Autonomous Program Structure of
Final Year B. Tech. Mechanical Engg.
Academic Year: 2019-2020

Final Year B. Tech. (Mechanical Engineering) Semester – I										
Course Code	Course Title	Teaching Scheme Hours /Week			Examination Scheme				Marks	Credit
		Lecture	Tutorial	Practical	In Semester	End Semester	Oral	Practical		
ME 4101	CAD/CAM and Automation	3	0	0	50	50	0	0	100	3
ME 4102	Transmission System Design	3	0	0	50	50	0	0	100	3
HS 4101	Economics for Engineers/ Advanced Entrepreneurship Development	3	0	0	50	50	0	0	100	3
OE 4101	Open Elective –I	3	0	0	50	50	0	0	100	3
ME 4103	CAD-CAM-CAE Lab Lab	0	0	2	0	0	50	0	50	1
ME 4104	Project Phase-I	0	2	14	100	0	50	0	150	9
	Total	**12**	**2**	**16**	**300**	**200**	**100**	**0**	**600**	**22**
	Grand Total	**30**			**600**				**600**	**22**

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ME 4101 – CAD/CAM and Automation

Teaching Scheme

Lecture: 3 Hrs/week

Examination Scheme

In semester: 50 marks

End semester: 50 marks

Credits: 3

Prerequisites:

1. Strength of material
2. Manufacturing process

Course Objectives:

1	To apply homogeneous transformation of geometric entities
2	To solve numerical on different type curve generation methods
3	To apply finite element methods for solve 1D and 2D structural problems
4	To apply G&M codes for writing part program of CNC lathe and milling
5	To understand advance manufacturing methods and basics of robotics and AI

Course Outcomes:

Upon completion of this course, students will be able to:

1	apply homogeneous transformation of geometric entities
2	solve numerical on different type curve generation methods
3	apply finite element methods for solve 1D and 2D structural problems
4	apply G&M codes for writing part program of CNC lathe and milling
5	understand advance manufacturing methods and basics of robotics

Unit 1: Computer Graphics **6 Hrs**

Transformations (2D & 3D) : Introduction, Formulation, Translation, Shear, Rotation, Scaling and reflection, Homogeneous representation, Concatenated transformation, Mapping of geometric models, Inverse transformations, Introduction to 3D transformation

Projections : Orthographic, Isometric, Perspective projections

Unit 2: Geometric Modeling **6 Hrs**

Curves – Introduction, Analytical curves (Line, circle, ellipse, parabola, hyperbola), Synthetic curves (Hermite Cubic Spline, Bezier, B-Spline Curve)

Surfaces – Introduction, Surface representation, Analytic surfaces, Synthetic Surfaces, Hermite bicubic, Bezier, B-Spline, Coons patch surface, Applications in freeform surfaces

Solids - Introduction, Geometry and Topology, Solid Representation, Boundary Representation, Euler's equation, Constructive Solid Geometry (CSG), Boolean operation for CSG

Unit 3: Finite Element Analysis (FEA) **8 Hrs**

Introduction : Brief History of FEM, Finite Element Terminology (nodes, elements, domain, continuum, Degrees of freedom, loads and constraints), General FEM procedure, Applications of FEM in various fields, meshing, p and h formulation, Advantages and disadvantages of FEM

One Dimensional Problem: Finite element modeling, coordinate and linear shape function, Assembly of Global Stiffness Matrix and Load Vector, Properties of Stiffness Matrix, Finite Element Equations, (stepped bar, spring in series and parallel]

Trusses : Introduction, 2D Trusses, Element stiffness matrix for truss, Assembly of Global Stiffness Matrix , load vector

Unit 4: Computer Aided Manufacturing **6 Hrs**

Introduction to Computer Aided Manufacturing (CAM), Coordinate system, Working principal of CNC Lathe, Turning Centers, Milling Machine, Steps in developing CNC part program, Tool and geometric compensations, subroutine and Do loop using canned cycle. [Only theory – 2 hrs]

