Autonomous Program Structure of
M. Tech. Mechanical Engineering (Spl: Mechanical Engineering Design)
Academic Year: 2019-2020

F Y M Tech Mech Engg (MED) Semester - I										
Course Code	Course Title	Teaching Scheme Hours/Week			Examination Scheme				Marks	Credit
		Lecture	Tutorial	Practical	In Semester	End Semester	Oral	Practical		
MED1101	Advanced Mathematics and Numerical Techniques	3	1	0	50	50	0	0	100	4
MED1102	Design of Experiments and Research Methodology	3	1	0	50	50	0	0	100	4
MED1103	Advance Mechanics of Materials	3	0	0	50	50	0	0	100	3
MED1104	Design Of Tribosystems	3	0	0	50	50	0	0	100	3
PEMED1101	Elective I	3	0	0	50	50	0	0	100	3
MED1105	Design Of Tribosystems Lab	0	0	2	0	0	25	0	25	1
MED1106	Advance Mechanics of Materials Lab	0	0	2	0	0	0	25	25	1
PEMED1102	Elective I Lab	0	0	2	0	0	25	0	25	1
Total		**15**	**2**	**6**	**250**	**250**	**50**	**25**	**575**	**20**
Grand Total		**23**			**575**				**575**	**20**

Elective I: (Programme)

1. Transport Phenomena
2. Advance Materials Technology
3. Power Train Design

DEAN ACADEMICS
MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

Principal
MKSSS's Cummins College of Engg. For Women, Karvenagar, Pune-52

APPROVED BY
Governing Body Members
MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

MED 1101 Advanced Mathematics and Numerical Techniques

Teaching Scheme	**Examination Scheme**
Lecture: 3 Hrs/week	In semester: 50 marks
Tutorials: 1 Hr/week	End semester: 50 marks
	Credits: 4

Course Objectives:

1. To understand the philosophy and general procedure of Linear algebra applied to complex engineering problems
2. To familiarize students with the concepts of Ordinary and Partial Differential Equations and to introduce related analytical and computer tools.
3. To provide a bridge between hand calculations based on advanced mathematics and numerical solutions for more complex states.
4. To study approximate nature of the numerical methods and convergence of results are examined.
5. To provide some experience with a commercial MATLAB code and some practical modeling exercises

Course Outcomes:

On completion of the course, students will be able to -

1. Demonstrate an understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.
2. Apply numerical methods to obtain approximate solutions to mathematical problems.
3. Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
4. Implement numerical methods in MATLAB.
5. Write efficient, well-documented MATLAB code and present numerical results in an informative way.

Unit 1: Linear Algebra **8 Hrs**

Matrices and systems of linear equations; Solution of **Ax = b** (Gauss elimination/ Gauss-Jordan elimination, Rank of matrix); Vectors in n-dimensions; Linear dependence and independence of vectors; Matrix Arithmetic; Inverse of a matrix; Jacobi and Gauss-Seidel Iterative Methods; LU decomposition; Cholesky Method; Determinants of square matrices, minors and cofactors; Adjoint of a matrix; Norm and inner product of vectors; Orthogonal vectors and matrices; Eigenvalues; Diagonalization and Quadratic forms.

Unit 2: Ordinary Differential Equations: 7 Hrs

Introduction, Classification of ODE's, Linear differential equations of n-th order with constant coefficients (homogeneous and non-homogeneous), Solutions of systems of linear differential equations (homogeneous and non-homogeneous); Initial Value Problem -- Solution Concept, Euler's Method, Modified Euler's Method, Heun's Method, First, second, third and fourth order Runge-Kutta methods, Predictor-corrector method; Boundary Value Problem – Solution Concept for second order equation using Finite Difference Methods.

Unit 3: Partial Differential Equations: 6 Hrs

Introduction and classification of linear partial differential equations of second order (Parabolic, Elliptic and Hyperbolic), Solutions for homogeneous forms for a variety of boundary conditions using Finite Difference Methods -- Elliptic and Parabolic equations.

Unit 4: Numerical Differentiation and Integration 6 Hrs

Numerical Differentiation: Definition of derivatives, Engineering applications, basic finite difference method, Taylor's series expansion, Difference operators, Differentiation of interpolating polynomials

Numerical Integration: Engineering Applications, Newton Cotes formulae, Simpson's, Richardson's extrapolation, Romberg integration, Gauss Quadrature for double and triple integration, Integration in two- and three-dimensional domains

Unit 5: Curve Fitting and Interpolation 5 Hrs

Introduction, Engineering applications, Collocation polynomial fit, Interpolation using Splines (Step, Linear, Quadratic, Cubic), Least-Squares regression (Linear, Polynomial, Non-Linear, Linearization)

Unit 6: Transforms: 6 Hrs

Concept of transforms, Fourier transforms, Applications to partial differential equations, Laplace transforms and its inverse, Laplace transform of special functions: Unit step, Unit impulse, Periodic and Error. Applications to initial value problem and wave equation using transform techniques.

