors, step-less regulation of speed and feed rates.
3. Design of Machine Tool Structures: Function of Machine tool structure and their requirements. Design criteria. Materials. Static and dynamic stillness. Basic design procedure. Design Items like beam. Column, housing, Rams etc.
4. Design of Guide ways and Power screws: Function and types of guide ways, Design of slide ways, Design of Antifriction guide ways, Design of Power Screws.
5. Design of Spindle and Spindle Support: Function of spindle unite requirement, material of spindles. Design calculations. Design of Antifriction. Bearings, Bearings, sliding bearing used for spindles.
6. Dynamics of Machine Tools : Machine Tool system. General procedure for assessing Dynamic stability of equivalent elastic system, Forced vibrations in a machine tool.
7. Introduction to Machine Tool control:

Term Work – 6 assignments based on above syllabus.

Reference Books:

1. .Machine Tool Design – N.K. Mehta 1984, Tata McGraw Hills publishing Co. Ltd.
2. Principle of Machine Tool – G.C. Sen and A. Bhattacharyya, New Central Book agency, Calcutta.
3. Design of Machine Tool – S. K. Basu. Allied publishers Bombay.
4. Design Principles of Metal Cutting Machine Tools – F. Keenigs.-Berger.

M.E.- (MECHANICAL ENGG). -II

5. Elective –II

TRIBOLOGY & SURFACE ENGINEERING

Teaching Scheme: Examination Scheme:

Lectures: 3 Hrs/ Week Uni. Exam:100Marks

Practical: 1 Hrs/ Week Term Work: 25 marks

SECTION I: TRIBOLOGY

1. Friction Wear and Corrosion: Theory of friction- sliding and rolling friction, Tabor's model of friction, Friction properties of metallic and non metallic materials, friction in extreme conditions, Wear, types of wear, mechanisms of wear, wear resistant materials, Mechanisms and types of corrosion, Measurement and testing of Friction, Wear and Corrosion, Prevention of wear and Corrosion. (5)

2. Lubrication Theory: Lubricants and their physical properties, lubricants standards, Lubrication regimes, Hydrodynamic lubrication, Reynolds equation, Thermal, inertia and turbulent effects, Elasto, Plasto and magneto hydrodynamic lubrication, Hydrostatic, Gas lubrication. Design of fluid film bearings, Design of air bearing and gas bearing. (9)

3.Tribo Measurement and Instrumentation: Surface topography measurements, Electron microscope, Laser method, Instrumentation, International Standards, Bearing performance measurements, Bearing Vibration Measurement (4)

SECTION II: SURFACE ENGINEERING.

4. Introduction to Surface Engineering: Concept and Scope of Surface Engineering, Mathematical modeling and manufacturing of surface layers, The solid surface- geometrical , mechanical and physico chemical concept, Three dimensional structure of surface, The superficial layer and its parameters.

(4)

5. Surface Engineering for Wear and Corrosion Resistance: Diffusion Coatings, Electro and Electroless platings, Hot dip coating, Metal Spraying, Cladded

coatings, Crystallizing coatings, Flame and arc processes, Conversion coatings, selection of coatings for wear and corrosion resistance, Potential properties and parameters of coatings. (8)

6. Thin Layer Engineering Processes: Laser and electron beam hardening, its process parameters and their effects, Physical vapour deposition, Thermal evaporation Arc vapourisation, Sputtering, Chemical vapour deposition, ion implantation technique, Coating of tools, TiC, TiN, Al2O3 and Diamond coating properties, applications of thin Coatings.
(8)

TERM WORK:

1. Measurement of Friction sliding / Rolling friction - case study

2. Measurement of wear of cutting tool

3. Measurement of corrosion – a case study.

4. Measurement of a bearing performance.

5. Study of general characteristics of superficial layer obtained by Machining.

6. Industrial visit to study techniques of coating – case study.

7. Case study of Physical Vapour deposition method.

8. Case study of Chemical vapour deposition method.

REFERENCE BOOKS:

1. Hulling J. “ Principles of Tribology” Mc Millan, 1984

2. Williams J.A. “Engineering Tribology” Oxford University press, 1994.

3. Davis J. “Surface Engineering for corrosion and Wear Resistance”, Woodhead Publishing, 2001.

4. Tadausz Burakowski, “Surface Engineering of Metals: Principles, Equipments, Technologies” Taylor and Francis.

Web References:
1 http://www.csetr.org
2. http://www.bstsa.org
3. http://www.sea.org.