CNC Lathe part programming (FANUC) : Linear and circular interpolation, Canned cycles for facing, threading, grooving, etc. [Theory + Program]

CNC Milling part programming (FANUC): Linear and circular interpolation, Pocketing, contouring and drilling cycles. [Theory + Program]

Unit 5: Digital Manufacturing **6 Hrs**

Rapid Prototyping : Introduction, classification of RP Processes (SLA, LOM, SLS, FDM, 3D printing), Working principle, features, models & specification of process, application, advantages and disadvantages, Rapid Tooling and STL format, Concept of 4D Rapid Prototyping.

Unit 6: Introduction Robotics and Artificial Intelligence **6 Hrs**

Introduction to Robotics: Structure of Robotic System - Point to point & continuous path robotic systems, Joints, End Effectors, Grippers - Mechanical, Magnetic and Pneumatic. Drives, Controllers, Industrial Applications

Artificial Intelligence: Introduction, need and application, problem solving through forward and backward search, introduction to machine learning and industry 4.0

Suggested Texts and Reference Materials:

1. Ibrahim Zeid and R. Sivasubramanian - CAD/CAM - Theory and Practice Tata McGraw Hill Publishing Co. 2009
2. Rao P. N., Introduction to CAD/CAM Tata McGraw Hill Publishing Co.
3. Chandrupatla T. R. and Belegunda A. D. -Introduction to Finite Elements in Engineering - Prentice Hall India.
4. Seshu P. Text book of Finite Element Analysis, PHI Learning Private Ltd. New Delhi, 2010
5. S. K. Sinha, CNC Programming using Fanuc Custom Macro B, McGraw-Hill Professional
6. S. R. Deb, Robotics Technology and Flexible Automation, Tata McGraw Hill.

ME4102 – Transmission System Design

Teaching Scheme

Lecture: 3 Hrs/week

Examination Scheme

In semester: 50 marks

End semester: 50 marks

Credits: 3

Prerequisites:

1. Strength of machine elements (S.O.M.)
2. Engineering materials and their properties (Material Science and Metallurgy)
3. Principles of machine design (Machine Design)
4. Mechanical Drives (Machines and Mechanisms)

Course Objectives:

1 To analyze the forces in rigid drives during power transmission.
2 To apply the AGMA standard to design a gear pair.
3 To select a drive element from manufacturer's catalogue.
4 To evaluate the tensions and stresses to design a flexible drive..
5 To design mechanical transmission system.
6 To explain the design considerations of electric and hybrid transmission systems.

Course Outcomes:

Upon completion of this course, the student will be able to,

1 Analyze the forces in rigid drives during power transmission.
2 Apply the AGMA standard to design a gear pair.
3 Select a drive element from manufacturer's catalogue.
4 Evaluate the tensions and stresses to design a flexible drive.
5 Design mechanical transmission system.
6 Explain the design considerations of electric and hybrid transmission systems.

Unit I: Elements of transmission systems-I (Rigid drives-I): Classification and selection of gears, standard tooth systems, modes of failures, terminology and force analysis, gear design based on strength (AGMA standard), dynamic load by velocity factor and Buckingham's equation. **8 Hrs**

Unit II: Elements of transmission systems-II (Rigid drives-II): Formative gear and force analysis of helical and bevel gears, design based on strength (AGMA standard), velocity factor and Buckingham's equation. Design of worm and worm gear based on strength and thermal considerations. **8 Hrs**

Unit III: Anti-friction Bearings and Flexible Drives : Ball and roller bearings, magnetic

bearings, ball screw systems: Modes of failures, static and dynamic load ratings, equivalent dynamic load, reliability of bearing, bearing life, load-life relationship and selection of bearings from manufacturer's catalogue. Power rating, tensions, stresses and selection from manufacturer's catalogue for flexible drives. **6 Hrs**

