**KERALA TECHNOLOGICAL UNIVERSITY**

**M.Tech. DEGREE COURSE**

**MACHINE DESIGN**

**KERALA TECHNOLOGICAL UNIVERSITY**

**M.Tech Machine Design**

**Semester : I**

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| **Exam Slot** | **Course No** | **Name** | **L** | **T** | **P** | **Internal Marks** | **End Semester Exam** | | **Credits** |
| **Marks** | **Duration (hrs)** |
| A | 08ME6011 | Advanced Engineering Mathematics | 4 | 0 | 0 | 40 | 60 | 3 | 4 |
| B | 08ME6021 | Advanced Mechanics of Solids | 3 | 0 | 0 | 40 | 60 | 3 | 3 |
| C | 08ME6031 | Theory of Vibrations | 3 | 0 | 0 | 40 | 60 | 3 | 3 |
| D | 08ME6041 | Design Engineering | 3 | 0 | 0 | 40 | 60 | 3 | 3 |
| E | 08ME6051 | Elective-1 | 3 | 0 | 0 | 40 | 60 | 3 | 3 |
| F | 08GN 6101 | Research Methodology | 0 | 2 | 0 | 100 | 0 | 0 | 2 |
| G | 08ME6071 | Seminar – I | 0 | 0 | 2 | 100 | 0 | 0 | 2 |
| H | 08ME6081 | Advanced Measurements Lab | 0 | 0 | 2 | 100 | 0 | 0 | 2 |

**Total Credits: 22**

**Elective - 1**

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| 08ME6051(A) | Fluid Power Control |
| 08ME6051(B) | Mechatronics System Design |
| 08ME6051(C) | Computer Aided Design |

**Semester : II**

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| **Exam Slot** | **Course No** | **Name** | **L** | **T** | **P** | **Internal Marks** | **End Semester Exam** | | **Credits** |
| **Marks** | **Duration (hrs)** |
| A | 08ME6012 | Advanced Machine design | 4 | 0 | 0 | 40 | 60 | 3 | 3 |
| B | 08ME6022 | Advanced Mechanisms Design and Simulation | 3 | 0 | 0 | 40 | 60 | 3 | 3 |
| C | 08ME6032 | Advanced FEA | 3 | 0 | 0 | 40 | 60 | 3 | 3 |
| D | 08ME6042 | Elective-2 | 3 | 0 | 0 | 40 | 60 | 3 | 3 |
| E | 08ME6052 | Elective-3 | 3 | 0 | 0 | 40 | 60 | 3 | 3 |
| F | 08ME6062 | Mini Project | 0 | 0 | 4 | 100 | 0 | 0 | 2 |
| G | 08ME6072 | CAD Lab | 0 | 0 | 2 | 100 | 0 | 0 | 2 |

**Total Credits: 19**

**Elective - 2**

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| 08ME6042(A) | Composite Materials |
| 08ME6042(B) | Tribology in Design |
| 08ME6042(C) | Experimental Stress Analysis |

**Elective - 3**

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| 08ME6052(A) | Optimization Techniques in Design |
| 08ME6052(B) | Vibrations Control and Condition Monitoring |
| 08ME6052(C) | Design of pressure vessels and Piping |

**Semester : III**

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| **Exam Slot** | **Course No** | **Name** | **L** | **T** | **P** | **Internal Marks** | **End Semester Exam** | | **Credits** |
| **Marks** | **Duration (hrs)** |
| A | 08ME7013 | Elective 4 | 3 | 0 | 0 | 40 | 60 | 3 | 3 |
| B | 08ME7023 | Elective 5 | 3 | 0 | 0 | 40 | 60 | 3 | 3 |
| C | 08ME7033 | Seminar- II | 0 | 0 | 2 | 100 | 0 | 0 | 2 |
| D | 08ME7043 | Project (Phase I) | 0 | 0 | 12 | 50 | 0 | 0 | 6 |

**Total Credits: 14**

**Elective - 4**

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| 08ME7013(A) | Fracture Mechanics and design |
| 08ME7013(B) | Computational Fluid Dynamics |
| 08ME7013(C) | Industrial Noise Control |

**Elective - 5**

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| 08ME7023(A) | Design of Experiments |
| 08ME7023(B) | Robotics |
| 08ME7023(C) | Computer Integrated Manufacturing |

**Semester : IV**

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| **Exam Slot** | **Course No** | **Name** | **L** | **T** | **P** | **Internal Marks** | **End Semester Exam** | **Credits** |
| **Viva Voce** |
| A | 08ME7014 | Project (Phase II) | 0 | 0 | 21 | 70 | 30 | 12 |

**Total Credits: 12**

**08ME6011 ADVANCED ENGINEERING MATHEMATICS**

Pre requisites: Nil **Credits: 4-0-0:4**

Year: **2015**

**Course objective:**

* To provide a better knowledge about the concepts like beta gamma functions, Tensor analysis and Integral transforms.
* To provide a better knowledge of problems relevant to partial differential equations and Integral equations.

**Syllabus:**

Beta Gamma functions ; Bessel functions; Recurrence relations and orthogonality property ; Tensor Analysis ; Laws of Transmations ; Integral Transforms ; Initial and Boundary value problems ; Integral Equations ; Relations between Integral and Differential equations ; Partial differential equations ; Conformal Transformations.

**Course outcome:**

By end of the course, the students will have a thorough knowledge about Integral, differential and partial differential equations.

The students will be able to solve the mathematical problems associated with Integral, differential and partial differential equations.

The students will be well versed with Beta gamma functions and conformal transformations.

**Text Books:**

1. Dr.B.S.Grewal, “Higher Engg. Mathematics”, Khanna Publishers, 2008.

2. Santhi Swaroop, “Integral equations”, Krishna Prakasan media.

3. N.P.Bali, “Higher Engineering Mathematics”, Lakshmi Publications, New Delhi,

2007.

**References:**

1. M.K.Venkataraman, “Higher Engineering Mathematics”, National Publishers

2. Sokol Nikof, “Tensor analysis”, John Wiley, Newyork, 1951.

3. Erwin Kreyzig, “Advanced Engineering Mathematics”, John Wiley, 1999.

4. Sneddon I.N., “Partial Differential Equations”, McGrawHill, 1957.

**COURSE PLAN**

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| **COURSE NO: 08ME6011 COURSE TITLE: ADVANCED ENGINEERING MATHEMATICS**  **(L-T-P : 4-0-0) CREDITS:4** | | |
| **MODULES** | **Contact**  **hours** | **Sem.Exam**  **Marks;%** |
| MODULE : 1  Beta Gamma functions – Elliptic integrals of all kinds, Bessel functions, recurrence relations, generating functions, Legendre’s equation and Legendre’s polynomials. Recurrence relations and orthogonality property. | 9 | 15 |
| MODULE : 2  Tensor Analysis - Range and summation conventions – Laws of transmations of covariant, Contra variant and mixed tensors, additions, multiplications, quotient rule etc. | 9 | 15 |
| **FIRST INTERNAL TEST** |  |  |
| MODULE : 3  Integral transforms – Laplace transforms – Fourier, Milline and henkel transforms inverse transforms-transforms of derivatives – solutions of initial and boundary value problems. | 9 | 15 |
| MODULE : 4  Integral Equations - Equations of ii kind - relation between integral and differential equations- solutions by transforms of derivatives - solutions of initial and boundary value problems. | 9 | 15 |
| **SECOND INTERNAL TEST** |  |  |
| MODULE : 5  Partial differential equations – The Plaff’s problem, parabolic, elliptic and hyperbolic equations, D’Alembert’s method. Canonical form, Characteristics, Green functions, Laplace equation in polar co-ordinates-solutions-application. | 10 | 20 |
| MODULE : 6  Conformal transformations-Schwarz- Christoffel transformations. | 10 | 20 |

**08ME6021 ADVANCED MECHANICS OF SOLIDS**

Pre requisites: Nil **Credits: 3-0-0:3**

Year: **2015**

**Course objective:**

* To impart knowledge of elasticity and plasticity
* To provide knowledge about types of co-ordinate systems, shear center and contact stresses

**Syllabus:**

Introduction to theory of elasticity; plane stress and plane strain; Differential equation of equilibrium, compactibility, biharmoic equation; Mohr’s circle; two dimensional problems in rectangular co-ordinates, Saint vanent’s principle; Two dimensional problems in polar co-ordinates; Pure bending of curved bars, rotating discs, stresses in circular discs; shear center; buckling of shafts; Thin rectangular plates; governing differential equation; Navier solution for rectangular plates carrying a uniformly distributed load; contact stresses ; Theory of plasticity; Von Mises and Tresca criteria for isotropic materials; introduction to viscoelasticity; Rheological model, Maxwell and kelvin model and for four element Maxwell- kelvin model.

**Course outcome:**

Students can able to understand the concept of theory of elasticity, pasticity, contact stress and co-ordinate system; also they can able to solve the problems of shear center, buckling of shafts by torsion.

**Text Books:**

1 S.Timoshenko & J.W.Goodier, “ Theory of Elasticity” , McGraw Hill, 2007.

2 S.P.Timoshenko, “ Theory of Plates & Shells” , McGraw Hill, 1958.

3 Seely & Smith, “Advanced Mechanics of Materials”, John Wiley, 1952.

**References:**

1 Filonenko & Borodic, “Theory of Elasticity “, Foreign Languages Publishing House,1965.

2 Fluggue.W, “Handbook of Engineering Mechanics”, McGraw Hill, 1962.

3 Prager W., “Introduction to Plasticity”, Oxford University Press, 1959.

4 Kachanov.L.M., “Foundations of Theory of Plasticity”,North – Holland Publishing Co., 1971.

5 Den Hartog, “Advanced Strength of Materials”, McGraw Hill, 1952.

**COURSE PLAN**

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| **COURSE NO: 08ME6021 COURSE TITLE: ADVANCED MECHANICS OF SOLIDS (L-T-P : 3-0-0) CREDITS:3** | | |
| **MODULES** | **Contact**  **hours** | **Sem.Exam**  **Marks;%** |
| MODULE : 1  Introduction to theory of Elasticity: Plane stress and Plane strain, Differential Equations of equilibrium, Boundary conditions, Compatibility, Stress function and Biharmonic equation. Mohr’s circle for three dimensions. | 7 | 15 |
| MODULE : 2  Two dimensional problems in rectangular co-ordinates: Applications to Polynomials is rectangular co-ordinates, Saint Venant’s principle. Two dimensional problems in Polar coordinates: General equations in Polar co-ordinates, Pure bending of curved bars, Strain components in polar co-ordinates, Rotating disks, Stresses in circular disks. | 7 | 15 |
| **FIRST INTERNAL TEST** |  |  |
| MODULE : 3  Shear center: Shear stress distribution and Shear center for thin walled open sections. Buckling: Buckling of shafts by Torsion and thin flat plates. | 7 | 15 |
| MODULE : 4  Thin rectangular plates: Governing differential equation, Boundary conditions – Navier solution for a rectangular plate carrying a uniformly distributed load. Thin spherical shell. Members stresses in shell and storage vessels shells and vessels of uniform strength. | 7 | 15 |
| **SECOND INTERNAL TEST** |  |  |
| MODULE : 5  Contact stresses: Problem of determining contact stresses, Assumptions, Expressions for principal stresses, Assumptions, Expressions for principal stresses, Examples. | 7 | 20 |
| MODULE : 6  Theory of Plasticity: Fundamental aspects of general inelastic behaviour. Structural metals under tension, compression combined stress-yield conditions, Von Mises and Tresca criteria for isotropic metals. Loading function. Introduction to Viscoelasticity: Rheological models, Maxwell model, Kelvin model and for four elements Maxwell-Kelvin model. | 7 | 20 |

**08ME6031 THEORY OF VIBRATIONS**

Pre requisites: Nil **Credits: 3-0-0:3**

Year: **2015**

**Course objective:**

* To impart knowledge of Characteristics of discrete systems components, Two degree of freedom systems and Transient Vibrations
* To provide knowledge about self-excited vibration and Vibration instrumentation

**Syllabus:**

Characteristics of discrete systems components; Analysis of un damped, damped, free and forced SDOF systems; types of damping; Rotating and revolving unbalance; transmissibility; Seismic instruments; Two degree of freedom systems; principal coordinates co-ordinate coupling transformation; Centrifugal pendulum absorber; Transient Vibrations; Laplace Transforms formulation; Shock isolation; Introduction to self-excited vibration; Mathematical criterion for stability, Instability caused by friction; Vibration instrumentation; shock measurements; calibration.