Books:

1. S.S.Rao, Applied Numerical Methods for Engineers and Scientists, Prentice Hall, 2002
2. Steven C. Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists, TATA McGRAW-HILL, 3rd Edition, 2012
3. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley Eastern Ltd., 10th Edition, 2004.
4. Peter V. O' Neil, Advanced Engineering Mathematics, Thomson Brooks Cole, Singapore, 5th ed.

MED 1102 Design of Experiments and Research Methodology

Teaching Scheme
Lecture: 3 Hrs/week
Tutorial: 01 Hr/Week

Examination Scheme
In semester: 50 marks
End semester: 50 marks
Credits: 4

Prerequisite: Technical Seminar, Mini/Minor Project and Major/Final year B.E./BTech. Projects.

Course Objectives: Students are expected to –

1. Understand Phases of Research, Types of Research,
2. Understand the concept and application of Research Methodologies and Statistical Techniques used in research.
3. Understand the concept and application of System Engineering
4. Understand the key elements of Systems Engineering
5. Understand systems engineering processes, requirements analysis, interface definition and management, system models, and design validation techniques

Course Outcome:

1. Students will be capable of doing a critical literature review and formulate the research problem.
2. Students will be capable to do select appropriate Research methods (s) and Statistical Techniques used in research.
3. Students will be able to analyse the major activities of the systems engineering process.
4. Students will be able to apply the system engineering.

Course Description:

- Research Methodology component of this course is designed to impart education in the foundational methods and techniques of research. Research scholars would examine and be practically exposed to the main components of a research process and framework i.e., literature review, problem definition, research design, data collection, ethical issues in research, report writing, and presentation. Once equipped with this knowledge, students would be well placed to conduct disciplined research under supervision in an area of their choosing. In addition to their application in an academic setting, many of the methodologies discussed in this course would be similar to those deployed in professional research environments.
- Systems engineering component of this course is designed to impart an interdisciplinary approach and means to enable the realization of successful systems. It focuses on defining customer needs and required functionality early in the development cycle, documenting requirements, then proceeding with design synthesis and reliability improvement while considering the complete problem including operations, performance, test, manufacturing, cost and schedule. This course emphasizes the links of systems engineering to fundamentals of decision theory, statistics, and optimization. The course also introduces the most current, commercially successful techniques for systems engineering.

Unit 1: Research Problem definition and research methodologies 6

Introduction to research: Definitions and characteristics of research; Types of research; Main components of any research work. Scope and objectives of research problem. Criteria / Characteristics of a good research problem, Errors in selecting a research problem.

Literature review and Problem identification: Purpose of literature review; Source of information; Organization of information, identifying gap areas from literature review and formulating the problem statement.

Research design and Work Plan: – Research design – Basic Principles- Need of research design Features of good design – Important concepts relating to research design; Work Plan

Writing a research report: Format of research proposal, Individual research proposal, Institutional proposal, Proposal of a student.

Unit 2: Data Collection, Analysis and Applied Statistics 6

Study of: Population; Variables; Sampling; Sample size determination; Plan for data collection; Methods of data collection; Plan for data processing and analysis; Ethical considerations.

Co-relation analysis, Regression analysis, Parameter estimation, Multivariate statistics.

Unit 3: Introduction to Mathematical Modeling and Design of Experiment 6

Mathematical Modeling: Introduction, Modeling methods, examples from engineering

Design of Experiment: Introduction to: Full Factorial Method Taguchi DoE, Response Surface Method

Unit 4: Systems Engineering in New Product Development 6

What is SE? - Origin and evolution - Definitions of systems - Need of Systems Engineering - Objectives of SE –Importance - Relation of SE to architecture

Introduction to the Systems Engineering Process - SE relationship to the generic Product Development (PD) Process – Systems Engineering & Program Management

Unit 5: Requirements Development and Management 7

Requirement Development Process - Requirement Elicitation - Sources of Requirements Quality Functional Deployment (QFD)

Requirements Attributes – Rationale - Conditions of operation – How to write good requirements– Requirement Validation