Unit IV: Mechanical Transmission Systems: Gear boxes for automobiles and industrial use: Constant mesh, sliding mesh, synchromesh, differential and planetary gear box, and epicyclic power train. **6 Hrs**

Unit V: Electric and Hybrid Vehicle Transmission Systems: EV transmission configurations, transmission components, torque-speed characteristics, EV motor sizing, hybrid drive trains, sizing of components. **6 Hrs**

Unit VI: Series and Parallel Electric Drive Systems: Control strategies, sizing of major components, power ratings, traction motors, engine generator, and drive train parameters.
Design examples: GM two mode hybrid, Toyota Prius, Hyundai Ioniq Hybrid, Volkswagen Golf GTE. **6 Hrs**

Suggested Texts and Reference Materials:

1. Shigley J.E. and Mischke C.R., "Mechanical Engineering Design", McGraw Hill Publication Co. Ltd.
2. Spotts M.F. and Shoup T.E. ,"Design of Machine Elements" ,Prentice Hall International.
3. Bhandari V.B ,"Design of Machine Elements", Tata McGraw Hill Publication Co. Ltd.
4. Black P.H. and O. Eugene Adams ,"Machine Design",McGraw Hill Book Co. Inc.
5. Willium C. Orthwein,"Machine Components Design",West Publishing Co. and Jaico Publications House.
6. "Design Data",P.S.G. College of Technology, Coimbatore.
7. Juvinal R.C,"Fundamentals of Machine Components Design",John Wiley and Sons.
8. Hall A.S., Holowenko A.R. and Laughlin H.G,"Theory and Problems of Machine Design" , Schaum's Outline Series.
9. Michael Nikowitz, 'Advanced Hybrid and Electric Vehicles, System Optimization and Vehicle Integration', Springer International Publishing Switzerland 2016.
10. Iqbal Husain, 'Electric and Hybrid Vehicles, Design Fundamentals', CRC PRESS.

HS 4101 -- Economics for Engineers

Teaching Scheme

Lecture: 3 Hrs/week

Examination Scheme

In semester: 50 marks

End semester: 50 marks

Credits: 3

Course Objectives:

1 To enable students to understand the Fundamental Economic Concepts
2 To enable students to understand the techniques of Inflation Factor
3 To Enable students to understand market structure and pricing theory.

Course Outcomes: Upon completion of this course, the student :

1 Will develop the Basics of Economics to solve engineering problems
2 Will be able to apply cost analysis in industry domain
3 Will be able to apply economically sound decisions

Unit 1: INTRODUCTION TO ECONOMICS **8 Hrs**

Introduction To Economics- Flow In An Economy, Concept Of Engineering Economics – Engineering Efficiency, Revision of concepts like Economic Efficiency, Scope Of Engineering Economics – Element Of Costs, Marginal Revenue, Sunk Cost, Opportunity Cost, Break Even Analysis -P/V Ratio, Elementary Economic Analysis – Material Selection For Product Design Selection For A Product, Process Planning.

Unit 2: VALUE ENGINEERING **8 Hrs.**

Make Or Buy Decision, Value Engineering – Function, Aims, Value Engineering Procedure. Interest Formulae And Their Applications –Time Value Of Money, Single Payment Compound Amount Factor, Single Payment Present Worth Factor, Equal Payment Series Sinking Fund Factor, Equal Payment Series

Unit 3: CASH FLOW **8 Hrs.**

Methods Of Comparison Of Alternatives – Present Worth Method (Revenue Dominated Cash Flow Diagram), Future Worth Method (Revenue Dominated Cash Flow Diagram, Cost Dominated Cash Flow Diagram), Annual Equivalent Method (Revenue Dominated Cash Flow Diagram, Cost Dominated Cash Flow Diagram), Rate Of Return Method, Examples In All The Methods.