**Course outcome:**

Students can able to understand the concept of vibration and importance of damping, also they can able to solve the problems of two degree of freedom system.

**Text Books:**

1. Meirovitch L, “Elements of Vibration analysis”, Tata McGrawHill, 2007.
2. Den Hartog, “mechanical Vibrations”, Dover, 1985.
3. K.K.Pujara, “Vibration and Noise for Engineers”, Dhanapati Rai & Sons, 2004
4. Web address: http://nptel.ac.in/courses/112103112/

**References:**

1. Thomson W.T., “Theory of vibration with Applications”, Pearson, 1998.
2. Rangan, et al., “ Instrumentation devices and systems”. TMH, 1989.
3. S.S. Rao, “Mechanical Vibrations”, Pearson, 1992.

**COURSE PLAN**

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| **COURSE NO: 08ME6021 COURSE TITLE: THEORY OF VIBRATIONS (L-T-P : 3-0-0) CREDITS:3** | | |
| **MODULES** | **Contact**  **hours** | **Sem.Exam**  **Marks;%** |
| MODULE : 1  Characteristics of discrete systems components – equivalent springs and dampers .Analysis of undamped, damped, free and forced SDOF systems – logarithmic decrement damping factor – types of damping – frequency response – magnification factor | 7 | 15 |
| MODULE : 2  Rotating and revolving unbalance – Base excitation – transmissibility – Seismic instruments – Amplitude and phase distortion. Response to periodic excitation – square wave – saw tooth triangular and half sine wave – even and odd functions. | 7 | 15 |
| **FIRST INTERNAL TEST** |  |  |
| MODULE : 3  Two degree of freedom systems – normal modes and natural frequencies – principal coordinates co-ordinate coupling-transformation – Natural of Principal co-ordinates response to initial excitation – beat dynamic vibration absorbers – Centrifugal pendulum absorber – damped vibration absorber – orthodogonality of normal modes – idealized car-body  vibration. | 7 | 15 |
| MODULE : 4  Transient Vibrations – Impulse excitation, arbitrary excitation, Laplace Transforms formulation, Pulse excitation and rise time, Shock response spectrum, Shock isolation. | 7 | 15 |
| **SECOND INTERNAL TEST** |  |  |
| MODULE : 5  Introduction to self excited vibration, Mathematical criterion for stability, Instability caused by friction. Examples; Internal hysteresis of shafts and oil film lubrication, Galloping of electric transmission lines, Hunting of steam engine governors, Diesel- Engine fuel – injection valve, Vibration of turbines, Airplane wings flutter. | 7 | 20 |
| MODULE : 6  Vibration instrumentation – displacement, velocity and acceleration – sensors- electro dynamic and electromagnetic devices – strain gauge accelerometers – piezo electric accelerometers – digital accelerometers – signal conditioning – shock measurements –vibration exciters –calibration. | 7 | 20 |

**08ME6041 DESIGN ENGINEERING**

Pre requisites: Nil **Credits: 3-0-0:3**

Year: **2015**

**Course objective:**

**To give the students:**

* A foundation in the fundamentals of Design Engineering
* Practice in the analytical formulation of Design problems using different design theories and boundary conditions.
* An introduction to Industrial product design and their life cycles.

**Syllabus:**

Fundamental concepts and overview; Design considerations; Material selection; Functional design; Cost analysis; Design for wear and corrosion; Form design; Design consideration of rubber springs; Advanced shaft design; Thermal design; Reliability in design; Industrial product design; design optimization ; Creative design ; Conceptual design; Quality and Maintenance.

**Course outcome:**

Students have successfully complete this course will have demonstrated an ability to understand the basic requirements of design.

Make conceptual and preliminary design, select materials, carryout stress analysis and finalise the product design.

**Text Books:**

1. P.Orlov, Fundamentals of Machine Design, Volume I, II & III, Mir Publications.

2. Asimo, “Introduction to design”, Prentice Hall, 1962.

**References:**

1. M.F.Spotts, “Mechanical Design Analysis”, Prentice Hall, 1964.

2. Woodson T.T., “Introduction to Engineering Design” Mcgraw Hill, 1966.

3. Henry Edel, D.Jr., “Introduction to creative Design’, Prentice Hall, 1967.

**COURSE PLAN**

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| **COURSE NO: 08ME6021 COURSE TITLE : DESIGN ENGINEERING (L-T-P : 3-0-0) CREDITS:3** | | |
| **MODULES** | **Contact**  **hours** | **Sem.Exam**  **Marks;%** |
| MODULE : 1  Design considerations – materials selection, functional design, and cost analysis. Fatigue considerations in design – fatigue in materials – fracture mechanics approach to fatigue – theories of fracture nucleation and growth of fracture – creep in materials – laws of creep – estimated time to rupture – relaxation and creep in bending. | 7 | 15 |
| MODULE : 2  Design for wear and corrosion resistance - contact stresses – the plastic flow process- shape factor – spring back – residual stresses. | 7 | 15 |
| **FIRST INTERNAL TEST** |  |  |
| MODULE : 3  Form design - principles – effect of method of production, material, space, size and weight on form design. Design consideration of rubber springs, air springs and Belleville springs | 7 | 15 |
| MODULE : 4  Advanced shaft design – deflection of stepped shafts – variable cross-section shafts – conjugate beam and strain energy method. Design of high speed cams - kinematic design and dynamic design – polydyne cams. | 7 | 15 |
| **SECOND INTERNAL TEST** |  |  |
| MODULE : 5  Thermal stresses - addition of thermal and working stresses – methods of heat removal and decreasing thermal stresses – composite cylinder design for thermal stresses. Introduction to reliability in design – reliability function, failure data analysis, failure distribution function,  MTTF/MTBF, hazard rate and models methods, of improving reliability, reliability testing. | 7 | 20 |
| MODULE : 6  Systematic approach to design of engineering systems – problem definition – constraints – role of engineering design in the production, consumption cycle – design optimization –system reliability. Industrial product design - Creative design, ergonomics and aesthetic requirements – quality and maintainability considerations conceptual design. | 7 | 20 |

**08ME6051(A) FLUID POWER CONTROL**

Pre requisites: Nil **Credits: 3-0-0:3**

Year: **2015**

**Course objective:**

* To impart knowledge of fluid power, fluid systems and fluid control devices.
* To provide knowledge about pneumatic systems, circuits and their design.

**Syllabus:**

Fluid power fundamentals; operation principle of fluid power;Hydraulic cylinders; Classification and characteristics,Control Valves**;** Directional control valve , structure and operation of pilot , operated check valves and the directional control valves, Pressure control valves, Flow control valves, Cartridge valves.Hydraulic circuits**;** Rapid motion circuits, speed control circuits, synchronous circuits, sequential circuits, counter balance circuits and unloading circuits;Pneumatic circuits**;** Compressed air production and distribution, pneumatic control components;Design of circuits; Hydraulic circuit design for typical hydraulic systems, Pneumatic circuit design for and associated design calculations.

**Course outcome:**

Students can able to understand the concept of fluid power and pneumatic power, also they can able to design fluid and pneumatic systems with suitable circuits.

**Text Books:**

1. Pippengar, John J. and Koff, Richard M, “Fluid Power Controls” Mcgraw Hill, 1959.

2. Pippengar, John J. and Hicks, Tyler G, Industrial Hydraulics” McGraw Hill 1979.

**References:**

1. Kirshner, Joseph M, “Fluid amplifiers”, McGraw Hill, 1966.

2. Krishner, Joseph M. and Silas Katz, “Design Theory of Fluidic Components”,

Academic press, 1975.

3. Dr. Heinza Zoebl. Techn, “Fundamentals of Hydraulic Circuitry”, Iliffe, 1970.

1. Leskiewics H.J. and Zarhmba M, “Pneumatic and Hydraulic components and

instrumentations in automatic controls”, International Federation of Automatic

Control, 1980.

**COURSE PLAN**

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| **COURSE NO : 08ME6051 (A) COURSE TITLE : FLUID POWER CONTROL**  **(L-T-P : 3-0-0) CREDITS:3** | | |
| **MODULES** | **Contact**  **hours** | **Sem.Exam**  **Marks;%** |
| MODULE : 1  Fluid power fundamentals: Introduction – operation principle of fluid power –definitions, units, standards and symbols – advantages and disadvantages – applications in various fields | 6 | 15 |
| MODULE : 2  Hydraulic cylinders: Classification and characteristics - connection types and performance parameters – differential and float concepts – typical cylinder structure –ancillary hydraulic elements. | 6 | 15 |
| **FIRST INTERNAL TEST** |  |  |
| MODULE : 3  Control Valves: Directional control valve – structure and operation of pilot – operated check valves and the directional control valves – standard symbols for representing the elements – concepts of position and way – actuation mechanisms. Pressure control valves– operation – remote pressure adjustment of the pilot – operated pressure relief valve pressure reducing valve, sequence valve, counterbalance valve and pressure switch. Flow control valves – throttle characteristics of various orifices – flow regulating valve. Cartridge valves, Proportional valves and servo valves. | 8 | 20 |
| MODULE : 4  Hydraulic circuits: Rapid motion circuits, speed control circuits, synchronous circuits, sequential circuits, counter balance circuits and unloading circuits. Typical hydraulic system examples – movable platform system of modular machine tools and the hydraulic systems of truck cranes. | 7 | 15 |
| **SECOND INTERNAL TEST** |  |  |
| MODULE : 5  Pneumatic circuits: Compressed air production and distribution, pneumatic control components, examples of application including electro-pneumatic and hydro pneumatic controls. | 7 | 15 |
| MODULE : 6  Design of circuits: Hydraulic circuit design for typical hydraulic systems such as hydraulic press, movable platform of modular machine tools, truck cranes – design calculations. Pneumatic circuit design for and associated design calculations. | 8 | 20 |

**08ME6051 (B) MECHATRONICS SYSTEM DESIGN**

Pre requisites: Nil **Credits: 3-0-0:3**

Year: **2015**

**Course objective:**

**To give the students:**

* A foundation in the fundamentals of Mechatronics system.
* Practice in the programming of Microprocessor and Programming Logic Controller (PLC)
* An introduction to the types of sensors and transducers used in Mechatronic system.