Boundary diagrams - Interface definition and management - Managing changes to Requirements

Unit 6: System Design, Analysis, Verification and Validation 7

Concept Selection - Managing System Interactions – Design Structure Matrix (DSM) - System Architecture - System integration – Design for X - Design Optimization - Design reviews

Risk/uncertainty management – Design Failure Modes and Effects Analysis (DFMEA) - Technical Performance Measure (TPM) – Critical Parameter Management (CPM)

Verifying process capability - Design verification and validation plan – Execution – Interpretation - Reliability

Text Books:

1. Research methodology: an introduction for science & engineering students', by Stuart Melville and Wayne Goddard
2. 'Research Methodology: A Step-by-Step Guide for Beginners', by Ranjit Kumar, 2nd Edition
3. 'Research Methodology: Methods and Trends', by Dr. C. R. Kothari.
4. Systems Engineering Principles and Practice, 2nd Edition, A. Kossiakoff, W. Sweet, and S. Biemer, Wiley Series in Systems Engineering and Management, Wiley Interscience, 2011.

References:

1. Creswell, J. W. Research design: Qualitative, Quantitative and Mixed Methods Approaches. 4th Ed. Thousand Oaks, CA: Sage, 2014.
2. 'Research Methodology: An Introduction' by Wayne Goddard and Stuart Melville
3. System Engineering Management, Benjamin Blanchard, Wiley & Sons, Inc., 2008
4. The Engineering Design of Systems: Models and Methods, Dennis M. Buede, John Wiley & Sons, Inc., 2000.
5. Customer–Centered Products, Amacom, IvyF Hooks and Kristin A Farry
6. Systems Engineering Handbook: A 'What to' Guide for All SE Practitioners, INCOSE-TP-2003-016-02, Version 2a, 1 June 2004 http://www.incose.org/ProductsPublications/sehandbook.

MED1103 ADVANCE MECHANICS OF MATERIALS

Teaching Scheme
Theory: 3 Hrs/week

Examination Scheme
In SEM: 50 Marks
End Sem: 50 Marks
Credit: 3

Prerequisites

Applied Mechanics, Strength of Materials, Engineering Materials

Course Objectives

Introduce students to

1. basics of theory of elasticity
2. basics of theory of plasticity
3. fracture mechanics and fatigue behavior of material
4. nature and behavior of composite materials

Course Outcomes

Students will be able to

1. solve the problems on theory of elasticity and plasticity
2. understand the fracture mechanics and fatigue failure of the material
3. understand the composite material and its failure criteria
4. test different physical and mechanical properties of the material

Unit 1 **Theory of Elasticity** **(10)**

Analysis of stress and strain, Stress-Strain Relations for Linearly Elastic Solids, Yield Criteria and Introduction to ideally Plastic Solid.

Unit2 **Theory of Plasticity** **(10)**

Non-linear material response, Yield criteria: maximum principal stress criteria, maximum principal strain criteria, strain-energy density criteria, alternative yield criteria, general yielding.

Unit3 **Introduction to fatigue and fracture mechanics** **(10)**

Stress life: S-N diagram, Mean stress effect, modifying factors, Strain-life: material behaviour, strain-life curve, fatigue properties, mean stress effect, Brittle Fracture, Stress Intensity Factor, Fracture Toughness, Fracture Conditions, Fracture Modes, Plane Stress and Plane Strain, Plastic Collapse at a Notch, Experimental Determination of K_{IC}, Strain-Energy Release Rate, Meaning of Energy Criterion, Design Consideration.

Unit4 **Mechanics of Composite Materials** **(10)**

Stress-Strain Relations, Basic Cases of Elastic Symmetry, Laminates, Ply Stress and Ply Strain, Failure Criteria of Composite Materials, Micromechanics of Composites.

References

1 Advanced Mechanics of Solids, L. S. Srinath, Tata McGraw-Hill
2 Advanced Mechanics of Materials, A. P. Boresi, Wiley
3 Theory of Elasticity, S. P. Timoshenko, Mc Graw Hill
4 Fundamentals of metal Fatigue, J. A. Bannantine, Prentice Hall
5 Mechanics of Composite Materials, A. K. Kaw, CRC Press

MED1104 DESIGN OF TRIBOSYSTEMS

Teaching Scheme
Lecture: 3 Hrs/week

Examination Scheme
In semester: 50 marks
End semester: 50 marks
Credits: 3

Course Objectives:

1. To understand and system level functioning of a frictional process and lubrication system
2. To learn contact stress analysis of a frictional processes
3. To study material properties for a bearings
4. To understand design process of tribological systems

Course Outcomes:

Students will be able to:

1. Identify the system model of a lubrication system
2. Perform contact stress analysis of a frictional process
3. Select materials for bearings and lubricant oil specifications
4. Design a lubrication system for a mechanical system

UNIT I: System Concept for Tribosystems

Application of system concepts to tribology, Function of Tribomechanical systems, Structure of Tribo-mechanical systems, Tribological interaction, Functional plane, mechanical work plane, thermal plane and material plane.