Unit 4: REPLACEMENT AND MAINTENANCE ANALYSIS **5 Hrs.**

Replacement And Maintenance Analysis – Types Of Maintenance, Types Of Replacement Problem, Determination Of Economic Life Of An Asset, Replacement Of An Asset With A New Asset – Capital Recovery With Return And Concept Of Challenger And Defender, Simple Probabilistic Model For Items Which Fail Completely.

Unit 5: DEPRECIATION **8 Hrs.**

Depreciation- Introduction, Straight Line Method Of Depreciation, Declining Balance Method Of Depreciation-Sum Of The Years Digits Method Of Depreciation, Sinking Fund Method Of Depreciation/ Annuity Method Of Depreciation, Service Output Method Of Depreciation-Evaluation Of Public Alternatives- Introduction, Examples, Inflation Adjusted Decisions – Procedure To Adjust Inflation, Examples On Comparison Of Alternatives And Determination Of Economic Life Of Asset.

Suggested Texts :

1.Panneer Selvam, R, "Engineering Economics", Prentice Hall Of India Ltd, Second Edition ,New Delhi, 2013.

2. Banga and Sharma, "Industrial Organisation and Engineering Economics", Khanna Publishers,Twenty Fifth ,2006

Reference books :

1.Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics And Analysis" Engg. Press, Texas, 2010. 2.Degarmo, E.P., Sullivan, W.G And Canada, J.R, "Engineering Economy", Macmillan, New York, 2011. 3.Zahid A Khan: , "Engineering Economy", Dorling Kindersley, 2012

OE 4101 Automotive Technology

Teaching Scheme

Lectures: 3Hrs/week

Examination Scheme

In Sem: 50 marks

End Sem.: 50 Marks

Credits: 3

Pre-requisite:

1. Basic Mechanical Engineering.

Course Objectives:

1. To study layout of the vehicles.
2. To understand function of various components of automotive systems.
3. To understand use of alternative fuels for vehicle.

Course Outcomes: Students will be able to:

1. Identify different layouts of automobile vehicle.
2. Identify engine auxiliary systems.
3. Explain types and function of transmission systems in vehicle.
4. Identify types and function of different steering, brakes and suspension systems.
5. Understand use of alternative fuels.

Unit 1: Vehicle Structure and Engine auxiliary systems: **8 Hrs**

Vehicle construction and different layouts, chassis, frame and body, resistances to vehicle motion and need for a gearbox, components of engine. Electronically controlled gasoline injection system for SI engines. Electronically controlled diesel injection system, Electronic ignition system.

Unit 2: Transmission Systems: **7 Hrs**

Conventional transmission system, Automatic transmission system (fluid coupling, clutch less drive, fluid flywheel – torque converter), Semi-automatic transmission, continuously variable transmission (CVT), dual clutch hybrid transmission.

Unit 3: Steering, Brakes and Suspension Systems: **7 Hrs**

Steering geometry and types of steering gear box - Power Steering, Active and passive Suspension Systems, Pneumatic and Hydraulic Braking Systems, Regenerative breaking, Anti-lock Braking System (ABS) and Traction Control.

Unit 4: Electric and hybrid vehicles: **6 Hrs**

Concept of electric and hybrid vehicle, EV and HEV fundamentals, architecture and dynamics (power, torque speed relationship, performance, etc.) of EV and HEV power train, drives and energy sources in EV and HEV. Vehicles with hydrogen fuel cells.

Unit 5: Modern Energy Sources: **6 Hrs**

Compressed Natural Gas (CNG), Liquefied Petroleum Gas (LNG), Bio-fuels, lithium-ion battery, hydrogen fuel cell in Automobiles.

Unit 6: Emission control in automobiles: **6 Hrs**

Emission and Fuel Roadmap Euro 6 / BS V norms (proposed 2020-21), Exhaust gas re-circulation (EGR), Electrostatic precipitation (Particulate matter) and Engine emission control (three way catalytic converter system SCR and particulate filter).

