Curriculum and Syllabi of B.Tech Mechanical Engineering with Specialization in Automotive Engineering

(FFCS 2010-11 onwards)

VIT UNIVERSITY
(Estd. u/s 3 of UGC Act 1956)

ARAI
Progress through Research

SCHOOL OF MECHANICAL AND BUILDING SCIENCES

Curriculum

B.Tech Mechanical Engineering with Specialization in Automotive Engineering

Category-wise Breakup of Credits

Category	Number of Credits	Credit distribution (%)	Recommended distribution (%)
Engineering	121	69	64%
Humanities	8	4.5	8%
Management	12	6.8	8%
Sciences	35	20	20%
Sub Total	176	100	
University Elective	6	NA	
Co Curricular and Extra curricular activities	2		
Total	**184**	**100**	

Breakup of Courses

Category	Credits
University Core	33
University Elective	6
Programme Core	129
Programme Elective	15
Minimum credits required to quality	182
Credits Offered	184

Curriculum

SUB. CODE	COURSE TITLE	L	T	P	C	CAT	Type
Semester - I							
CSE101	Computer Programming and Problem solving	2	0	2	3	UC	Engineering
MEE101	Engineering Graphics – I	0	0	4	2	PC	Engineering
MEE102	Workshop Practice – I	0	0	2	1	PC	Engineering
ENG101	English for Engineers – I	3	0	0	3	UC	Humanities
CHY101	Engineering Chemistry	3	0	2	4	UC	Science
MAT101	Multivariable Calculus and Differential Equations	3	1	0	4	UC	Science
PHY101	Modern Physics	3	0	2	4	UC	Science
Semester – II							
MEE103	Engineering Graphics – II	0	0	4	2	PC	Engineering
MEE104	Workshop Practice – II	0	0	2	1	PC	Engineering
MEE202	Engineering Mechanics	3	1	0	4	PC	Engineering
ENG102	English for Engineers – II	3	0	0	3	UC	Humanities
FRE/GER/ JAP/CHI101	Foreign Language	2	0	0	2	UC	Humanities
CHY104	Environmental Studies	3	0	0	3	UC	Science
MAT201	Complex Variables and Partial Differential Equations	3	1	0	4	PC	Science
PHY102	Material Science				4	PC	Science
Semester – III							
EEE101	Basic Electrical & Electronics Engineering	2	1	2	4	PC	Engineering
MEE203	Materials Engineering and Technology	3	0	2	4	PC	Engineering
MEE207	Computer Aided Machine Drawing	0	0	4	2	PC	Engineering
	Manufacturing Processes	3	0	2	4	PC	Engineering
MEE204	Engineering Thermodynamics	2	1	0	3	PC	Engineering
MGT301	Ethics and Values	3	0	0	3	UC	Management
MAT104	Probability and Statistics	3	1	0	4	PC	Science
Semester – IV							
MEE214	Strength of Materials	2	1	2	4	PC	Engineering
	Thermal Engineering & I C Engines	2	1	2	4	PC	Engineering
MEE399	Industrial Internship	-	-	-	2	PC	Engineering
	Fluid Mechanics and Machinery	3	1	2	5	PC	Engineering
	Automotive Electronic & Instrumentation Systems	3	0	0	3	PC	Engineering
	Co Curricular and Extra Curricular actives	-	-	-	2	UC	
MAT105	Differential and Difference Equations	3	1	0	4	PC	Science
Semester – V							
MEE303	Heat and Mass Transfer	3	1	2	5	PC	Engineering
	University Elective				3	UE	

	Vehicle Technology (Automotive Chassis & Body Engineering)	2	1	0	3	PC	Engineering
	Kinematics & Dynamics of Machinery	2	1	2	4	PC	Engineering
MEE302	Design of Machine Elements	2	1	0	3	PC	Engineering
	Mini Project	-	-	4	2	PC	Engineering
MAT204	Numerical Methods	3	1	0	4	PC	Science
Semester – VI							
MEE307	CAD/CAM	2	0	4	4	PC	Engineering
	University Elective				3	UE	
	Management Elective				3	PE	Engineering
	Elective-1				3	PE	Engineering
	Elective-2				3	PE	Engineering
MEE308	Industrial Engineering and Management	3	0	0	3	PC	Management
	Automotive Transmission Systems	2	1	0	3	PC	Engineering
	Comprehension				2	UC	Engineering
Semester – VII							
	Engine Design & Development	2	1	0	3	PC	Engineering
	Fundamentals of Noise & Vibration	2	1	0	3	PC	Engineering
	Vehicle Dynamics & Structures	2	1	0	3	PC	Engineering
	Auto Material & Component Testing Lab	0	0	4	2	PC	Engineering
	Auto Electronics & EMC Lab	0	0	4	2	PC	Engineering
	Engine & Vehicle Evaluation Lab	0	0	4	2	PC	Engineering
	Elective-3				3	PE	Engineering
	Elective-4				3	PE	Engineering
	Soft Skill	2	0	2	3	PC	Management
Semester - VIII							
MEE499	Project Work	-	-	40	20	PC	Engineering

List of Electives

VI-Semester Electives						
Two and Three Wheeler	2	1	0	3	PE	Engineering
Vehicle Inspection & Maintenance (I&M)	2	1	0	3	PE	Engineering
Finite Element Analysis	2	1	0	3	PE	Engineering
Automotive Aerodynamics	2	1	0	3	PE	Engineering
Computational Fluid Dynamics	2	1	0	3	PE	Engineering
Tribology	2	1	0	3	PE	Engineering
Computer Simulation of Engines	2	1	0	3	PE	Engineering
VII-Semester Electives						
Auto Certification & Homologation or	2	1	0	3	PE	Engineering
Automotive HVAC	2	1	0	3	PE	Engineering
Auto Materials & Manufacturing	2	1	0	3	PE	Engineering
Ergonomics and Styling	2	1	0	3	PE	Engineering

CSE 101 COMPUTER PROGRAMMING AND PROBLEM SOLVING L T P C
2 0 2 3

Version No.	1.0
Course Prerequisites	-
Objectives	To provide an overview of computers and problem solving methods using 'C' Language to serve as a foundation for the study of programming languages.
Expected Outcome	The student would acquire various problem solving techniques and will be able to implement them in 'C' language.

Unit I Introduction to Computers and Algorithms

Parts of a computer – Overview of operating systems, compilers, interpreters and programming languages. Algorithms for exchanging the values of two variables, counting, summation of a set of numbers, factorial computation, sine function computation, generation of the Fibonacci sequence, reversing the digits of an integer, base conversion and character to number conversion.

Unit II Constructs of C

Lexical elements – Operators - data types – I/O statements – format specifications – control statements – decision making and looping.

Unit III Arrays

Array handling in C – declaration – single dimensional arrays, two – dimensional arrays, multi-dimensional arrays, sorting and searching on single and two dimensional arrays. Array order reversal, array counting or histogramming, finding the maximum number in a set, removal of duplicates from an ordered array, partition an array, finding the k^{th} smallest element strings: Character array – string handling functions – manipulation on strings.

Unit IV Functions

Prototype – declaration - arguments (formal and actual) – return types – types of functions difference between built-in and user-defined functions.

Unit V Structures

Declarations - nested structures- array of structures - structure to functions - unions- difference between structure and union

Text Books
1. Alexis Leon and Mathews Leon (2001), Introduction to Informati Technology, Tata McGraw-Hill.

Reference Books
1. R.G. Dromey (2001), How to Solve it by Computer, Prentice Hall of India.
2. Al Kelley and Ira Pohl (1998), A Book on C Programming in C, 4^{th} Edition, Pearson Education.

Mode of Evaluation Written examinations, case analysis, mini projects, and assignments

Recommendation by Board of Studies on

Date of approval by the Academic Council

CSE101	COMPUTER PROGRAMMING AND PROBLEM SOLVING LABORATORY	L	T	P	C
		-	-	-	-

Exercises

1. Simple programs using I/O functions
    a. To read two numbers and display the result of addition
    b. To read a name and display it.
    c. To display multiple lines using a single print statement for using escape sequences

2. Program using Control structures
    a. Write a C program to evaluate the series: S = 1+1+1+1+1+….+N terms
    b. Write a C program to solve the series S = 1+2+3+4+…+N
    c. Program to print Multiplication table
    d. Program to print Fibonacci series
    e. Program to check for Prime numbers
    f. To check whether a number is Armstrong number, Perfect number, Perfect square using switch case.
    g. Write a C program to solve the series S = $\frac{1}{2}-\frac{4}{3}+\frac{9}{4}-\frac{25}{5}+.....N$
    h. To find the biggest among N numbers.
    i. To solve the series S = -1+3-11+43-171+….
    j. To find sum of digits of an integer and reverse a number.
    k. Conversion of numbers from one base to another.

3. Program using Arrays
    a. Read and display the sum and biggest element in an array
    b. Read and sort the names in an array in descending order.
    c. Perform Matrix operations
    d. To search for a number in an array.
    e. To find the sum of diagonal elements.
    f. To find transpose of a matrix.

4. Program using Structures
    a. To access students' details
    b. To add two complex numbers
5. Program using Functions
    a. Write a C program to calculate nCr value using recursion
    b. Write a C program to read an integer and pass the integer to a function where the integer is doubled to illustrate the concept of call by reference

Mode of Evaluation Laboratory examinations, viva-voce, quizzes, assignments and seminar

MEE101	ENGINEERING GRAPHICS-I	0	0	4	2

Version No. 1.10

Prerequisite -

Objectives:
1. To create awareness and emphasize the need for Engineering Graphics in all the branches of engineering.
2. To follow basic drawing standards and conventions.
3. To develop skills in three-dimensional visualization of engineering component.
4. To develop an understanding of 2D and 3D drawings using the SolidWorks software.

Expected Outcome:
On completion of this course, the students will be able to
1. Prepare drawings as per standards (BIS).
2. Solve specific geometrical problems in plane geometry involving lines, plane figures and special Curves.
3. Produce orthographic projection of engineering components working from pictorial drawings.
4. Prepare 2D Drawings using the SolidWorks software.

Unit I Introduction

Introduction to Engineering Graphics – Geometrical Construction – Conics and Special Curves.

Unit II Free Hand Sketching and Dimensioning

Free hand Sketching – Dimensioning Principles.

Unit III Orthographic Projection – Points and Lines

Orthographic Projection – Projection of Points and lines.

Unit IV Orthographic Projection – Solids

Orthographic Projection – Projection of solids in simple position, Axis Inclined to one plane.

Unit V Orthographic Projection – Objects

Conversion of Pictorial view into Orthographic projections.

Text Books

1. Venugopal K and Prabhu Raja V, “Engineering Graphics”, New AGE International Publishers, 2007.
2. CAD Manual prepared by VIT staff.

References

1. Bhatt N. D., “Engineering Drawing”, Charotar publishing House, 1998.
2. French and Vierk, “Fundamentals of Engineering Drawing”, McGraw Hill, 2002.
3. Natarajan, K. V., “Engineering Graphics”, Dhanalakshmi Publishers, 2006.

Mode of Evaluation Tutorials / Class Tests / Lab Exam

Recommended by the Board of Studies on:

Date of Approval by the Academic Council:

MEE102 WORKSHOP PRACTICE-I 0 0 2 1

Version No. 1.10

Prerequisite -

Objectives: 1. To train the students in metal joining process like welding, soldering, etc.
2. To impart skill in fabricating simple components using sheet metal.
3. To cultivate safety aspects in handling of tools and equipment.

Expected Outcome: On completion of this course, the students will be able to
1. Welding and soldering operations.
2. Fabrication of simple sheet metal parts.

Unit I Welding Shop

1. Instruction of BI standards and reading of welding drawings.
2. Butt Joint
3. Lap Joint
4. TIG Welding
5. MIG Welding

Unit II Sheet Metal Shop

1. Making of Cube
2. Making of Cone using development of surface.
3. Making of control panel using development of surface.

Unit III Soldering Shop

1. Soldering and desoldering of Resistor in PCB.
2. Soldering and desoldering of IC in PCB.
3. Soldering and desoldering of Capacitor in PCB.

Unit IV Bosch Tools

Demonstration of all BOSCH TOOLS

Text Books

Workshop Manual prepared by VIT staff

Mode of Evaluation Tutorials / Class Tests / Lab Exam

Recommended by the Board of Studies on:

Date of Approval by the Academic Council:

		L	T	P	C
ENG101	ENGLISH FOR ENGINEERS – I	3	0	0	3

Version No. 1.0

Course Prerequisites + 2 level English

Objectives
- To help the second language learners to acquire fluency in spoken and written English.
- To make students communicate with clarity and precision in the workplace.
- To give the students a perspective to appreciate life in its variables by exposing them to comprehension texts to enrich their word power.
- To enable students to acquire structure and written expression required for their profession.

Expected Outcome The students will get the required training in LSRW through the prescribed texts.

Unit 1

Communication Skills - Aspects of Communication and Body Language

Textual - Comprehension Text 1,2

Structure and Word Magic - Tenses, Concord, Tag Question; Word formation

Stylistic Expression - Paragraph Writing, Cloze test, Informal letter writing and email

Unit 2

Communication Skills - Listening and Interpersonal Communication Skills

Textual - Comprehension Text 3,4

Structure and Word Magic - Voice Conditionals, Transformation of sentences; Work and Study

Stylistic Expression - General Essay, Note making

Unit 3

Communication Skills - Speaking and Group discussion

Textual - Comprehension Text 5,6

Structure and Word Magic - Answer as Directed; Leisure and lifestyle

Stylistic Expression - Reading Comprehension

Text Books
1. English for Professionals - Book 1, Faculty of English, SSH, VIT.
2. Sunita Mishra and C. Muralikrishna, Communication Skills for Engineers.
3. R. Srinivasan and M. Sahul Hameed (2008), Functional Grammar & Composition, VIT Workbook.

Reference Books	1. Michael McCarthy and Felicity (2003), English Vocabulary in Use - Advanced, Cambridge University Press. 2. Krishna Mohan and Meera B. Annerji (1997), Developing Communication Skills, Macmillan India Ltd. 3. Murphy (2006), Essential English Grammar, CUP. 4. Adrian Doff and Chris Jones (2006), Language in Use, Cambridge University Press. 5. Kris Cole (2005), Crystal Clear Communication, East West Book.
Mode of Evaluation	Writing and speaking skills, tests, quizzes, assignments and seminars.

Recommended by the Board of Studies on :

Date of approval by the Academic Council :

CHY 101	ENGINEERING CHEMISTRY	L T P C 3 0 2 4

Version No. 1.0

Course Prerequisites: Basic Chemistry at 12th Standard or equivalent level.

Objectives:
- To impart technological aspects of modern chemistry
- To lay foundation for the application of chemistry in engineering and technology disciplines.

Expected Outcome: At the end of the course, the students will be familiar with the fundamentals of water technology; corrosion and its control; applications of polymers in domestic and engineering areas; types of fuels and their applications; and recent trends in electrochemical energy storage devices.

Unit I Water Technology 8

Hardness of water: Hard and soft water, Units of Hardness (numerical problems). Disadvantages of hard water: Scale and sludge, caustic embrittlement, priming and foaming, corrosion. Estimation of hardness: EDTA, alkali titration method (numerical problems). Softening methods: Lime soda (numerical problems), zeolite, ion exchange, mixed bed deionizer, treatment of municipal water. Desalination: Desalination of sea water, brakish water, electrodialysis, reverse osmosis.

Unit II Corrosion & Corrosion Control 8

Corrosion: Types and causes of corrosion, factors influencing corrosion, corrosion inhibitors. Corrosion control: Protective coatings, electroplating, metal finishing, physical vapour deposition, chemical vapour deposition. High energy coating processes: Ion implantation.

Unit III Polymers 8

Classification of polymers: Thermoplastics, thermosetting plastics - properties and industrial applications of important thermoplastic, thermosetting plastics. Moulding of plastics into articles: Compression, injection, transfer and extrusion methods. Conducting polymers: Properties and applications - biodegradable polymers.

Unit IV Fuels and Combustion 8

Fuels: Classification of fuels, calorific value - LCV, HCV; measurement of calorific value using bomb calorimeter (numerical problems). Combustion: Calculation of air qualities (problems). Liquid Fuels: Knocking and anti-knocking for petrol and diesel (octane number and cetane number) - diesel index. Gaseous fuels: LPG, natural gas, CNG: Composition and applications. Biofuels: Biodiesel and Biogas -composition and applications.

Unit V Electrochemical Energy systems 8

Electrochemical energy systems: Basic concepts of electrochmical energy systems. Conventional primary batteries: Dry cell. Advanced primary batteries: Lithium and alkaline primary batteries. Conventional secondary batteries: Lead-acid, nickel-cadmium

secondary batteries. Advanced secondary batteries: Nickel-Metal hydride and lithium-ion secondary batteries. Fuel cells: Key issues – Hydrogen-oxygen fuel cells - new generation fuel cells – electric vehicle application – solid oxide fuel cells.

Text Books

1. P.C. Jain and M. Jain (2006), Engineering Chemistry, 15th Edition, Dhanpat Rai Publishing Co., New Delhi.
2. S.S. Dara (2006), A Text book of Engineering Chemistry, 11th Revised Edition, S. Chand & Co Ltd., New Delhi.

Recommended by the Board of Studies on

Date of approval by the Academic Council

CHY 101L ENGINEERING CHEMISTRY LAB

Objectives To impart training in analysis of chemical and instrumental methods

To develop skills in analysis and estimation of a given sample by chemical and instrumental methods

Expected Outcome Students will know how to carry out chemical analysis using various analytic instruments

Experiments Volumetric Analysis

1. Estimation of total, permanent and temporary hardness of water by EDTA method
2. Estimation of Copper (II) in ground water by EDTA method
3. Estimation of alkalinity of water using pH meter / volumetric method
4. Estimation of Iron (II) in waste water by dichrometry

Instrumental method of Analysis

5. Estimation of Fe^{2+} by potentiometric titration
6. Measurement of single electrode potential of various metals by potentiometry
7. Determination of Chemical Oxygen Demand of sewage water
8. Determination of molecular weight of a polymer by viscometry (Ostwald's viscometer)

Demonstration Experiments

9. Visit to the Biomass plant
10. Construction and working of fuel cell and lead acid battery
11. Determination of calorific value using Bomb Calorimeter

Mode of Evaluation: Laboratory Examinations / Record work / Assignments / Viva-voce.

MAT101	MULTIVARIABLE CALCULUS AND DIFFERENTIAL EQUATIONS	L	T	P	C
		3	1	0	4

Version No. 1.0

Course Prerequisites: Mathematics at 10+2 level (or) Basic Mathematics (MAT001)

Objectives
- To provide the requisite and relevant background necessary to understand other important engineering mathematics courses offered for Engineers and Scientists.
- To introduce three important topics of applied mathematics, viz., Multiple integrals, Vector calculus and Laplace transforms.

Expected Outcome: By the end of the course, the students are expected to learn
- how to evaluate multiple integrals in Cartesian, Cylindrical and Spherical geometries.
- vector calculus with application in Fluid Dynamics and Electromagnetic fields.
- to solve ordinary differential equations

Unit 1 Multivariable Calculus 9 hours

Functions of two variables - limits and continuity - partial derivatives – total differential – Taylor's expansion for two variables – maxima and minima – constrained maxima and minima - Lagrange's multiplier method - Jacobians

Unit 2 Multiple Integrals 12 hours

Evaluation of double integrals – change of order of integration – change of variables between cartesian and polar co-ordinates - evaluation of triple integrals - change of variables between cartesian and cylindrical and spherical polar co-ordinates - beta and gamma functions – interrelation - evaluation of multiple integrals using gamma and beta functions - error function and its properties.

Unit 3 Vector Calculus 12 Hours

Scalar and vector valued functions – gradient – physical interpretation - total derivative – directional derivative -divergence and curl – physical interpretations - vector identities (without proof) - scalar and vector potentials -line, surface and volume integrals - Green's, Stoke's and Gauss divergence theorems (without proof) -verification and evaluation of vector integrals using them.

Unit 4 Ordinary Differential Equations 12 Hours

Linear higher order ordinary differential equation with constant coefficients – solutions of homogenous and non-homogenous ODEs - method of undetermined coefficients – method of variation of parameters – equations reducible to linear equations with constant coefficients.

Unit 5 Laplace Transforms 15 hours

Definition: Laplace transforms of functions - properties of Laplace transforms - initial and final values theorems - CHY 101transforms - transforms of periodic functions - convolution theorems – step functions, impulse functions - concept of transfer functions – applications to the solution of differential equations.

Text Books
1. Erwin Kreyszig (2004), Advanced Engineering Mathematics, 8th Edition., John Wiley & Sons.
2. B.S. Grewal (2005), Higher Engineering Mathematics, 38th Edition, Khanna

	Publications.
Reference Books	1. G.B. Thomas and R.L. Finney (2002), Calculus and Analytical Geometry, 9th Edition, Pearson Education. 2. Michale D. Greenberg (2002), Advanced Engineering Mathematics, 2nd Edition, Pearson Education. 3. Peter V.O' Neil (2003), Advanced Engineering Mathematics, 5th Edition, Thomson, Book/Cole.
Mode of Evaluation	Continuous Assessment Examinations, assignments, tutorial sheets, class Tests, quizzes.

PHY101	MODERN PHYSICS	L	T	P	C
		3	0	2	4

Version No. 1.0

Course Prerequisites: Physics as one subject in 12th Standard or equivalent level.

Objectives: To enable the students to understand the basics of the latest advancements in Physics, viz., Quantum Mechanics, Lasers, Fiber Optics, Ultrasonics, Microwaves and Nanotechnology.

Expected Outcome: At the end of the course, students will acquire the necessary knowledge about modern physics and its applications in various engineering and technology disciplines.

Unit I Quantum Physics 10

Dual nature of electron magnetic radiation - de Broglie waves – Compton effect experimental verification -Heisenberg uncertainty principle – Schrodinger equation – application - particle in a box (ID) – Spectroscopy. Application of Quantum Mechanics - Scanning Tunneling Microscope - Atomic Force Microscope problems.

Unit II Laser 10

Laser characteristics - Einstein's coefficients - its significance - population inversion - three level, four level laser – Schawlow and Townes condition – Nd. YAG, He-Ne-CO_2 laser – welding, drilling, cutting – optical disk systems – recording – data readout from optical disks – Holography – Recording and Reconstruction – Problems.