**Syllabus:**

Introduction to Mechatronics; Control system; Sensors and Transducers; Signal Processing; Servo Systems; Microprocessor; Programming of 8085 microprocessor; Interfacing D/A and A/D converters; Programming Logic Controllers; Data handling; Selection of PLC.

**Course outcome:**

Students have successfully complete this course will have demonstrated an ability to understand the basic fundamentals of Mechatronics system.

They will be familiarize with PLC and microprocessor programming and be able to write program for 8085 microprocessor and Programming logic controllers.

**Text Books:**

1. Michel B.Histand and David G.Clciatore, “Introudction to Mechatronics and

Measurement Systems”, MCGraw-Hill international Editions, 1999.

2. Ramesh.S, Gaonkar, “Microprocessor Architecture, Progarmming and Applications,

“Wiley Eastern, 1998.

**References:**

1. Bradley, D.A.Dawson, D, Buru, N.C and Loader, A.J., “Macaronis”, Chapman and

Hall, 1993.

2. Lawrence J.Kamm, “Uderstanding Electro – Mechanical Engineering, An introduction

to Mechatronics,” Prentice – Hall, 2000

3. Ghosh, P.K. and Sridhar, P.Or 0000 to 8085, “Introduction to Microprocessors for

Engineers and Scientists”, Second Edition, Prentice Hall, 1995.

**COURSE PLAN**

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| **COURSE NO: 08ME6051 (B) COURSE TITLE : MECHATRONICS SYSTEM DESIGN (L-T-P : 3-0-0) CREDITS:3** | | |
| **MODULES** | **Contact**  **hours** | **Sem.Exam**  **Marks;%** |
| MODULE : 1  Introduction to Mechatronics – Systems – Mechatronics in Products – Measurement systems – Control Systems – Traditional design and Mechatronics Design. | 6 | 15 |
| MODULE : 2  SENSORS AND TRANSDUCERS -Introduction – Performance Terminology – Displacement, Position and Proximity –Velocity and Motion – Fluid pressure | 7 | 15 |
| **FIRST INTERNAL TEST** |  |  |
| MODULE : 3  Temperature sensors – Light sensors – selection of sensors – signal processing – servo systems. | 6 | 15 |
| MODULE : 4  MICROPROCESSORS IN MECHATRONICS -Introduction – Architecture – Pin configuration – Instruction set – Programming of Microprocessors using 8085 instructions – interfacing input and output devices –  interfacing D/A converters and A/D converters – Applications | 8 | 20 |
| **SECOND INTERNAL TEST** |  |  |
| MODULE : 5  Temperature control –Stepper motor control – Traffic light controller | 7 | 15 |
| MODULE : 6  PROGRAMMABLE LOGIC CONTROLLERS - Introduction – Basic structure – input / Output processing – Programming – Mnemonics Timers, Internal relays and counters – Data handling – Analog input / output – selection of  PLC | 8 | 20 |

**08ME6051 (C) COMPUTER AIDED DESIGN**

Pre requisites: Nil **Credits: 3-0-0:3**

Year: **2015**

**Course objective:**

* To get knowledge of computer integrated design and manufacturing.
* To provide knowledge about part programming and part modelling.

**Syllabus:**

Role of computers in design and manufacture; Drafting system, Surface Modeling ; 3 D surface design, composite curves and splines, Solid Modeling ; Techniques of modeling ; Data structure for solid models;Computer animation**;** animation systems, types and techniques, design applications, computer graphics standard;Fundamentals of FEM; Weighted residual technique ; Variational approach element types ; plane, triangular, quadrilateral, curved isoperimetric elements, 3 D elements; CAM **-** Introduction to part programming and manufacturing; Part production cycle; Manufacturing systems; Manufacturing process ; Process planning ; Part programming.

**Course outcome:**

Students can able to understand the recent techniques in computer aided manufacturing and different types of codes for part programming.

**Text Books:**

1. CB.Besant and C.W.K. Lui, “Computer aided design and manufacture”

Affiliated east west, NIDNA 1988.

2. J.Rooney and P.Steadman, “Principles of computer aided design “Prentice Hall, INDIA

1998.

3. M.P.Groover and E.W.Zimmers, “CAD/CAM –Computer Aided Design and

Manufacture”, *Prentice* – Hall, India, 1984

**References:**

1. Vera B Anand, “Computer Graphcis and Geometric Modeling, for Engineers”, John Wiley, New Delhi, 2000

2. C.S.Krishnamoorthy, “Finite Element Analysis”, Tata McGraw Hill, 1994

**COURSE PLAN**

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| **COURSE NO: 08ME6051 (C) COURSE TITLE : Computer Aided Design (L-T-P : 3-0-0) CREDITS:3** | | |
| **MODULES** | **Contact**  **hours** | **Sem.Exam**  **Marks;%** |
| MODULE : 1  Introduction – role of computers in design and manufacture. Wire – frame modeling –representation and data structure | 6 | 15 |
| MODULE : 2  Drafting system – configuration, function and facilities – parametric representation – examples of drafting systems. | 6 | 15 |
| **FIRST INTERNAL TEST** |  |  |
| MODULE : 3  Surface Modeling - 3 D surface design – composite curves and splines, composite surface - application to computer aided manufacture – Solid Modeling – techniques of modeling – data structure for solid models | 7 | 15 |
| MODULE : 4  Computer animation, animation systems, types and techniques, design applications, computer graphics standard – databases for CAD product at a exchange (IGES), graphical kernel system (GKS) and programmer’s hierarchical interactive graphics systems (PHIGS) | 7 | 15 |
| **SECOND INTERNAL TEST** |  |  |
| MODULE : 5  Fundamentals of FEM - weighted residual technique – variational approach element types –plane, triangular, quadrilateral, curved isoperimetric elements, 3 – D elements, axisymmetric elements, automatic mesh generation – pre and post processors application to design. | 8 | 20 |
| MODULE : 6  CAM - Introduction to part programming and manufacturing – Part production cycle – manufacturing systems – manufacturing process – process planning - Part programming – Tool path generation and verification – Design and Engineering applications. | 8 | 20 |

**08GN6101 RESEARCH METHODOLOGY**

Pre requisites: Nil **Credits: 0-2-0:2**

Year: **2015**

**Course objective:**

**To give the students:**

* A foundation in the fundamentals and formulation of Research tasks.
* Analysis of the measured output parameters using Analysis of Variance (ANOVA) method.
* An introduction to types of report and to develop the skill of Report writing.

**Syllabus:**

Research concepts and formulation of Research tasks; Motivation types of Research; Research- Descriptive, conceptual, theoretical and experimental; Literature Review - Importance and Method; Cause-Effect Relations; Critical analysis of previously generated facts; Prioritization of research; Mathematical modelling and simulation; Analysis of Results; Report writing; Writing research papers for publication; Landscape of creativity; Collective creativity.

**Course outcome:**

Students have successfully complete this course will have demonstrated an ability to understand the basic fundamentals of Research tasks.

They will be able to analyse the measured output response parameters using Analysis of Variance.

They will be well versed with the skill of Report writing

**Text Books:**

1. C.R.Kothari, “Research Methodology” Wiley Eastern Ltd., New Delhi.

2. Douglas Montgomery, “Design of Experimens”, John Wiley, 2004.

**References:**

1. Cochran and Cocks, “Experimental Design” John Wiley.

2. John W.Best and James V.Khan, “Research in Education”, PHI Publication

3. Adler and Granovky, “Optimization of Engineering Experiments” Mir Publication

4. S.S.Rao, “Optimization theory, and applications”, Wiley Eastern Ltd., New Delhi

**08ME6071 SEMINAR - I**

**Credit:0-0-2:2 Year: 2015**

Each student shall prepare a seminar paper on any topic of interest related to the core /

elective courses being undergone in the first semester of the M.Tech programme. He/she shall get the paper approved by the Programme Coordinator/Faculty Members in the concerned area of specialization and shall present it in the class in the presence of Faculty in charge of seminar class. Every student shall participate in the seminar. Grade will be awarded on the basis of the student’s paper, presentation and his/her participation in the seminar.

Goals: This course is designed to improve written and oral presentation skills and to develop confidence in making public presentations, to provide feedback on the quality and appropriateness of the work experience, and to promote discussions on design problems or new developments or ethical and safety issues in the workplace.

**08ME6081 ADVANCED MEASUREMENTS LAB**

**Credits: 0-0-2: 2 Year: 2015**

**List of Experiments**

1. Preparation and calibration of Photo elastic sheets

2. Preparation of Photo elastic models like Discs, Beams and Columns

3. Stress determination for different models having regular shapes, loaded conventionally, and comparison, of result with theoretical values.

4. Measurement of strains for different shapes, by different arrangements of strain gauges

5. Determination & verification of natural frequency of Tran serve vibration of beams with different end conditions.

6. Determination and verification of Logarithmic Decrement of a damped system.

7. Determination and verification of Displacement, Velocity, Acceleration and phase lag of forced vibration systems.

8. Vibration signature analysis of different existing machines such as Lathe, Grinder, Blower etc.

**SEMESTER 2**

**08ME 6012 ADVANCED MACHINE DESIGN**

Pre requisites: Nil **Credits: 3-0-0: 3**

Year: **2015**

**Course objective:**

**To give the students:**

* A foundation in the fundamentals of Advanced Machine Design.
* Practice in the analytical formulation of Advanced Design problems using different methodologies.
* An introduction to failure of mechanical components subjected to fatigue load.

**Syllabus:**

Modes of mechanical failure; Review of failure theories; Introductory concepts of fatigue of materials; Fatigue design methods; Fatigue Mechanisms; Fatigue testing; General S-N behaviour; Mean stress effects ; Fatigue life estimation using S-N approach ; LEFM concepts; Regression analysis of fatigue data ; Spectrum loads and cumulative damage theories ; Cycle counting methods ; Surface geometry ; Surface friction and wear.

**Course outcome:**

Students have successfully completed this course will an ability to understand different failure modes of mechanical components.

They will be in the position to understand fatigue failure of machine components

They will be able to estimate fatigue life and predict the component life in use.

**Text Books:**

1. Metal Fatigue in engineering, Ralph l. Stephens, Ali Fatemi, Robert.R. Stephehs,

Henry O.Fuchs, John wiley Newyork, Secondedition.2001.

2. Failure of Materials in Mechanical Design, Jack.A.Collins, JohnWiley, Newyork

1992.