Text Books:

1. Kirpal Singh, Automobile Engineering Vol 1 and 2, Standard Publishers, 7th Edition, 1997.
2. M. Chris and M. A. Masrur, Hybrid Electric Vehicles, Wiley Publications, 2nd Edition, 2017.

Reference Books:

1. K. K. Jain and R. B. Asthana, Automobile Engineering, Tata McGraw Hill Publishers, New Delhi, 1999.
2. Dr. K. R. Govindan, Automobile Engineering, Anuradha Publications, Chennai, 2013.
3. Joseph Heiner, Automotive Mechanics, Litton Education Publishing Ins., New York, 1999.
4. Angelin, Automotive Mechanics, Tata McGraw Hill Pub. Comp. Ltd., 10th Edition, 2004.

OE 4101 Finite Element Analysis

Teaching Scheme

Lectures: 3Hrs/week

Examination Scheme

In Semester: 50 marks

End Semester: 50 Marks

Credits: 3

Pre-requisite:

1. Engineering Mathematics
2. Numerical Methods
3. Applied Mechanics

Course Objectives:

1. To carry out discretization of differential equations using finite element method
2. To perform analysis of engineering problems using finite element method
3. To understand and interpret results obtained with FEA software tools.

Course Outcomes: Students will be able to

1. Derive discretization equations from differential equations for one- and two-dimensional problems
2. Solve static and dynamic engineering problems using FEA
3. Develop numerical codes in C/C++/Matlab for simple problems.
4. Perform simulations of rweal-life problems using FEA software tools

Unit 1: Introduction: **4 Hr**

Typical Application Examples, Automotive Applications, Manufacturing Process Simulation, Electrical and Electronics Engineering Applications, Aerospace Applications

Unit 2: **10 Hrs**

Finite Element Formulations: Weighted Residual Method, Use of a Single Continuous Trial Function, The General Weighted Residual (WR) Statement, Weak (Variational) Form of the Weighted Residual Statement, Functional and Differential Equation Forms, Principle of Stationary Total Potential (PSTP), Rayleigh–Ritz Method, One-dimensional Bar Finite Element, One-dimensional Heat Transfer Element

Unit 3: **12 Hrs**

One-dimensional Finite Element Analysis: General Form of the Total Potential for 1-d, Generic Form of Finite Element Equations, The Linear Bar Finite Element, The Quadratic Bar Element, Determination of Shape Functions, Element Matrices, Beam Element, Selection of Nodal d.o.f., Determination of Shape Functions, Element Matrices, Frame Element, One-dimensional Heat Transfer

Unit 4: **8 Hrs**

Two-dimensional Finite Element Analysis: Approximation of Geometry and Field Variable, Simple Three-noded Triangular Element, Four-noded Rectangular Element, Six-noded Triangular Element, Natural Coordinates and Coordinate Transformation, Alternate Methods of Deriving Shape Functions,

Natural Coordinates—Quadrilateral Elements, Natural Coordinates—Triangular Elements, 2-d Elements for Structural Mechanics, Generic Relations, Three-noded Triangular Element, Four-noded Rectangular Element

Unit 5: **6 Hrs**

Dynamic Analysis Using Finite Elements: Vibration Problems, Equations of Motion Based on Weak Form, Axial Vibration of a Rod, Transverse Vibration of a Beam, Transient Vibration Analysis, Modelling of Damping, The Mode Superposition Scheme, Direct Integration Methods, Thermal Transients-Unsteady Heat Transfer in a Pin-Fin

Books:

1. Daryl L. Logan, A First Course in the Finite Element Method
2. Cook, R. D., Malkus, D. D. and Plesha, M. E., Concepts and Applications of Finite Element Analysis
3. Seshu, P., Textbook of Finite Element Analysis
4. Chandrupatla, T. R. and Belegundu, A. D., An Introduction to the Finite Element Method in Engineering

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OE 4101 -- Industrial Engineering and Management

Teaching Scheme

Lecture: 3 Hrs/week

Examination Scheme

In semester: 50 marks

End semester: 50 marks

Credits: 3

Course objectives: The Industrial Engineering course prepares students to…

1. Understand type of organisation and calculate partial and total productivity
2. Learn the fundamental knowledge, skills, tools and techniques of methods study and work measurement.
3. Understand type of production environments, resource planning and control methods.
4. Learn basic resource scheduling techniques, human resource management and industrial safety norms.