M.E.- (MECHANICAL ENGG). -II

6. SEMINAR – II

Teaching Scheme:	Examination Scheme:
Practical: 2 Hours/ Week	Term Work: 25 marks

Seminar - II should be based on the literature survey on any topic relevant to

Mechanical Engineering Research. It may be leading to selection of a suitable topic of dissertation. The report shall contain some contribution by the candidate in the form of experimental results, deductions, compilation and inferences etc.

Each student has to prepare a write-up of about 25 pages. The report typed on A4 sized sheets and bound in the necessary format should be submitted after approved by the guide and endorsement of the Head of Department. The student has to deliver a seminar talk in front of the teachers of the department and his classmates. The Guide, based on the quality of work and preparation and understanding of the candidate, shall do an assessment of the seminar.

M.E.- (MECHANICAL ENGG). -II

7. MINI PROJECT

Teaching Scheme:	Examination Scheme:
Practical: --	Term work: --

A Mini Project based on the subjects studied during Semester-I and Semester-II, shall be undertaken and completed by the candidate during vacation after Semester-II. **The report of this project shall be submitted in the prescribed format at the beginning of Semester III.** It will be approved by the guide and endorsed by the Head of Department. **It will be assessed for term work during Semester III**, by the evaluation committee(*) appointed by the Head of the Department.

(*) Note: The evaluation committee shall consist of the Guide, one senior expert faculty member and the Head of the Department or his/her representative.

M.E.- (MECHANICAL ENGG)

Part II

Sem III

MINI PROJECT (Term Work)

Teaching Scheme:	Examination Scheme:
Practical: --	Term work: 50

Mini project will be assessed for term work , by the evaluation committee(*) appointed by the Head of the Department.

(*) Note: The evaluation committee shall consist of the Guide, one senior expert faculty member and the Head of the Department or his/her representative.

M.E.- (MECHANICAL ENGG)

Part II

Sem III

SEMINAR- III

Teaching Scheme:	Examination Scheme:
Practical: 1 Hour/ Week	Term Work: --
	Oral Examination: 50 Marks

Seminar - III shall be based on topic of the Dissertation Work. It may include literature review, required theoretical input, study and comparison of various approaches for the proposed dissertation work. The candidate shall prepare a report of about 25 pages. The report typed on A4 sized sheets and bound in the prescribed format shall be submitted after approval by the Guide and endorsement of the Head of Department.

M.E.- (MECHANICAL ENGG)

Part II

Sem III

DISSERTATION

The dissertation work to be carried out individually commences in the Semester III and extends through Semester IV. The topic of dissertation work should be related to the areas of developments in the field of Mechanical Engineering. Applications of computer as a tool for conceptualization, design, analysis, optimization, simulation of products / processes / mechanisms / systems, experimental study, etc. are to be encouraged and preferred.

SYNOPSIS APPROVAL

The Head of the Department shall appoint a committee comprising of the Guide and two experts to review and approve the synopses before submitting them to the University for approval. The candidates shall submit the synopsis to the University authorities for approval in the prescribed format before the due date.

M.E.- (MECHANICAL ENGG)

Part II

Sem III

DISSERTATION PHASE I

Teaching Scheme: Examination Scheme:

Practicals: 4 Hours/ Week Term Work: 50 marks

It shall include the problem definition, literature survey, approaches for handling the problem, finalizing the methodology for the dissertation work and design calculations / experimental design etc. A report of the work shall be submitted at the end of Semester III after approval by the Guide and endorsement of the Head of Department. It will be assessed for term work, by the evaluation committee(*) appointed by the Head of the Department, for appropriateness, sufficiency of contents and offer suggestions if any.

(*) Note: The evaluation committee shall consist of the Guide, one senior expert faculty member and the Head of the Department or his/her representative.

M.E.- (MECHANICAL ENGG)

Part II

Sem IV

DISSERTATION

Teaching Scheme:	Examination Scheme:
Practicals: 5 Hours/ Week	Term Work: 200 marks
	Oral Examination: 100 Marks

The candidate shall submit the detailed report as per the synopsis approved by the university, of the dissertation work in the prescribed format after approval by the Guide and endorsement by the Head of the Department. It will be assessed for term work by the evaluation committee(*)appointed by the Head of the Department, for completion of the proposed work.

(*) Note: The evaluation committee shall consist of the Guide, one senior expert faculty member and the Head of the Department or his/her representative.

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