**References:**

1. Fatigue of Materials, S.Suresh, Cambridge University Press, Cambridge, U.K

2. Fundamentals of Metal Fatigue Analysis, Julie.A.Benantine Prentice Hall, 1990.

3. Fatigue and Fracture, ASM Hand Book, Vol 19, 2002.

**COURSE PLAN**

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| **COURSE NO: 08ME 6012 COURSE TITLE : ADVANCED MACHINE DESIGN (L-T-P : 3-0-0) CREDITS:3** | | |
| **MODULES** | **Contact**  **hours** | **Sem.Exam**  **Marks;%** |
| MODULE : 1  INTRODUCTION AND FATUGUE OF MATERIALS -Role of failure prevention analysis in mechanical design, Modes of mechanical failure, Review of failure theories for ductile and brittle materials including Mohr’s theory and modified Mohr’s theory, Numerical examples. | 9 | 15 |
| MODULE : 2  Introductory concepts, High cycle and low cycle fatigue, fatigue design models, Fatigue design methods, Fatigue design criteria, Fatigue testing, Test methods and standard test specimens, Fatigue fracture surfaces and macroscopic features, fatigue mechanisms and microscopic features. | 9 | 15 |
| **FIRST INTERNAL TEST** |  |  |
| MODULE : 3  STESS-LIFE (S-N) APPROACH AND STRAIN-LIFE (-N) APPROACH -S-N curves, Statistical nature of fatigue test data, General S-N behaviour, Mean stress effects, different factors influencing S-N behaviour, S-N curve representation and approximations, Constant life diagrams, Fatigue life estimation using S-N approach. Monotonic stress-strain behaviour, Strain controlled test methods, Cyclic stress-strain behaviour,  Strain based approach to life estimation, determination of strain life fatigue properties, mean stress effects, Effect of surface finish, Life estimation by S-N approach. | 9 | 15 |
| MODULE : 4  LEFM APPROACH AND STATUSTUCAL ASPECTS OF FATIGUE -LEFM concepts, Crack tip plastic zone, Fracture toughness, Fatigue crack growth, Mean stress effects, Crack growth life estimation. Definitions and quantification of data scatter, Probability distributions, Tolerance limits,  Regression analysis of fatigue data, Reliability analysis, Problems using the Weibull distribution. | 9 | 15 |
| **SECOND INTERNAL TEST** |  |  |
| MODULE : 5  FATIGUE FROM VARIABLE AMPLITUDE LOADING - Spectrum loads and cumulative damage, Damage quantification and the concepts of Damage fraction and accumulation, Cumulative damage theories, Load interaction and sequence effects, Cycle counting methods, Life estimation using stress life approach. Isoperimetric elements, 3 – D elements, axisymmetric elements, automatic mesh generation – pre and post processors application to design. | 10 | 20 |
| MODULE : 6  SURFACE FAILURE - Introduction, Surface geometry, Mating surface, Friction, Adhesive wear, Abrasive wear, Corrosion wear, Surface fatigue spherical contact, Cylindrical contact, General contact,  Dynamic contact stresses, Surface fatigue strength. | 10 | 20 |

**08ME 6022 ADVANCED MECHANISMS DESIGN AND SIMULATION**

Pre requisites: Nil **Credits: 3-0-0:3**

Year: **2015**

**Course objective:**

* To understand the fundamentals of kinematics and degree of freedom of different mechanisms
* To provide knowledge in position, velocity and acceleration analysis of simple and plane complex mechanisms
* To provide knowledge in different synthesis of mechanisms
* To study about dynamics of mechanisms, spatial mechanisms and robotics

**Syllabus:**

Review of fundamentals of kinematics – mobility analysis –formation of one D.O.F- Position Analysis – velocity and acceleration Analysis –Equations of graphical

Constructions –different synthesis of mechanisms-cam profile-static, inertia, shaking force and kinetostatic analysis-robotics

**Course outcome:**

Students can able to understand the concept of degree of freedom and the kinematics fundamentals. Also they have obtained a very good knowledge in different analysis and synthesis of different mechanisms. Their design and drafting skills will improve by using modern software’s.

**Text Books:**

1. Sandor G.N., and Erdman A.G., “Advanced Mechanism Design Analysis and

Synthesis”, Prentico Hall, 1984.

2. Shigley, J.E., and Uicker, J.J., “Theory of Machines and Mechanisms”, McGraw Hill,

1995.

**References:**

1. AmitabhaGhosh and Asok Kumar Mallik, “Theory of Mechanism and Machines”,

EWLP, Delhi, 1999.

2. Nortron R.L., “Design of Machinery”, McGraw Hill, 1999.

3. Kenneth.J, Waldron, Gray L.Kinzel, “Kinematics, Dynamics and Design of

Machinery”, John Wiley-sons, 1999.

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| **COURSE NO:08ME 6022 COURSE TITLE : ADVANCED MECHANISMS DESIGN AND SIMULATION (L-T-P : 3-0-0) CREDITS:3** | | |
| **MODULES** | **Contact**  **hours** | **Sem.Exam**  **Marks;%** |
| MODULE : 1  INTRODUCTION - Review of fundamentals of kinematics – mobility analysis –formation of one D.O.F. multi loop kinematic chains – Network formula – Gross motion concepts. | 6 | 15 |
| MODULE : 2  KINEMATIC ANALYSIS - Position Analysis – Vector loop equations for four bar, slider crank, inverted slider crank, geared five bar and six bar linkages – Analytical methods for velocity and acceleration Analysis – four bar linkage jerk analysis – Plane complex mechanisms. | 6 | 15 |
| **FIRST INTERNAL TEST** |  |  |
| MODULE : 3  PATH CURVATURE THEORY - Fixed and moving centrodes – inflection circle – Euler Savary equation – graphical constructions – cubic of stationary curvature. | 7 | 15 |
| MODULE : 4  SYNTHESIS OF MACHANISMS - Type synthesis – Number synthesis – Associated Linkage Concept – Dimensional synthesis – function generation, path generation, motion generation – Graphical methods – cognate linkages – Coupler curve synthesis – design of six-bar mechanisms – determination of optimum size of Cams. | 7 | 15 |
| **SECOND INTERNAL TEST** |  |  |
| MODULE : 5  DYNAMICS OF MECHNISMS- Static force analysis with friction – Inertia force analysis – combined static and inertia force analysis, shaking force, Kinetostatic analysis – Introduction to force and moment balancing of linkages | 8 | 20 |
| MODULE : 6  Kinematic Analysis of Spatial RSSR mechanism – Denavit – Hartenberg  Parameters – Forward and inverse Kinematics of Robotic Manipulators. Study and use of Mechanism using Simulation Soft-ware packages. | 8 | 20 |

**08ME 6032 ADVANCED FEA**

Pre requisites: Nil **Credits: 3-0-0:3**

Year: **2015**

**Course objective:**

* To get knowledge of bending of plates and shells, non-linear and dynamic problems
* To provide knowledge about fluid mechanics and heat transfer problems and error estimates and adaptive refinement methods.

**Syllabus:**

Bending of Plates and Shells; conforming and Non-Conforming Elements; iterative Techniques; Material non-linearity; Elasto Plasticity; Plasticity; Visco Plasticity; Geometric Non linearity; Free, Transient and forced Response; lterative Technique – Houbolt, Wilson, Newmark – Methods; Governing Equations of Fluid Mechanics ; Inviscid and Incompressible Flow; Slow Non-Newtonian Flow; Metal and Polymer Forming; Navier Stokes Equation; Error norms and convergence rates; Adaptive refinement.

**Course outcome:**

Students can able to understand and solve different non-linear problems, fluid mechanics and heat transfer problems using different FEA iterative techniques.

**Text Books:**

1. Zienkiewicz, O.C. and Taylor, R.L., “The Finite Element Method”, Fourth Edition,

Volumes 1 &2, McGraw Hill International Edition, Physics Services, 1991.

1. Cook R.D., “Concepts and Applications of Finite Element Analysis”, John Wiley and

Sons Inc., Newyork, 1989.

**References:**

1. Bather K.J., “Finite Element Procedures in Engineering Analysis”, Prentice Hall, 1990.
2. Web address: http://nptel.ac.in/courses/112106130/

**COURSE PLAN**

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| **COURSE NO: 08ME 6032 COURSE TITLE : ADVANCED FINITE ELEMENT ANALYSIS (L-T-P : 3-0-0) CREDITS:3** | | |
| **MODULES** | **Contact**  **hours** | **Sem.Exam**  **Marks;%** |
| MODULE : 1  BENDING OG PLATES AND SHELLS - Review of Elasticity Equations – Bending of Plates and Shells – Finite Elements-conforming and Non Conforming Elements-C0 and C1 Continuity Elements – Application and Examples. | 6 | 15 |
| MODULE : 2  NON-LINEAR PROBLEMS - Introduction- lterative Techniques – Material non-linearity – Elasto Plasticity, - Plasticity – Visco Plasticity – Geometric on linearity – large displacement Formulation – Application in  Metal Forming Process and Contact Problems. | 7 | 15 |
| **FIRST INTERNAL TEST** |  |  |
| MODULE : 3  DYNAMIC PROBLEM -Direct Formulation – Free, Transient and forced Response – solution Procedures Subspace lterative Technique – Houbolt, Wilson, Newmark – Methods – Examples. | 6 | 15 |
| MODULE : 4  FLUID MECHANICS- Governing Equations of Fluid Mehanics – Inviscid and Incompressible Flow – Potential Formulations – Slow Non-Newtonian Flow | 7 | 15 |
| **SECOND INTERNAL TEST** |  |  |
| MODULE : 5  HEAT TRANSFER- Metal and Polymer Forming – Navier Stokes  Equation – Steady and Transient Solution. | 8 | 20 |
| MODULE : 6  Error norms and convergence rates – h-refinement with adaptivity – Adaptive refinement. | 8 | 20 |

**08ME 6042 (A) COMPOSITE MATERIALS**

Pre requisites: Nil **Credits: 3-0-0:3**

Year: **2015**

**Course objective:**

* To get knowledge about composite materials and its fabrication process
* To provide knowledge about mechanical properties, analysis of composite materials and design considerations

**Syllabus:**

Introduction; Types of fibers and matrices; characteristics of fibers and matrices; smart materials; mechanics and performance, reinforced lamina, interlaminar stresses; fatigue and impact properties, manufacturing processes ,analysis of composite materials, design; failure predictions; laminate design considerations; bolted and bonded joints design.

**Course outcome:**

Students can able to understand about composite materials, fabrication process, mechanics and analysis of composite materials.