Course Outcomes: Students will be able to…

1. Identify type of organisation and analyze partial and total productivity
2. Manage and implement different techniques of methods study and work measurement of process under consideration for improvement.
3. Analyze production environment under consideration w.r.to its resource planning and control.
4. Apply basic resource scheduling and human resource management techniques.

Unit 1: Introduction to Industrial Management and Productivity Analysis **6 Hrs**

Industrial management: Functions and principles of management; Organisation: Concept, characteristics, structures and types of organisation- (formal line, military, functional, line and staff organisation);

Productivity analysis: Definition, measurement of productivity: productivity models and index (numerical); factors affecting the productivity; productivity improvement techniques;

Definition and scope of Industrial Engineering.

Unit 2: Method Study **7 Hrs**

Work Study: Definition, objective and scope of work-study.

Method Study : Definition, objective and scope of method study, activity recording and exam aids, Charts to record moments in shop - operation process charts, flow process charts, travel chart, two handed chart and multiple activity charts. Charts to record movement at work place - principles of motion economy, classification of moments, SIMO chart, and micro motion study. Definition and installation of the improved method;

Human factors in Work-Study; **Value Engineering and Value Analysis**.

Unit 3: Work Measurements **6 Hrs**

Introduction: Definition, objectives and uses; Work measurement techniques:

Time study: Definition, time study equipment, selection of job, steps in time study. Breaking jobs into elements, recording information. Rating and standard rating, standard performance, scales of rating, factors affecting rate of working, allowances and standard time determination(numerical);

Work sampling: Need and procedure, sample size determinations (numerical);

Unit 4: Synthetic motion studies: PMTS and MTM. Introduction to MOST (numerical).

Production Management **7 Hrs**

Production Planning and Control: Types of production systems, functions of PPC, Aggregate production planning; Master Production Schedule; ERP

Forecasting techniques: Causal and time series models, moving average, exponential smoothing, trend and seasonality; (Numerical).

Supply Chain Management: Concept, Strategies, Supply Chain Network, Push and Pull Systems, Logistics, Distribution; Order Control strategies: MTO, MTA, MTS.

Unit 5: Facility Management **6 Hrs**

Facility Layout: Factors affecting facility location; Types of Plant Layout; Computer Aided Layout Design Techniques; Assembly Line Balancing (Numerical);

Material Handling and Inventory Control: Principles, Types of Material Handling Devices; Stores Management, Inventory costs, Types of inventory models - Deterministic and Probabilistic, Concept of EOQ, purchase model without shortages (Numerical); ABC and VED Analysis (Numerical).

Unit 6: Project Scheduling, Human Resource and Industrial Safety **6 Hrs**

Scheduling Techniques: CPM and PERT(Numerical);

Human Resource Development: Functions: Manpower Planning, Recruitment, Selection, Training; Concept of KRA (Key Result Areas); Performance Appraisal (Self, Superior, Peer, 360^0);

Text Books

1. Industrial Engineering and Production Management, M Mahajan, Dhanpat Rai and Co.
2. Industrial engineering and management by O. P. Khanna, Dhanpatrai publication
3. Industrial Engineering , Martend Telsang, S. Chand Publication.
4. Industrial Organisation & Engineering Economics by Banga and Sharma, Khanna publication.
5. Prem Kumar Gupta, D. S. Hira, Problems in Operations Research: Principles and Solutions, S. Chand, 1991
6. J. K. Sharma, Operations Research : Theory And Application, Laxmi pub. India.

