VINAYAKA MISSIONS RESEARCH FOUNDATION

SALEM, TAMILNADU

FACULTY OF ENGINEERING AND TECHNOLOGY

CURRICULAM AND SYLLABUS

(REGULATION - 2012)

B.E MECHANICAL ENGINEERING (FULLTIME) - CBCS

VINAYAKA MISSSION'S KIRUPANANDA VARIYAR ENGINEERNG COLLEGE
SALEM – 636 308.
AND
AARUPADAI VEEDU INSTITUTE OF TECHNOLOGY, CHENNAI

SCHOOL OF MECHANICAL SCIENCES

BOARD : MECHANICAL ENGINEERING
REGULATION : 2012
PROGRAM : B.E – Mechanical Engineering - Full Time

CURRICULUM & SYLLABUS

SEMESTER I

SL.NO	COURSE CODE	COURSE TITLE	DEPT	L	T	P	C
THEORY							
1	34112101	ENGLISH FOR EFFECTIVE COMMUNICATION	ENG	3	0	0	**3**
2	34112102	ENGINEERING MATHEMATICS-I	MATHS	3	1	0	**4**
3	35012101	COMPUTER FOUNDATION PROGRAM	CSE	3	0	0	**3**
4	34212101	ENVIRONMENTAL SCIENCE AND ENGINEERING	CHEM	3	0	0	**3**
5	34112103	ENGINEERING PHYSICS	PHY	3	0	0	**3**
6	34412102	ENGINEERING MECHANICS - STATICS	MECH	3	0	0	**3**
PRACTICAL							
7	341121101	ENGINEERING PHYSICS LAB	PHY	0	0	4	**2**
8	344121101	WORKSHOP PRACTICE LAB	MECH	0	0	4	**2**
9	350121101	COMPUTER FOUNDATION PROGRAM LAB	CSE	0	0	4	**2**
TOTAL				**18**	**1**	**12**	**25**

SEMESTER II

SL.NO	COURSE CODE	COURSE TITLE	DEPT	L	T	P	C
THEORY							
1	34112201	BUSINESS ENGLISH	ENG	3	0	0	**3**
2	34112202	ENGINEERING MATHEMATICS-II	MATHS	3	1	0	**4**
3	34112203	ENGINEERING CHEMISTRY	CHEM	3	0	0	**3**
4	35012201	PROGRAMMING IN C	CSE	3	0	0	**3**
5	34112204	MATERIAL SCIENCE	PHY	3	0	0	**3**
6	34412201	ENGINEERING MECHANICS-DYNAMICS	MECH	3	1	0	**4**
PRACTICAL							
7	35012221	PROGRAMMING IN C	CSE	0	0	4	**2**
8	34412221	ENGINEERING GRAPHICS LAB	MECH	2	0	3	**3**
9	34112221	ENGINEERING CHEMISTRY LAB	CHEM	0	0	4	**2**
TOTAL				**20**	**2**	**11**	**27**

SEMESTER III

SL.NO	COURSE CODE	COURSE TITLE	DEPT	L	T	P	C
THEORY							
1		ADVANCED ENGINEERING MATHEMATICS	MATHS	3	1	0	**4**
2		ENGINEERING THERMODYNAMICS	MECH	3	1	0	**4**
3		MANUFACTURING TECHNOLOGY-I	MECH	3	0	0	**3**
4		FLUID MECHANICS AND MACHINERY	MECH	3	0	0	**3**
5		ELECTRICAL MACHINES AND DRIVES	EEE	3	0	0	**3**
6		KINEMATICS OF MACHINERY	MECH	3	1	0	**4**
PRACTICAL							
7		MACHINE DRAWING LAB	MECH	1	0	3	**2**
8		FLUID MECHANICS AND MACHINERY LAB	MECH	0	0	4	**2**
9		ELECTRICAL MACHINE DRIVES LAB	EEE	0	0	4	**2**
TOTAL				**18**	**3**	**9**	**27**