Unit III Fiber Optics 8

Light propagation through fibers – Acceptance angle - numerical aperture – types of fibers – step index, graded index – single mode, multimode – dispersion– intermodal, intramodal – application of fiber optics in communication – source LED – Laser diode – Detector – PIN photodiode – endoscope – problems.

Unit IV Ultrasonic and Microwaves 8

Properties – generation – Magnetostriction method – Piezo-electric method – detection of ultrasonic – applications- NDT Characteristic features of micro waves – TE and TM modes – Klystron – Gunn diode – applications of microwaves.

Unit V Nano Technology 9

Nanoscale – Nanomaterials – properties of Nanomaterials – Moore's Law Semiconductor nanoparticles – Nanocomposites – Quantum well – Wire – Dots – Nanolithography – Applications

of Nanotechnology – Aerospace components – sensors – Medicine.

Reference Books

1. B.B. Laud, Lasers and Non-Linear Optics, 2nd Edition, New Ages International.
2. Ghatak and K. Thyagarajan (2002), Introduction to Fiber Optics, Cambridge University Press.
3. William Silfvast (2002), Laser Fundamentals, Cambridge University Press.
4. Djafar K. Mynbaeu (2004), Fibre Optic Communication Technology, Pearson Education Asia.
5. Kittel (2001), Solid State Physics, 7th Edition, John Wiley & Sons.
6. K.C. Gupta (2002), Microwaves, New Age International.
7. Arthur Beiser (2003), Concepts of Modern Physics, 6th Edition, Tata-McGraw Hill.
8. Charles P. Poole, Jr. and Frank J. Owens (2003), Introduction to Nanotechnology, John Wiley & Sons.
9. Edward L. Wolf (2006), Nano Physics and Nanotechnology – An introduction to Modern Concepts in Nanoscience, Wiley VCH verlagambh & Co., Weinheim.

Mode of Evaluation: Written examinations, surprise test, quizzes, assignments, seminar, group discussion

Recommended by the Board of Studies on

Date of approval by the Academic Council

		L	T	P	C
PHY101	MODERN PHYSICS LABORATORY	-	-	-	-

Experiments

1. Traveling microscope – Length of a glass plate
2. Spectrometer – Angle of Prism
3. Air Wedge – Thickness of a thin wire
4. Planck's constant – LED method
5. Ultrasonic interferometer – Velocity of Ultrasonic waves in liquid
6. Sonometer – Frequency of AC mains
7. Spectrometer – Refractive index of a glass Prism
8. Refractive index of liquid
9. Laser grating – Determination of wavelength
10. Optical fiber – Numerical aperture and acceptance angle

Mode of Evaluation: Laboratory examinations, viva-voce, quizzes, assignments and seminar

MEE103 ENGINEERING GRAPHICS - II 0 0 4 2

Version No. 1.0

Prerequisite MEE101 Engineering Graphics

Objectives:
1. To prepare sectional views of solids.
2. To draw the development of surfaces and estimate the sheet metal requirement.
3. To develop skills in three-dimensional visualization of engineering components.
4. To provide students with the basic knowledge and skills in producing Engineering Graphics and with the capability to read and interpret engineering drawings.
5. To develop an understanding of solid modelling using the SolidWorks software.

Expected Outcome:
On completion of this course, the students will be able to
1. Prepare sectional views of solids.
2. Estimate the sheet metal requirement for fabrication.
3. Draw isometric drawings of combined solids and simple components.
4. Prepare solid modelling of machine components using the Solidworks software.

Unit I Sections of solids

Introduction to Sections of Solids.

Unit II Development of Surfaces

Development of Surfaces.

Unit III Isometric Projection

Isometric Projection and drawing.

Unit IV Solid Modelling –I

Solid Modelling of Engineering Components using SolidWorks.

Unit V Solid Modelling –II

Solid Modelling of Engineering Components using SolidWorks.

Text Books

1. Venugopal K and Prabhu Raja V, “Engineering Graphics”, New AGE International Publishers, 2007.
2. CAD Manual prepared by VIT staff.

References

1. Bhatt N. D., “Engineering Drawing”, Charotar Publishing House, 1998.
2. French and Vierk, “Fundamentals of Engineering Drawing”, McGraw Hill, 2002.
3. Natarajan, K. V., “Engineering Graphics”, Dhanalakshmi Publishers, 2006.

Mode of Evaluation Tutorials / Class Tests / Lab Exam

Recommended by the Board of Studies on:

Date of Approval by the Academic Council:

EE104	WORKSHOP PRACTICE - II	0	0	2	1

Version No. 1.0

Prerequisite MEE102 Workshop Practice

Objectives:
1. To train the students in safety handling of tools, equipment and machineries.
2. To carry out exercise in metal removal process by using drilling and lathe machines.
3. To train students in plumbing operation and techniques.
4. To expose the student in house wiring.
5. To train students in basic carpentry exercise using modern Bosch Tools.

Expected Outcome:
On completion of this course, the students will be able to
1. Basic operation in drilling and lathe.
2. Plumbing and simple house wiring.
3. Basic wooden components

Unit I Machine Shop

1. Drilling and Countersinking using Drilling machine
2. Drilling and Tapping
3. Lathe Exercise - Facing operation
4. Lathe Exercise - Straight turning and Chamfering

Unit II Plumbing Shop

1. L – Joint
2. T - Joint

Unit III House Wiring Shop

1. Single point wiring
2. Staircase wiring

Unit IV Bosch Tools Exercises

1. Planning & Polishing operation
2. Sawing operation
3. Profile cutting
4. Making of rectangular slot

Text Books

Workshop Manual prepared by VIT staff

Mode of Evaluation Tutorials / Class Tests / Lab Exam

Recommended by the Board of Studies on: 23.5.2008

Date of Approval by the Academic Council: 16.6.2008

MEE202 ENGINEERING MECHANICS 3 1 0 4

Version No. 1.0

Prerequisite -

Objectives:
1. To calculate the reactive forces.
2. To analyse the structures.
3. To know the geometric properties of the different shapes.
4. To teach energy and momentum methods.

Expected Outcome: Student will be able to
1. Solve the engineering problems in case of equilibrium conditions.
2. Calculate the reaction forces of various supports of different structures.
3. Solve the problems involving dry friction.
4. Determine the centroid, centre of gravity and moment of inertia of various surfaces and solids.
5. Calculate the forces acting on the rigid body, structures using the principle of virtual work.

Unit I Equilibrium of Particle and Rigid body

Introduction to Mechanics – Fundamental Principles – Coplanar forces – Equilibrium of particles – Free body diagram – Equilibrium of particle in space – Single equivalent force -- Equilibrium of rigid bodies in two dimensions.

Analysis of plane trusses – Method of joints – Method of sections – Zero-force member.

Unit II Friction and Virtual work

Characteristics of dry friction – Problems involving dry friction – Ladder – Wedges – Square threaded screws.

Definition of virtual work – Principle of virtual work – System of connected rigid bodies – Degrees of freedom – Conservative forces – Potential energy – Potential energy criteria for equilibrium.

Unit III Properties of Surfaces and Solids

Centroid – First moment of area – Theorems of Pappus and Guldinus – Second moment of area – Moment and Product of inertia of plane areas – Transfer Theorems – Polar moment of inertia – Principal axes – Mass moment of inertia.

Unit IV Kinematic and Kinetics

Position, Velocity and Acceleration – Rectilinear motion – Curvilinear motion of a particle – Tangential and Normal components – Radial and Transverse components – Rotation of rigid bodies about a fixed axis – General plane motion – Absolute and relative motion method – Instantaneous centre of rotation in plane motion.

Linear momentum – Equation of motion – Angular momentum of a particle and rigid body in plane motion – D'Alembert's principle.

Unit V Energy and Momentum Methods

Principle of work and energy for a particle and a rigid body in plane motion – Conservation of energy - Principle of impulse and momentum for a particle and a rigid bodies in plane motion – Conservation of momentum – System of rigid bodies – Impact - direct and central impact – coefficient of restitution.

Text Books

Tayal.A.K, (2002), Engineering Mechanics – Statics and Dynamics, Umesh Publications.

References

1. Ferdinand P. Beer, E. Russell Johnston, (2000), Vector Mechanics for Engineers, McGraw-Hill International Edition.
2. Irving H. Shames, (2003), Engineering Mechanics – Statics and Dynamics, Prentice-

Hall of India Private limited.

Mode of Evaluation Quiz/Assignment/ Seminar/Written Examination

ENG102	ENGLISH FOR ENGINEERS – II	3	0	0	3

Version No. 1.0

Prerequisites + 2

Objectives
1. To make the students communicate in English for academic and social purpose.
2. To develop the ability to write assignments in a style that is appropriate for university study or within a training context.
3. To develop the ability to understand spoken language in both lecture format, formal and informal conversational styles.
4. To develop the ability to speak on general and specific topics in real life situations.

Outcome The learners will get the required training in LSRW through the prescribed texts. They will also have a holistic outlook as they go into the world.

Unit 1 14

Communication Skills - Team Talk, Negotiation and Emotional Intelligence

Textual - Comprehension Text 1, 2

Structure and Word Magic - Error Detection (Errors in Formation of Sentences : Tenses, Passivity, Conditionals, Synthesis of Sentences, Direct & Indirect Speeches, Degrees of Comparison, Affirmative & Negative Sentences, Begin with the given word) (- based on workbook); Technology

Stylistic Expression - Lab Report; Polite Expression; Dialogue Writing; Case Study

Unit 2 16

Communication Skills - Creativity And Leadership skills

Textual - Comprehension Text 3, 4

Structure and Word Magic - Error Detection (errors in use of words : Nouns, Pronouns, Verbs, Adjectives, Adverbs, Prepositions, Articles, Antonyms / Synonyms, Homonyms, Affixes (from General Study); Health and Travel

Stylistic Expression - Technical Reports, Transcoding, Business Letter Writing, Technical description.

Unit 3 15

Communication Skills - Mind Mapping and Career Planning (Self-efficacy skills)

Textual - Comprehension Text 5, 6

Structure and Word Magic - Error Detection – contd.; Idioms and Phrasal Verbs

Stylistic Expression - Tackling Situations / Argumentative Essays

Text Books

1. English for Professionals, Book II Ed., Faculty, English – SSH, VIT.
2. Mishra, Sunita & C. Muralikrishna, Communication Skills for Engineers, Pearson Education, Delhi, 2004.
3. 3. Functional Grammar & Composition: VIT Workbook, 2005, (for Semesters I & II) by R. Srinivasan, M.A. Sahul Hameed.

Reference Books

1. English Vocabulary in Use Advanced, Michael McCarthy and Felicity, Cambridge University Press, 2003.
2. Developing Communication Skills, Krishna Mohan and Meera Bannerji, Macmillan India Ltd. 1990
3. Essential English Grammar, Raymond Murphy, Cambridge University Press, 2006.
4. Language in Use, Adrian Doff and Chris Jones, Cambridge University Press, 2006.
5. Corporate Soft skills, Sarvesh Gulati, 2006.
6. Effective Communication, John Adair , Macmillan Ltd.1997.

JAP101 Basic Japanese 2 0 0 2

Version No. 1.0
Prerequisite -
Objectives -
Expected Outcome -

Unit I

1. Introduction to Japanese Alphabets
2. Vowels and Consonants
3. Hiragana, Katakana
4. Pronunciation
5. Writing practice
6. Japanese Numerals
7. Demonstrative pronoun
   Kore, Sore, Are and Dore (This, That, Over there, which)
   Kono, sono, Ano and Dono (this, that, over there, which)
   Kochira, Sochira, Achira and Dochiora (this way....)
   Koko, Soko, Asoko and Doko (Here, There….location)
8. Greetings
9. Classification of verbs (be verb desu (Present tense)
10. Part of body (look and learn)
11. Particle -Wa

Unit II

1. Basic structure of sentence (Subject+ Object+ Verb)
2. Classification of verbs
   a) Be verb desu Present and Present negative Past and Past negative
   b) Aru and Iru for living things and non living things
   c) Masu form (Present and Present negative)
3. Particle- Ka, Ni, Ga,
4. Conjunction-Ya
5. Grammar- ~ Go, ~Jin, San
6. Days/ Months /Year/Week (Current, Previous, Next, Next to Next)
7. Nation, People and Language
8. Classification of Adjectives I and Na
9. Vocabulary and its Meaning
10. Audio tape listening
11. Class tests

Unit III

Classification of Particle
(Ga, Ka, Wa, O, E, Ni, De, No, Kara, Made)

2. Classification of Adjectives I and Na
3. Classification of verbs
   Go dan verb, Ichdan vers and Irregular verbs
   (Present, Present negative and past negative)
4. Classification of question words
   (Doko, Dore, Dono, Dochira)

5. Time expressions (Jikan)
6. Number of hours
7. Vocabulary and its Meaning
8. Number of months, calendar of a month
9. Audio tape listening
10. Class tests

Unit IV

1. Classification of Question words
   (Dare, Nani, , Itsu, Doyatte, Doo, To, Ne, Yo, Ikutsu, Ikura)
2. Classification of Te forms
3. At the departmental store
4. At the Railway /Bus station
5. Polite form of verbs
6. At the hospital (Byoki)
7. Vocabulary and its Meaning
8. Audio tape listening
9. Class tests

Unit V

1. Words of degree (Gurai and Kurai)
2. Adverb (Mazu,Sore kara,Saigo ni)
3. Name of the things you carry (look and learn)
4. Relation ship of family (look and learn)
5. Visit a office and University
6. Set phrase – Onegaishimasu – Sumimasen
7. Positions and Direction
8. Vocabulary and its Meaning
9. Audio tape listening
10. Revision
11. Test

Text Books:

1. Nihongo no KISO-1
2. Randan house Japanese-English-Japanese dictionary
3. Ootsubo et al, A course in Modern Japanese, Vol. 1, 1983, The University of Nagoya Press, Japan.
4. Shiyo Suzuki and Ikuo kawase, Nihongo Shoho text book with Audiotapes, 1981, The Japan Foundation, Tokyo, Japan.
5. Yan-san Serial, Video tapes, Japan.
6. Ooesto et a, A course in Modern Japanese, Vol. II, 1983, The University of Nagoya Press, Japan.

Mode of Evaluation:

Recommended by the Board of Studies on: 22.05.2008

Date of Approval by the Academic Council: 16.06.2008

FRE101	Basic French	2	0	0	2
Version No.	-				
Prerequisite	-				
Objectives:	The course aims at basic written and oral skills (comprehension and expression) in French which will enable the students to have higher education and job opportunities abroad.				
Expected Outcome:	The learners will get the required training in the above mentioned language skills and they will also have the additional advantage of communicating in French which is the second most commonly used language worldwide.				

Unit I Rencontres 9

Saluer, se présenter, demander, remercier, le genre des noms, les pronoms sujet et tonique, l'article défini et indéfini.

Unit II Radio Belleville, j'adore ! 9

Parler de ses gouts et de ses loisirs, poser des questions, décrire quelqu'un, les verbes au présent, la négatic du verbe, le pluriel des noms, les adjectifs.

Unit III C'est ma carte 9

Demander/donner des informations sur une personne, parler de soi, de sa famille, comprendre et écrire mail, l'adjectif possessif, le verbe « aller », l'article contracte, c'est/ce sont.

Unit IV Une radio, mais pourquoi ? 9

Nommer/situer un objet, exprimer la surprise, demander de faire quelque chose, exprimer une obligation, l'adjectif interrogatif, les prepositions de lieu, la negation de l'article indefini, il faut…, pouvoir, vouloir.

Unit V En direct de Radio Belleville 9

Demander/dire l'heure, demander pourquoi et répondre, l'interrogation, faire, connaitre, l'accord des adjectifs en genre et en nombre, le pronom "on".

Text Book: Belleville 1, Méthode de français, Flore Cuny, Anne-Marie Johnson, CLE International, 2004.

References: Champion 1: Méthode de français – Annie Monnerie-Goarin – Evelyne Sirejols CLÉ International 2001

Campus 1 : Jacky Girardet, Jacques Pecheur; CLE International

Mode of Evaluation: Written Examination, assignments, oral examination, group discussion, quiz, viva

Recommended by the Board of Studies on:

Date of Approval by the Academic Council:

GER101	Basic German	2	0	0	2

Version No. -

Prerequisite -

Objectives: The course aims at basic written and oral skills (comprehension and expression) in German which will enable the students to have higher education and job opportunities abroad. As a whole, it will bring an idea about the German culture and society.

Expected Outcome: The learners will get the required training in the above mentioned language skills which will enable them to practice it in day to day life, in higher education and in carrier too.

Unit I Wohnort

Personalpronomen, Konjugation von Verben: heiβen, lernen, kommen,arbeiten, wohnen, machen.

Unit II Studium und Beruf

Possessivpronomen, Verb- Sein, Singular, Plural, Wortbildung, Ja/ Nein Frage und Fragewoerter, Tempus-Praesens, Dialoge, Imperativ.

Unit III Familie -Alter

Bestimmter und Unbestimmter Artikel, Verb- Haben, Negation- Nicht, Kein, Zahlen, Partikeln, Maskulin, Feminin und Neutrum. Kasus – Nominativ und Akkusativ, Dialoge,

Unit IV Tagesablauf ;Termine

Die Zeit, Starke Verben, Praepositionen Fragewoerter (Zeitangabe), Das Essen und Leben in Deutschland, Landkarte und Geschichte von Deutschland.

Unit V Einladung ; Stellensuche

Trennbare Verben, Modal Verben, Dialoge mit Kontext: Bahnhof, Universität, Flughafen usw, Technische Wörter.

Text Book - Hieber Wolfgang, Lernziel Deutsch.München: 2005

1. References - Gick, Cornelia, Momentmal, Grundstufenlehrwerk Deutsch als Fremdsprache.M: 2003
2. Maria Dallapiazza, Eduard von Jan, Til Schonherr.Tangram, Deutsch als Fremdsprache.Berlin: 2005
3. Griesbach, Schulz. Deutsche Sprachlehre für Ausländer. München: 2005

Mode of Evaluation: Written Examination, assignments, oral examination, group discussion, quiz, viva

Recommended by the Board of Studies on:

Date of Approval by the Academic Council:

FRE101	BASIC FRENCH	L T P C 2 0 0 2

Version No.	1.0
Objectives	The course aims at basic written and oral skills (comprehension and expression) in French which will enable the students to have higher education and job opportunities abroad.
Expected Outcome	The learners will get the required training in the above mentioned language skills and they will also have the additional advantage of communicating in French which is the second most commonly used language worldwide.

Unit 1 Rencontres

Saluer, se présenter, demander, remercier, le genre des noms, les pronoms sujet et tonique, l'article défini et indéfini.

Unit 2 Radio Belleville, j'adore !

Parler de ses gouts et de ses loisirs, poser des questions, décrire quelqu'un, les verbes au présent, la négation du verbe, le pluriel des noms, les adjectifs.

Unit 3 C'est ma carte

Demander/donner des informations sur une personne, parler de soi, de sa famille, comprendre et écrire un mail, l'adjectif possessif, le verbe « aller », l'article contracte, c'est/ce sont.

Unit 4 Une radio, mais pourquoi ?

Nommer/situer un objet, exprimer la surprise, demander de faire quelque chose, exprimer une obligation, l'adjectif interrogatif, les prepositions de lieu, la negation de l'article indefini, il faut…, pouvoir, vouloir.

Unit 5 En direct de Radio Belleville

Demander/dire l'heure, demander pourquoi et répondre, l'interrogation, faire, connaitre, l'accord des adjectifs en genre et en nombre, le pronom "on".

Text Books	*Belleville* 1, Méthode de français, Flore Cuny, Anne-Marie Johnson, CLE International, 2004.
Reference Books	La France de toujours, Nelly Mauchamp; CLE international Déclic 1; Jacques Blanc, Jean-Michel Cartier, Pierre Lederlion; CLE International Champion 1 ; Annie Monnerie – Goarin, Evelyne Sirejols; CLE International Campus 1; Jacky Girardet, Jacques Pecheur; CLE International
Mode of Evaluation	Written examinations/ quiz/ assignments/seminars/online test Term End examination

Recommended by the Board of Studies on 28.11.2007

Date of approval by the Academic Council on 16.6.2008

CHY104	Environmental Studies	L	T	P	C
		3	0	0	3

Version No. 1.0

Objectives
- Making the students understand and appreciate the unity of life in all its forms, the implications of life style on the environment.
- To give students a basic understanding of the major causes of environmental degradation on the planet, with specific reference to the Indian situation.
- To inspire students to find ways in which they can contribute personally and professionally to preventing and rectifying environmental problems.

Expected Outcome
- Students will understand the need for ecobalance
- Knowledge on the method of pollution prevention would be acquired

Unit I Environment & Natural Resources

Definition, scope, importance, need for public, Natural Resources – forest resources – use, exploitation, deforestation, construction of multipurpose dams – effect on forests, Water resources – use of surface and subsurface water; effect of floods, drought, water conflicts, food resources – food problems, advantage and disadvantage of fertilizers & pesticides, effect on environment, Energy resources – need to develop renewable energy, land resources – Land degradation, land slides, soil erosion, desertification & case studies

Unit II Ecology & Bio-diversity

Concept of ecosystem, structure & function of an ecosystem, producers, consumers and decomposers, energy flow, ecological succession, food chains, food webs and ecological pyramids.
Bio diversity: Definition, genetic, species and ecosystem diversity, bio-geographical classification of India, hotspots, threats related to habitat loss, poaching of wildlife, man-wildlife conflicts, Conservation of bio-diversity.

Unit III Environmental Pollution

Definition – Causes, pollution effects and control measures of Air, Water, Soil, Marine, Noise, Thermal, Nuclear hazards. Solid waste management: causes, effects and control measures of urban and industrial wastes, pollution measures, case studies, Disaster management: floods, earthquake, cyclone and landslides.

Unit IV Social Issues and the Environment

Urban problems related to energy & sustainable development, water conservation, rain water harvesting, watershed management, problems related to rehabilitation – case studies, Wasteland reclamation, Consumerism and waste products - Environment Protection Act, Air, Water, Wildlife, Forest Conservation Act, Environmental legislation and public awareness.

Unit V Human Population and the Environment

Population growth, variation among nations, Population explosion – Family Welfare Programme, Environment and human health, Human Rights, Value Education, HIV/ AIDS, Women and Child Welfare, Role of Information Technology – Visit to local polluted site / Case Studies.
Customer Orientation –etention - QFD – CSM – TQM Models – Case Studies.

Text Books
1. Kurian Joseph & R. Nagendran, "Essentials of Environmental Studies", 1st Edition, Pearson Education, 2004.