**Text Books:**

1 Mallick, P.K., “Fiber-Reinforced Composites: Materials, manufacturing and Design”,Maneel Dekker Inc, 1993.

**References:**

1 Halpin, J.C., “Primer on Composite Materials, Analysis”, Techomic Publishing Co.,1984.

2 Agarwal, B.D., and Borutman L.J., “Analysis and Performance of Fiber Composites”,John Wiley and Sons, 1990.

3 Mallick, P.K. and Newman, S., “Composite Materials Technology: Processes and Properties”, Hansen Publisher, 1990

**COURSE PLAN**

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| **COURSE NO: 08ME 6042 (A) COURSE TITLE : COMPOSITE MATERIALS (L-T-P : 3-0-0) CREDITS:3** | | |
| **MODULES** | **Contact**  **hours** | **Sem.Exam**  **Marks;%** |
| MODULE : 1  INTRODUCTION - Definition – Need – General characteristics, Applications – Fibers: Glass, Carbon, Ceramic and Aramid fibers -Matrices: Polymer, Graphite, Ceramic and Metal Matrices –  Characteristics of fibers and matrices – Smart materials – Types and Characteristics. | 7 | 15 |
| MODULE : 2  MECHANICS AND PERFORMACE -Characteristics of Fiber-reinforced Lamina-Laminates-Interlaminar stresses-Static Mechanical Properties – Fatigue and impact Properties – Environmental effects – Fracture Behavior and Damage Tolerance. | 7 | 15 |
| **FIRST INTERNAL TEST** |  |  |
| MODULE : 3  MANUFACTURING - Bag Moulding – Compression Moulding – Pultrusion-Filament, Winding – Other Manufacturing Processes – Quality Inspection methods. | 6 | 15 |
| MODULE : 4  Stress Analysis of Laminated Composites Beams, Plates and Shells – Vibration and Stability Analysis | 6 | 15 |
| **SECOND INTERNAL TEST** |  |  |
| MODULE : 5  Reliability of Composites – Finite Element Method of Analysis – Analysis of Sandwich structures. | 8 | 20 |
| MODULE : 6  DESIGN - Failure Predictions – Laminate Design Consideration – Bolted and Bonded Joints Design Examples | 8 | 20 |

**08ME 6042 (B) TRIBOLOGY IN DESIGN**

Pre requisites: Nil **Credits: 3-0-0:3**

Year: **2015**

**Course objective:**

* To impart knowledge of lubrication and friction.
* To provide knowledge of bearings and their applications in space and automotive domains.

**Syllabus:**

Friction – mechanism of friction, measuring friction, equations and models in friction; Wear – Types, mechanism, mapping, measurements, wear resistance materials ; Surface treatment, surface modifications and surface coatings; Hydrodynamic lubrication, Hydrostatic lubrication; Reynold’s equation; Journal bearings and hydrostatic bearing design; Bearing geometry and kinematics, load rating and life prediction, torque calculation, temperature analysis, endurance testing and failure analysis; Liquid and solid lubricants; Principles of Aerospace eccentric bearing test mechanism; Engine Tribology, Tribology in manufacturing.

**Course outcome:**

Students will be able to understand the concept of Tribology and importance of lubrication and bearings. They will be able to design bearings and predict their life and do the failure analysis. Also students can apply tribology concepts in space and automotive applications.

**Text Books:**

1. Cameron, A “Basic Lubrication Theory”, Ellis Herward Ltd. UK 1981
2. Hulling.J. (Editor) “Principles of Tribology”, MacMillam, 1984
3. Williams.J.A” Engineering Triboogy”, Oxford University Press, 1994.

**References:**

1. Neale, M.J.”Tribology Handbook”, Butterworth Heineman, 1995
2. Bharath Bhushan, “Modern Tribology Handbook”VBol – I & II.

**COURSE PLAN**

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| **COURSE NO: 08ME 6042 (B) COURSE TITLE : TRIBOLOGY IN DESIGN (L-T-P : 3-0-0) CREDITS:3** | | |
| **MODULES** | **Contact**  **hours** | **Sem.Exam**  **Marks;%** |
| MODULE : 1  Topography of surfaces – Surfaces features – Experimental Determinations of surface structure – Chemical analysis of surface – surface effects in Tribology – Analysis of surface roughness- measurements of surface roughness. | 6 | 15 |
| MODULE : 2  Friction – mechanism of friction, measuring friction, equations and models in friction - friction properties of metallic and non metallic materials, friction in extreme conditions. Wear – Types, mechanism, mapping, measurements, wear resistance materials – surface treatment, surface modifications and surface coatings. Computer simulations of friction, lubrication and wear. | 6 | 15 |
| **FIRST INTERNAL TEST** |  |  |
| MODULE : 3  Lubrication Theory- Lubricants – selection criteria – lubrications regimes – Hydrodynamic, elasto and plasto hydrodynamic lubrication, basis equations, Reynold’s equation, energy equation, boundary lubrication, boundry lubrication films and its properties. Hydrostatic lubrication – Gas lubrication. | 7 | 15 |
| MODULE : 4  Design of Fluid Film Bearing- Dynamic analysis of hydrodynamic bearing performance, trust and journal bearings – full partial, fixed and pivoted – mass flow, rate, friction, power loss, heat and temperature difference, dynamic loads, oil film thickness, stiffness or squeeze and film and dynamic co-efficient – hydrostatic bearing design. | 7 | 15 |
| **SECOND INTERNAL TEST** |  |  |
| MODULE : 5  Industrial Components and systems Silder bearings – self acting finite bearing, failure modes, materials rolling element bearings – Types, contact machines, bearing internal load distribution, lubrication – bearing geometry and kinematics, load rating and life prediction, torque calculation, temperature analysis, endurance testing and failure analysis. | 8 | 20 |
| MODULE : 6  Space and Automotive Tribology- Introduction – Mechanism, Components, liquid and solid lubricants, accelerated testing and life testing of space mechanism. Principles of Aerospace eccentric bearing test mechanism. Engine Tribology – importance, lubrication regimes, engine bearing, wheel bearing, and tire. Mechanics of load transfer – contact area and normal pressure distribution, brakes, effect of  service on engine oil properties. Tribology in manufacturing – macro and micro tribology of MEMS materials. Technologies for machinery diagnosis and prognosis. | 8 | 20 |

**08ME 6042 (C) EXPERIMENTAL STRESS ANALYSIS**

Pre requisites: Nil **Credits: 3-0-0:3**

Year: **2015**

**Course objective:**

* To impart knowledge of stress analysis
* To provide knowledge about vibration instruments, acoustics, non destructive testing methods etc.

**Syllabus:**

Forces And Strain Measurement**;** strain Gauge, Principle, Types, Performance and Uses. Photo Elasticity, Principle andApplication, Morie Fringe, Electronic Load Cells,Proving Rings, Calibration of Testing Machines. Vibration measurements;Characteristics of structural vibrations, LVDT, vibration meter, seismograpohs, Vibration analyzer, display and recording of signals, digital data acquisition systems.Acoustics and wind flow measures; Principles of pressure and flow measurements, wind tunnel structural analysis, structural modelling and model analysis. Distress measurements; diagnosis of distress in structure, measurements, corrosion of Reinforcement in concrete, damage. Non destructive testing methods; Load testing on structures, building, bridges and towers, Emission ultrasonic testing principles and application.

**Course outcome:**

Students can able to understand the concept of strain measurement, various instruments for measuring vibration, distress measurements and non destructive testing methods

**Text Books:**

1. L.S.Srinath et al, “Experimental Stress Analysis”, TATA mcgraw Hill Company, New

Delhi, 1984

2. JW Dalley and WF Riely,” Experimental Stress Analysis”, MC Graw Hill BookCompany

N.Y. 1991

**References:**

1 Sadhu Singh, “ Experimental Stress Analysis” , Khanna Publishers, New Delhi, 1996.

2. R.S.Sirohi, HC Radhakrishna,” Mechanical Measurements”, New AgeInternational(P)

Ltd. 1997

3. F.KGaras, J.L. Clarke and GST Armer, “Structural Assessment”, Butterworth London,

1987

4. D.E.Bray & R.K.Stanley. “ Non – destructive Evaluation””, MC Graw Hill Publishinig

Company, N.Y.1989.

**COURSE PLAN**

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| **COURSE NO: 08ME 6042 (C) COURSE TITLE : EXPERIMENTAL STRESS ANALYSIS (L-T-P : 3-0-0) CREDITS:3** | | |
| **MODULES** | **Contact**  **hours** | **Sem.Exam**  **Marks;%** |
| MODULE : 1  Strain gauge, principle, types, performance and uses. Photo elasticity – principle and application – morie Fringe | 6 | 15 |
| MODULE : 2  Hydraulic jacks and pressure gauges – Electronic load cells – Proving Rings – Calibration of Testing Machines | 6 | 15 |
| **FIRST INTERNAL TEST** |  |  |
| MODULE : 3  VIBRATION MEASUREMENTS- 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. | 7 | 15 |
| MODULE : 4  ACOUSTICS AND WIND FLOW MEASURES- Principles of Pressure and flow measurements – pressure transducers – sound level meter – venturimeter and flow meter - wind tunnel and its use in structural analysis – structural modeling – direct and indirect model analysis. | 7 | 15 |
| **SECOND INTERNAL TEST** |  |  |
| MODULE : 5  DISTRESS MEASUREMENTS- Diagnosis of distress in structure – crack observation and measurements – corrosion of reinforcement in concrete – Half – cell, construction and use – damage assessment – controlled blasting for demolition. | 8 | 20 |
| MODULE : 6  NON DESTRUCTIVE TESTING METHODS- Load testing on structures, building, bridges and towers – Rebound Hammer – Acoustic emission – ultrasonic testing principles and application – Holography – use of laser for structural testing – Brittle Coating. | 8 | 20 |

**08ME 6052 (A) Optimization Techniques in Design**

Credit: 3-0-0:3

**Pre-requisites**:- Nil Year: 2015

**Course Objective:-**

* To provide the basic knowledge of optimization techniques and optimal output.
* Design optimization for achieving best result compared with conventional design.

**Syllabus:**

General Characteristics of mechanical elements; Optimum design principles of optimization; Classification of optimization problem; Unconstrained optimization and Constrained optimization; Single variable and multivariable optimization Techniques; Golden section, pattern and gradient search methods and interpolation methods; Equality and Inequality constraints like indirect methods using penalty function; Lagrange multipliers; Geometric programming; Genetic algorithms.

**Course Outcome:**

To know the mechanical elements and optimum design principles of optimization. In design field optimization plays optimal role compared to conventional design. Applications of optimization are large with multi-disciplinary field.

**Text Book:**

1. Kalyanamody Deb, “Optimization for Engineering design algorithms and examples” Prentice Hall of India Pvt 1995

**Reference Book:**

1 Singiresu.S.Rao., “Engineering Optimization Theory and Practice” New Age International (P) Limited, Publishers 1996.

1. Johnson Ray.C., “Optimum design of mechanical elements” Wiley, John & Sons, 1990
2. Goldberg, DE “Genetic algorithms in search, Optimization and Machine: Barmen, Addison – Wesely, New York 1989.
3. Saravanan.R, “Manufacturing Optimization through intelligent techniques”, Taylor and Francis Publications, CRC Press. 2006.