SEMESTER IV

SL.NO	COURSE CODE	COURSE TITLE	DEPT	L	T	P	C
THEORY							
1		NUMERICAL METHODS	MATHS	3	1	0	**4**
2		DYNAMICS OF MACHINERY	MECH	3	1	0	**4**
3		MANUFACTURING TECHNOLOGY-II	MECH	3	0	0	**3**
4		PHYSICAL METALLURGY	MECH	3	0	0	**3**
5		STRENGTH OF MATERIALS	MECH	3	1	0	**4**
6		COMPUTER AIDED DESIGN AND COMPUTER AIDED MANUFACTURING	MECH	3	0	0	**3**
PRACTICAL							
7		COMPUTER AIDED DRAWING LAB	MECH	0	0	4	**2**
8		STRENGTH OF MATERIALS LAB	CIVIL	0	0	4	**2**
9		A. MANUFACTURING TECHNOLOGY LAB - I B. METALLURGY LAB	MECH	0	0	4	**2**
TOTAL				**19**	**3**	**12**	**27**

SEMESTER V

SL.NO	COURSE CODE	COURSE TITLE	DEPT	L	T	P	C
THEORY							
1		DESIGN OF MACHINE ELEMENTS	MECH	3	1	0	**4**
2		THERMAL ENGINEERING	MECH	3	1	0	**4**
3		HYDRAULICS AND PNEMAUTICS	MECH	3	0	0	**3**
4		COMPUTER INTEGRATED MANUFACTURING	MECH	3	0	0	**3**
5		INDUSTRIAL ENGINEERING	MECH	3	0	0	**3**
6		ELECTIVE - I	MECH	3	0	0	**3**
PRACTICAL							
7		COMPUTER AIDED MANUFACTURING LAB	MECH	0	0	4	**2**
8		MANUFACTURING TECHNOLOGY LAB-II	MECH	0	0	4	**2**
9		THERMAL ENGINEERING LAB	MECH	0	0	4	**2**
10		PROFESSIONAL COMMUNICATION AND PERSONALITY DEVELOPMENT	MECH	0	0	2	**1**
TOTAL				**18**	**2**	**14**	**27**

SEMESTER VI

SL.NO	COURSE CODE	COURSE TITLE	DEPT	L	T	P	C
THEORY							
1		AUTOMOBILE ENGINEERING	MECH	3	0	0	**3**
2		HEAT AND MASS TRANSFER	MECH	3	1	0	**4**
3		DESIGN OF TRANSMISSION SYSTEMS	MECH	3	1	0	**4**
4		ENGINEERING METROLOGY AND MEASUREMENTS	MECH	3	0	0	**3**
5		GAS DYNAMICS AND JET PROPULSION	MECH	3	0	0	**3**
6		ELECTIVE – II	MECH	3	0	0	**3**
PRACTICAL							
7		A. DYNAMICS LAB AND B. METROLOGY LAB	MECH	0	0	4	**2**
8		HEAT TRANSFER LAB	MECH	0	0	4	**2**
9		AUTOMOBILE ENGINEERING	MECH	0	0	4	**2**
10		VALUE ADDED COURSE – I	MECH				
TOTAL				**18**	**3**	**12**	**26**

SEMESTER VII

SL.NO	COURSE CODE	COURSE TITLE	DEPT	L	T	P	C
THEORY							
1		MECHATRONICS	MECH	3	0	0	**3**
2		FINITE ELEMENT ANALYSIS	MECH	3	1	0	**4**
3		POWER PLANT ENGINNEERING	MECH	3	0	0	**3**
4		TOTAL QUALITY MANAGEMENT	MECH	3	0	0	**3**
5		ELECTIVE – III	MECH	3	0	0	**3**
6		ELECTIVE – IV	MECH	3	0	0	**3**
PRACTICAL							
7		FINITE ELEMENT ANALYSIS LAB	MECH	0	0	4	**2**
8		HEAT TRANSFER LAB	MECH	0	0	4	**2**
9		COMPREHENSION LAB	MECH	0	0	4	**2**
TOTAL				**18**	**1**	**12**	**25**