Reference
1. Keerthinarayana & Daniel Yesudian, "Environmental Science and Engineering", 1st Edition, Hi-Tech publications, 2004.

Books

2. Erach Bharucha, “A Text Book for Environmental Studies”, Text Book of University Grants Commission, 2004.
3. Peavy, H.S., D.R. Rowe & T.George, “Environmental Engineering”, New York: Mc Graw Hill, 1987.
4. Metcalf & Eddy,"Waste water Engineering: Treatment and Reuse", New Delhi, Tata McGraw Hill, 2003.

Mode of Evaluation Written Examination, Assignment, Mini Project.

MAT 201	Complex Variables and Partial Differential Equations	3	1	0	4

Version No. 1.0

Course Prerequisites MAT105 Differential And Difference Equations

Objectives The aim of this course is to present a comprehensive, compact and integrated treatment of two most important branches of applied mathematics for engineers and scientists namely

(i) the functions of complex variable and

(ii) partial differential equations in finite and infinite domains.

Expected Outcome By the end of the course, the students are expected to develop the necessary mathematical skills, physical understanding of problems and intuition to independently analyze the mathematical equations which model the problems in their respective fields of study.

Unit 1 Functions of a Complex Variable 9+3 hours

Limits and continuity- Cauchy – Riemann equations- analytic and harmonic functions – complex potential – applications to flow around a corner and around a cylinder, multivalued functions()- branch points- branch cuts, linear transformations- bilinear transformation-cross-ratio- conformal mappings()– qualitative discussion on applications (regions bounded by straight lines).

Unit 2 Complex Integration 9+3 hours

Integration of a complex plane along a contour - Cauchy-Goursat theorem- Cauchy's integral formula – Taylor and Laurent series- zeros- singularities – poles- residues- Cauchy's residue theorem – evaluation of integrals by the method of residues- statement of Jordan's lemma - indented contour integral.

Unit 3 Partial Differential Equations 9+3 Hours

Introduction – formation of PDEs – solution of PDE – general, particular, and complete singular integrals – Lagrange's linear equations – linear PDE of higher order with constant coefficients – homogeneous and non homogeneous equations – solution of PDE's by the method of separation of variables.

Unit 4 Applications of Partial Differential Equations 9+3 Hours

Classification of PDEs- solution of Laplaces equations in cartesian, cylindrical and spherical coordinates – variable separable method: potential flow over a sphere.

Wave equation-vibrations of a stretched string- D'Alembert's solution for the initial value problem, vibrations of a circular membrane diffusion equation in cartesian and cylindrical coordinates.

Unit 5 Fourier Transforms 9+3 hours

Complex Fourier series – Fourier integral theorem- Fourier transform pairs – Fourier sine and cosine transform pairs – simple problems-properties of Fourier transforms – Convolution theorem for Fourier transforms – Parseval's identity for Fourier transforms -application of Fourier transforms to partial differential equations: (i) Heat flow in an infinite bar (ii) Wave propagation on a semi infinite string (iii) Steady state heat flow in a semi-infinite domain.

Text Books

1. Erwin Kreysizing, Advanced Engineering Mathematics, 8th Edition, John Wiley & Sons, (Wiley student Edison)(2004).
2. B.S.Grewal, Higher Engineering Mathematics, 40th Edition. Khanna Publications(2007).

Reference Books

1. J. W. Brown and R.V. Churchill, Complex variables and application, Mc Graw Hill International ed., 7th Edition (2004).
2. R. V. Churchill and J. W. Brown, Fourier series and Boundary value problems, International student edition (1978) .
3. Ian Sneddon, Elements of Partial Differentail equations, MC Graw – Hill International edition (1985).
4. MichaelD. Greenberg, Advanced Engineering Mathematics, 2nd Edition, PearsonEducation (2002).
5. Peter V. O' Neil, Advanced Engineering Mathematics, 5th Edition, Thomson, Book/Cole (2003).

Mode of Evaluation: Continuous Assessment Tests, Assignments, Tutorial sheets, Class Tests, Quizzes.

Recommended by the Board of Studies on:

Date of approval by the Academic Council:

PHY 102	MATERIALS SCIENCE	L	T	P	C
		3	0	2	4

Version No.	1.0
Course Pre-requisites	-
Objectives	To enable the students to understand the nature of different types of materials namely Dielectrics, Magnetic, Semi conducting, Conducting and Superconducting materials.
Expected Outcome	This course will be the base to understand the various concepts involved in the applications of materials in Engineering and Technology.

Unit I Conducting Materials 8

Drude – Lorentz Classical free electron theory of metals – electrical conductivity – thermal conductivity – Wiedemann – Franz law - drawbacks of classical theory; Band theory of solids– Quantum theory and its success; relaxation time – drift velocity – Matthiessen's rule -Problems.

Unit II Semiconducting Materials: 8

Introduction – P and N type – direct and indirect semiconductor; Band theory of semiconductors; Density of energy state; Variation of Fermi level with respect to temperature and carrier concentration in intrinsic and extrinsic semiconductors; Hall effect – theory – experimental proof; Problems.

Unit III Magnetic and Superconducting Materials 10

Magnetic parameters and their relations; Origin of magnetization – orbital magnetic moment – spin magnetic moment – Bohr magneton; Properties of dia, para, ferro, antiferro and ferri magnetic materials; Domain theory of ferromagnetism – Hysteresis – soft and hard magnetic materials; Application – Hard disk – Superconductors – types – properties – BCS theory – applications; Problems.

Unit IV Dielectric Materials 9

Polarization and dielectric constant; dielectric susceptibility; electric field inside a dielectric – macroscopic and microscopic electric field – Clausius – Mosotti relation; Polarization mechanisms – electronic, ionic and orientation; Temperature dependence of dielectric constant – Frequency dependence of dielectric constant; Dielectric loss – dielectric breakdown – types; dielectric materials as electrical insulators – examples; Problems.

Unit V Optical Properties of Materials 10

Light waves in a homogeneous medium; Refractive index – Dispersion:– Group Velocity and Group Index; Magnetic filed; Irradiance and pointing vector ; Quantum theory of optical properties – Absorption – inter and intra band transition; Absorption spectra of materials; Luminescence – colour centres; Problems.

Text Books
1. C.M. Srivasta and Srinivasan, “Science of Engineering Materials”, Tata McGraw Hill Publications, 2003.

Reference Books
1. Pillai S O, “Solid State Physics”, revised sixth edition, New Age International (P) Ltd, 2007.
2. S.O. Kasap, “Principles of Electronic Materials and devices”, Second edition, Tata McGraw – Hill Publishing Company Ltd., 2002.
3. Van Vlack L, “Materials Science for Engineers”, Addison Wesley, 1995.
4. Raghavan V, “Materials Science and Engineering”, Prentice – Hall of India, New Delhi, 1998.

Mode of Evaluation Written examination, assignment, seminar and spot test.

Recommendation by Board of Studies on 31.10.2008

Date of approval by the academic council 25.11.2008

PHY102 L

MATERIALS SCIENCE LAB

L	T	P	C
-	-	-	-

Experiments

1. LCR Bridge to find the dielectric constant of solids.
2. EPR for the measurement of G factor.
3. Newton Rings – Radius of curvature of a convex lens.
4. Hall Effect – Hall Coefficient of a given Germanium Crystal.
5. Band Gap – Four Probe Method.
6. Solar Cell – V-I Characteristics.
7. Dielectric Constant – Curie temperature.
8. Lee’ Disc – Thermal Conductivity of an Insulator.
9. Strain Gauge – Measurement of micro strain.
10. Quincke’s Method – Magnetic Susceptibility.

Mode of Evaluation Laboratory examinations, viva-voce.

EEE101	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L T P C 2 1 2 4

Version No. 1.0

Course Prerequisites Physics at +2 Standard or equivalent level.

Objectives

Expected Outcome

Unit I Elementary Circuit Analysis 6

Ohm's law, KCL, KVL, node voltage analysis, mesh current, circuits with dependant and controlled sources, Thevenin's & Norton's equivalent, maximum power transfer and superposition theorem, VI characteristics for capacitors and inductors.

Unit II Analysis of DC and AC Circuits 7

Steady state DC analysis, RL and RC transients in circuits with DC source, analysis of a second order circuit with a DC source, RMS values, the use of phasors for constant frequency sinusoidal sources, steady state AC analysis of a series circuit, series and parallel combinations of complex impedances, AC power calculations.

Unit III Digital Systems 8

Basic logic circuit concepts, representation of numerical data in binary form - combinatorial logic circuits, synthesis of logic circuits, minimization of logic circuits - sequential logic circuits - computer organization, memory types, digital process control, computer based instrumentation systems, measurement concepts and sensors, signal conditioning, analog to digital conversion.

Unit IV Semiconductor Devices 15

Basic diode concepts, zener diode voltage regulator concepts, ideal diode model, rectifier and wave-shaping circuits, linear small signal equivalent circuits, basic amplifier concepts, cascaded amplifiers, ideal amplifiers, differential amplifiers, NMOS and PMOS transistors, bias circuits, small signal equivalent circuits, CMOS logic gates, bipolar junction transistors, current and voltage relationship, common emitter characteristics, large signal DC circuit models, small signal equivalent circuits, ideal operational amplifiers, inverting and non-inverting amplifiers, integrators & differentiators.

Unit V Electromechanics 9

Magnetic fields and circuits, self and mutual inductance, ideal and real transformers, principles of rotating DC machines, shunt, separately excited and series connected DC motors, speed control of DC motors, 3-phase induction motors, synchronous machines and single phase induction motors, stepper motors and brushless DC motors.

Text Books

1. Allan R. Hambley (2008), Electrical Engineering-Principles and Applications, Pearson Education.
2. D.P. Kothari and I.J. Nagrath (2002), Basic Electrical Engineering, 2nd Edition, Tata McGraw-Hill.
3. D.P. Kothari and I.J. Nagrath (1998), Theory and Problem of Basic Electrical Engineering, Prentice Hall of India, New Delhi.
4. R.A. DeCarlo and Pen-Min Lin (2001), Linear Circuit Analysis, 2nd Edition, Oxford University Press, New Delhi.

Reference Books

1. W.H. Hayt, J.E. Kemmerly and S.M. Durbin (2002), Engineering Circuit Analysis, 6th Edition, Tata McGraw-Hill, New Delhi.
2. Ramakalyan (2005), Linear Circuits, Oxford University Press, New Delhi.
3. J. Edminister and M. Nahvi (2002), Electric Circuits, 3rd Edition, Tata McGraw-Hill, New Delhi.

Mode of Evaluation: Assignments, seminars, written examinations

Recommended by the Board of Studies on

Date of approval by the Academic Council

EEE101 L BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING LAB

Objectives

1. To provide students practical knowledge of electrical machines for their design and analysis.
2. To help the students to do experiments on motors, generators and alternators.

Outcome Student will be able to

1. Design circuits for testing the performance of various machines.
2. Understand the importance of earthing and their methodology.
3. Conduct load tests on electrical motors.

Experiments

1. Load test on D.C Shunt and Compound motor
2. Load test on D.C Series motor
3. OCC and load characteristics of Self excited DC Generator
4. Load test on Single phase Induction motor
5. Load test on Three phase Induction motor
6. Regulation of Three phase alternator by EMF
7. Thyristorised speed control of motors
8. Motor control circuits – Drives
9. Exercise in domestic wiring
10. OCC and SC test on transformer
11. Study of 'V' curves and inverted 'V' curves in synchronous machines
12. OCC and load characteristics of separately excited dc generator
13. Speed control of DC motor
14. Exercise in earthing.
15. Electrical Measurement Techniques
16. Synchronous motor
17. Power factor measurement

Reference Book

Lab Manual Prepared by VIT Staff

Mode of Evaluation : Experiments/Record work/Oral/ Practical Examination

MEE203 MATERIALS ENGINEERING AND TECHNOLOGY 2 1 2 4

Version No. 1.0

Prerequisite PHY102 Material Science

Objectives:
1. The main objective of this course is to provide the basic knowledge needed to explore the discipline of materials science and engineering.
2. To develop the knowledge of how the structure of materials is described technically, including crystallography, microstructure, defects, and phase diagrams
3. To develop the knowledge of how the properties of materials are described technically and how material failure is analyzed
4. To introduce the concepts of structure-property relationships
5. To develop knowledge in various class of materials and their applications

Expected Outcome: Student will be able to
1. Understand how materials are formed and their classification based on atomic arrangement
2. Describe the mechanical behaviour of metallic systems and its importance
3. Evaluate system for fatigue failures
4. Gain knowledge on different class of materials and their applications
5. Evaluate the failure mode of the materials and to know the steps to be taken to prevent the failures

Unit I Crystal structure

Introduction to materials science – Primary and Secondary bonding in materials- Crystalline and amorphous materials –Single crystal and polycrystalline materials – Space Lattice-Unit cell –Crystal systems – Bravais Lattice- Miller indices – Closed packed structures- Principal Metallic crystal structures stacking sequence and stacking faults and crystal defects- Point, Line, Planar and volume; Volume, planar and Linear density calculations- Polymorphism and allotropy.

Unit II Phase Diagrams

Basics of Solidification mechanism – Cooling curve of pure metal and alloy – Phase –Phase Diagram– Gibbs's Phase rule – Interpretation of mass fractions using Lever's rule – Hume Rothery rules-Binary Iso-morphous system- Binary Eutectic alloy system (Lead-Tin System) –Binary Peritectic alloy system (Iron-Nickel System) – Invariant reactions – Iron-Iron carbide phase diagram- Slow cooling of Hypo and hyper eutectoid steels – Temperature-Time-Transformation (TTT) and Continuous Cooling Transformation (CCT) Diagrams – Effect of alloying elements in steel – types of stainless steel and cast iron.

Unit III Heat Treatment

Heat Treatment – Annealing and its types, Normalizing, Hardening tempering, Aus-tempering and Mar-tempering – Microstructure observation – Surface Heat treatment processes – Carburizing, Nitriding, cyaniding, carbonitriding, flame and induction hardening.

Unit IV Mechanical Properties of Materials & Testing

Mechanical properties of materials – Strengthening mechanism –- Plastic deformation of single and poly-crystalline materials – Effect of Slip and twinning – Stress-strain curves of various ferrous and non-ferrous metals –Engineering stress strain – true stress strain

relations –problems - Tensile test of ductile material – properties evaluation
Hardness measurement tests – Fracture of metals – Ductile and Brittle fracture; Fatigue – Endurance limit of ferrous and non-ferrous metals – Fatigue test ; Creep and stress rupture– mechanism of creep – stages of creep and creep test – SEM, XRD.

Unit V Advanced materials and Applications

Composites – Fiber reinforced, Metal Matrix, Ceramic Matrix – properties and applications; Ceramics – Alumina, Zirconia, Silicon Carbide, Sialons, Reaction Bonded Silicon Nitride(RBSN), Glasses– properties and applications- Magnetic materials – Hard and soft magnets – Ferromagnetic Hysteresis – properties of magnetic materials – Intermetallic compounds-Polymers – thermosetting and thermoplastics – mechanical properties of polymers-Material selection procedure (two case studies)

Text Books

1. William F. Smith and Javad Hashemi (2004), Foundations of Materials Science and Engineering 4th ed., Mc Graw Hill Publishers.
2. William D. Callister (2003), Jr., Materials Science and Engineering: An Introduction, 4th ed., Wiley & Sons.

References

1. J.C. Anderson, K.D. Leaver, P. Leavers and R.D. Rawlings, (2003), Materials Science for Engineers, 5th edition, Tata McGraw Hill Publishers
2. Donald R. Askeland, Pradeep Phule, (2006), The Science and Engineering of Materials, 5th Edition, Thomson Education
3. George Dieter, (1998), Mechanical Metallurgy, Tata McGraw Hill Publishers.

Mode of Evaluation Quiz/Assignment/ Seminar/Written Examination
Recommended by the Board of Studies on: 10-04-2009
Date of Approval by the Academic Council: 24-04-2009

MEE203L MATERIALS ENGINEERING AND TECHNOLOGY LAB

Objectives:

1. To train students in the preparation of samples to perform characterization such as microstructure, volume fraction of phases, determination of porosity, film thickness, grain size and avoid measurement.
2. To help the students understand the microstructure of engineering materials, phase diagrams, various testing standards and acquire knowledge on the material behaviour by conducting tests.
3. To teach students how to improve the mechanical properties of materials by various methods.

Expected Outcome:

Student will be able to

1. Acquire experimentation skills in the field of metallurgy.
2. Develop theoretical understanding of the mechanical properties of materials by performing experiments.
3. Apply the knowledge of phase diagrams and testing methods in related areas.
   Know how to improve structure of materials for various industrial applications.

Experiments

1. Metallographic sample preparation
2. Phase diagram determination
3. Microstructures of plain carbon steel
4. Microstructures of cast iron
5. Heat treatment of plain carbon steels
6. Hardness measurement
7. Phase analysis and porosity determination using image analysis soft ware
8. Microstructure of non-ferrous alloys
9. Determination of grain size
10. NDT testing – using ultrasonic flaw detector
11. Stress analysis using XRD pattern
12. Creep Test

References Lab Manual Prepared by VIT Staff

Mode of Evaluation Experiments/Record work/Oral/ Practical Examination

Recommended by the Board of Studies on: 10-04-2009

Date of Approval by the Academic Council: 24-04-2009

MEE 206 COMPUTER AIDED MACHINE DRAWING L T P C

0 0 4 2

Pre Requisite MEE 103 Engineering Graphics -II

Objectives

1. To introduce students to the basics and standards of engineering drawing related to machines and components.
2. To teach students technical skills regarding assembly, production and part drawings.
3. To familiarize students with various limits, fits and tolerances.
4. To help students gain knowledge about standard CAD packages on modeling and drafting.

Outcome Student will be able to

1. Acquire the knowledge of various standards and specifications about standard machine components.
2. Make drawings of assemblies with the help of part drawings given.
3. Ability to select, configure and synthesize mechancial components into assemblies.
4. Apply the knowledge of fits and tolerances for various applciaitons.
5. Able to model components of their choice using CAD software.
6. Get exposure to advanced CAD packages.

UNIT I Drawing standards

Code of Practice for Engineering Drawing - BIS specifications –Conventional representation - Welding symbols - riveted joints - keys - fasteners - Reference to hand book for the selection of standard components like bolts - nuts - screws - keys etc.

UNIT II Limits, fits and tolerances

Limits - Fits and tolerances - Allocation of fits for various mating parts – Tolerance data sheet – Tolerance table preparation -Geometric tolerance.

UNIT III Computer aided assembly and detailed drawing

Solid modeling of simple and Intricate machine and automobile components-Surface modelling of automobile body and Appliances(electrical and domestic). Preparation of assembled and detailed drawings of I.C.Engine components viz: Cylinder head - Piston - Connecting rod and Crankshaft assembly - Carburettor - Fuel pump etc,.

Text book

1. Bhatt, N.D., (1999), Machine Drawing , Published by R.C.Patel, Chartstar Book Stall, Anand, India.

Reference Books

1. James Barclay, Brian Griffiths, (2003), Engineering Drawing for Manufature Kogan Page.
2. Cecil Jensen, Jay Helsel and Donald D. Voisinet, (2000), Computer-aided engineering drawing, McGraw-Hill: New York.
3. Sidheswar, N., Kanniah, P. and Sastry, V.V.S., (2005), Machine Drawing .

Mode of Evaluation : Experiments/Record work/Oral/ Practical Examination

MANUFACTURING PROCESSES	L	T	P	C
	3	0	2	4

Verasion:1

Prerequisites: Nil

Objectives

1. To understand the basic concepts of foundry and casting processes
2. To acquire knowledge about the fundamental principles of metal forming processes
3. To study in detail about the modern welding processes followed in industries
4. To have an in depth study about various forming processes
5. To acquire knowledge about various plastic materials that are commonly used for various applications and their manufacturing process

Outcome

Student will be able to

1. select correct manufacturing process for a particular engineering application
2. get in-depth knowledge of various manufacturing processes

Unit - I

Manufacturing - selecting manufacturing process, global competitiveness of manufacturing costs - Fundamentals of materials: Their behavior and manufacturing properties - Ferrous metals and alloys – Non-ferrous metals and alloys – Fundamentals of metal casting, fluidity of molten metal, solidification time, sand casting, shell mold casting, investment casting, plaster mold casting, ceramic mold casting, diecasting, centrifugal casting - Melting practice and furnaces defects in casting - Testing and iInspection of casting

Unit - II

Metal fusion welding processes – Oxyfuel gas welding, arc welding processes – Consumable electrode: SMAW, SAW, GMAW, FCAW, electro gas welding, and electro slag welding – Non-consumable electrode: GTAW, AHW, PAW, EBM, LBM - Solid state welding processes: Ultrasonic welding, friction welding, resistance welding. weld quality - Testing of welded joints

Unit - III

Cold and hot working: Rolling, forging, extrusion, drawing, sheet metal forming processes - High energy rate forming processes: Explosive forming, electro-hydraulic forming, Electro magnetic forming

Unit - IV

Production of metal powders: Compaction, sintering and finishing - Shaping of ceramics, forming and shaping of glass - Types of plastics, types of molding, reinforced plastics - Metal matrix composites, ceramic matrix composites

Unit - V

Lathe and its operations - Drilling machine and its types – Shaper – Planner-milling machine

Text Book

1. S. Kalpakjian and S.R. Schmid (2004), Manufacturing Engineering and Technology, 4th Edition, Pearson Education (Singapore) Pvt. Ltd.

Reference Books

1. S.K. Hajra Choudhury (2001), Elements of Workshop Technology, Vol. - I, Media Pro,oters Pvt Ltd., Mumbai.
2. P.N. Rao (1998), Manufacturing Technology – Foundry, Forging and Welding, Tata McGraw-Hill Publishing Co., New Delhi.
3. Roy A. Lindberg (2004), Processes and Materials of Manufacture, 4th Edition, Prentice-Hall of India, New Delhi.

Mode of Evaluation: Assignments / Seminars / Written Examination

Recommended by the Board of Studies on :
Date of approval by the Academic Council:

MANUFACTURING PROCESSES - LABORATORY

Objectives

1. To understand the basic concept of moulding and sequence of processes involved
2. To determine the permeability number, grain fineness number, compressive, shear strength of moulding sand, etc.
3. To broaden the understanding of various mechanisms involved in a lathe
4. To perform some simple exercises on lathe such as turning, drilling, countersinking, etc.
5. To decide upon various cutting parameters for different materials for turning operation

Outcome

On completion of this course, the student will be

1. familiar with green sand moulding process, gating system and risening system

2. able to understand the cutting parameters of turning processes, etc.