UNIT II: Friction and Wear Process

Role of tribo processes in mechanical systems, Wear as a system property. Contact Mechanics, number of bodies taking part in contact process, macro geometry of bodies, Deformation mode; elastic, plastic and elastic-plastic, Types of relative motion; static contact, rolling contact, sliding contact, contact physics and geometry, contamination layer, absorbed gas layer, oxide layer, work hardened layer, metal substrate.

UNIT III: Bearing Materials

Materials for various tribo-components, materials for plane bearing, materials for gear, materials for brakes, clutches, materials for Internal combustion engines, ceramics and special alloys, cermets, polymer materials, selection considerations in design.

UNIT IV: Design of Tribological Systems

Design of various tribo-elements; such as Plane bearing, Gear, Seals, Piston and cylinder, Friction devices, cutting tools, chains. Design of lubrication systems.

Text Book:

1. Czichos, H., “Tribology: A system approach to the science & technology of friction, lubrication and wear,”– Tribology Series 1, Elsevier Scientific Publishing Company, Amsterdam, Netherland, 1978.

Reference Books:

1. Peterson, M. B., Winer, W. O., “Wear Control Handbook,” ASME, N. Y., 1992.
2. Glaeser, W. A., “Tribology: Materials for Tribology,” –Tribology series – Vol. 20, Elsevier,N. Y. 1992.
3. Stolarski, T., “Tribology in Machine Design”, Butterworth-Heinemann, N. Y., 1990

PEMED1101A Elective I Transport Phenomena

Teaching Scheme
Lecture: 3 Hrs/week

Examination Scheme
In semester: 50 marks
End semester: 50 marks
Credits: 4

Prerequisites:
1. Engineering Physics
2. Engineering mathematics
3. Fluid Mechanics

Course Objectives:

1 To Interpret the mathematical and physical foundations of the continuum mechanics of fluids,
2 To apply the conservation laws to viscous, inviscid, incompressible flows; and boundary layer flows
3 Be able to apply the principles of fluid mechanics to solve engineering problems and to design systems or components to meet desired needs
4 To derive the generic form of N-S equation and able to deduce an analytical solution for simple fluid mechanics and mass transfer problems.

Course Outcomes:

Upon completion of this course, the student will be able to:
1 Student will be able to understand the concepts of continuum mechanics of fluids,
2 Student will be relating the conservation laws to different types of fluid flow conditions
3 Student will produce the solution for complex fluid mechanics problems and to design system using fundamental principles.
4 Student will derive the generic form of N-S equations and illustrate the analytical solution for simple flow and mass transfer problems

Unit 1: **(4 hrs)**
Introduction to transport phenomena, momentum transfer, heat transfer and mass transfer.

Unit 2: **(10 hrs)**
Description of fluid flow motion, conservation of mass, momentum equation, energy equation (Integral and differential approach)

Unit 3: **(8 hrs)**
Inviscid and viscous fluid flow, boundary layers

Unit 4: **(8 hrs)**
Differential equation of heat transfer, steady state conduction, convective heat transfer and radiation heat transfer

Unit 5: **(8 hrs)**

Fundamentals of mass transfer, differential equation of mass transfer, steady state mass diffusion, convective mass transfer

Unit 6: **(6 hrs)**

Applications: Fluid machinery, heat and mass transfer equipment

Suggested Texts and Reference Materials:

1. Introduction to Fluid Mechanics R. Fox and A. MacDonald, John Wiley and Sons
2. Introduction to Fluid Mechanics and Fluid Machines: S. K. Som, Gautam Biswas and Suman Chakraborty, McGraw-Hill Education
3. Fluid Mechanics and its Applications, Vijay Gupta Santosh Gupta New Age international
4. Fluid Mechanics: Pijush K. Kundu, Ira M. Cohen, David R Dowling, Academic
5. Transport Phenomena, R. B. Bird, W. Stuart, Press Wiley; Second edition (1 January 2006)

PEMED1101B Advanced Material Technology

Teaching scheme
Lectures:3 Hrs./week

Examination Scheme
In semester:50 marks
End semester: 50 marks
Credit: 3

Unit 1 Methods for Selection of material
Material indices, Material property and process property charts,

Unit 2 Material for stiffness limited design
Standard solution to elastic problems, deriving material limits and indices, plotting material property charts.