SEMESTER VIII

SL.NO	COURSE CODE	COURSE TITLE	DEPT	L	T	P	C
THEORY							
1		ELECTIVE – VI	MECH	3	0	0	3
2		ELECTIVE – VII	MECH	3	0	0	3
PRACTICAL							
3		PROJECT WORK	MECH	0	0	8	6
TOTAL				**6**	**0**	**8**	**12**
						TOTAL CREDIT -	**196**

LIST OF ELECTIVES

SL.NO	COURSE CODE	COURSE TITLE	DEPT	L	T	P	C
1		REFRIGERATION AND AIR CONDITIONING	MECH	3	0	0	**3**
2		TURBO MACHINERY	MECH	3	0	0	**3**
3		INDUSTRIAL ROBOTICS	MECH	3	0	0	**3**
4		ADVANCED IC ENGINES	MECH	3	0	0	**3**
5		OPERATION RESEARCH	MECH	3	0	0	**3**
6		INDUSTRIAL TRIBOLOGY	MECH	3	0	0	**3**
7		COMBUSTION ENGINEERING	MECH	3	0	0	**3**
8		CRYOGENIC ENGINEERING	MECH	3	0	0	**3**
9		EMERGING MATERIALS	MECH	3	0	0	**3**
10		NANOTECHNOLOGY	MECH	3	0	0	**3**
11		AUTOMOTIVE INFOTRONICS	MECH	3	0	0	**3**
12		COMPUTATIONAL FLUID DYNAMICS	MECH	3	0	0	**3**
13		UNCONVENTIONAL MANUFACTURING PROCESSES	MECH	3	0	0	**3**
14		LEAN MANUFACTURING SYSTEMS	MECH	3	0	0	**3**
15		ENVIRONMENTAL POLLUTION	CIVIL	3	0	0	**3**
16		ENTREPRENEURIAL SKILLS DEVELOPMENT FOR ENGINEERS	MECH	3	0	0	**3**
17		MARKETING TECHNIQUES FOR ENGINEERS	MECH	3	0	0	**3**
18		RENEWABLE SOURCES OF ENERGY	MECH	3	0	0	**3**
19		RAPID PROTOTYPING AND TOOLING	MECH	3	0	0	**3**
20		INTRODUCTION TO AIRCRAFT INDUSTRY AND AIRCRAFT SYSTEMS	AERO	3	0	0	**3**
21		DESIGN OF AIRCRAFT STRUCTURES	AERO	3	0	0	**3**
22		FUNDAMENTALS OF PIPING ENGINEERING	MECH	3	0	0	**3**
23		ADVANCED CERAMIC TECHNOLOGY	MECH	3	0	0	**3**
24		VIBRATION AND NOISE CONTROL	MECH	3	0	0	**3**
25		CYBER SECURITY	CSE	3	0	0	**3**

SEMESTER	SUBJECT	L	T	P	C
I	**ENGLISH FOR EFFECTIVE COMMUNICATION (Common for all branches)**	3	0	0	3

Aim: To Strengthen the basic LSRW (Listening, Speaking, Reading and Writing) skills.

Objectives:

1. To make the students of Engineering courses learn English for Effective communication
2. To make them competent enough in the use of English in today's global scenario.
3. To make our Engineering graduates fit for any MNC today.

Outcome:

1. It is hoped that the students who are taught the revised English for Effective communication syllabus will be able to communicate in English.
2. This syllabus will enable our U.G Engineering graduates to face any challenges with confidence and they will prove with their counter part any where in the globe.

UNIT – I

Word formation with prefixes and suffixes, Antonyms & Synonyms-Tense Forms , Active and Passive voices- Different kinds of Nouns and Pronouns - Use of Verbs and Adverbs – Adjectives, Degrees of Comparison - Conditional Sentences -– Common Errors in English- Reported Speech- Articles.