**COURSE PLAN**

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| **COURSE NO: 08ME 6052 (A) COURSE TITLE : OPTIMIZTION TECHNIQUES IN DESIGN (L-T-P : 3-0-0) CREDITS:3** | | |
| **MODULES** | **Contact**  **hours** | **Sem.Exam**  **Marks;%** |
| MODULE : 1  INTRODUCTION- General Characteristics of mechanical elements, adequate and optimum design, principles of optimization, formulation of objective function, design constraints – Classification of optimization problem. | 6 | 15 |
| MODULE : 2  UNCONTRAINED OPTIMIZATION- Single variable and multivariable optimization, Techniques of unconstrained minimization –Golden section, pattern and gradient search methods – interpolation methods | 6 | 15 |
| **FIRST INTERNAL TEST** |  |  |
| MODULE : 3  CONTRAINED OPTIMIZATION- Optimization with equality and inequality constraints – indirect methods using penalty function, Lagrange multipliers, Geometric programming – Constrained mixed inequality and Unconstrained minimization, Genetic algorithms. | 7 | 15 |
| MODULE : 4  STATIC APPLICATIONS-Structural applications – Design of simple truss members. Design applications | 7 | 15 |
| **SECOND INTERNAL TEST** |  |  |
| MODULE : 5  Design of simple axial, transverse loaded members for minimum cost, maximum weight design of shafts and torisioinally loaded members –Design of Springs. | 8 | 20 |
| MODULE : 6  Dynamic Applications – Optimum design of single, two degree of freedom systems, vibration absorbers. Application in Mechanisms – Optimum design of simple linkage mechanisms. | 8 | 20 |

**08ME 6052 (B) VIBRATION CONTROL AND CONDITION MONITORING**

Credit: 3-0-0:3

**Pre-requisites**:- Nil Year : 2015

**Course objective:**

* To understand the fundamentals of single degree, two degree and multi degree freedom system.
* To provide a thorough knowledge about the methods for controlling vibrations.
* To provide knowledge in condition monitoring, machine maintenance and predictive maintenance of machines.

**Syllabus:**

Review of single, two and multi degree freedom system; Numerical methods in Vibration analysis; Methods for Vibration control; Smart materials-types and characteristics; Condition monitoring; Machine maintenance techniques; Predictive maintenance and signature analysis; Diagnostic maintenance; Dynamic balancing and alignment of machinery; Alignment methods; Shaft to coupling spool method.

**Course outcome:**

Students can able to understand the concept of single, two and multi degree freedom system. Also they have obtained a very good knowledge in different methods for vibration control, machine maintenance and predictive maintenance of machines. Also they will have a thorough knowledge in dynamic balancing and alignment of machinery.

**Text Books:**

1. Singiresu S.Rao, “Mechanical Vibrations”, Addison-Wesley Publishing Company,

1995.

2. J.O.Den Hartog, “Mechanical Vibrations”, McGraw Hill, Newyork, 1985.

**References:**

1. R.A.Collacott, “Vibration monitoring and diagnosis”, Wiley, 1979.

2. “Condition Monitoring manual”, National Productivity Council, New Delhi.

3. Rao, J.S., “Vibratory Condition Monitoring of Machines”, CRC Press, 2000.

4. “Hand Book of Condition Monitoring”, Elsevier Science, 1996.

**COURSE PLAN**

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| **COURSE NO: 08ME 6052 (B) COURSE TITLE : VIBRATION CONTROL AND CONDITION MONITORING (L-T-P : 3-0-0) CREDITS:3** | | |
| **MODULES** | **Contact**  **hours** | **Sem.Exam**  **Marks;%** |
| MODULE : 1  Introduction - Review of Fundamentals of Single Degree Freedom Systems – Two Degree Freedom Systems, Multi Degree Freedom System, continuous system, Determination of Natural frequencies and mode shapes, Numerical methods in Vibration Analysis. | 7 | 15 |
| MODULE : 2  Vibration Control – Reduction of Vibration at the Source – Control of Vibration – by Structural design – Material Selection – Localized additions – Artificial damping – Resilient isolation, Vibration isolation, Vibration absorbers. Active vibration control – review of smart materials – types and characteristics – smart structures. | 7 | 15 |
| **FIRST INTERNAL TEST** |  |  |
| MODULE : 3  Selecting methods of condition monitoring – Machine condition monitoring and diagnosis – Vibration severity criteria – Machine maintenance techniques – Machine condition monitoring techniques – Vibration monitoring techniques – Instrumentation systems – Choice of monitoring parameter. | 7 | 20 |
| MODULE : 4  Signature Analysis – observational and estimation techniques, online techniques specially dealing with instrumentation system, offline technique like visual inspection, non destructive testing and destructive testing for materials, fluids and general mechanical and electrical components, predictive analysis of potential failures and end of useful life. | 7 | 15 |
| **SECOND INTERNAL TEST** |  |  |
| MODULE : 5  Predictive Maintenance-Diagnostic maintenance, applications to specific industrial machinery and plants. | 7 | 15 |
| MODULE : 6  Dynamic balancing and alignment of machinery: Dynamic Balancing of Rotors, field Balancing in one plane, two planes, and in several Planes, Machinery Alignment, “Rough” Alignment Methods, the Face – Peripheral Dial Indicator Method, Reverse Indicator Method,  Shaft-to-coupling spool method. | 7 | 20 |

**08ME 6052 (C) DESIGN OF PRESSURE VESSELS AND PIPING**

Credit: 3-0-0:3

**Pre-requisites**:- Nil Year : 2015

**Course objective:**

* To impart knowledge on design considerations of pressure vessels and piping.
* To provide knowledge on thermal stresses and failure modes of different types of pressure vessels.

**Syllabus:**

Stress analysis for modern pressure vessels, membrane stress analysis of vessel shell components; Thermal Stresses-Discontinuity stresses in pressure vessels, excessive elastic deformation, plastic instability, brittle, rupture, creep; Supports for short vertical vessels – stress concentration; Theory of reinforcement; Use of ASME codes in pressure vessel design; Elastic buckling of cylinders under external pressure; Effect of supports on Elastic Buckling of Cylinders; Design of circumferential stiffeners; Design of covers –vessels that can survive fatigue, shock, high pressure, high temperature, corrosion; Vessels resistant to external high pressures found in undersea; Design of tube- sheets.

**Course outcome:**

Students will be able to design pressure vessels. They will be able to do the design analysis based on the stresses acting and also failure mechanisms involved. Also students can apply vessel design concepts in high temperature and high pressure applications.

**Text Books:**

1. John F.Harvey, “Pressure Vessel Design”, CBS publishers, 2007.
2. Henry H.Bedner, “Pressure Vessels”, Design Hand Book, CBS publishers.

**References:**

1. William.J., Bees, “Approximate Methods in the Design and Analysis of Pressure Vessels and Piping”, Presented at ASME Pressure Vessels and Piping Conference, 1997.

2. ASME Code for Pressure Vessel Design.

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| **COURSE NO: 08ME 6052 (C) COURSE TITLE : DESIGN OF PRESSURE VESSELS AND PIPING (L-T-P : 3-0-0) CREDITS:3** | | |
| **MODULES** | **Contact**  **hours** | **Sem.Exam**  **Marks;%** |
| MODULE : 1  Design and analysis of unfired pressure vessels – stress analysis for modern pressure vessels, membrane stress Analysis of Vessel Shell components – Cylindrical sheels, Spherical Heads, Conical heads | 6 | 15 |
| MODULE : 2  Thermal Stresses-Discontinuity stresses in pressure vessels, excessive elastic deformation, plastic instability, brittle, rupture, creep. | 6 | 15 |
| **FIRST INTERNAL TEST** |  |  |
| MODULE : 3  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 – related components like relief values etc. – Use of ASME codes. | 7 | 15 |
| MODULE : 4  Buckling of pressure vessels - 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. | 7 | 15 |
| **SECOND INTERNAL TEST** |  |  |
| MODULE : 5  Other design considerations – design of circumferential stiffeners, design of covers – vessels that can survive fatigue, shock, high pressure, high temperature, irradiation, corrosion, and other hostile environments-high strength, lightweight pressure vessels – vessels resistant to external high pressures found in undersea exploration, offshore drilling, and mineral mining. | 8 | 20 |
| MODULE : 6  Design and analysis of piping systems – pipes and tubing under external and internal pressure – design of tube- sheets and tube seats, and use of post-weld heat treatment to affect residual stress in final rupture. | 8 | 20 |

**08ME 6062 MINI PROJECT**

**Credits:** 0-0-4:2

The students have to do a mini project during the second semester itself. The mini project work is allotted individually on different topics. The students shall be encouraged to do their project work in the parent institute itself. If found essential, they may be permitted to do their project outside the parent institute. The mini project should be in the field of Mechanical Engineering and particularly relevant to the specialization of Machine Design. The students have to submit a report of the undergone project and present the contents of the report before the evaluation committee constituted by the Department. An internal evaluation will be conducted for examining the quality and authenticity of contents of the report and award the marks at the end of the semester.

**Internal continuous assessment: Marks 100**

**08ME 6072 cad lab**

Credit: - 0-0-2:2

Year - 2015

**Objective:-**

Students must be trained in 3D Modelling and Finite Element Software such as Pro-E, Solid Works, CATIA, ANSYS, NASTRAN or COSMOS, as part of the Lab exercise.

**List of Software to be Used:-**

**Computer aided drafting :** Use of AutoCAD or Drawing Editor for 2-D drafting plan/elevation/side view, etc.

**3D Solid modelling:** part creation, surface generation and sold modelling of machine parts, assembly of parts (simple exercises only).

**Finite Element Analysis:** Creation of models, use of different elements, mesh generation, assigning material properties, treatment of different loads and boundary conditions. Solution for static and dynamic analysis. Post processing results displacement, stress and strain plots, stress concentration. Various exercise problems using software (simple exercises only).

**SEMESTER 3**

**08ME 7013(A) FRACTURE MECHANICS AND DESIGN**

Pre requisites: Nil **Credits: 3-0-0:3**

Year: **2015**

**Course objective:**

**To give the students:**

* A foundation in the fundamentals of Fracture mechanics.
* Practice in the analytical formulation of fracture problems, analyse them and take necessary corrective actions.
* An introduction to fracture prevention in practice.

**Syllabus:**

Introduction to Fracture mechanics ; Elastic, Plastic and Elasto-plastic deformation ; Damage tolerant fracture mechanics ; Analysis of crack tip field ; Crack resistance curve ; Principles of crack arrest ; crack growth relation in SSY - Plane stress and Plane strain fracture ; Nonlinear fracture mechanics; J integral - fracture Mechanics design ; Selection of materials for fracture mechanics design ; Stress intensity factor ; Use of crack growth law.

**Course outcome:**

Students have successfully completed this course will an ability to understand use of fracture mechanics.

They will be in the position to analyse the crack growth and arrest the crack growth further and save the structure from catastrophic failure involving human life.

**Text Books:**

**References:**

1. Kanninen, M.F and Popelar, C.H, “Advanced fracture mechanics”, Oxford University

Press, 1985.

2. Knott, J.F., “Fracture in engineering materials”, Butterworth, 1973.

3. Hortezberg, R.W., “Determination of fracture mechanics of engineering materials”, Wiley,

1983.