Reference Books

1. Introduction to Work Study by ILO, ISBN 978-81-204-1718-2, Oxford & IBH Publishing Company, New Delhi, Second Indian Adaptation, 2008
2. Maynard's Industrial Engineering Hand Book By H.B. Maynard, KJell, McGraw Hill Education, 2001
3. Zandin K.B. - Most Work Measurement Systems, ISBN 0824709535, CRC Press, 2002.

- Assignment based evaluations are designed. **This evaluation is treated as T1-Marks.** Marks will be calculated (at the end of semester) on the basis of successful completion / submission of assignments explained to you time to time on the basis of syllabus content. [Note: these assignments are part of activity based learning. Hence, students are to work in a group to complete following assignments].

ME 4101 – CAD/CAM and Automation Lab

Teaching Scheme

Lab: 2 Hrs/week

Examination Scheme

Oral: 50 marks

Credits: 1

Prerequisites:

1. Strength of material
2. Manufacturing process

Course Objectives:

1	To prepare program in MATLAB tool for finding transformations of object
2	To use finite element tool for solve bar and truss problem
3	To use manufacturing simulation tool for simulation of lathe and milling part
4	To use 3D printing technique for prepare solid models

Course Outcomes: Upon completion of this course, students will be able to:

1	prepare program in MATLAB tool for finding transformations of object
2	use finite element tool for solve bar and truss problem
3	use manufacturing simulation tool for simulation of lathe and milling part
4	use 3D printing technique for prepare solid models

List of Practical Activities:

1. Write a Programs for transformation of different objects using mat lab solver
2. Solve 1D bar problems using finite element analysis tool ANSYS
3. Solve 2D truss problems using finite element analysis tool ASYSS
4. Stress and deflection analysis of plate/bracket using ANSYS
5. Tool path generation of Turning components using Feature CAM tool
6. Tool path generation of Milling components Feature CAM tool
7. Manufacture assembly components using 3D printing machine
8. Assignment of robot gripper design

Text Book:

1. Ibraim Zeid, Mastering CAD/CAM – Tata McGraw Hill Publishing Co. 2000
2. Nitin S. Gokhale, Practical Finite Element Analysis, Finite to Infinite; First edition

ME 4104 – Project Phase -I

Teaching Scheme

Tutorial: 2 Hrs/week

Lab : 14 Hrs./week

Examination Scheme

In-Sem : 100 marks

Oral: 50 marks

Credits: 9

Course Outcomes:

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

1. extract desired understanding and conclusions consistent with objectives and limitations of the analysis by using mechanical engineering concepts
2. build models/prototypes to develop diverse set of design solutions
3. use appropriate procedures, tools and techniques to conduct experiments to identify various engineering roles
4. demonstrate effective communication, problem solving, conflict resolution and leadership skills considering moral & ethical principles
5. read, understand and interpret technical and non-technical information
6. produce clear, well-constructed, and well-supported written engineering documents
7. use project management tools to schedule a sustainable engineering project so it is completed on time and on budget

INSTRUCTIONS FOR DISSERTATION WRITING (Project Stage I)

1. Print the manuscript using
   a. Letter quality computer printing.
   b. The main part of manuscript should be Times New Roman 12 pt. with alignment - justified.
   c. Use 1.5 line spacing.
   d. Entire report shall be of 5- 7 chapters.
2. Use the paper size 8.5'' × 11'' or A4 (210 × 197 mm). Please follow the margins given below. Margin Location
   a. Top - 1'' (25.4 mm)
   b. Left - 1.5'' (37 mm)
   c. Bottom - 1.25'' (32 mm)
   d. Right - 1'' (25.4 mm)
3. The footer must include the following: Institute Name, B.Tech. (Mechanical) Times New Roman 10 pt. and centrally aligned.
4. Page number as second line of footer, Times New Roman 10 Pt, centrally aligned.
5. All paragraphs will be 1.5 lines spaced with a one blank line between each paragraph. Each paragraph will begin with without any indentation.
6. Section titles should be bold with 14 pt typed in all capital letters and should be left aligned.