Contents

- Foundry
- Welding
- Lathe (Simple operations only)

Experiments

Foundry:

1. Preparation of green sand mould using woodern pattern
2. Determination of grain fineness number of moulding sand
3. Determination of permeability number of moulding sand
4. Determination of compressive strength of moulding sand
5. Demonstration of pouring non-ferrous metal using crucible tilting furnace

Welding:

1. Straight line bead and butt welding joints (ARC)
2. Preparation of MIG weld lap joint
3. Preparation of TIG weld 'T'-joint

Lathe: (Simple operations only)

1. Facing and straight turning
2. Shoulder turning
3. Taper turning
4. Drilling, countersinking and tapping

Reference: Lab Manual prepared by VIT Staff

Mode of EvaluationL: Experiments / Record work / Oral / Practical Examination

MEE 202	ENGINEERING THERMODYNAMICS	L	T	P	C
		2	1	0	3

Pre requisite -

Objectives

1. To teach students the basic principles of classical thermodynamics and prepare them to apply basic conversion principles of mass and energy to closed and open systems for both steady and transient processes.
2. To enable the students to understand second law of thermodynamics and apply it to various systems, note the significance of the results and to know about availability, entropy and second law aspects of daily life.
3. To teach students about properties of pure substances and to analyze the performance of thermodynamic air and vapour power cycles.
4. To help the students understand various gas laws and equations of state and apply them to solve problems of gas mixtures in estimating enthalpy, entropy, specific heat and internal energy.
5. To teach students about fuels and combustion phenomenon, solve problems on stoichiometry, complete combustion, gravimetric and volumetric analysis.

Outcome Student will be able to

1. Demonstrate an understanding of the concepts such as conservation of mass, conservation of energy, work interaction, heat transfer and first law of thermodynamics.
2. Identify closed and open systems and analyze related problems.
3. Apply the concept of second law to design simple systems.
4. Analyze the performance of gas and vapor power cycles and identify methods to improve thermodynamic performance.
5. Demonstrate the importance of phase change diagrams of various pure substances.
6. Apply gas laws to mixtures.
7. Analyze problems of combustion and stoichiometry.

UNIT I Basic Concepts and First Laws Thermodynamics

Basic concepts of Thermodynamics-Thermodynamics and Energy-Closed and open systems-Properties of a system-State and equilibrium-Processes and cycles-Forms of energy-Work and heat transfer-Temperature and Zeroth law of thermodynamics-First law of thermodynamics-Energy balance for closed systems-Energy balance for unsteady-flow process-First law applied to steady-flow engineering devices

UNIT II Second Law of Thermodynamics

Limitations of the first law of Thermodynamics-Thermal energy reservoirs-Kelvin-Planck statement of the second law of thermodynamics-Clausius statement-Equivalence of Kelvin-Planck and Clausius statements-Refrigerators, Heat Pump and Air-Conditioners-COP-Perpetual Motion Machines-Reversible and Irreversible process-Carnot cycle-Entropy-The Clausius inequality-Availability and irreversibility-Second law efficiency-Second law aspects of daily life-Analysis of steady and unsteady flow systems.

UNIT III Vapour and Gas Power Cycles

Properties of pure substance-Property diagram for phase-change processes-Carnot vapour cycle-Rankine cycle-Methods for improving the efficiency of Rankine cycle-Ideal Reheat and Regenerative cycles-Binary vapour cycles-Combined gas-vapour power cycles-Analysis of power cycles-Carnot cycle-Air standard assumptions-Otto cycle-Diesel and Dual cycles-Brayton cycle-Stirling and Ericsson cycles

UNIT IV Ideal Gas Mixtures and Psychrometrics

Ideal and real gases-Van der Waals equation-Principle of corresponding states-Ideal gas equation of state-Other equations of state-Compressibility factor-Compressibility charts-Composition of gas mixtures- Mass and mole fractions-Dalton's law of additive pressures-Amagat's law of additive volumes-Relating pressure, volume and temperature of ideal gas mixtures-Evaluating internal energy - enthalpy - entropy and specific heats-Psychrometric application-Properties of atmospheric air-Psychrometric processes

UNIT V Fuels and Combustion

Types of fuels-Exothermic and endothermic reactions-Combustion equations-Stoichiometry-Combustion analysis by mass and volume-Conversion of gravimetric to volumetric analysis-Conversion of volumetric to gravimetric analysis-Analysis of exhaust gas-Excess air and air-fuel ratio-Molar heat capacity of a gas mixture-Combustion problem by mole method-Complete combustion of fuel-Calorific value-Definition-Types of calorimeter-Atmospheric and ecological pollution-Absolute Entropy and Third law of Thermodynamics

Text Book

1. P. K. Nag, (2004) Basic and Applied Thermodynamics, Tata McGraw hill.

Reference Books

2. Yunus A. Cengel,(2005), Thermodynamics: An Engineering Approach, Tata McGraw hill.
3. Y.V.C.Rao, (2004), An Introduction to Thermodynamics, Universities Press.
4. C. P. Arora, (2005) Thermodynamics, Tata McGraw Hill.
5. David R. Gaskell, (2003), Introduction to Thermodynamics of Materials, Taylor and Francis Publisher..
6. M. Achuthan, , (2004) Engineering Thermodynamics, Prentice Hall India Limited.
7. Eastop, (2004) Applied thermodynamics for Engineering Technologies, Addison-Wesley Logman Limited.

Mode of Evaluation: Assignment/ Seminar/Written Examination.

MAT104	PROBABILITY AND STATISTICS	L T P C 3 1 0 4

Version No.	1.0
Course Prerequisites	Multivariable Calculus and Differential Equations (MAT101)
Objectives	This course is intended to provide a comprehensive introduction to the probability models and statistical methods most likely to be encountered and used by students in their careers in engineering and the natural sciences.
Expected Outcome	By the end of the course the students are expected to (i) to identify the probability distribution for a given data. (ii) use the model with the parameters of the data for analyzing samples.

Unit 1 Probability 10

Introduction–sample spaces and events, axioms and properties of probability – conditional probability – Baye's theorem and its applications.

Unit 2 Random Variables 11

Random variable – distributions and density functions - mathematical expectation – moment generating function – characteristic function – Binomial, Poisson, Normal, Gamma and Exponential distributions

Unit 3 Joint Probability Distribution and Random Samples 15

Random vectors-joint distribution and joint density functions – conditional distribution and density functions–Co-variance-correlation–statistics and their distributions–distribution of the sample mean.

Unit 4 Inference Based on Single Sample 12

Confidence interval – population mean and proportion–variance and standard deviation–hypotheses and tests procedures-tests about a population mean and proportion – p-values.

Unit 5 Inference Based on Two Sample 12

Z-tests–confidence interval for a difference between two population mean – two sample t-test and confidence interval–analysis of paired data – inferences concerning a difference between two population proportion and variances.

Text Books Jay L. Devore, Probability and Statistics, Thomson Duxbury, Singapore, 2002.

References 1. Irwin Miller and John Freund, Probability and Statistics for Engineers, 7th Edition, Prentice Hall (2004).

2. R E Walpole, RH Myers, S.L. Myers and Kye, probability and statistics for

engineers and scientists, Prentice Hall, 7th Edition (2002).

Mode of Evaluation	Continuous assessment Examination, Assignments, Tutorial sheets, Class Test, Quiz.
Recommended by the board of studies	30.5.2008
Date of approval by the academic council	16.6.2008

MEE 204	STRENGTH OF MATERIALS	L	T	P	C
		2	1	2	4

Pre requisite MEE 201 Engineering Mechanics

Objectives

1. Develop the relationship between the loads applied to a non-rigid body and the internal stresses and deformations induced in the body.
2. Study the general state of stresses and strains in a given loaded member and the magnitude and direction of the principal stresses
3. Understand the different approaches to calculate slope and deflection for various types of beams.
4. Analyze the columns with different edge conditions by using different theories.

Outcome Students will be able to

1. Apply concepts of strength of materials to obtain solutions to real time Engineering problems.
2. Able to analyze the different types of loading and the consequent deflection.

UNIT I Stresses and Strains

Definition/derivation of normal stress, shear stress, and normal strain and shear strain – Stress-strain diagram- Elastic constants - Poisson's ratio - relationship between elastic constants and Poisson's ratio - Generalised Hook's law - Strain energy - Deformation of simple and compound bars - thermal stresses.

UNIT II Simple Bending

Types of beams: Cantilever, Simply supported, Overhanging: Shear Force and Bending Moment Diagrams

Theory of simple bending - bending stress and shear stress in beams.

UNIT III Deflection of Beams

Deflection of beams by Double integration method - Macaulay's method - Area moment theorems for computation of slopes and deflections in beams - Conjugate beam method.

UNIT IV Torsion and columns

Introduction to Torsion - derivation of shear strain - Torsion formula - stresses and deformations in circular and hollow shafts - Stepped shafts - shafts fixed at the both ends - Stresses in helical springs.

Theory of columns – Long column and short column - Euler's formula - Rankine's formula - Secant formula - beam column.

UNIT V Bi axial Stress system

Biaxial state of stress - Stress at a point - stresses on inclined planes - Principal stresses and Principal strains and Mohr's circle of stress, Theories of failure

Thin cylinders and shells - deformation of thin cylinders and shells; Thick Cylinders, Shrink fits, Compounding.

Fundamentals of theory of elasticity.

Text book

1. S. Ramamrutham and R. Narayanan, (2003), Strength of Materials, Dhanpat Rai Publications.

Reference Books

1. Rowland Richards, (2000), Principles of Solid Mechanics, CRC press.
2. R.K. Bansal, (2000), Strength of Materials, Laxmi Publications.

Mode of Evaluation : Assignment/ Seminar/Written Examination.

MEE 204L STRENGTH OF MATERIALS LAB

Objectives

1. To help the students gain experience in the determination of creep for various materials and understand how this property varies with time.
2. To provide students an opportunity to learn how to measure hardness of materials and analyze how heat treatment affects hardening.
3. To impart knowledge on phase development of two isomorphous metals.
4. To teach students determine phases present in a material using XRD graph.

Outcome Student will be able to

1. Interpret hardness curve measured after heat treatment.
2. Find correlation between material structure and its creep.
3. Index XRD plot and determine phases of a material.
4. Perform non destructive failure analysis.

I. TEST ON METALS

1. Tension Test
2. Shear Test
3. Hardness test
4. Torsion Test
5. Impact Test
6. Cold Bend Test
7. Ductility Test
8. Fatigue Test

II. TESTS ON TIMBER

III. TESTS ON STRUCTURAL COMPONENTS

1. Spring Test
2. Column Test
3. Beam Test
4. Deflection Test

Reference Books

1. Lab Manual prepared by VIT faculty
2. Timoshenko, S.P. and Young, D.H., (2000), Strength of Materials, East West Press Limited.
3. Relevant BIS Codes 2004

Mode of Evaluation : Experiments/Record work/Oral/ Practical Examination

THERMAL ENGINEERING AND IC ENGINES

L	T	P	C
2	1	2	4

Pre requisite: Engineering Thermodynamics

Objectives

1. To introduce students the basics and types of internal combustion engines and their pollution control norms
2. To enable the students understand the principles, working and performance of IC engines
3. To introduce students to the working of compressors, steam nozzles and various refrigeration and air-conditioning systems.

Outcome

Student will be able to

1. Understand the basics and types of internal combustion engines and get an awareness on the pollution control norms
2. Solve problems on internal combustion engines and prepare heat balance sheet.
3. Get an insight of various components and principles of engines, compressors etc.
4. Explain and demonstrate their knowledge on refrigeration and air-conditioning systems.

UNIT I Internal combustion Engines

Classification of IC engine - IC engine components and functions - Construction and working of two stroke and four stroke engines - Valve timing diagram and port timing diagram - Comparison of petrol and diesel engine - Comparison of two stroke and four stroke engines - Wankel engines – Fuels - Air-fuel ratio calculation - Catalytic converter - pollution control norms.

UNIT II CI and SI Engines

Types of carburetor – Simple carburetor – SI engines – Fuel systems — Ignition systems – Combustion – Detonation factors and remedies – Rating of fuels – Introduction to multi point and microprocessor based fuel injection system

CI engines – Fuel injection system – Fuel pump – Combustion – Knocking – Factors and remedies – Rating of fuels – Cooling and lubrication of IC engines.

UNIT III Performance of IC Engines

Supercharging and turbocharging of IC engines and their effect on various parameters – Stratified charged engines – Lean burn engines; Performance test- Measurement of brake power – Indicated power – Fuel consumption – Air consumption; Heat balance test – heat carried away by exhaust gases and Morse test on IC engines – Standard testing procedure of IC engines – Performance curves and effect of various parameters on the performance of the engines.

UNIT IV Compressors and Steam Nozzles

Reciprocating compressors – Construction – Working – Effect of clearance volume – Multi staging - Volumetric efficiency - Isothermal efficiency.

Steam Nozzle – One-dimensional steady flow of steam through a convergent and divergent nozzle – Equilibrium and Meta stable flow.

UNIT V Refrigeration and Air conditioning

Reverse Carnot cycle- Bell-Colman's cycle – Vapor compression cycle – Components – Working – P-H and T-S diagrams – Calculation of COP – Effect of sub-cooling and super-heating – Vapor absorption system – Psychrometry – Chart – Processes – Simple problems - Summer and winter air conditioning – Components used in air conditioner – Types of air conditioning units.

Text Books

1. Arora C.P, (2000), Refrigeration and Air Conditioning, Tata McGraw-Hill Publishing Company Ltd.
2. Ganesan.V., (2002), Internal Combustion Engines, Tata McGraw-Hill Publishing Company Ltd.

Reference Books

1. McConkey and Eastop, (1999), Applied Thermodynamics, Adission Wesly.
2. Gupta. J.K and R.S. Khurmi (2004), A Textbook of Thermal Engineering, S.Chand Publishers.

Mode of Evaluation: Quiz/Assignment/ Seminar/Written Examination.

THERMAL ENGINEERING AND IC ENGINES LAB

Objectives

1. To teach students how to apply the knowledge of Thermodynamics and Thermal Engineering Systems to conduct experiments.

2. To help the students to investigate various performance characteristic curves of thermal systems

Out come Student will be able to:

1. Conduct the experiments on internal combustion engines and determine the performance characteristics

2. Analyze the performance of blowers, fan, and refrigeration systems.

Experiments:

1. Performance and Heat balance test on S.I & C.I engines
2. Morse test
3. Measurement of Frictional power using retardation.
4. Determination of calorific value of fuels
5. Performance test on reciprocating air compressor
6. Performance test on air blower
7. Performance test on vapour compressor refrigeration system
8. Performance test on air-conditioning system

Reference Books: Lab Manual prepared by VIT Faculty

Mode of Evaluation: Experiments/Record work/Oral/Practical Examination

MEE 308	INDUSTRIAL INTERNSHIP	L	T	P	C
		0	0	4	2

Objectives

1. To provide students with some exposure to actual working life.
2. To allow students to extend their theoretical knowledge into practice, thus enhancing their understanding further.
3. To introduce students to the practical aspects of industries and their working environment.
4. To develop students' skills in work ethics, management, communication and human relations.

Outcome Students will be able to

1. Get acquaintance with industrial working environment.
2. Prepare a diary of the regular activities made during the internship.
3. Prepare a detailed report of the observations made.

FLUID MECHANICS AND MACHINERY 2 1 2 4

Version No.

Prerequisite Multivariable Calculus and Differential equation & Engineering Thermodynamics

Objectives:
1. The aim of this course is to introduce and explain basic fundamentals of Fluid Mechanics, which is used in the applications of Aerodynamics, Hydraulics, Marine Engineering, Gas dynamics and electronics cooling.
2. To understand the concept of advanced fluid mechanics in relation to Computational Fluid Dynamics. To understand the energy exchange process and complexities involved in fluid machinery and turbo machinery components.

Expected Outcome: Student will be able to

1. To understand the basic fluid properties and the effect of it in practical industrial applications.
2. To understand the basic governing equations including Navier – Stokes equations and its relation to CFD.
3. To understand the basics of laminar and turbulent flow with an introduction to boundary layer phenomenon.
3. To understand the energy exchange process in Fluid and Turbo Machinery components.

Unit I Fluid Properties and Industrial Applications

Density – Viscosity – Surface tension – compressibility – capillarity – Hydrostatic forces on plane – inclined and curved surfaces – Buoyant flow - Basic concept, Grashoff's number and its importance - Buoyancy driven flow in Industrial applications like Radiator cooling - Electronics cooling - Buoyancy driven Micro channel/ Micro cavity flow - Buoyant Nano- fluids for Power electronics cooling - Cavitation - Saturation pressure driven - Boundary layer detachment driven – Causes - Possibility of estimation with local boiling phenomena & its effect on solid structure - Noise induced by Cavitation at high pressure drop - Free surface flow - Layer between two-phases, two-species - Effect of hydrodynamic force due to layer of free surface - Effects on Ship sailing, Tidal energy generation - Wind effect on High raise buildings

Unit II Fluid Dynamics – Dimensional Analysis

Control volume – Fluid Kinematics - Types of flows; Steady flow, Unsteady flow, Uniform and Non Uniform flow, Rotational flow, Irrotational flow, 1-D, 2-D, 3-D flows– Streamline and Velocity potential lines- Euler and Bernoulli's equations and their applications – Momentum equation-Navier-Stokes Equations - Exact Solutions of Navier –Stokes Equations – Low Reynolds Number flow – Flow over flat plate – Hagen Poiseuille equation – Turbulent flow. Introduction to dimensional analysis – Raleigh and Buckingham π theorems.

Unit III Hydraulic Pumps and Turbines

Fluid machines: definition and classification - Construction of velocity vector diagrams - head and specific work - components of energy transfer - degree of reaction. Hydro turbines: definition and classifications - Pelton turbine - Francis turbine - propeller turbine - Kaplan turbine - working principles - velocity triangles - work done - specific speed - efficiencies - performance curve for turbines.

Pumps: definition and classifications - Centrifugal pump: classifications, working principles, velocity triangles, specific speed, efficiency and performance curves - Reciprocating pump: classification, working principles, indicator diagram, work saved by air vessels and performance curves - cavitations in pumps - rotary pumps: working principles of gear and vane pumps.

Unit IV Turbo Machinery Principles

Energy transfer between fluid and rotor, classification of fluid machinery, dimensionless parameters, specific speed, applications, stage velocity triangles, work and efficiency for compressors and turbines.

Unit V Centrifugal and Axial Flow Turbo Machineries

Centrifugal Fan - Types, stage and design parameters, flow analysis in impeller blades, volute and diffusers, losses, characteristics curves and selection, fan drives and fan noise.

Centrifugal Compressors - Construction details, types, impeller flow losses, slip factor, diffuser analysis, losses and performance curves.

Axial Compressors - Stage Velocity Triangles, enthalphy – entrophy diagrams, stage losses and efficiency, work done factor, simple stage design problems and performance characteristics.

Text Books

1. Dr.R.K.Bansal, (2000), Fluid Mechanics and Hydraulic Machines, Laxmi Publication (P) Ltd., New Delhi.
2. Dr. S K Som and G Biswas, (1998), Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
3. Yahya, S.H., " Turbines, Compressor and Fans ", Tata Mc Graw Hill Publishing Company, 1996

References

1. P.N.Modi and S.M.Seth (1999), Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House, Naisarak, Delhi.
2. Dixon, S.I., " Fluid Mechanics and Thermodynamics of Turbomachinery ", Pergamom Press, 1990.
3. Shepherd, D.G., " Principles of Turbomachinery ", Macmillan, 1969.

Mode of Evaluation Quiz/Assignment/ Seminar/Written Examination

AUTOMOTIVE ELECTRONIC AND INSTRUMENTATION SYSTEMS	3	0	0	3

Version No. 1.0

Prerequisite EEE101 Basic Electrical and Electronics Engineering

Objectives:
5. To understand the use of electronics in the automobile
6. To appreciate the various electronic and the instrumentation systems used in automobile

Expected Outcome: On completion of this course, the students will be able to
5. Tell the functions of the electronic components and the way they work.

Unit I Introduction to microcomputer

Microcomputer: Buses, memory, timing, CPU registers; Microprocessor architecture: Initialization, operation codes, program counter, branch and jump instructions, subroutine. Analog to digital converters and Digital to analog converters, sampling, polling and interrupts, digital filters, lookup table.

Unit II Sensors and actuators

Speed sensors, Pressure sensors: Manifold Absolute Pressure sensor, knock sensor, Temperature sensors: Coolant and Exhaust gas temperature, Exhaust Oxygen level sensor, Position sensors: Throttle position sensor, accelerator pedal position sensor and crankshaft position sensor, Air mass flow sensor. Solenoids, stepper motors and relays

Unit III Electronic engine management system

Electronic engine control: Input, output and control strategies, electronic fuel control system, fuel control modes: open loop and closed loop control at various modes, EGR control, Electronic ignition systems – Spark advance correction schemes, fuel injection timing control.

Unit IV Electronic vehicle management system

Cruise control system, Antilock braking system, electronic suspension system, electronic steering control, traction control system, Transmission control, Safety: Airbags, collision avoiding system, low tire pressure warning system

Unit V Automotive instrumentation system

Input and output signal conversion, multiplexing, fuel quantity measurement, coolant temperature and oil pressure measurement, display devices- LED, LCD, VFD and CRT, Onboard diagnostics(OBD), OBD-II, off board diagnostics

Text Books

1. Understanding Automotive Electronics, William B Ribbens, Newne Butterworth-Heinermann, 6th edition 2003.

References

1. Bechhold “Understanding Automotive Electronics”, SAE, 1998.
2. Robert Bosch “Automotive Hand Book”, SAE (5th Edition), 2000.
3. Tom Denton,”Automobile Electrical and Electronic Systems” 3rd edition- Edward Arnold, London - 2004.
4. Eric Chowanietz - ‘Automotive Electronics’ - SAE International USA – 1995

Mode of Evaluation Quiz/ Seminar/ Class test

Recommended by the Board of Studies on:

Date of Approval by the Academic Council:

MAT105	DIFFERENTIAL AND DIFFERENCE EQUATIONS	L T P C 3 1 0 4

Version No. 1.0

Course Prerequisites MAT 101 Multivariable Calculus and Differential Equations

Objectives This course is designed to give a comprehensive coverage at an introductory level to the subject of ordinary differential equations and difference equations. Matrix methods and eigenvalue problems are integrated in to the course. Sufficient emphasis is laid on mathematical modeling and analysis of simple engineering problems.