Unit 3 Material for strength limited design
Standard solutions to plastic problems, strength and toughness, fracture toughness, mechanics of fracture, Material property charts for strength and toughness.

Unit 4 Materials for cyclic loading and Vibrations
Vibrations and fatigue, energy loss and damping coefficient. S-N charts. Methods of increasing fatigue life of components.

Unit 5 Materials for friction and wear
The physics of friction and wear, charting friction of wear, tribological properties.

Unit 6 Materials for Thermal Applications
Effect of heat on thermal and mechanical properties of material, diffusion, charts for creep behaviour, high temperature applications.

Text Books:
Materials engineering, science, processing and design, Michael Ashby, Hugh Shercliff, David Cebon. Butterworth-Heineman, 2008

Reference Books:

1)“Engineering Metallurgy” Higgins R.A. Viva books Pvt. Ltd. 2004
2) “Properties of Engineering materials” R.A. Higgins, ELBS, Edward Arnold,1988.
3) “Material Science & Engineering” Raghavan V. Prentice Hall of India, New delhi,2003.
4) “Introduction to Physical Metallurgy”. Avner, S.H. Tata McGraw-Hill, 1997.
5) “Mechanical Metallurgy”. Dieter. G.E. McGraw-Hill, 1988.

PEMED1101C PROGRAMME ELECTIVE-I POWER TRAIN DESIGN

Teaching Scheme
Lecture: 3 Hrs/week

Examination Scheme
In semester: 50 Marks
End semester: 50 Marks
Credit: 3

Prerequisite: Theory of Machines, Machine Design, I/C Engines

Course Objectives: Students should be able to,

1. Acquire the knowledge of vehicle power train design.
2. Know the design of engine components and engine performance.
3. Know the design of transmission systems of vehicle.
4. Understand the dynamics of driveline.
5. Know the systems of hybrid electric vehicle.

Course Outcome: Students will be able to,

1. Apply the vehicle power train concepts
2. Design engine components and analyze the engine performance
3. Apply knowledge to compute the vehicle longitudinal dynamics
4. Design and analyze the transmission systems and dynamics of driveline of the vehicle

Unit 1: Vehicle Power Train Concepts
Introduction to Powertrain systems, Powertrain components, Power generation characteristics of SI and CI Engines, Engine Kinematics, Engine Torque, output characteristics.

Unit 2: Design of Internal Combustion Engines
Introduction, Design of cylinder and its components, Design of Piston and its components, Design of connecting rod, crankshafts and valve mechanisms and its component, Engine Torque speed characteristics, multi-cylinder engines firing order and its performance, Net Output Power.

Unit 3: Vehicle Longitudinal Dynamics
Introduction, Torque Generators, Tractive Force, Resistive Forces, Vehicle Constant Power Performance (CPP), Constant Torque Performance (CTP), Fixed Throttle Performance (FTP), Throttle Pedal Cycle Performance (PCP), Effect of Rotating Masses, Tyre Slip, Performance on slope, Vehicle Coast Down, Driveline Losses.

Unit 4: Design of Transmission System
Introduction, the need for a Gearbox, Design of Gearbox Ration, Gearbox Kinematics and Tooth Numbers, Manual Transmissions, Automatic Transmission, Conventional Automatics, CVTs Classification, Friction CVTs, Ratcheting CVTs, Non-Mechanical CVTs, Idling and Launch.

Unit 5: Driveline Dynamics
Introduction, Modeling Driveline Dynamics, Bond Graph Models of Driveline Components Driveline Models, Analysis: Effect of Clutch Compliance, Effect of Driveshaft Compliance, Effect of Clutch and driveshaft Compliances, Frequency Responses and Improvements.

Unit 6: Introduction to Hybrid Electric Vehicles

Introduction, types of hybrid electric vehicles, power split devices, HEV component characteristics HEV performance analysis, HEV component sizing, and Power management.

References:

1. Vehicle Powertrain Systems by Behrooz Mashadi, David Crolla, A John Wiley & Sons Ltd
2. Automobiles Power Train and Automobiles Dynamics by, David Crolla, A John Wiley & Sons Ltd
3. Automotive Engineering Powertrain, Chassis Systems and Vehicle Body by David Crolla, Elsevier BH New York, London, Oxford.