**COURSE PLAN**

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| **COURSE NO: 08ME 7013(A) COURSE TITLE : Fracture Mechanics and Design (L-T-P : 3-0-0) CREDITS:3** | | |
| **MODULES** | **Contact**  **hours** | **Sem.Exam**  **Marks;%** |
| MODULE : 1  Fracture mechanics: The geometry of stress and strain, elastic deformation, plastic and elastoplastic deformation - limit analysis. Damage tolerant fracture mechanics – Fatigue testing methods - statistical nature of fatigue data - theories of fatigue - crack initiation and growth in fatigue | 7 | 15 |
| MODULE : 2  Notches and stress concentration – Stress intensity solutions for 2-D and 3-D crack geometries – Fractography - Structure modes and types. | 6 | 15 |
| **FIRST INTERNAL TEST** |  |  |
| MODULE : 3  Analysis of crack tip field: Elements of elasticity - linear elastic crack tip fields. Stress intensity factor - energy release rate - Criterion for crack growth - Crack resistance curve - Principles of crack arrest - Small-scale yielding (SSY) - crack growth relation in SSY – Stable crack growth in SSY. Irwin plastic zone correction- Actual shape of plastic zone - Plane stress  - Plane strain. | 8 | 20 |
| MODULE : 4  Fatigue crack growth: Fatigue crack growth test - stress intensity factor, factors affecting stress intensity factor - variable amplitude service loading – Dynamic energy balance – crack arrest - retardation model. | 6 | 15 |
| **SECOND INTERNAL TEST** |  |  |
| MODULE : 5  Nonlinear fracture mechanics: J integral – Elastic – plastic stationary crack tip fields, ductile structure criterion, J-controlled crack growth and stability – Tearing modulus – the x factor. Engineering approach to plastic fracture - J-integral – testing single specimen testing - standard test methods. | 8 | 20 |
| MODULE : 6  Fracture design: Selection of materials - fatigue crack growth rate curve - stress intensity factor range - use of crack growth law. | 7 | 15 |

**08ME 7013(B)COMPUTATIONAL FLUID DYNAMICS**

**Pre requisites: Nil**  Credits: 3-0-0: 3

Year: 2015

**Course objective:**

* To study the flow of dynamic fluids by computational methods.
* To develop understanding about principles of fluid flow modelling.

**Syllabus:**

An overview of CFD; Governing equations; Classification of partial differential equations; Co-ordinate transformations-Grid generation and solution; Numerical Grid Generation; Elliptical and Hyperbolic grids; Solution of time dependent problems; Explicit and implicit schemes; Boundary conditions and implementation; Concept of hydrodynamic boundary layer; flow over circular and elliptical cylinders and airfoils; Viscous flow: A Finite difference scheme for solution of viscous flow ; Procedure for drawing contours plot and velocity vector plot; Applications on flow past bodies such as isolated airfoils and airfoils in cascades; Finite volume method; Algorithms for pressure velocity coupling; solution of two and three dimensional problems in Cartesian and cylindrical coordinate systems.

**Course outcome:**

At the end of this course students can able to understand the major theories, approaches and methodologies used in CFD.

**TEXT BOOKS**  
1. Fletcher, C.A.J., “Computational Techniques for Fluid Dynamics”, Vols. I and II, Springer - Verlag, Berlin, 1988.  
2. John F. Wendt (Editor), “Computational Fluid Dynamics - An Introduction”, Springer – Verlag, Berlin, 1992

**References:**

1. Charles Hirsch, “Numerical Computation of Internal and External Flows”, Vols. I and II. John Wiley & Sons, New York, 1988.  
2. Klaus A Hoffmann and Steve T. Chiang. “Computational Fluid Dynamics for  
Engineers”, Vols. I & II Engineering Education System, P.O. Box 20078, W. Wichita, K.S., 67208 - 1078 USA, 1993.

3. T.Sundararajan,”computational fluid flow and heat transfer”, Narosa publishing house.

**COURSE PLAN**

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| **COURSE NO: 08ME 7013(B) COURSE TITLE : Computational Fluid Dynamics (L-T-P : 3-0-0) CREDITS:3** | | |
| **MODULES** | **Contact**  **hours** | **Sem.Exam**  **Marks;%** |
| MODULE : 1  An overview of CFD: Fluid properties, characteristics, governing equations - potential, inviscid and viscous flow. Classification of partial differential equations. | 6 | 15 |
| MODULE : 2  Co-ordinate transformations: General and special (Cartesian, Cylindrical and Spherical Co-ordinates). Derivation of equations for generalized curvilinear coordinates, finite difference approximations for space and time coordinates. | 6 | 15 |
| **FIRST INTERNAL TEST** |  |  |
| MODULE : 3  Grid generation and solution: Stability analysis - solution of Laplace equation for regular and irregular geometrics using finite difference method. Numerical Grid Generation- Elliptical and Hyperbolic grids. Solution of time dependent problems- Explicit and implicit schemes. | 7 | 15 |
| MODULE : 4  Boundary conditions and implementation: Implementation of prescribed and gradient boundary conditions- application of potential flow and conductive heat transfer. Concept of hydrodynamic boundary layer- Prandtl boundary layer equations-momentum integral equations-Karman Pohlhausen method for flow over flat plate-flow over circular and elliptical cylinders and airfoils. | 7 | 15 |
| **SECOND INTERNAL TEST** |  |  |
| MODULE : 5  Viscous flow: A Finite difference scheme for solution of viscous flow – stream functionvorticity- vorticity transport equation-solution of stream function equations-wall vorticity estimation-solution of vorticity transport equation-procedure for drawing contours (Stream function and iso-vorticity) plot and velocity vector plot. Applications on flow past bodies such as isolated airfoils and airfoils in cascades. | 8 | 20 |
| MODULE : 6  Finite volume method: Finite volume method for convection - diffusion equations- Governing equations for incompressible variables in primitive variables - upward –hybrid and power law schemes - Discretization for one, two and three dimensions - false diffusion – Calculation flow field - Algorithms for pressure velocity coupling- semi implicit method for pressure linked equations - solution of two and three dimensional problems in Cartesian and cylindrical coordinate systems. | 8 | 20 |

**08ME 7013(C) Industrial noise control**

Pre requisites: Nil **Credits: 3-0-0:3**

Year: **2015**

**Course objective:**

* To understand the problems of noise pollution, affect of environment and other environmental issues
* To provide knowledge and awareness among the students to address these issues then conserve the environment and reduce the noise pollution

**Syllabus:**

Characteristics of discrete systems components; Analysis of undamped, damped, free and forced SDOF systems; types of damping; Rotating and revolving unbalance; transmissibility; Seismic instruments; Two degree of freedom systems; principal coordinates co-ordinate coupling transformation; Centrifugal pendulum absorber; Transient Vibrations; Laplace Transforms formulation; Shock isolation; Introduction to self-excited vibration; Mathematical criterion for stability, Instability caused by friction; Vibration instrumentation; shock measurements; calibration.

**Course outcome:**

Students can able to understand the concept of vibration and importance of damping; also they can able to solve the problems of two degree of freedom system.

**Text Books:**

1. Meirovitch L, “Elements of Vibration analysis”, Tata McGrawHill, 2007.

2. Den Hartog, “mechanical Vibrations”, Dover, 1985.

3. K.K.Pujara, “Vibration and Noise for Engineers”, Dhanapati Rai & Sons, 2004

4. Web address: http://nptel.ac.in/courses/112103112/

**References:**

1. Thomson W.T., “Theory of vibration with Applications”, Pearson, 1998.

2. Rangan, et al., “ Instrumentation devices and systems”. TMH, 1989.

3. S.S. Rao, “Mechanical Vibrations”, Pearson, 1992.

**COURSE PLAN**

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| **COURSE NO: 08ME 7013(C) COURSE TITLE : Industrial Noise Control (L-T-P : 3-0-0) CREDITS:3** | | |
| **MODULES** | **Contact**  **hours** | **Sem.Exam**  **Marks;%** |
| MODULE : 1  Introduction: Basic Acoustic Principles - Acoustic terminology and definitions - Plane waves harmonic solution-velocity of sound in inviscid fluids-relationship between wave length particle velocity, acceleration – Energy density – acoustic intensity – reference standards and measurement | 6 | 15 |
| MODULE : 2  Transmission through one, two and thee media. Transmission through pipes branched and unbranched-resonators-Transmission loss reflection at plane surface-standing waves and standing wave apparatus, spherical waves – radiation – simple source – hemispherical source-radiating piston-pressure intensity distribution-Beam width and directivity index | 7 | 15 |
| **FIRST INTERNAL TEST** |  |  |
| MODULE : 3  Noise measurement: Decibel scale-relationship between pressure, intensity and power-sound level meter, noise analyser and graphic level recorder-measurement in anechoic and reverberation chambers. | 6 | 15 |
| MODULE : 4  Noise reduction: Human reaction to sound-definitions of speech interference level, perceived noise level, phon and sone etc, hearing loss-principles of noise control-control at source, during transmission and at receiver-protection of receiver-Acoustic insulation-acoustic materials-acoustic filter and mufflers – plenum chamber-noise criteria and standards- noise and number index guide lines for designing quieter equipment’s – reducing machine noise generated by bearings, gears, motors, fans, propellers, generator sets, cooling towers, pump sets, pipes etc. | 8 | 20 |
| **SECOND INTERNAL TEST** |  |  |
| MODULE : 5  Environmental noise control: Noise ratings, human tolerance levels, equivalent sound level and loudness contours - Engine noise and muffler designs - Noise control through barriers and enclosures and absorbent linings - Vehicular noise and control. | 8 | 20 |
| MODULE : 6  Acoustic considerations in structural design: Sound transmission through structures – noise control by damping and other methods. Principles of noise control in an auditorium requirements of a good auditorium. | 7 | 15 |

**08ME 7023(A) DESIGN OF EXPERIMENTS**

Pre requisites: Nil **Credits: 3-0-0:3**

Year: **2015**

**Course objective:**

* To determine the number of experiments to be conducted for measuring the desired output responses.
* To provide a better knowledge about the concepts like modelling, simulation and process optimization.
* To analyse the experimental results or the collected data and to obtain the optimized output response.

**Syllabus:**

Research concepts and formulation of Research task ; Literature Review ; Prioritization of research ; Mathematical modelling and simulation ; Experimental modelling ; Process optimization ; Analysis of results ; ANOVA - Multiple regression ; Software for analysing the data ; Types of Report and Report writing ; Landscape of Creativity ; Techniques of creativity; Collective creativity.

**Course outcome:**

By end of the course, the students will have a thorough knowledge about research work and the design of experiments.

The students will be able to create the mathematical model for the measured output responses and to predict the desired values of input parameters.

The students will be well versed with report writing.

**Text Books:**

1. C.R.Kothari, “Research Methodology” Wiley Eastern Ltd., New Delhi.

2. Douglas Montgomery, “Design of Experimens”, John Wiley, 2004.

**References:**

1. John W.Best and James V.Khan, “Research in Education”, PHI Publication

2. Adler and Granovky, “Optimization of Engineering Experiments” Mir Publication

3. S.S.Rao, “Optimization theory, and applications”, Wiley Eastern Ltd., New Delhi

4. Wilkinson.T.S. and Bhanarkar, P.L., “Formulation of Hypothesis”, Himalaya

Publishing Co. 1987.