Expected Outcome By the end of the course, the students are expected to know how to model simple physical problems in the form of a differential and difference equations, analyze and interpret the solutions. Further the students are expected to acquire necessary background in matrix methods and eigenvalue problems so as to appreciate their importance to engineering systems.

Unit 1 Matrix methods to Linear Differential Equations 15

The eigenvalue problem- eigen values and eigen vectors, Cayley-hamilton theorem (with out proof), Symmetric matrices-theorems concerning eigen values and eigen vectors(with out proof),, Similar matrices, Diagonalisation

Solution of equations of type $X^{11} + AX=0$ by diagonalization, Reduction of nth order system to a system of first order equations, Evaluation of e^A , Solution of matrix differential equations of type $X^1 =AX$ and $X^1= AX+BU$ using Laplace transform approach

Unit 2 Power Series Solutions 15

The Strum-Liouville Problem-orthogonality of eigen functions, Fourier series, Bessel's and Legendre's equations- Power series solutions – method of Frobenius – Legendre functions – Bessels functions – orthogonality relations (Proof not required) – Fourier – Bessel and Fourier – Legendre series – generating functions and recurrence relations (derivations not required), Simple problems where Bessel functions and Legendre polynomials appear as solutions.

Unit 3 Difference Equations and Z-transforms 15

First order difference Equations, Second order difference equations with constant coefficients-Complementary function, and particular integrals by method of undetermined coefficients, method of variation of parameters

Z-trans form-Relation to Laplace transform, Z-transform of standard functions, Inverse z-transform by partial fraction method, solution of simple difference equations by Z-trans form method.

Unit 4 Applications Of Differential and Difference Equations 15

First order equations: Newton's law of cooling – radioactive decay, L-R and C-R circuits-Equation of motion for a particle in gravitational field – Terminal velocity.

Second order equations: Motion of a body in a resisting medium, Motion of an electron in a uniform magnetic field. Mechanical Vibrations: Free undamped and damped vibrations, Forced oscillations-Resonance phenomenon. Electrical Vibrations: series LCR circuit, Analogy with mass-spring system,

LCR circuit with voltage source, complex impedance, and Resonance phenomena. Systems of linear differential equations- Model of a vibrating systems with two masses- Solution by matrix methods.

Applications of difference equations: Fibonacci difference equation, Ladder type resistive network, Beads on a tightly stretched string-eigen value problem

Text Books	1. Erwin Kreysizing, Advanced Engineering Mathematics, 8th Edition, John Wiley & Sons, (Wiley student Edison) (2004). 2. B.S.Grewal, Higher Engineering Mathematics, 38th Edition. Khanna Publications (2005).
Reference Books	1. W.E.Boyce and R.C. Diprima, Elementary differential equations, 7th Edition. John Wiley & Sons, Inc.(2002). 2. Michale D. Greenberg, Advanced Engineering Mathematics, 2nd Edition, Pearson Education, First Indian reprint (2002). 3. Peter V. O' Neil, Advanced Engineering Mathematics, 5th Edition, Thomson, Book/Cole (2003). 4. C. Ray Wylie, Advanced Engineering Mathematics, 6th Edn, McGraw Hill (1995). 5. Gary L. Peterson, Linear Algebra and Differential Equations, Addison-Wesley (2002). 6. James C. Robinson, "An introduction to ordinary differential equations", Cambridge Univ. Press(2000).
Mode of Evaluation	Continuous Assessment Tests, Assignments, Tutorial sheets, Class Tests, Quizzes.
Recommended by the Board of Studies on	16.10.2008
Date of approval by the Academic Council	

MEE 306	HEAT AND MASS TRANSFER	L	T	P	C
		3	1	2	5

Pre requisite MEE 202 Engineering Thermodynamics

Objectives

1. To teach the students to comprehend and evaluate various modes of heat and mass transfer.
2. To help the students to design fin enhanced systems, evaporators, condensers and heat exchangers.
3. To enable the students understand boundary layer theory, condensation and boiling.
4. To expose students to heat exchangers and heat pipes.

Outcome Student will be able to

1. Apply basic principles of fluid mechanics, thermodynamics, heat transfer for designing heat and mass transfer systems.
2. Model heat, mass and momentum transport systems and develop predictive correlation.
3. Assess and evaluate various designs for heat and mass transfer and optimize the solution

UNIT-I Conduction – I

Basic concepts – conduction - convection and radiation – Laws – General equation of heat conduction – Derivation in cartesian - cylindrical and spherical coordinates – One dimensional steady state heat conduction in simple geometries – plane wall - cylinder and sphere – Heat transfer composite walls - composite cylinders and composite spheres – Critical thickness of insulation – Thermal contact resistance – Overall heat transfer coefficient – Electrical analogy – Heat generation in plane wall - cylinder and sphere – Extended surfaces – general equations – types and applications of fins – Fin efficiency and effectiveness – Fin performance.

UNIT-II Conduction – II

Two and Three dimensional steady state heat conduction – Analytical - Graphical and Numerical methods – Conduction shape factor – Unsteady state heat conduction – Lumped parameter system – Non-dimensional numbers in conduction – Significance of Biot and Fourier numbers – Transient heat flow in semi-infinite solid – Use of Heisler and Grober charts

UNIT-III Convection

Boundary layer theory – Conservation equations of mass - momentum and energy for laminar flow over a flat plate – Turbulent flow over a flat plate – Flow over cylinders - spheres - tube bank – Internal flow through pipes – annular spaces – Analogy between momentum and heat transfer – Natural convection in vertical - inclined and horizontal surfaces – Mixed convection – Dimentional analysis.

UNIT-IV Condensation, Boiling and Radiation

Condensation and Boiling – Filmwise and dropwise condensation – Film condensation on a vertical plate – Regimes of Boiling – Forced convection boiling – Radiation heat transfer – Thermal radiation – Laws of radiation – Black body concept – Emissive power – Radiation shape factor – Gray bodies – Radiation shields

UNIT-V Heat Exchanger and Mass Transfer

Heat Exchangers – Types and practical applications – Use of LMTD – Effectiveness – NTU method – Compact heat exchangers – Plate heat exchangers – Fouling factor – Heat pipes – Types and applications – Principle of Mass Transfer-Mass transfer by molecular diffusion – Fick's law of diffusion – Analogy of heat and mass transfer

Text book

1. R. C. Sachdeva, (2005), Fundamentals of Heat and Mass Transfer, New Age International (P) Ltd.

Reference Books

1. Yunus A. Cengel, (2000) Heat Transfer-A Practical Approach, Tata McGraw Hill Publishing Company Limited.
2. P. K. Nag, (2005), Heat Transfer, Tata McGraw Hill Publishing Company Limited.
3. J. P. Holman, (2005), Heat Transfer, 9th Edition, McGraw-Hill Publishing Company Limited.
4. S. P. Venkateshan, (2004), First Course in Heat Transfer, Ane Books Publishers.
5. Sarit K Das, (2005), Process Heat Transfer, Narosa Publishing House.
6. P. S. Ghoshdastidar, (2005), Heat Transfer, Oxford University Press.
7. Y. V. C. Rao, (2001), Heat Transfer, First Edition, Universities Press (India) Limited.
8. Frank P. Incropera and David P. Dewitt, (2002), Fundamentals of Heat and Mass Transfer, Fifth Edition, John Wiley & Sons.
9. C. P. Kothandaraman and S. Subramanyan, (2004), Heat and Mass Transfer Data Book, Fifth Edition, New Age International Publishers.

Mode of Evaluation: Assignment/ Seminar/Written Examination.

MEE 306L HEAT AND MASS TRANSFER LAB

Objectives

1. To enable the students to do experimentation on heat transfer equipment and improve practical knowledge of the systems.
2. To develop trouble shooting abilities of students for practical heat transfer systems.
3. To teach students how to measure heat transfer through various systems.

Outcome Student will be able to:

1. An ability to demonstrate the fundamental principles of heat transfer in practice.
2. Design and test practical heat transfer systems like heat exchangers, condensers, evaporators etc.
3. Develop empirical correlations for predicting heat and mass transfer rates for a given system.
4. Troubleshoot existing engineering heat transfer systems and develop alternatives and more energy efficient systems.

Experiments

1. Thermal conductivity studies of a metal bar and an insulating powder.
2. Thermal conductivity studies of a composite wall.
3. Thermal conductivity studies of a given liquid.
4. Transient heat conduction studies using a semi-infinite solid.
5. Two-dimensional heat conduction in finite solids and irregular geometries.
6. Unsteady state heat transfer studies of a system using the lumped capacity method.
7. Convective heat transfer studies - Natural convection and Forced convection mode.
8. Efficiency calculations of a pin fin - Natural and Forced convection mode.
9. Two phase heat transfer studies using boiling heat transfer apparatus.
10. Pool boiling studies using critical heat flux apparatus.
11. Phase change cooling of electronic components
12. Radiation heat transfer studies using the Stefan Boltzmann apparatus and emissivity studies of a given test surface.
13. Heat transfer studies using a plate type heat exchanger.
14. Heat transfer studies in a double pipe heat exchanger using parallel and counter flow of

fluids.

15. Heat transfer studies using a Finned tube heat exchanger.
16. Heat transfer studies in a regenerative heat exchanger.

Reference Books

Lab Manual prepared by VIT Staff

Mode of Evaluation : Experiments/Record work/Oral/ Practical Examination

VEHICLE TECHNOLOGY 2 1 0 3

Version No. 1.10
Prerequisite
Objectives:
1. To broaden the understanding of details of car body aspects.
2. To introduce car body and bus body details used.
3. To broaden the understanding of students in the structure of vehicle chassis.
4. To introduce students to steering, suspension and braking systems.

Expected Outcome:
Student will be able to
1. Carryout construction of different car bodies and designing of car for safety
2. Develop chassis and identify suitable engine for different applications
3. Formulate steering, braking and suspension systems

Unit I INTRODUCTION

General consideration relating to chassis layout, power plant location, types of automobiles, layout of an automobile with reference to power plant, weight distribution, stability, Terms used in body building construction, Angle of approach, Angle of departure, Ground clearance, Cross bearers, Floor longitudes, posts, seat rail, waist rail, cant rail, Roof stick, Roof longitude, Rub rail, skirt rail, truss panel, wheel arch structure, wheel arch, post diagonals, gussets

Unit II VEHICLE BODY

Car Body: Types, Regulations, drivers visibility, tests for visibility, methods for improving visibility and space in cars, safety design, safety requirements for car, car body construction.

Bus Body Details: Types, Mini bus, single decker, double decker, two level, split level and articulated bus, bus body layout, floor height, engine location, entrance and exit locations, seating dimensions, constructional details, frame construction, double skin construction, types of metal sections used, regulations, conventional and integral type construction.

Unit III FRONT AXLE AND STEERING SYSTEMS

Axle parts and materials, loads and stresses, centre sections, section near steering head, spring pads, front axle loads, steering heads, factors of wheel alignment, wheel balancing, centre point steering, correct steering angle, steering mechanisms, cornering force, self righting torque, under steer and over steer, Steering linkages, steering gears, special steering columns, power steering, trouble shooting, Numerical problems

Unit IV BRAKES

Necessity, stopping distance and time, brake efficiency, weight transfer, brake shoe theory, determination of braking torque, classification of brakes, types, construction, function, operation, braking systems - mechanical, hydraulic, disc, drum, details of hydraulic system, mechanical system and components, types of master & wheel cylinders, bleeding of brakes, brake drums, brake linings, brake fluid, factors influencing operation of brakes such as operating temperature, lining, brake clearance, pedal pressure, linkages etc, Numerical problems.Brake compensation, Parking and emergency brakes, hill holder, automatic adjustment, servo brakes, Power brakes-Air brakes, wagner air brake, vacuum brakes and

electric brakes and components brake valve, unloader valve, diaphragm, air-hydraulic brakes, vacuum boosted hydraulic brakes, trouble shooting, Numerical problems

Unit V SUSPENSION & WHEELS AND TYRES

Objects, basic considerations, Types of suspension springs, construction , operation & materials, leaf springs, coil springs, torsion bar, rubber springs, plastic springs, air bellows or pneumatic suspension, hydraulic suspension, constructional details of telescopic shock absorbers, independent suspension, front wheel independent suspension, rear wheel independent suspension, types, stabilizer, trouble shooting, Numerical problems.

WHEELS AND TYRES: Types of wheels, construction, structure and function, wheel dimensions, structure and function of tyres, static and dynamic properties of pneumatic tyres, types of tyres, materials, tyre section & designation, factors affecting tyre life, quick change wheels, special wheels, trouble shooting'

Text Books

1. Automotive Chassis – P.M. Heldt, Chilton & Co.
2. Automotive Mechanics – N.K. Giri , Khanna Publications, New Delhi, 2004

References

1. Automotive chassis and body – P.L. Kohli, TMH
2. Automobile Engineering Vol. I - Kirpal Singh, Standard publications, New Delhi, 2004.
3. Introduction to automobile engineering – N.R. Khatawate, Khanna pub. New Delhi
4. Automotive mechanics – Joseph I Heintner, Affiliated East West Press, New Delhi/Madras,1967
5. Automobile engineering – G.B.S. Narang, Khanna Publications, New Delhi, 1982
6. Automobile Engineering – T.R. Banga & Nathu Singh, Khanna Publications, 1993

Mode of Evaluation Quiz/Assignment/ Seminar/Written Examination
Recommended by the Board of Studies on:
Date of Approval by the Academic Council:

KINEMATICS & DYNAMICS OF MECHINERY L T P C
3 0 0 3

Objectives

1. To provide students an understanding of different types of mechanisms.

2. To teach students how to analyze cam-follower motion and gear train configurations.

3. To help students gain knowledge in solving problems related to gyroscopic effect on vehicles, ships and planes

4. To teach students the balancing procedures for rotating and reciprocating masses, rotors and engines.

5. To teach students the fundamentals of free and forced vibrations.

Outcome Student will be able to

1. Demonstrate an understanding of the concepts of various mechanisms and pairs.

2. Analyze and solve problems associated with mechanisms.

3. Solve problems related to cam-followers and gear trains.

4. Demonstrate an understanding of principle of gears.

5. Calculate gyroscopic couple effect on various vehicles.

Contents:

• Introduction to Mechanisms

• Friction

• Cam and Gears

• Balancing

• Vibrations

Unit – I

Introduction to mechanisms – Links - Pairs - Chains - Mobility - Degree of freedom – Gruebler's and Kutzbach criterion – Kinematics inversions- Grashoff's Law. Determination of velocity andacceleration - simple mechanisms – Relative motion method. Introduction to synthesis of mechanism. Inertia force analysis of slider crack mechanism- Klein's construction.

Unit – II

Friction in screw and nut – Pivot and collar – Thrust bearing – Plate and disc clutches – Belt (flat and V) and rope drives. Ratio of tensions – Effect of centrifugal and initial tension – Condition for maximum power transmission – Open and crossed belt drive. Gyroscopic forces and couple – Gyroscopic effects on the movement of air planes and ships - Stability of two wheel drive and four wheel drive and space vehicles - Gyroscope stabilization.

Unit – III

Types of Cams and Followers - Applications – Displacement - Velocity and Acceleration and construction of cam profiles for Uniform velocity - Uniform acceleration and retardation – Simple Harmonic Motion (SHM) - Cycloidal motions of followers Spur gear terminology and definitions -Types of gears- Fundamental law of toothed gearing– Interference and under cutting –Comparison of Involute and Cycloidal tooth forms.ear trains: Simple, compound gear trains and epicylic gear trains - Determination of speed and torque.

Unit – IV

Static and Dynamic balancing of rotating masses in different planes – Balancing of rotors - Balancing of machines - Partial balancing of reciprocating masses of inline 98

Unit – V

Free, and damped vibrations of single degree of freedom systems - longitudinal – transversetorsional –Forced vibration – harmonic excitation - Magnification factor - Vibration isolation and Transmissibility. Introduction to vibrations of multi-degree freedom systems.

Text book

1. S.S. Rattan, (1999), Theory of Machines, Tata McGraw Hill publishing companies Ltd.

References Books

1. J.S. Rao and R.V Dukkipati, (2000), Mechanism and Machine theory, Wiley- Eastern Ltd.

New Delhi.

2. J.E. Shigley and J.J Unicker, (1999), Theory of Machines and Mechanics, McGraw Hill.

3. Thomson. W.T. (1995), Theory of Vibration with applications, Prentice Hall of India.

4. Dukkipati, Srinivas, (2005), Theory of mechanical vibrations, Prentice Hall of India.

Mode of Evaluation: Assignment/ Seminar/Written Examination.

MEE 305	DESIGN OF MACHINE ELEMENTS	L	T	P	C
		2	1	0	3

Pre requisite MEE 204 Strength of Materials

Objectives

1. To understand the design methodology for machine elements.
2. To analyse the forces acting on a machine element and apply the suitable design methodology.
3. To understand the various standards and methods of standardisation.
4. To apply the concept of parametric design and validation by strength analysis.

Outcome

Student will be able to

1. Determine stress, strain and deflection of simple machine elements.
2. Estimate saftey factors of simple structures exposed to static and repeated loads.
3. Determine performance requirements in the selection of commercially available machine elements.
4. Demonstrate an ability to design couplings and joints.
5. Apply designing aspects to all mechanical components.
6. Integrate various machine elements and components into the design of a machine or mechanical system.

UNIT I Introduction to Design Process

Introduction to Design process – Factors – Materials selection Direct - Bending and Torsional stress equation - Impact and Shock loading - Stress concentration factor - Size factor - Surface limits factor - Factor of safety - Design stress - Theories of failures – Problems

UNIT II Fatigue strength and design of springs

Variable and cyclic loads – Fatigue strength - S- N curve - Continued cyclic stress - Soderberg and Goodman equations – Design of Helical - Leaf - Disc springs under Constant and Varying loads.

UNIT III Design of shafts and joints

Design of Shafts - Riveted joints, Welded joints and Screwed fasteners, Computer aided assignments for the design of joints and fasteners.

UNIT IV Design of couplings

Design and drawings of couplings – Rigid - Flexible - Design and Drawings of Cotter joints - Knuckle joints, Computer aided assignments for the design of couplings and Joints.

UNIT V Design of Engine components

Design and Drawings of Piston - Connecting rod - Crankshaft – Flywheel, Design of Cams for parabolic - SHM and Cycloidal follower motions. Computer aided assignments for the design of Piston, connecting rod, Flywheel and cam.

Text book

1. J.E. Shigley, (2001), Mechanical Engineering design, McGraw Hill International.

Reference Books

1. V.B. Bhandari , (2001), Design of Machine elements, Tata Mc Graw Hill.
2. Design Data, (2005), PSG College of Technology, DPV Printers, Coimbatore.

Mode of Evaluation : Assignment/ Seminar/Written Examination.

NUMERICAL METHODS L T P C

3 1 0 4

Pre requisite MAT 201 Complex Variables and Partial Differential Equations

Objectives

1. To introduce students to some of the basic computational methods that are of great use to engineers.
2. To enable the students learn computer oriented numerical methods for solving ordinary and partial differential equations.
3. To help the students to develop MAT LAB / FORTRAN/C programs for various numerical methods and obtain results.

Outcome students will be able to

1. Understand and solve transcendental/polynomial equations.
2. Get exposure to system of linear algebraic equations, interpolation and approximation.
3. Demonstrate the ability of differentiation and integration to find solutions of equations by finite difference approximations.
4. To program using computational languages.

UNIT-I Algebra and Transcendental System of Equations and Numerical Integration

Newton-Raphson method, Newton-Raphson method for non-linear equations, solution of system of equations), Secant method - Rate of convergence. Gauss – Seidel method for system of algebraic equations – convergence criterion – positive definite of a matrix- spectral radius of a matrix, Tridiagonal system of equations – Thomas algorithm- Numerical Integration: Trapezoidal rule, Simpsons 1/3 rd and 3/8th rules

UNIT-II Analysis of Data

Numerical Differentiation, Langrage Interpolation, Interpolation with cubic splines, General Linear Least squares fit, goodness of fit, correlation, Linear regression Spectral analysis: Discrete Fourier transform, Aliasing and Nyquist frequency, Fast Fourier transform

UNIT-III Ordinary Differential Equations

Review : Euler and Modified Eulers Methods Initial value problems: Fourth order Runge Kutta Method – Sustems of equations and higher order equationsBoundary value problems : The shooting method, characteristic – value problems, Finite difference method

UNIT-IV Partial Differential Equations

2-Dimensional Laplace and Poisson’s equations – Liebmann’s method, 1-Dimensional Diffusion equation – explicit method – Von Neumann Stability condition, Crank – Nicholson implicit method, 1-Dimensional wave equation – Explicit method, CFL stability condition

UNIT-V The Finite Element Method

The Rayleigh – Ritzr method, The collection and Galerkin methods, Finite elements for ordinary Differential equations

Text Books

1. M. K. Jain, S.R.K. Iyengar and R.K.Jain, (2003), Numerical Methods for Scientific and Engineering,
   Fourth Edition, New Age International Ltd.
2. C.F. Gerald and P.V.Wheatley, (2004), Applied Numerical analysis, Seventh Edition, Addition-wesley.

Reference Books

1. R.J. Schilling and S.L.Harris, (2000), Applied Numerical Methods for Engineers using MATLAB and C, Brooks/Cole
2. Erwin Kreysizig, (2004.), Advanced Engineering Mathematics, Eighth Edition, John Wiley &Sons,
3. Steren C. Chapra and Ra P. Canale, (2001), Numerical Methods for Engineers with Programming and Software Applications, Third Edition, Tata McGraw-Hill.
4. E. Balagurusamy, (2005), Numerical Methods, Fifteenth Reprint, Tata McGraw-Hill Company Limited.
5. K. Sankara Rao, (2005), Numerical Methods for Scientists and Engineers, Second Edition, Prentice Hall of India Limited.