MED1105 DESIGN OF TRIBOSYSTEMS LAB

Teaching Scheme
Lecture: 2Hrs/week

Examination Scheme
End semester: 50 marks
Credit/s: 1

Course Objectives:

1. To learn experimental methods to determine coefficient of friction
2. To demonstrate rolling failure of wear of materials
3. To study material properties for lubricants and bearings
4. To understand design process of tribological systems

Course Outcomes:

Students will be able to:

1. Determine coefficient of friction experimentally for various materials
2. Determine wear rate experimentally for various materials and dynamic conditions
3. Select materials for bearings and lubricant oil specification
4. Analyze and simulate friction and wear processes

List of Experiments: (Any 5)

1. Determine the coefficient of friction for different conditions and different material pairs.
2. Experiments on wear measurement.
3. Study effect of lubricants and their properties on friction and wear.
4. Study effect of additives on lubricant performance.
5. Experiment on gas lubricated bearing.
6. Experimental study on Journal bearing performance.
7. Simulation of friction and wear mechanisms

Assignment:

Design of **Anyone** tribo-element; such as: Plane bearing, Gear, Seals, Piston and cylinder

MED1106ADVANCE MECHANICS OF MATERIALS LAB

Teaching Scheme
Practical: 2Hrs/week

Examination Scheme
Oral Exam: 25 M
Credit: 1

Course Objectives

Introduce students to

1. details of fracture testing
2. basics of physical property testing
3. mechanical property testing
4. FEA of machine element

Course Outcomes

Students will be able to

1. Test and interpret the results of fracture testing
2. Test and interpret the results of physical property testing
3. Test and interpret the results mechanical property testing
4. Perform the FEA of machine element and interpret the results

Assignments

1. Testing of Fracture toughness of Single Edge Notch Bend specimen.
2. Fatigue life estimation of the test specimen.
3. Physical properties of polymer matrix composites.
4. Testing of Mechanical properties of polymer matrix composite (Tensile/Flexural/Impact).
5. FEA of machine member by using commercial software for stress distribution, stress concentration.

PEMED 1102A Transport Phenomenon Lab

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
End Sem: 25 Marks
Credits: 1

Prerequisites:
1. Engineering Mathematics
2. Engineering Physics
3. Fluid Mechanics

Course Objectives:
1. To understand fluid flow and mass transfer characteristics experimentally
2. To study and find temperature distribution in conduction heat transfer
3. To calculate heat transfer coefficient
4. To understand the simulation and analysis of flow and mass transfer

Course Outcomes:
completion of this lab course, the student will be able to:
1. measure flow characteristics of laminar flow through pipe
2. determine temperature distribution in conduction heat transfer
3. determine heat transfer coefficient in convective heat transfer
4. analyse and simulate flow and mass transfer

List of Experiments:
1. Flow characteristics of laminar flow through a pipe
2. Temperature distribution in conduction heat transfer trough cylinder and sphere
3. Heat transfer coefficient in convective heat transfer
4. Radiation Heat Transfer shape factor analysis
5. Demonstration of mass diffusion
6. Numerical code on fluid flow and heat transfer

PEMED 1102C: ELECTIVE-I LAB POWER TRAIN DESIGN LABORATORY

Teaching Scheme
Lecture: 2 Hrs/week

Examination Scheme
Oral: 25 Marks
Credit: 1

Prerequisite: Theory of Machines, Machine Design, I/C Engines

Course Objectives: Students should be able to,

1. Acquire the knowledge of vehicle power train design.
2. Know the design of engine components and engine performance.
3. Know the design of transmission systems of vehicle.
4. Understand the dynamics of driveline.
5. Know the systems of hybrid electric vehicle.

Course Outcome: Students will be able to,

1. Apply the vehicle power train concepts
2. Design engine components and analyze the engine performance
3. Apply knowledge to compute the vehicle longitudinal dynamics
4. Design and analyze the transmission systems and dynamics of driveline of the vehicle

Assignments:

1. Determination of Power generation characteristics of IC Engines using programming
2. Determination of engine torque and power verses speed using programming
3. Determination of engine power loss with altitude using programming
4. Plot the variation of speed, vehicle acceleration, speed and distance travel with time,
5. Determination of effect of rotating masses on the performance of vehicle in terms of gear shift.

Project on full imperial size drawing sheet for the following

Design and draw the of IC engine components details and its assembly