7. Sub-Section headings should be aligning at the left with 12 pt, bold and Title Case (the first letter of each word is to be capitalized).
8. Illustrations (charts, drawings, photographs, figures) are to be in the text. Use only illustrations really pertinent to the text. Illustrations must be sharp, clear, black and white. Illustrations downloaded from internet are not acceptable.
    a. Illustrations should not be more than two per page. One could be ideal
    b. Figure No. and Title at bottom with 12 pt
    c. Legends below the title in 10 pt
    d. Leave proper margin in all sides
    e. Illustrations as far as possible should not be photo copied.
9. Photographs if any should be of glossy prints
10. Please use SI system of units only.
11. Please number the pages on the front side, centrally below the footer
12. References should be either in order as they appear in the thesis or in alphabetical order by last name of first author
13. Symbols and notations if any should be included in nomenclature section only
14. Following will be the order of report
    a. Cover page and Front page as per the specimen on separate sheet
    b. Certificate from the Institute as per the specimen on separate sheet
    c. Acknowledgements
    d. List of Figures
    e. List of Tables
    f. Nomenclature
    g. Contents
    h. Abstract (A brief abstract of the report not more than 150 words. The heading of abstract i.e. word Abstract‖ should be bold, Times New Roman, 12 pt and should be typed at the centre. The contents of abstract should be typed on new line without space between heading and contents. Two sentences each on motive, method, key-results and conclusions in Abstract

The main body of your report will contain:

1. Introduction (Times New Roman (TNR) – 14 Bold)
    a. Problem statement (TNR – 12)
    b. Objectives
    c. Scope
    d. Methodology
    e. Organization of Dissertation
2. Literature Review: Discuss the work done so far by researchers in the domain area and their significant conclusions. No derivations, figures, tables, graphs are expected.
3. This chapter shall be based on your own simulation work (Analytical/ Numerical/FEM/CFD)
4. Experimental Validation - This chapter shall be based on your own experimental work
5. Concluding Remarks and Scope for the Future Work
6. References
7. ANNEXURE (if any) (Put all mathematical derivations, Simulation program as Annexure)

Note:

1. All section headings and subheadings should be numbered. For sections use numbers 1, 2, 3… and for subheadings 1.1, 1.2… etc and section subheadings 2.1.1, 2.1.2… etc.
2. References should be given in the body of the text and well spread. No verbatim copy or excessive text from only one or two references. If figures and tables are taken from any reference then indicate source of it.

Please follow the following procedure for references

Reference Books

[1] Collier, G. J. and Thome, J. R., Convective boiling and condensation, 3rd ed., Oxford University Press, UK, 1996, pp. 110 – 112.

Papers from Journal or Transactions

[1] Jung, D. S. and Radermacher, R., Transport properties and surface tension of pure and mixed refrigerants, ASHRAE Trans, 1991, 97 (1), pp. 90 – 98.

[2] Bansal, P. K., Rupasinghe, A. S. and Jain, A. S., An empirical correction for sizing capillary tubes, Int. Journal of Refrigeration, 1996, 19 (8), pp.497 – 505.

Papers from Conference Proceedings

[1] Colbourne, D. and Ritter, T. J., Quantitative assessment of flammable refrigerants in room air conditioners, Proc. of the Sixteenth International Compressor Engineering Conference and Ninth International Refrigeration and Air Conditioning Conference, Purdue University, West Lafayette, Indiana, USA, 2002, pp. 34 – 40.

Reports or Handbooks

[1] United Nations Environmental Programme, Report of the Refrigeration, Air Conditioning and Heat Pumps, Technical Option Committee, 2002, Assessment - 2002. ASHRAE Handbook: Refrigeration, 1994 (Chapter 44)

Patent

[1] Patent no, Country (in parenthesis), date of application, title, year.

Avoid Internet reference as far as possible, but if you have no other chice

[1] www.(Site) [Give full length URL]