Mode of Evaluation: Assignment / Seminar / Written Examination

MEE 402	COMPUTER AIDED DESIGN AND COMPUTER AIDED MANUFACTURING	L	T	P	C
		2	0	4	4

Prerequisites MEE 206 Computer aided Machine Drawing

Objectives
1. To understand the basics of CAD/CAM
2. To gain exposure over the concepts of computer graphics
3. To learn about the geometric issues concerned to the manufacturing and its related areas
4. To understand the latest advances in the manufacturing perspectives

Expected Outcome
Student will be able to
1. Understand the importance of CAD/CAM principles in the Product development
2. Develop programs related to manufacturing using Codes
3. Analyze the importance of networking in manufacturing environment

UNIT-I

Product Development Cycle – Introduction to CAD/CAM – Graphics input devices- cursor control devices, Digitizers, Scanners, speech oriented devices and touch panels, Graphics display devices – CRT, color CRT monitors, DVST, Flat- panel display, Graphics output Devices – Printers and Plotters – Graphics Standards – Neutral File formats –IGES, STEP

UNIT-II

Geometric Modeling – Wireframe, Surface and Solid – CSG and B-Rep- World/device co-ordinate representations, 2D and 3D geometric transformations, Matrix representation-translation, scaling, shearing, rotation and reflection, composite transformations, concatenation - Graphics software, Graphics functions, output primitives- Bresenham's Algorithm and DDA algorithm

UNIT-III

Introduction to NC, CNC, DNC- Manual part Programming – Computer Assisted Part Programming – Examples using NC codes- Adaptive Control - Canned cycles and subroutines - CAD / CAM approach to NC part programming - APT language, machining from 3D models

UNIT-IV

Introduction to part families-parts classification and cooling - group technology machine cells-benefits of group technology – Process Planning – CAPP & types of CAPP - Flexible manufacturing systems

(FMS) - the FMS concept-transfer systems - head changing FMS - Introduction to Rapid prototyping, Knowledge Based Engineering.

UNIT-V

CIM wheel - CIM Database- CIM-OSI Model– Networking Standards in CIM Environment - Network structure - Network architecture –TCP/IP, MAP – Virtual Reality, Augmented Reality- Artificial Intelligence and Expert system in CIM.

Text Book

Mikell P. Groover and Emory W. Zimmers, “CAD/CAM Computer Aided Design and Manufacturing”, Prentice Hall Edition, 2004

References

1. Mikell P. Groover, “Automation, Production Systems and Computer Integrated Manufacturing”, Pearson Education, 2005

2. James A. Rehg, Henry W. Kraebber, “Computer Integrated Manufacturing”, Pearson Education. 2002

3. Ibrahim Zeid, “Mastering CAD/CAM”, Tata McGraw Hill International Edition, 2005

4. Donald Hearn and M.Pauline Baker “Computer Graphics” Prentice Hall, International., 1992

5. Ranky, Paul G., “Computer Integrated Manufacturing”, Prentice Hall, International., 1986

Mode of Evaluation: Assignment/ Seminar/Written Examination.

MEE 402L	COMPUTER AIDED DESIGN AND COMPUTER AIDED MANUFACTURING LABORATORY	
CAD Experiments	1. Structural analysis of deferent Types of Beams and Truss 2. Structural analysis of Trusses 3. Structural analysis of plate with a hole 4. Thermal analysis in different modes of heat transfer 5. Model analysis for different structures	
CAM Experiments	1. Manual part programming using G and M codes for Turning, Step turning, Taper turning, multiple turning, Facing, Multiple facing, thread cutting and radius turning on cylindrical components. 2. CNC Milling program involving linear motion and circular interpolation. 3. CNC Milling program involving contour motion and canned cycles. 4. CNC Milling program involving Pocket milling 5. Diagnosis and trouble shooting in CNC machine 6. CNC code generation using any CAM software. 7. Simulation of machining operations using any CAM software. 8. Route sheet generation using CAM software. 9. Study and practical demonstration on Wire-Cut EDM, 10. Study and practical demonstration on Coordinate measuring machine, 11. Study and practical demonstration on Vertical Machining center and Horizontal Machining center 12. Study on Rapid Prototyping Technologies, Student shall submit team work in the form of project /assignments with neat documentation.	

Mode of Evaluation: Experiments/Record work/Oral/ Practical Examination.

MEE308 INDUSTRIAL ENGINEERING AND MANAGEMENT 3 0 0 3

Version No. 1.0

Prerequisite -

Objectives:
1. To enable the students understand the demand forecasting techniques and costing.
1. To provide students an insight into the concepts of industrial engineering and organization.
2. To familiarize the students with principles of work-study and Ergonomics.
3. To introduce students to various aspects of plant design and materials planning.

Expected Outcome: Student will be able to
1. Conduct market research, demand forecasting and costing
2. Demonstrate the knowledge of designing plants and controlling production.
3. Optimize the resources of an organization and improve productivity.

Unit I Demand Forecasting and Elements of Cost

Macro and micro economics - Demand and supply – Factors influencing demand – Elasticity of demand – Demand forecasting – Time series - Exponential smoothing casual forecast - Delphi method – Correlation and Regression - Barometric method – Long run and Short run forecast.

Elements of cost – Determination of Material cost - Labour cost - Expenses – Types of cost – Cost of production - Over head expenses – Problems.

Unit II Industrial Organisation

Introduction to Industrial Engineering – Concepts - History and Development of Industrial engineering – Roles of Industrial Engineer – Applications – Productivity – Factors affecting productivity – Increasing productivity of resources – Kinds of productivity measures.

Unit III Work Design

Introduction to work study – Method study – Time study – stopwatch time study - Standard data - Method Time Measurement (M-T-M) – Work sampling – Ergonomics.

Unit IV Plant Layout and Group Technology

Plant location - Factors - Plant layout - Types - Layout design process - Computerized Layout Planning – Construction and Improvement algorithms -ALDEP - CORELAP and CRAFT.

Group technology-Problem definition - Production flow analysis - Heuristic methods of grouping by machine matrices – Flexible Manufacturing System - FMS work stations-Material handling and Storage system-Cellular Manufacturing System.

Unit V Production Planning and Control

Types of productions, Production cycle-Process planning, Forecasting, Loading, Scheduling, Dispatching, Routing- Simple problems.

Materials Planning – ABC analysis – Incoming materials control – Kanban system – Just in time. MRP systems- Master Production Schedule – Bill of Materials – MRP calculations - MRP II.

Text Books

Khanna O.P., (2001), Industrial Engineering and Management, Khanna Publishers.

References

1. Buffa E.S., (2000), Modern Production / Operational Management, John Wiley & Sons
2. Kumar B., (2000), Industrial Engineering, Khanna publishers.

3. Panneerselvan. R. (2000), Engineering Economics, Prentice Hall of India Pvt Ltd
4. Panneerselvan. R. (2000), Production/Operations Management, Prentice Hall of India Pvt Ltd

Mode of Evaluation Quiz/Assignment/ Seminar/Written Examination

Recommended by the Board of Studies on: 31-10-2009

Date of Approval by the Academic Council: 27-11-2009

AUTOMOTIVE TRANSMISSION SYSTEM 3 0 0 3

Version No. 1.0
Prerequisite -
Objectives:
7. To create awareness and emphasize on the need for automotive transmission system equipments.
8. To develop skills in maintenance of transmission equipments.
9. To develop an understanding of working of transmission systems.

Expected Outcome: On completion of this course, the students will be able to
6. Understand the need for transmission system.
7. Identify and solve problems in transmission system.
8. Demonstrate the working of transmission system.s

Unit I Clutch 9

Necessity of clutch in an automobile, different types of clutches, friction clutches namely Single plate clutch, multi plate clutch, cone clutch, centrifugal clutch, electromagnetic clutch, hydraulic clutches, Clutch - adjustment, Clutch troubles and their causes, requirements of a clutch , Clutch materials, clutch lining Vacuum operated clutch. Fluid coupling.

Unit II Gear box 9

Various Resistances to Motion of the Automobile, Traction, tractive effort Performance curves, acceleration grade ability, drawbar pull . The need for transmissions, Necessity of gear box, Desirable ratios of 3speed & 4speed gear boxes, Constructional details of , Sliding-mesh gear box , Constant-mesh gear box, synchromesh gear box, automatic and semi automatic transmission , overdrive.

Unit III Torque Converter and Automatic Transmission 9

Principal of torque conversion, single, multi stage and polyphase torque converters, performance characteristics, constructional and operational details of typical hydraulic transmission drives.

Automatic transmission: relative merits and demerits when compared to conventional transmission – epicyclic and hydromatic transmission – continuously variable transmission.

Unit IV Special transmission systems 9

Hydrostatic drives: advantages and disadvantages, principles of hydrostatic drive systems, construction and working of typical hydrostatic drives, Janney Hydrostatic drive.

Electrical drives: advantages and limitations, principles of Ward Leonard system of control Modern electric drive for buses and performance characteristics

Unit V Drive line 9

Effects of driving thrust and torque reaction. Hotchkiss drive. Torque tube drive, radius rods. Propeller shaft. Universal joints. Final drives – different types, double reaction final drive. Two speed rear axle. Rear axle construction – full floating, three quarter floating and semi-floating arrangements. Differential – conventional type, non-slip type. Differential locks.

Text Books

1. Crouse. W.H., Anglin., D.L., " Automotive Transmission and Power Trains construction ", McGraw-Hill
2. Crouse W.H-"Automotive chassis and body"-McGraw-Hill, New York- 1971.

References

1. Newton K and Steeds. W. "motor Vehicle", Butter Worth's & Co., Publishers Ltd, 1997
2. Automatic vehicle transmission, John Wiley Publications 1995
3. Automotive chassis system – Thomas W . Birch
4. Heldt P.M - Torque converters- Chilton Book Co.-1992

Mode of Evaluation Quiz/Assignment/ Seminar/Written Examination
Recommended by the Board of Studies on:
Date of Approval by the Academic Council:

COMPREHENSIVE EXAMINATION	L	T	P	C
	0	0	0	2

Objectives

1. To enable the students acquire overview of Mechanical Engineering aspects.
2. To develop students' skills in facing competitive examinations.
3. To expose students to real time testing scenario and acquire presentation and technical skills.
4. To enable the students apply Mechanical Engineering skills in other fields of Engineering and find applications.

Outcome Student will be able to

Get acquaintance with all the objectives of Mechanical Engineering.

1. Improve technical and presentation skills.
2. Ready to face real time testing scenarios.

Engine Design and Development	L	T	P	C
	2	1	0	3

Prerequisite -

Objectives:

1. To understand the functions and design of engine components
2. To understand the requirements of materials of engine components
3. To understand the phenomenological process taking place in engines for issue of design of various engine components, Mechanical limitations of obtaining ideal performance.

Expected Outcome:

Unit I **Engine Basic Theory**

Classification of I.C Engines, Customer & Functional requirements, Efficiency, Overall engine system parameters & configuration, General design considerations, Forces generated within engine, Duty cycle, Downsizing.

Unit II **Cylinder Head & Block**

Functional requirement, Block material like Gray Iron, Aluminium, Compacted Graphite Iron and Magnesium, Cylinder head alloys, Design layout, Basic block, Block head design, Cylinder liner design approach and Thermal loads, 2 Valve & 4 velve cylinder heads. Bolts loads and gasket design.

Unit III **Crank & Valve train**

Function, Requirements, Materials – Piston and crankshaft.

Recent trends in design of piston assembly – Piston, Piston rings, Piston pin, Connecting rod assembly and Crankshaft.

Unit IV **Fuel Injection , Cooling & Lubrication**

Functional requirement, Fuel Filter, Types of Injectors, Pump-line-injector injector system, Unit Injection, CRDI, Injection Pressure, Multiple Injections. Cooling system, Cooling Circuits, Water Pump and Thermostat and its types.

Lubrication – Types & Layout, Requirement of Lubricants, Oil Filters, Oil Pan, Oil pump types.

Unit V **Intake & Exhaust System**

Functional Requirement, Air Induction, Swirl & Turbulance, Swirl Generation, Air Filter, Intake Manifold, Positive Crankcase Ventilation (PCV), Exhaust Manifold, Turbochargers, EGR, EGR Cooler, Silencer etc, Part design philosophy.

References

1. Design Of Automotives Engine, Kolchin A. & Demidov V.;MIR Publishers,1984.
2. Goetze Piston Rings Manual.
3. I.C Engine Design & Development proceeding of 03 Day Seminar organised by ARAI,Pune and SAEINDIA.
4. I.C Engines – Mathur and Sharma.
5. An Introduction To I.C Engines – John B Heywood.
6. A book by Obert: Internal Combustion Engines Obert Edward F, Scranton, International Text book co. (1968)

Mode of Evaluation Tutorials / Class Tests

Recommended by the Board of Studies on:

Date of Approval by the Academic Council:

FUNDAMENTALS OF NOISE AND VIBRATION

L	T	P	C
2	1	0	3

Subject Code

Objectives

1. 1. To introduce source of noise and vibration
2. To broaden the understanding of sound measurement and human sensitivity
3. To introduce the importance of simulation, anechoic chamber and acoustic holography
4. To broaden the importance of statistical and frequency analysis and its applications

Expected Outcome: Upon completion of this course the student will be able to:

1. Identify the sources of noise and vibration.
2. Measure sound intensity and human sensitivity.
3. Carryout statistical energy analysis and simulators
4. Determine active control techniques

Unit 1:**Introduction to Vibrations**

Oscillatory motion, Harmonic Motion Natural vibration, single DOF, two DOF and Multi DOF. Forced vibration, Damped, Undamped Vibrations, Modal Analysis, frequency response function, transient vibration, laplace transformation formulation, langrange's Equation

Unit 2: Single DoF Two DoF

Damped – Undamped Vibration, Forced vibration, Balancing of Reciprocating mass, Balancing of Rotary Mass, Transmissibility, Logarithmic decrement, Isolation Absorption. Car Model (2 DOF) Coupled System.

Unit 3:-Multi DoF

Normal Mode of Vibrations-Flexibility and Stiffness Matrix, Eigen Values & Vectors, Orthogonal Modes, Modal Damping in forced Vibration, Forced Vibration by Matrix inversion, Numerical methods of fundamental frequencies, Continuous System Vibration of String, Euler's Equation of Beams.

Unit 4:- Introduction to Noise

What is Noise? Decibel, Various noise sources, Sound Quality, Sound Propagation, Sound Intensity, Sound Pressure level, Sound Intensity ratio, Sound power, Quantification of sound Machinery noise and Noise induced hearing loss. Noise Control

Unit 5:- Vibration and Noise Measuring Instruments.

Vibration Instruments- Vibration Exciters, Analyzers, Principle, Free and Forced Vibration test, Frequency and Domain Analysis, Sound Intensity and mapping and introduction to array technique. Digital Signaling Process.

Text Books:

1. S.S.Rao (Mechanical Vibration)
2. Mechanical Vibration 4th Edition,Pearson Education,2006,
3. William Thomson (Introduction to Vibration)
4. J B K Das.

Reference:

1. Malcom J. croker, "Noise and Vibration Control", wiley, 2007.
2. Norton MP "Fundamental of Noise and Vibration", cmbridge University Press, 1989.
3. Boris and Korney,"Dynamic Vibration Absorbers", John Wiley,1993.
4. Lweis L, " Industrial Noise Control, McGraw Hill Inc,1991

VEHICLE DYNAMICS AND STRUCTURES

L	T	P	C
2	1	0	3

Version No.

Prerequisite -

Objectives:

1. Understand vibrating systems and its analysis, modeling and simulation and modal analysis
2. Understand various Suspension systems, selection of springs and dampers
3. Understand the stability of vehicles on curved track and slope, gyroscopic effects and cross wind handling
4. Know about tyres, ride characteristics and effect of camber, camber thrust
5. Learn about vehicle handling under different steering conditions and directional stability of vehicles

Expected Outcome: On completion of this course, the students will be able to

1. Simulate and analyse vibrations from vehicles
2. Select suitable suspension system for a vehicle
3. Analyse the stability of vehicle at different operating conditions
4. Analyze and select suitable tires for a vehicle
5. Analyze the vehicle handling characteristics at different conditions

Unit I **Introduction**

Classification of vibration, Specification and Vibration, Vibration System and human comforts, Modal Analysis, One DOF, Two DOF, Free and Forced Vibration, Random Vibration, Magnification and Transmissibility, Vibration Absorber.

Unit II **Tyres and Suspension**

Tyres: Types designation and specifications, Relative merits and demerits, Ride characteristics, Behavior while Cornering, Slip angle, Cornering force, Power consumed by Tyre, Definition of Camber, Castor, King Pin Inclination, Scrub Radius, Toe-in Toe-out and Effect of Camber, Camber Thrust.

Suspension: Types, Requirements wheel Hop, Wheel Wobble and Wheel Shimmy. Solid Axles, Independent Suspension Interconnected Suspension, Active Suspension, Latest Trends.

Unit III **Stability of Vehicles**

Load Distribution, Stability on Curved Track and on slope, Gyroscopic Effect, weight Transfer during Acceleration, Cornering and Braking, Overturning and Sliding. Cross wind stability, stability and Equations of motions, Latest Trends.

Unit IV **Vehicle Handling**

Over steer, under steer, steady state cornering. Effect of braking, driving torques on steering. Effect of camber, transient effects in cornering. Directional stability of vehicles.

Unit V **Structural Dynamics**

Various Types of Chassis structures, Forces and Deflection of Chassis, Four Poster Test, Multi-Axis Simulator, Structural analysis of Vehicle Body, Chassis Engineering, Latest trends in vehicle and structural dynamics.

Text Books

References

1. Thomas D.Gillespie, Fundamentals of vehicle dynamics,SAE,1992
2. J.G. Giles, ‘Steering, Suspension and Tyres, Illiffe Books Ltd., 1968.

3. J. Y. Wong, ‘Theory of Ground Vehicles’, John Wiley and Sons Inc., New York, 2001.
4. David Crolla, ‘Automotive Engineering’, ‘Powertrain, chasis system and Vehiocle Body’, Butterworth Heinmann, 2009
5. Robert E Coleman, ‘Experimental Structural Dynamics’. AuthorHouse, 2004

Mode of Evaluation Tutorials / Class Tests

Recommended by the Board of Studies on:

Date of Approval by the Academic Council:

Automotive Materials and Component Testing Practical
Component Testing

L	T	P	C
0	0	4	2

Experiment No.1 – Tests for Horn:

a) Visual Examination and Dimension check
b) High voltage test
c) Current drawn test
d) Operating voltage test

Experiment No. 2 – Tests for Rear view mirror:

a) Impact Test
b) Bending Test
c) Radius of Curvature Test

Experiment No. 3 – Tests for Brake hose:

a) Pressure Test
b) Cold bend test

Experiment No. 4 – Tests for Fuel Tank:

a) Impact resistance test
b) Leakage test

Experiment No. 5 – Tests for Hinges and Latches

Experiment No. 6 – Tests for Wheel Rims

a) Radial Impact resistance test

Experiment No. 7 – Tests for Safety Glass

a) Head form test
b) Optical distortion test
c) Light transmission test

Experiment No. 8 – Steering Impact Test

Experiment No. 9 – Photometric Measurement
Head lamp – forward illumination

Experiment No. 10 – Colorimetry for signaling devices

Experiment No. 11 – High voltage (Flash) Test for bulbs

Materials Testing

Mechanical Testing:

Experiment No. 1 – Tensile Testing of

a) Metallic Material as per ASTM E8
b) Plastic Material as per ASTM D638
c) Rubber Material as per ASTM D412

Experiment No.2 – Hardness Test

a) Brinnel
b) Rockwell
c) Vicker's
d) Knoop

Chemical Testing:

Experiment No. 3 – Testing for

a) Optical emission spectrometer for Elemental Analysis/ Atomic Absorption Spectrometer
b) Oil Analysis by X-ray fluorescence spectrometer
c) Polymer Analysis - Fourier Transform Resolution(FTR), Differential Scanning Calorimetry (***DSC)*** *and* Thermogravimetric Analyzer (***TGA***)

Experiment No. 4 – Microscopy Analysis from sample preparation

Experiment No. 5 – Super Conductor Materials and Standard Reference Materials

Automotive Electronics and EMC Lab

L	T	P	C
0	0	4	2

1. Radiated Emission (RE) Test.
2. Radiated Immunity (RI) Test – Free Field Method.
3. Radiated Immunity (RI) Test – TEM Cell Method.
4. Radiated Immunity (RI) Test – BCI Method.
5. Radiated Immunity (RI) Test – Strip-line Method.
6. Conducted Emission (CE) Test.
7. Conducted Immunity (CI) & Transient Emissions Test on power lines.
8. Electrostatic Discharge (ESD) Test.
9. EMI/EMC Testing of Industrial Electronic Systems.
10. Combined Temperature & Vibration Test.
11. Combined Temperature & Vibration Test.
12. Altitude Test & Thermal shock test.

Engine & Vehicle evaluation Lab

L	T	P	C
0	0	4	2

Engine Evaluation Lab

1. Performance test on Gasoline engine.
2. Performance & emission test on Genset diesel engine.
3. Performance & emission test on Alternate fuel engine.
4. Performance & emission test on heavy duty diesel engine (Transient dyno).
5. Study of emission test on chassis dyno.

Reference books:

1. SAE SP- 582: Engine Testing, SAE Publication, 1984.
2. Facilities for engine testing of fuels & lubricants, SP-350, SAE Publication, 1968
3. Introduction to engine testing & development SAE R-344, Atkins, Richard D, SAE Publisher, 2009
4. Statistics for Engine optimization, Edwards, S P, Professional Engineering Publishing Limited, 2000

Vehicle Evaluation Lab

1. Testing of braking system as per CMVR for any LCV.
2. Installation requirements for lighting & signaling devices.
3. Drivers field of vision (M1 category).
4. Size & ply rating of tyres.
5. Gradeability Test.
6. Turning circle diameter test.
7. Steerability test on Steering pad.

References:

1. Bosch Automotive handbook.
2. Motor vehicle handbook.
3. ECE.
4. FMVSS.
5. AIS.
6. CMVR.

VEHICLE INSPECTION & MAINTENANCE (I & M)		**L**	**T**	**P**	**C**
TWO & THREE WHEELERS		**2**	**1**	**0**	**3**

Version No.	**2.1**
Prerequisite	-
Objectives:	1. To impart knowledge on two and three wheeler vehicles 2. To enable students to understand the working of various components of two and three wheeled vehicles and their features.
Expected Outcome:	On completion of this course, the students will be able to 1. Acquire knowledge on the working of two and three wheelers 2. Identify and demonstrate the working of various components of two and three wheelers

Unit I **Introduction**

Need for maintenance, types of maintenance: preventive and breakdown maintenance, Development, classification & layout of two wheelers (motorcycles, scooters, mopeds) and Three wheelers, applications & capacity – goods & passengers, study of technical specifications of Two & Three wheelers.