**COURSE PLAN**

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| **COURSE NO: 08ME 7023(A) COURSE TITLE : Design of Experiments (L-T-P : 3-0-0) CREDITS:3** | | |
| **MODULES** | **Contact**  **hours** | **Sem.Exam**  **Marks;%** |
| MODULE : 1  Research concept and formulation of research task: Meaning, objectives, motivation types of research, approaches, research (descriptive research, conceptual theoretical, applied and experimental). | 6 | 15 |
| MODULE : 2  Literature review, Importance and methods, sources, qualification of cause – effect relations discussions, filed study, laboratory experiments, and critical analysis of already generated facts, hypothetical proposal for future development and testing, selection of research task, prioritization of research. | 6 | 15 |
| **FIRST INTERNAL TEST** |  |  |
| MODULE : 3  Mathematical Modeling and simulation: Concept of modeling, classification of mathematical methods, 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. Experimental modeling : experimental design and validation, process optimization. | 7 | 15 |
| MODULE : 4  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 of variance, analysis of covariance, multiple regression, testing linearity / non linearity of model, testing adequacy of model, testing model / hypothesis, use of computational tools, software for research work. | 7 | 15 |
| **SECOND INTERNAL TEST** |  |  |
| MODULE : 5  Report Writing : Types of report, layout of research report, interpretation of result, 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. | 8 | 20 |
| MODULE : 6  Landscape of creativity: Convergent Vs divergent thinking, creativity, creativity Vs intelligence, creativity abilities, creativity and madness, determination of creativity, increasing creativity, creativity achievement, techniques of creativity, collective creativity. | 8 | 20 |

**08ME 7023(B) ROBOTICS**

Pre requisites: Nil **Credits: 3-0-0:3**

Year: **2015**

**Course objective:**

**To give the students:**

* A foundation in the fundamentals of Robot components and configuration.
* A thorough knowledge about Robot drive system and Transmission system.
* An introduction to Robot control, Fuzzy logic, Artificial Intelligence and Neural Network.

**Syllabus:**

Definitions and concepts in Robots ; General consideration of Robotic Manipulator ; Degree of freedom and Degree of Mobility ; Robot Intelligence ; Geometrical Configuration ; Types of Robot ; Robot components ; Drive system and Transmission system ; Robot arm kinetics and dynamics ; D Alember equation of motion ; Control of Robot ; Fuzzy logic ; Artificial Intelligence and Neural Network.

**Course outcome:**

By end of the course, the students will have a thorough knowledge about the configuration and components of Robot.

The students will be able to solve the direct kinetics problem and to obtain the inverse kinematics solution using various formulations studied.

The students will be well versed with the types, components, configuration and control of the Robot.

**Text Books:**

1. KS Fu, RC Gonzalaz, “Robotics”, McGraw Hill, 1987

2. Moihsen Shahinpoor, “A Robot Engineering – Text Book:, Harper & Royal

Publications, New York, 1987

**References:**

1. F.L’ ttole, J M Kauffmann, Pierre Andree’ and J P Taillard, “Robot Components and systems Volume IV” Prentice Hall, 1983 edition

2. F N Nagy, Andras Seigler, “Engineering foundations of Robotics” Premtice Hall

India, New Delhi, 1987.

**COURSE PLAN**

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| **COURSE NO:08ME 7023(B) COURSE TITLE : Robotics (L-T-P : 3-0-0) CREDITS:3** | | |
| **MODULES** | **Contact**  **hours** | **Sem.Exam**  **Marks;%** |
| MODULE : 1  General Consideration of Robotic Manipulators: Historical Development Function of a ‘Robot’ Role of ‘Real’ robot, structure of the robot, Human arm characteristics, classification of robots, Robot System organization and operation. | 6 | 15 |
| MODULE : 2  Definitions and concepts in Robotics, - kinematics, Kinetic and dynamics, degree of freedom (DOF) and degree of mobility (DOM), Accuracy and reliability, Ambiguities with robotics, long term speed holding accuracy, Robot intelligence. | 6 | 15 |
| **FIRST INTERNAL TEST** |  |  |
| MODULE : 3  Robot Geometrical Configurations : Cartesian or Rectangular Robot, Cylindrical robots, spherical or polar robots, snakelike or Tensor – arm robot | 7 | 15 |
| MODULE : 4  Robot Components and Systems : Arm structure, Architectural components, Wrist and Grabber sub – assemblies, Robot drive system – DC Motors, Stepping motors, A C Servoe motors, Pneumatic and hydraulic actuators, Transmission systems using gearing, Screw – nut  systems etc. | 7 | 15 |
| **SECOND INTERNAL TEST** |  |  |
| MODULE : 5  Robot Arm Kinetics and Dynamics: Direct Kinetics problem, Inverse kinematics solution. Lagrange – Euler Formulation, Newton – Euler Formulation, Generalised D Alember equations of motion. | 8 | 20 |
| MODULE : 6  Robot Control: Introduction to robotic control, sensing of object to be manipulated robotic vision, fuzzy logic, artificial intelligence and neural networks. | 8 | 20 |

**08ME 7023(C) COMPUTER INTEGRATED MANUFACTURING**

Pre requisites: Nil **Credits: 3-0-0:3**

Year: **2015**

**Course objective:**

* To impart in depth knowledge in various fields of Computer Aided Design and

Manufacture (CAD / CAM).

* To provide a better knowledge about CNC programming.
* To impart depth knowledge in Computer aided process planning and Computer application in Inventory control.

**Syllabus:**

Introduction to CAD **;** Concepts of Manufacturing systems ; Drafting for manufacture; 2D and 3D drafting; CAD – CAM integration; Computer control of machines; Programming of CNC Lathes; CIM machine tools;Flexible manufacturing systems (FMS); Robots and their application; Computer aidedstorage and retrieval of tools;Material computer aided manufacturing planning; Computer application in inventory control; Computer in quality control.

**Course outcome:**

On completion of the course the students are expected to be knowledgeable in 2D and 3D transformations, modelling and analysis, CAD/CAM integration, CNC machine tool building, CNC programming using manual method and generation of CNC codes using CAM software.

**Text Books:**

1. M.P.Groover and E.W Zimmers, “CAD/CAM – Computer aided design and manufacture”, Prentice Hall, INDIA, 1984 .

2. P Radhakrishnan, S Subramanyan, “CAD/CAM/CIM”, New Age Publishers, 1994.

**References:**

1 . Yorem Koren, “Computer Integrated Manufacturing Systems”, McGraw Hill, 1983

2 . David Bedworth, “Computer Integrated Design and Manufacturing

3 . Groover, M.P., “Automation, Production System, and CIM”, Prentice – Hall, India 2007

**COURSE PLAN**

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| **COURSE NO: 08ME 7023(C) COURSE TITLE : Computer Integrated Manufacturing (L-T-P : 3-0-0) CREDITS:3** | | |
| **MODULES** | **Contact**  **hours** | **Sem.Exam**  **Marks;%** |
| MODULE : 1  Introduction to CAD – design process benefits of CAD – Hardware in CAD programming languages – implementation and evolution of CAD / CAM Systems. | 6 | 15 |
| MODULE : 2  Concepts of Manufacturing systems and computer applications. Drafting for manufacture. | 6 | 15 |
| **FIRST INTERNAL TEST** |  |  |
| MODULE : 3  Introduction to work stations and other hardware, fundamentals of 2D and 3D drafting, sectional and exploded views, application in design of castings forgings, sheet metal working etc. | 7 | 15 |
| MODULE : 4  Computer aided manufacture concepts of database, CAD – CAM integration. Computer control of machines – metal cutting machines, unconventional machines, turret press, etc. | 7 | 15 |
| **SECOND INTERNAL TEST** |  |  |
| MODULE : 5  Programming of CNC Lathes, machining centres, CIM machine tools and related equipment’s handling systems. | 8 | 20 |
| MODULE : 6  Flexible manufacturing systems (FMS) – robots and their application – computer aided storage and retrieval of tools and material computer aided manufacturing planning, computer application in inventory control – computer in quality control. | 8 | 20 |

**08ME 7033 SEMINAR - II**

**Credits: 0-0-2:2**

**Year: 2015**

Each student shall prepare a seminar paper on any topic of interest related to the core / elective courses being undergone in the third semester of the M.Tech programme. He/she shall get the paper approved by the Programme Coordinator/Faculty Members in the concerned area of specialization and shall present it in the class in the presence of Faculty in charge of seminar class. Every student shall participate in the seminar. Grade will be awarded on the basis of the student’s paper, presentation and his/her participation in the seminar.

Goals: This course is designed to improve written and oral presentation skills and to develop confidence in making public presentations, to provide feedback on the quality and appropriateness of the work experience, and to promote discussions on design problems or

new developments or ethical and safety issues in the workplace.

**08ME 7043 PROJECT (PHASE-I)**

**Credits: 0-0-12:6**

**Year: 2015**

**Teaching scheme: 12** hours per week

**Objective:**

To improve the professional competency and research aptitude by touching the areas which otherwise not covered by theory or laboratory classes. The project work aims to develop the work practice in students to apply theoretical and practical tools/techniques to solve real life problems related to industry and current research.

The project work should be a project in Machine Design stream. The project work is allotted individually on different topics. The students shall be encouraged to do their project work in the parent institute itself. If found essential, they may be permitted to do their project outside the parent institute. Department will constitute an Evaluation Committee to review the project work. The Evaluation committee consists of at least three faculty members of which internal guide and another expert in the specified area of the project shall be two essential members.

The student is required to undertake the masters research project phase-I during the third semester and the same is continued in the 4th semester.(Phase-II). Phase-I consists of preliminary thesis work, two reviews of the work and the submission of preliminary report. First review would highlight the topic, objectives, methodology and expected results. Second review evaluates the progress of the work, preliminary report and scope of the work which is to be completed in the 4th semester.

**Internal Continuous assessment: 50 Marks**

**08ME 7043 PROJECT (PHASE-II)**

**Credits: 0-0-21:12**

**Year: 2015**

**Teaching scheme: 21** hours per week

**Objectives:**

To improve the professional competency and research aptitude by touching the areas which otherwise not covered by theory or laboratory classes. The project work aims to develop the work practice in students to apply theoretical and practical tools/techniques to solve real life problems related to industry and current research.

Project phase-II is a continuation of project phase-I started in the third semester. Before the end of the fourth semester, there will be two reviews, one at middle of the fourth semester and other towards the end. In the first review, progress of the project work done is to be assessed. In the second review, the complete assessment (quality, quantum and authenticity) of the Thesis is to be evaluated. Both the reviews should be conducted by guide and Evaluation committee. This would be a pre qualifying exercise for the students for getting approval for the submission of the thesis. At least one technical paper is to be prepared for possible publication in journal or conferences. The technical paper is to be submitted along with the thesis. The final evaluation of the project will be external evaluation.

**Internal Continuous assessment : 70 Marks**

**External ( Viva-Voce) assessment: 30 Marks**