Frames & Body: Types of frame, construction, loads, design consideration, materials, Types of three wheeler bodies, layout, RTO regulations, aerodynamic, aesthetic & ergonomics considerations for body work, side car.

Unit II **The Power unit**

Selection of engine for two wheeler & three wheeler. Design considerations for two wheeler & three wheeler power plants, special systems requirements for lubrication, cooling, starting. Recent engine developments.

Unit III **Transmission and steering system**

Transmission Systems : Clutch – special requirements, different types used in two & three wheelers, need of primary reduction, selection of transmission - gear transmission, gear shift mechanism, belt transmission, automatic transmission (Continuous Variable Transmission - CVT, Epicyclic), final drive & differential for three wheeler, wheel drive arrangement.

Steering : Steering geometry, steering column construction, steering system for three wheelers.

Unit IV **Brake and suspension system**

Brake, Wheel & Tyres: Design consideration of brake, types of brakes – disc, drum, braking mechanism – mechanical, hydraulic & servo, wheel types - spokes, disc, split, special tyre requirements for two & three wheelers.

Suspension requirements, design considerations, trailing & leading link, swinging arm, springs & shock absorbers.

Unit V **Performance and maintenance** **8**

Road Performance: Handling characteristics, driver & pillion seating arrangement, ergonomics & comfort, road holding & vehicle stability, riding characteristics, safety arrangements, Racing bikes – special requirements.

Maintenance: Preventive & brake down maintenance, factors affecting fuel economy & emission.

Text Books

1. Newton Steed, "The Motor Vehicle", McGraw Hill Book Co. Ltd., New Delhi
2. Service Manuals of Manufacturers of Indian Two & Three wheelers.

References

1. " Encyclopedia of Motor cycling, 20 volumes ", Marshall Cavensih, New York and London, 1989
2. " The Cycle Motor Manual ", Temple PressLtd., London, 1990.

Mode of Evaluation Quiz/Assignment/ Seminar/Written Examination

Recommended by the Board of Studies on:

Date of Approval by the Academic Council:

MEE519 Automotive Aerodynamics

L	T	P	C
2	1	0	3

Pre-requisites : Nil

Version No. :

Objectives:

1. To broaden the understanding of vehicle aerodynamics
2. To analyze the stability, safety and comfort of the vehicles
3. To understand wind tunnels and testing techniques
4. To apply CFD for aerodynamic design of vehicle

Expected Outcome:

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

1. Understand vehicle aerodynamics
2. Analyze stability, safety and comfort of vehicles
3. Understand wind tunnels and testing techniques
4. Apply CFD for aerodynamic design of vehicle

Fundamentals of Aerodynamics

Scope – Development trends – Flow phenomena related to vehicles – External and Internal flow problems – Performance of cars and light vans – Resistance to vehicle motion – Drag – Types of drag – Flow field around car – Aerodynamic development of cars – Optimization of car bodies for low drag.

Stability, Safety and Comfort

The origin of forces and moments – effects – vehicle dynamics under side wind – Force and Moment coefficients – Safety limit – dirt accumulation on vehicle - wind noise – Air flow around individual components – High performance vehicles – Very log drag cars – Design alternatives – High efficiency radiator arrangement – Development and simulation methods.

Wind Tunnels and Test Techniques

Principles of wind technology – Limitations of simulation – Scale models – Existing automobile wind tunnels – Climatic tunnels – Measuring equipment and transducers. Pressure measurement – velocity measurements – Flow visualization techniques – Road testing methods – Wind noise measurements.

Application of CFD

Methods to solve Navier–Stokes equation – Forces acting in a fluid element – Compressibility effects in a flow field – Inviscid flow – Governing equations – Irrotation flow field and consequences – Potential flows – Boundary layer methods – Numerical modelling of fluid flow around vehicle body.

Aerodynamic Design

Development and simulation methods –cars, buses, trucks

References :

1. W.H. Hucho, ‘Aerodynamics of Road Vehicles’, Butterworth and Co., 1987.
2. Schlichting, H. ‘Boundary Layer Theory’, McGraw Hill, New York, 1999.
3. Pope, A., Low speed Wind Tunnel Testing, John Wiley and Sons, New York, 1999.
4. Vehicle aerodynamics, SAE, !996.

Mode of Evaluation : Assignments / Seminars / Term end Examinations

Recommended by Board of Studies on :

Date of approval of the Academic Council :

MEE E05	TRIBOLOGY	L	T	P	C
Pre requisites	MEE 201 Engineering Mechanics, MEE 305 Design of Machine Elements Fluid Mechanics& Machinery	**2**	**1**	**0**	**3**

Objectives

1. To introduce tribology as an important design consideration that affects the performance of engine and automotive elements
2. To teach different bearing types, modeling and performance considerations
3. To introduce concepts in friction and wear phenomena

Outcome

Student will be able to

1. Select triobological elements based on design considerations.
2. Realise the importance of proper choice of tribological elements
3. Apply the knowledge of wear and lubricants for different applications

UNIT I Dry Friction

Topography of Engineering Surfaces – Types of contact sliding friction - Energy dissipation - Friction characteristics of metals and non-metals - Types of friction - Measurement of friction.

UNIT II Wear

Types of Wear – Dry sliding wear - Abrasive wear - Principles and mechanism - Corrosive wear - Surface Fatigue wear - Measurement of wear - Examples - Applications.

UNIT III Lubricants and Lubrication

Types of Lubricants - Properties - Testing principles - Hydrodynamic - Elasto hydrodynamic lubrication - boundary lubrication and Solid lubrication - Hydrostatic lubrication.

UNIT IV Hydrodynamic Lubrication

Fluid film in simple shear - Viscous flow shear stress variation - Reynolds equation for film lubrication - High speed unloaded journal bearings - Loaded journal bearings - Reaction torque of the bearings - Co efficient of friction.

UNIT V Surface Modification

Surface modification – Transformation hardening - Thermo-chemical process - Laser - Electron beams and Plasma treatment - Materials for rolling element bearings - Fluid film bearings - Dry bearing - Applications

Text book

1. A.D. Sarkar , (1999), Friction and Wear, Wiley Eastern Publishers
2. Prasanta Sahoo(2009), Engineering Tribology, PHI Learning Private Limited, New Delhi.

Reference Books

1. Bowden, F.P. & Tabor, D.,(1996) Friction and Lubrication of solids, Oxford University press.
2. Ernest Rabinowiez, (1995), Friction and wear of materials, Interscience Publishers.
3. Neale, M.J., Tribology ,(1999), Hand Book, Butterworth.
4. Fuller D.D., (1999),Theory and practice of Lubrication for engineers, John Wiley sons.
5. Gross, W.A., (1990), Gas film lubrication,Willey.
6. Bernard J Hamrock(1994), Fundamentals of Fluid film Lubrication, McGraw Hill, New York.

Mode of Evaluation : Assignment/ Seminar/Written Examination.

COMPUTER SIMULATION OF ENGINES **L T P C**
2 1 0 3

Version No.

Prerequisite Thermal Engineering

Objectives:
1. The aim of this course is to introduce and explain the basic fundamentals involved in the simulation of IC engines.
2. The simulation process is explained in stages and hence it will be helpful to differentiate the various processes and understand the concept of ideal and actual engine cycles. The computer simulation will help to understand the effect of various parameters by easy coding and allows optimizing the engine performance parameters.

Expected Outcome: Student will be able to
1. Understand the IC engine process in a more elaborate way by understanding the simulation concept.
2. Explain the physical process involved in IC engines completely with mathematics and can appreciate the importance of Mathematics.
3. Understand completely the various processes of IC engine parameters.

Unit I Introduction

Introduction – Heat of reaction – Measurement of URP – Measurement of HRP – Adiabatic Flame temperature – Calculations under constant Pressure and constant volume — Effect of change of pressure , temperature on Heat of reaction – Introduction to laminar flame speed – detonation – deflagration - Complete and Partial combustion .

Unit II Ideal Cycle Simulation of SI Engines (ICS)

Basic approach – Assumptions of cycle with air as working medium – Ideal Otto cycle – Ideal cycle simulation – Deviation between actual and Ideal cycles – programmable exercises.

Unit III Fuel – Air Cycle Simulation (FCS)

Fuel and air – Working medium – Effect of temperature drop due to fuel vaporization – Full throttle operation – Adiabatic heat addition – work output and efficiency calculations – Part throttle operation – super charged operation – programmable exercises.

Unit IV Progressive Combustion Simulation (PCS) and Actual Cycle Simulation (ACS)

Actual combustion process simulation – progressive not instantaneous - Gas exchange process - re-examination of inlet and exhaust processes – Heat transfer process – Actual Cycle simulation – determination of heat transfer coefficients – Friction Calculations – Comparison of various simulation - Comparison of simulated values – Validation of engine performance like pressure-crank angle – brake power – brake thermal efficiency – Mechanical and Volumetric efficiency – Effect of speed on engine performance

Unit V Simulation of CI Engines and Comparisons.

Introduction to simulation of CI engines – comparison of simulation between SI and CI engines - programmable exercises of SI engines with GUI domains.

Text Books

1. Dr.V.Ganesan (1996), Computer Simulation of Spark – Ignition Engine Processes. University Press (India) Lmited, Hyderabad.
2. Dr.V.Ganesan (1996), Computer Simulation of Compression – Ignition Engine Processes. University Press (India) Lmited, Hyderabad.

References

1. Ramoss A.L. (1992)., "Modelling of Internal Combustion Engines Processes" McGraw Hill Publishing Co., 1992
2. Ashley Campbel (1986) " Thermodynamic analysis of Combustion Engines" , John Wiley and

Sons, New york.
3. Benson R.S., Whitehouse N.D. (1979) “Internal Combustion Engines” , Pergamon Press, Oxford.

Mode of Evaluation Quiz/Assignment/ Seminar/Written Examination

AUTOMOTIVE CERTIFICATION AND HOMOLOGATION

L	T	P	C
2	1	0	3

Version No.

Prerequisite -

Objectives:

1. To understand the vehicle classifications, regulations and need for certification
2. To learn the various test to be done on brakes, steering system and vehicle related tests
3. To impart knowledge about the various tests performed on the vehicle engine
4. To learn the various tests to be performed on the wheels, tires and windshields of the vehicle
5. To learn the various tests to be done on the vehicle lighting system

Expected Outcome: On completion of this course, the students will be able to

1. Classify the vehicle and identify the regulations governing for each vehicle type
2. Perform and analyze the braking, steering systems of any vehicle
3. Perform various test related to vehicle engine emissions
4. Test and analyze the performance of wheels, tires and windshields
5. Perform the tests to be done on the vehicle lighting system

Unit I **Introduction**

Specification & Classification of Vehicles (including M, N and O layout), Regulations overview (ECE, EEC, FMVSS, AIS, CMVR, ADR), Type approval and Conformity of Production, Engine and Vehicle specifications, 2 Wheeler certification

Unit II **4 wheeler passenger vehicle – m1 category (vehicle related tests)**

Vehicle Testing - Photographs, CMVR physical verification, Vehicle weightment, Coast down test, Brake test, ABS, Turning circle diameter test, Steering effort test, Speedometer calibration, Pass by noise test, External projection test, Gradeability test, Acceleration control system, Horn installation, Rear view mirror installation, Installation requirement for lighting & signaling devices, Wind screen wiping system.

Unit III

Steering Impact test (GVW<1500 kg), Body block test, Head form test, Fixtures charges, Crash test with dummies, OBD I, Bumper testing, Documentation SHL, Certification charges, Engine power test (petrol & diesel), Indian driving cycle, Vehicle mass emission, Evaporative emission (petrol vehicles), Broad band / Narrow band EMI test.

Unit IV **4 wheeler passenger vehicle – m1 category (component related tests)**

Size and Ply rating of tyres, Safety Glasses: Windscreen laminated safety glass, Side window / door glass, Back light / Rear toughened glass, Wind screen wiping system, Wiper Blade, Hydraulic brake hose, Hydraulic brake fluid, Rear view mirror specification (Exterior), Rear view mirror specification (Interior), Wheel rims, Wheel nut, Wheel discs & hub caps, Safety belt assemblies, Safety belt anchorages, Seat anchorages & head restraints, door locks & door retention.

Unit V

Performance requirement for lighting & signaling devices - Vertical orientation of dipped beam- head lamp, driver's field of vision, Head lamp assembly (glass lens & plastic lens), Head lamp + Front position lamp / Front indicator lamp / front fog lamp, Rear combinational lamp (each additional function), Independent front position lamp / Front direction indicator lamp / Front fog lamp, Rear combination lamp (single function),

Warning triangles, Fuel tank: Metallic & Plastic (excluding fire resistance test).

Text Books

References

1. "Vehicle Inspection Handbook", American Association of Motor Vehicle Administrators
2. Michael Plint & Anthony Martyr, "Engine Testing & Practice", Butterworth Heinmenn, 3rd edition, 2007
3. Proceedings- Automotive Testing & Certification held on 20th to 24th July 2010 at ARAI PUNE
4. Bosch Automotive Handbook, Robert Bosch, 7th Edition, 2007
5. Motor Vehicle Manual
6. ECE
7. EEC
8. FMVSS
9. CMVR

Mode of Evaluation Tutorials / Class Tests

Recommended by the Board of Studies on:

Date of Approval by the Academic Council:

Automotive HVAC	L	T	P	C
	2	1	0	3

Version No.

Prerequisite -

Objectives:

1. To provide introduction to students the fundamentals of refrigerant, refrigeration systems and air conditioning controls to automobile applications.
2. To teach students the principle of psychometry.
3. To enable the students to understand heating and cooling load calculations.
4. To develop the knowledge about air distribution systems.
5. To introduces the general servicing of automotive air conditioning systems.

Expected Outcome:

Student will be able to

1. Design and implement refrigeration and air conditioning systems using standards.
2. Apply the concept of psychometry to estimating the heating and cooling load for automobiles.
3. Check operation of automatic heating, ventilation and air conditioning (HVAC) control systems.
4. Diagnose and correct air-conditioning system.

Unit I **Refrigeration**

Introduction - Methods of refrigeration - Air Refrigeration System and its applications - Vapour compression refrigeration system - Vapour absorption refrigeration system - Applications of refrigeration & air conditioning -Automobile air conditioning -Air conditioning for passengers, isolated vehicles, transport vehicles-Applications related with very low temperatures

Classification, properties and selection criteria - Commonly used refrigerants - Alternative refrigerants - Eco-friendly refrigerants - Applications of refrigerants -Refrigerants used in automobile air conditioning

Unit II **Psychometry**

Psychometric properties, tables, charts - Psychometric processes - Comfort charts - Factor affecting comfort - Effective temperature - Ventilation requirements

Unit III **Air Conditioning Systems and Load Analysis**

Classification and layouts - Central / unitary air conditioning systems - Components like compressors, evaporators, condensers, expansion devices, fan blowers, heating systems etc.

Load Analysis: Outside & inside design consideration - Factors forming the load on refrigeration & air conditioning systems - Cooling & heating load calculations - Load calculations for automobiles - Effect of air conditioning load on engine performance

Unit IV **Air Distribution Systems**

Distribution duct system, sizing, supply / return ducts - Types of grills, diffusers, ventilation, air noise level - Layout of duct systems for automobiles and their impact on load calculations.

Air Routine & Temperature Control: Objectives - evaporator care air glow - Through the dash recirculating unit - Automatic temperature control - Controlling flow - Control of air handling systems.

Unit V **Air Conditioning Service and Control**

Air conditioner maintenance & service - servicing heater system - Removing & replacing components - Trouble shooting of air conditioning system -Compressor service, methods of dehydration, charging & testing.

Air Conditioning Control: Common control such as thermostats- Humidistat us - Control dampers - Pressure cutouts and relays

Text Books

1. Refrigeration and Air-Conditioning - W.F. Stoecker and J.W. Jones, Tata McGraw Hiil Pub.
2. Paul Lung, "Automotive Air Conditioning", C.B.S. Publisher & Distributor, Delhi.

References

1. Modern Air-Conditioning Practice - Norman C. Harris, Principles of Refrigeration -R.J. Dcssat, Wiley Eastern Pub.
2. Refrigeration and Air-Conditioning - C.P. Arora, Tata McGraw Hill Pub
3. Refrigeration and Air-Conditioning – S.S.Thipse, Jaico
4. Automotive air conditioning by Crouse
5. Harris, "Modern Air Conditioning"

Mode of Evaluation Quiz/Assignment/ Seminar/Written Examination

Recommended by the Board of Studies on:

Date of Approval by the Academic Council:

AUTOMOTIVE MATERIALS AND MANUFACTURING TECHNOLOGY	L	T	P	C
	2	1	0	3

Version No.

Prerequisite Materials Engineering and Technology
Fundamentals of manufacturing process

Objectives:
1. The objective of the course is to provide the basic knowledge needed to explore the application of materials science and engineering in automobile field.
2. To develop the knowledge of the properties of materials and its alloys
3. To introduce the modern materials and alloys.
4. To develop knowledge in recent trends in manufacturing techniques of automobile components.

Expected Outcome: Student will be able to
1. Understand various materials and its alloys are formed and their classification based on atomic arrangement
2. Describe the mechanical behaviour of metallic systems and its importance
3. Understand the need for modern materials and its alloys.
4. Gain knowledge on different class of materials , alloys and their manufacturing techniques ,applications in automobile field.

Unit I Engineering alloys 10

Ferrous alloys-Iron-Iron carbide phase diagram with all phases & critical temperatures-steel,Types of steels-Effect of alloying elements on physical and chemical properties-Automotive applications- cast iron-Types-properties-factors affecting structures of cast iron-Automotive application.

Non ferrous alloys- Al,Cu,Tin,Baased alloys,Light metal alloys(mg and Ti)

Unit II Surface modification of materials 9

Mechanical surface treatment and coating- case hardening and hard facing-thermal spraying-Vapor deposition-ion implantation-diffusion coating-Electroplating and Electroless plating-Conversion coating-Ceramin and Organic coating-Diamond coating-Laser surface treatment-Selection of coating for Automotive applications

Unit III Modern materials and alloys 9

Super alloys-super plastic alloys for autobody panels-refractory metals-shape memory alloys-dual phase steels-micro alloyed steels-high strength low alloy steels-smart materials - Composite materials-ceramic –plastics-introduction,overview of processing,their characteristic features,Types and automotive application-Nanomaterials-Introduction and automotive applications.

Unit IV Engine materials and manufacturing 8

Cylinder block and head-cylinder head and gasket-valves,seats and guides-piston and pin-piston ring and liner-con rod-crankshaft and bearing-turbocharger.

Unit V Recent Trends in manufacturing Auto components 9

Special processing techniques-Hydroforming-stretch forming-Recent developments in auto body panel forming-squeeze casting of pistons,Aluminium composite brake rotors-sinter diffusin bonded idler sprocket-Gas injection moulding of window channel-Cast con process for auto parts-computer modeling and simulation-material characterestics and failure analysis.

Text Books

1. Callister W.D. (2006) “Material Science and Engineering- An introduction”, Wiley – Eastern
2. Flinn R. A. and Trojan P. K., (1999)”Engineering Materials and their Applications”, Jaico.

References

1. KENNETH BUDINSKI – (1988) “Surface Engineering for wear resistance", Prentice Hall.
2. Avner S.H., (2006) “Introduction to physical metallurgy” –Tata McGraw Hill.
3. Haslehurst.S.E., " Manufacturing Technology ", ELBS, London, 1990.
4. Rusinoff, " Forging and Forming of metals ", D.B. Taraporevala Son & Co. Pvt Ltd., Mumbai,1995. . Sabroff.A.M. & Others, " Forging Materials & Processes ", Reinhold Book Corporation, New York,
5. Upton, " Pressure Die Casting ", pergamon Press, 1985.
6. High Velocity " Forming of Metals ", ASTME, prentice Hall of India (P) Ltd., New Delhi, 1990

Mode of Evaluation Quiz/Assignment/ Seminar/Written Examination

Recommended by the Board of Studies on: 13-11-2010

Date of Approval by the Academic Council:

	AUTOMOTIVE ERGONOMICS AND STYLING	L	T	P	C
		2	1	0	3

Version No.	
Prerequisite	-
Objectives:	1. To impart the skills on styling an automobile. 2. To impart the skills on clay modeling an automobile and form studies 3. To understand the basics and importance of ergonomics. 4. To develop an understanding on the basics of vehicle ergonomics 5. To impart knowledge on the design of the vehicle entry and exit and visibility inside the vehicle
Expected Outcome:	On completion of this course, the students will be able to 1. Prepare sketch of automobile with new style 2. Prepare clay models of the car and study the model. 3. Apply the basic techniques of ergonomics on vehicle design. 4. Design the layout of instrument panels and controls inside the vehicle ergonomically. 5. Design a vehicle with good visibility from inside.
Unit I	**Introduction to styling**
Car Design, Fundamentals of perspective drawing, Automotive Sketching, Styling process, Car proportions, Aerodynamics, Crashworthiness and its influence on body design, Designing of Interiors	
Unit II	**Form studies**
Form studies, Speed Forms, Clay Modeling, 2D systems, 3D systems	
Unit III	**Fundamentals of Ergonomics**
Dimension Determination, Anthropometry – Need, Data collection methodology, Different postural considerations, Measuring Procedures Subject and Sampling size selection, Measurement of Hands/Feet/Full posture, Applying Anthropometry data, Application of percentile curves	
Unit IV	**Vehicle Ergonomics**
Passenger Compartment, Floor Pan, Technical requirements, Dash board equipments arrangement, Positioning of operational controls, Force Analysis, Seating and position(ECE Regulations),s Human Factors, Navigation systems, pedal positioning	
Unit V	**Vehicle Packaging**
R-Point, AHP, Manikin positioning of 2-D pattern, car entry/exit, Sight – All round visibility, View of Instruments, Mirror design, Logical formation of cockpit, Boot lid packaging, Loading/Unloading analysis.	
Text Books	
References	
1. Julian Happian-Smith, “An introduction to modern vehicle design”, Butterworth Heinmenn, 2001 2. Tony Lewin, “How to Draw Cars like a Pro”, Motorbooks International, 2003 3. Thom Taylor, Lisa Hallett, “How to Draw Cars like a Pro”, Motorbooks International; 2Rev Ed edition, 2006 4. Fenton John, “Handbook of automotive body and system design”, Wiley-Blackwell, 1998 5. J. Brian Peacock, Waldemar Karwowski, “Automotive ergonomics”, Taylor & Francis ltd, 1993 6. Chakrabarti debkumar, “Indian Anthropometry Dimensions”, National Institute of Design edition, 1997, 7. Wilson, “New methods in applied ergonomics”, Taylor & Francis Ltd, 1987	
Mode of Evaluation	Tutorials / Class Tests
Recommended by the Board of Studies on:	
Date of Approval by the Academic Council:	

Soft Skills

L	T	P	C
2	0	2	3

Version No: 1.0

Course Prerequisites Nil

Course Objectives

Objectives

1. This course aims to polish the skills of the students like a diamond.
2. Teach Etiquettes and Ethics to improve his overall branding
3. Reinforce passion, team work and communication skills
4. Prepare him to be ready to face the corporate world and be successful.

Expected Outcome

4. Understanding the essence of Soft Skills
5. Understand "What is meant by Passion?"
6. The Concept of Personal Brand.
7. Understand self, self confidence, self esteem, and self assessment.
8. Identify professional & personal goals and plan for its achievements.
9. Build on your strengths and estimate ones weaknesses through SWOT analysis.
10. Learn the fundamentals of leadership & skills needed to become a real and effective leader, Motivate and energize one's team. Achieve confidence. Improve productivity.
11. Demonstrate independent learning ability
12. Become self-disciplined, self-motivated, demonstrating personal responsibility in the pursuit of studies and professional practice.

Unit 1 Introduction

Introduction to Soft Skills, Personality Development and Human Values, Self Awareness & Esteem, Perception and Attitudes, Self Assessment & SWOT Analysis, Career Plan & Personal Goal setting, Building Personal Brand, Johari Window and Leadership.

Unit 2 Communication and Skill Building

Communication Skills, Verbal Communication, Written communication, Body Language, Event Management, How to write Report & SAE Papers, Paper Review, Book Review, Presentation, Intelligence Building, Emotional Quotient, Intelligence Quotient & Memory Improvement, Cracking Written tests, Interviews & Group Discussions.

Unit 3 Ethics and Etiquettes

Professional Ethics & Etiquettes, Business Ethics, Corporate Ethics, Engineering Ethics, Office Etiquettes, Email Etiquettes, Telephone Etiquettes, Lunch/Dinner Etiquettes Social and Public Etiquettes.

Unit 4 Soft Skills at Workplace:

How an Industry Works, Various Departments of Industry, Industry Review, Team building & Motivation, Auto Passion, Confidence Building, Product Development Cycle, Customer Satisfaction & Quality Function Deployment (QFD), Benchmarking, Design for Failure Mode Effects Analysis (DFMEA), Design Review, Vehicle Review.

Unit 5 Business/Work Success

Time Management, Interpersonal Skills, Negotiation Skills, Delegating Skills, Executive Summary & Business Report, Handling of Difficult People, Business Analysis, Business Strategy, Meeting Skills, Stress Management & Meditation, Knowledge Management, Project Management, Performance Management System, Total Quality Management.

Text Books:

1. Narian Ram, Twelve Management Sills for Success, Viva Books, 2006.
2. Dr Bond Allan, Your Masters Thesis, Viva Books, 2006.
3. Verity Judith, Succeeding at Interviews, Viva Books.
4. High Jana L., High Tech Etiquettes, Viva Books.
5. Haynes Marion E., Effective Meeting Skills, Viva Books.

Reference Books

1. Ramesh & Ramesh, AE of Soft skill
2. ARAI & SAEINDIA W.S. Proceedings, 3 Day Certificate Course on Quality Function Deployment
3. ARAI & SAEINDIA W.S. Proceedings, 3 Day Certificate Course on Design Failure Mode & Effect Analysis.

MEE 404	PROJECT WORK	L	T	P	C
		0	0	0	20

Obejctives

1. To teach students to apply creative and critical thinking skills.
2. To enable the students to develop a proto type or working model for the solution of a real-time problem.
3. To enable them to improve practical working skills and foster collaborative learning skills.
4. To help the students develop self-directed inquiry and life-long learning skills.
5. To involve the students in the actual design and development of the end-product or project proto type.

Outcome Student will be able to

1. Improve creative and critical thinks skills.
2. Solve a real time problem on the basis of governing methods or equations.

Involve in the development of the end-product or project proto type.

TWO AND THREE WHEELERS 2 1 0 3

Version No. 1.0
Prerequisite -
Objectives:
1. To help students to acquire knowledge about the two and three wheeler vehicles.
2. To enable students to understand the working of various components of two and three wheeled vehicles and their features.

Expected Outcome:
On completion of this course, the students will be able to
1. Acquaint with basic understanding of two and three wheelers.
2. Identify and demonstrate the working of various components of two and three wheelers.

Unit I Introduction 9

Development, Classification & layouts of two wheelers (motorcycles, scooters, mopeds) and Three wheelers, applications & capacity – goods & passengers, study of technical specification of Two & Three wheelers.
Frames & Body: Types of frame, construction, loads, design consideration, materials, Types of three wheeler bodies, layout, RTO regulations, aerodynamic, aesthetic & ergonomics considerations for body work, side car.

Unit II The Power unit 8

Selection of engine for two wheeler & three wheeler, Design considerations for two wheeler & three wheeler power plants, special systems requirements for lubrication, cooling, starting. Recent engine developments.

Unit III Transmission and steering system 10

Transmission Systems : Clutch – special requirements, different types used in two & three wheelers, need of primary reduction, selection of transmission - gear transmission, gear shift mechanism, belt transmission, automatic transmission (Continuous Variable Transmission - CVT, Epicyclic), final drive & differential for three wheeler, wheel drive arrangement.
Steering : Steering geometry, steering column construction, steering system for three wheelers,

Unit IV Brake and suspension system 10

Brake, Wheel & Tyres: Design consideration of brake, types of brakes – disc, drum, braking mechanism – mechanical, hydraulic & servo, wheel types - spokes, disc, split, special tyre requirements for two & three wheelers.
Suspension requirements, design considerations, trailing & leading link, swinging arm, springs & shock absorbers.

Unit V Performance and maintenance 8

Road Performance: Handling characteristics, driver & pillion seating arrangement, ergonomics & comfort, road holding & vehicle stability, riding characteristics, safety

arrangements, Racing bikes – special requirements.
Maintenance: Preventive & brake down maintenance, factors affecting fuel economy & emission.

Text Books

1. Newton Steed, "The Motor Vehicle", McGraw Hill Book Co. Ltd., New Delhi
2. Service Manuals of Manufacturers of Indian Two & Three wheelers.

References

1. " Encyclopedia of Motor cycling, 20 volumes ", Marshall Cavensih, New York and London, 1989
2. " The Cycle Motor Manual ", Temple PressLtd., London, 1990

Mode of Evaluation Quiz/Assignment/ Seminar/Written Examination
Recommended by the Board of Studies on:
Date of Approval by the Academic Council:

VEHICLE INSPECTION & MAINTENANCE (I & M) 2 1 0 3

Version No. 1.0

Prerequisite Vehicle technology(Automotive chassis & body engineering)

Objectives:
3. To understand the need for vehicle maintenance and its importance
4. To appreciate the maintenance procedure for various components of an automobile

Expected Outcome: On completion of this course, the students will be able to
3. Inspect and diagnose the problems occurring in the various components of the vehicle.

Unit I Inspection schedule and maintenance of records

Need for maintenance, types of maintenance: preventive and breakdown maintenance, requirements of maintenance, preparation of check lists. Inspection schedule, maintenance of records, log sheets and other forms, safety precautions in maintenance: General safety, tool safety.

Unit II Engine maintenance

Tools used for engine disassembly, dismantling of engine components: cylinder head, valve train, cylinder block, connecting rod, piston and crankshaft assembly; cleaning and inspection of engine components, reconditioning of components.

Unit III Engine subsystem maintenance

Servicing and maintenance of fuel system, Engine tune-up, cooling system: water pump, radiator, thermostat. Lubrication system maintenance, Anticorrosion and anti freeze additives.

Unit IV Chassis maintenance

Servicing and maintenance of clutch, gear box, universal joints, propeller shaft, differential system. Service and maintenance of brake – disc and drum brakes, steering wheel and suspension systems, wheel alignment, vehicle body maintenance

Unit V Electrical system maintenance

Servicing and maintenance of battery, starter motor, alternator and generator, ignition system, lighting system, electric horn, and wiper motor

Text Books

1. Automotive Mechanics, 10th edition, William H. Crouse and Donald L. Anglin, 2007
2. Automotive technology: A systems approach, Jack Erjavec, 5th edition, 2009

References

7. Automotive service: Inspection, maintenance and repair, Tim Giles, 3rd edition, 2007
8. Service manuals of various OEMs

Mode of Evaluation Quiz/ Seminar/ Class test

Recommended by the Board of Studies on:

Date of Approval by the Academic Council:

MEE E10	FINITE ELEMENT ANALYSIS	L	T	P	C
Pre requisite	MEE 201 Engineering Mechanics,	2	1	0	3
	MEE 204 Strength of Materials				

Objectives

1. To enable the students understand the mathematical and physical principles underlying the Finite Element Method (FEM) as applied to solid mechanics and thermal analysis
2. Introduce students to the theory of elasticity
3. To teach students the characteristics of various elements in structural and thermal analysis and selection of suitable elements for the problems being solved
4. To introduce students to various field problems and the discretization of the problem
5. To make the students derive finite element equations for simple and complex elements

Outcome Student will be able to:

1. Apply the knowledge of Mathematics and Engineering to solve problems in structural and thermal engineering by approximate and numerical methods
2. Design a new component or improve the existing components using FEA
3. Solve the problems in solid mechanics and heat transfer using FEM
4. Use commercial FEA packages like ANSYS and modern CAD/CAE tools for solving real life problems

UNIT I Introduction to Theory of Elasticity

Introduction to Theory of Elasticity: Definition of stress and strain – plane stress – plane strain – stress strain relations in three dimensional elasticity.

Introduction to Variational Calculus: Introduction –General field problems, discrete and continuous models, Variational formulation in finite elements – Ritz method - Weighted residual methods – Galerkin – sub domain – method of least squares and collocation method - numerical problems.

UNIT II Discretization of the problem

Discretization of the Problem: Introduction – Geometrical approximations – Simplification through symmetry – Element shapes and behaviour – Choice of element types – size and number of elements – Element shape and distortion – Location of nodes – Node and Element numbering.

Interpolation Function: Simplex - complex and multiplex elements – Linear interpolation polynomials for various simplex elements – Convergence requirements – derivation of shape function equations.

UNIT III Stiffness matrix formulation

One dimensional elasticity – Bar with constant and varying cross section - and Pin jointed truss member – Two dimensional elasticity – Plane stress - plane strain and axisymmetric simplex elements only - simple numerical problems

UNIT IV Field problems

General field equation – Formulation of 1D and 2D – steady state heat transfer problems involving conduction and convection and torsion of prismatic members – simple numerical problems.

UNIT V Higher order problems

Natural coordinate system and numerical integration – Higher order 1D and 2D elements – Derivation of shape function equations for Four node quadrilateral - six node triangle and eight node quadrilateral elements– formulation of element equation.

Text books

1. Tirupathi R. Chandrupatla and Ashok D. Belugundu, (2003), Intodution to Finite Elements in Engineering, Prentice Hall of india, Third Edition.
2. Seshu, (2004), Text book of finite element analysis, Prentice Hall of india.
3. Larry Segerland, (1999), Applied Finite Element Analysis, John Wiley & Sons, Inc., 2nd Edition

Reference Books

1. Robert D. Cook, Dravid S. Malkus, Michael E. Plesha and Robert J. Witt, (2004), Concepts and Applications of Finite Element Analysis, John Wiley & Sons, Inc., Fourth Edition.
2. Reddy J.N., (2001), An Introduction to the Finite Element Method, McGraw-Hill, Third Edition.
3. Rao S. S., (2001), The Finite Element Method in Engineering, Butterworth-Heinemann, Third Edition
4. Zienkiewicz O.C., (1999), The Finite Element Method, McGraw-Hill.

Mode of Evaluation : Assignment/ Seminar/Written Examination.

MEE519 Automotive Aerodynamics

L	T	P	C
2	1	-	3

Pre-requisites : Nil

Version No. : 1.0

Objectives:

5. To broaden the understanding of vehicle aerodynamics
6. To analyze the stability, safety and comfort of the vehicles
7. To understand wind tunnels and testing techniques
8. To apply CFD for aerodynamic design of vehicle

Expected Outcome:

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

5. Understand vehicle aerodynamics
6. Analyze stability, safety and comfort of vehicles
7. Understand wind tunnels and testing techniques
8. Apply CFD for aerodynamic design of vehicle

Fundamentals of Aerodynamics

Scope – Development trends – Flow phenomena related to vehicles – External and Internal flow problems – Performance of cars and light vans – Resistance to vehicle motion – Drag – Types of drag – Flow field around car – Aerodynamic development of cars – Optimization of car bodies for low drag.

Stability, Safety and Comfort

The origin of forces and moments – effects – vehicle dynamics under side wind – Force and Moment coefficients – Safety limit – dirt accumulation on vehicle - wind noise – Air flow around individual components – High performance vehicles – Very log drag cars – Design alternatives – High efficiency radiator arrangement – Development and simulation methods.

Wind Tunnels and Test Techniques

Principles of wind technology – Limitations of simulation – Scale models – Existing automobile wind tunnels – Climatic tunnels – Measuring equipment and transducers. Pressure measurement – velocity measurements – Flow visualization techniques – Road testing methods – Wind noise measurements.

Application of CFD

Methods to solve Navier–Stokes equation – Forces acting in a fluid element – Compressibility effects in a flow field – Inviscid flow – Governing equations – Irrotation

flow field and consequences – Potential flows – Boundary layer methods – Numerical modelling of fluid flow around vehicle body.

Aerodynamic Design

Development and simulation methods –cars, buses, trucks

References :

5. W.H. Hucho, ‘Aerodynamics of Road Vehicles’, Butterworth and Co., 1987.
6. Schlichting, H. ‘Boundary Layer Theory’, McGraw Hill, New York, 1999.
7. Pope, A., Low speed Wind Tunnel Testing, John Wiley and Sons, New York, 1999.
8. Vehicle aerodynamics, SAE, !996.

Mode of Evaluation : Assignments / Seminars / Term end Examinations

Recommended by Board of Studies on :

Date of approval of the Academic Council :

MEE E25	COMPUTATIONAL FLUID DYNAMICS	L	T	P	C
Pre requisites	MEE 205 Fluid Mechanics, MEE 306 Heat and Mass Transfer	2	0	2	3

Objectives

1. To provide the students with sufficient background to understand the mathematical representation of the governing equations of fluid flow and heat transfer
2. To enable the students to solve one and two dimensional ordinary and partial differential equations using traditional CFD tools
3. To teach students how to express derivatives and differential equations through discretization techniques
4. To help the students to understand the general transformation equations for grid generation
5. To teach students how to apply explicit, implicit and semi-implicit methods of finite differencing
6. To help the students solve fluid flow field using some popular CFD techniques

Outcome Student will be able to

1. Possess the knowledge of CFD techniques, basic aspects of discretization and grid generation
2. Solve fluid flow fields using CFD methods
3. Model fluid flow problems and heat transfer

UNIT I Introduction and Governing Equations

Introduction - Impact and applications of CFD in diverse fields - Governing equations of fluid dynamics – continuity - momentum and energy - generic integral form for governing equations - Initial and Boundary conditions - Classification of partial differential equations – Hyperbolic - Parabolic - Elliptic and Mixed types - Applications and Relevance.

UNIT II Discretization

Basic aspects of discretization - Discretization techniques – Finite difference - Finite volume and Finite element method– Comparison of discretization by the three methods. Introduction to Finite differences - Difference equations - Uniform and non-uniform grids - numerical errors - Grid independence test - Optimum step size.

UNIT III Grid Generation and Transformation

Grid generation – Transformation of non-uniform grids to uniform grids - General transformation of the equations - Form of the governing equations suitable for CFD - Compressed grids - Boundary fitted co-ordinate systems – Elliptic grid generation - Adaptive grids - Modern developments in grid generation.

UNIT IV CFD Techniques

Steady one-dimensional conduction - two and three-dimensional conduction -Steady one-dimensional convection and Diffusion - Transient one-dimensional and two-dimensional conduction – Explicit - Implicit - Crank-Nicolson - ADI scheme – Stability criterion.

UNIT V Finite Differences and Methods

Representation of the pressure - Gradient term and continuity equation – Staggered grid - Momentum equations –Pressure and velocity corrections - Pressure Correction equation - Numerical procedure for SIMPLE algorithm - Boundary conditions for the pressure correction method. Stream function – Vorticity method - Discussion of case studies.

Text book

1. K.A.Hoffman, (1999), Computational Fluid Dynamics for Engineering, Engineering education system, Austin, Texas.

Reference Books

1. J.D.Anderson, Jr., (2000), Computational Fluid Dynamics – the basic with applications, Mc Graw – Hill, ISE.
2. K. Muralidhar, T. Sundarajan, (2001), Computatioanl Fluid Flow and Heat Transfer, Narosa Publishing House, New Delhi.
3. S.V.Patankar, (1999), Numerical Heat Transfer and Fluid Flow, Hemisphere, New York.

Mode of Evaluation : Assignment/ Seminar/Written Examination.

MEE E05	TRIBOLOGY	L	T	P	C
Pre requisites	MEE 201 Engineering Mechanics, MEE 305 Design of Machine Elements	2	1	0	3

Objectives

4. To introduce tribology as an important design consideration that affects the performance of engine and automotive elements
5. To teach different bearing types, modeling and performance considerations
6. To introduce concepts in friction and wear phenomena

Outcome Student will be able to

1. Select triobological elements based on design considerations.
2. Realise the importance of proper choice of tribological elements
3. Apply the knowledge of wear and lubricants for different applications

UNIT I Dry Friction

Topography of Engineering Surfaces – Types of contact sliding friction - Energy dissipation - Friction characteristics of metals and non-metals - Types of friction - Measurement of friction.

UNIT II Wear

Types of Wear – Dry sliding wear - Abrasive wear - Principles and mechanism - Corrosive wear - Surface Fatigue wear - Measurement of wear - Examples - Applications.

UNIT III Lubricants and Lubrication

Types of Lubricants - Properties - Testing principles - Hydrodynamic - Elasto hydrodynamic lubrication - boundary lubrication and Solid lubrication - Hydrostatic lubrication.

UNIT IV Hydrodynamic Lubrication

Fluid film in simple shear - Viscous flow shear stress variation - Reynolds equation for film lubrication - High speed unloaded journal bearings - Loaded journal bearings - Reaction torque of the bearings - Co efficient of friction.

UNIT V Surface Modification

Surface modification – Transformation hardening - Thermo-chemical process - Laser - Electron beams and Plasma treatment - Materials for rolling element bearings - Fluid film bearings - Dry bearing - Applications

Text book

1. A.D. Sarkar , (1999), Friction and Wear, Wiley Eastern Publishers

Reference Books

1. Bowden, F.P. & Tabor, D.,(1996) Friction and Lubrication of solids, Oxford University press.
2. Ernest Rabinowiez, (1995), Friction and wear of materials, Interscience Publishers.
3. Neale, M.J., Tribology ,(1999), Hand Book, Butterworth.
4. Fuller D.D., (1999),Theory and practice of Lubrication for engineers, John Wiley sons.
5. Gross, W.A., (1990), Gas film lubrication,Willey.

Mode of Evaluation : Assignment/ Seminar/Written Examination.

COMPUTER SIMULATION OF IC ENGINES 2 1 2 4

Version No.

Prerequisite Thermal Engineering with IC Engines

Objectives:
3. The aim of this course is to introduce and explain the basic fundamentals involved in the simulation of IC engines.
4. The simulation process is explained in stages and hence it will be helpful to differentiate the various processes and understand the concept of ideal and actual engine cycles. The computer simulation will help to understand the effect of various parameters by easy coding and allows optimizing the engine performance parameters.

Expected Outcome: Student will be able to

1. Understand the IC engine process in a more elaborate way by understanding the simulation concept.
2. Explain the physical process involved in IC engines completely with mathematics and can appreciate the importance of Mathematics.
3. Understand completely the various processes of IC engine parameters.

Unit I Introduction

Introduction – Heat of reaction – Measurement of URP – Measurement of HRP – Adiabatic Flame temperature – Calculations under constant Pressure and constant volume – – Effect of change of pressure , temperature on Heat of reaction – Introduction to laminar flame speed – detonation – deflagration - Complete and Partial combustion .

Unit II Ideal Cycle Simulation of SI Engines (ICS)

Basic approach – Assumptions of cycle with air as working medium – Ideal Otto cycle – Ideal cycle simulation – Deviation between actual and Ideal cycles – programmable exercises.

Unit III Fuel – Air Cycle Simulation (FCS)

Fuel and air – Working medium – Effect of temperature drop due to fuel vaporization – Full throttle operation – Adiabatic heat addition – work output and efficiency calculations – Part throttle operation – super charged operation – programmable exercises.

Unit IV Progressive Combustion Simulation (PCS) and Actual Cycle Simulation (ACS)

Actual combustion process simulation – progressive not instantaneous - Gas exchange process - re-examination of inlet and exhaust processes – Heat transfer process – Actual Cycle simulation – determination of heat transfer coefficients – Friction Calculations – Comparison of various simulation - Comparison of simulated values – Validation of engine performance like pressure-crank angle – brake power – brake thermal efficiency – Mechanical and Volumetric efficiency – Effect of speed on engine performance

Unit V Simulation of CI Engines and Comparisons.

Introduction to simulation of CI engines – comparison of simulation between SI and CI engines - programmable exercises of SI engines with GUI domains.

Text Books

4. Dr.V.Ganesan (1996), Computer Simulation of Spark – Ignition Engine Processes. University Press (India) Lmited, Hyderabad.
5. Dr.V.Ganesan (1996), Computer Simulation of Compression – Ignition Engine Processes. University Press (India) Lmited, Hyderabad.

References

4. Ramoss A.L. (1992)., “Modelling of Internal Combustion Engines Processes” McGraw Hill Publishing Co., 1992
5. Ashley Campbel (1986) “ Thermodynamic analysis of Combustion Engines” , John Wiley and Sons, New york.
6. Benson R.S., Whitehouse N.D. (1979) “Internal Combustion Engines” , Pergamon Press, Oxford.

Mode of Evaluation Quiz/Assignment/ Seminar/Written Examination