UNIT – II

Phonetics (Vowels, Consonants and Diphthongs) - Pronunciation Guidelines - Vocabulary (Homophones).

UNIT – III

Principles of Communication - Defining and Describing Objects -.Role Play- Debate- Telephonic Etiquettes.

UNIT – IV

How to write reports, report writing – Recommendations - Discussing data and coming to conclusions –Technical Reports –Project proposals- Brochures- News Letters- Memorandum (or) Memo

UNIT – V

Flowcharts - Pie-charts – Bar charts- Interpreting tables- Formal and Informal letters - Resume Writing.

TEXT BOOK

1. **English for Effective Communication,**
   Departments of English, VMKV & AVIT.
   Erode: SCM Publishers, 2009.

REFERENCE BOOKS

1. M.Ashraf Rizvi, **Effective Technical Communication.**
   New Delhi:Tata McGraw Hill Publications, 2007.
2. Pickett and Laster.**Technical English: Writing, Reading and Speaking.**
   New York: Harper and Row Publications, 2002.

3. Cutts, Martin.**ThePlain English Guide – How to Write Clearly and Communicate Better.** New Delhi: OxfordUniversity Press, 1995.
4. Narayanaswami.V.R.**Strengthen Your Writing.** Chennai: Orient Longman Ltd., 1996.
5. Prof.K.R.Lakshmi Narayanan & Dr.T.Murugavel, **Communication Skills for Engineers,** Chennai: SCI Publications, 2002.

SEMESTER	SUBJECT	L	T	P	C

I	**ENGINEERING MATHEMATICS - I** **(COMMON TO THE BRANCHES MECH, ECE, CSE, CSSE, EEE, EIE,CIVIL,IT,MECHTRONICS, AERONAUCTICAL ,ETC, AUTOMOBILE)**	**3**	**1**	**0**	**4**

AIM: To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.

OBJECTIVES: The syllabus for the Engineering Mathematics I have been framed catering to the needs of the Engineering students. It is purely applications oriented. To mention a few i)To utilize the powerful features of MATLAB one has to be an expert in Matrix theory (ii) The matrix theory plays an vital role in simplifying large arrays of equation and in determining their solution.(iii)Partial differential equation frequently occured in the theory of elasticity and Hydraulics.(iv)In circuit branches the current flow can be calculated by using Laplace transform when EMF, resistance and inductions are known.

OUTCOME: At the end of this course the students will be in a position to apply the knowledge of Mathematics in the respective Engineering branches.

UNIT I MATRICES 09

Characteristic equation – Eigen values and eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors (Without proof) – Cayley-Hamilton theorem (excluding proof) – Orthogonal transformation of a symmetric matrix to diagonal form.

UNIT II DIFFERENTIAL CALCULUS 09

Curvature – Cartesian and Parametric Co-ordinates – Centre and radius of curvature – Circle of curvature – Evolute

UNIT III FUNCTIONS OF SEVERAL VARIABLES 09

Partial Derivatives – Total Differential - Maxima and Minima – constrained Maxima and Minima by Lagrangian Multiplier Method.

UNIT IV LAPLACE TRANSFORMS 09

Laplace transform – transform of elementary functions – basic properties – derivatives and integrals of transforms – transforms of derivatives and integrals – initial and final value theorems – Transform of periodic functions.

UNIT V APPLICATIONS OF LAPLACE TRANSFORMS 09

Inverse Laplace transform – Convolution theorem – Initial and Final value theorem-Solution of linear ODE of second order with constant coefficients and first order simultaneous equation with constant coefficients using Laplace transforms.

Tutorial Hours: 15 Lecture Hours: 45 Total hours: 60

TEXT BOOKS

1**. "**Engineering Mathematics**"** by Department of Mathematics, VMU

2.Veerarajan, T., "Engineering Mathematics", Tata McGraw Hill Publishing Co.,NewDelhi, 2006.

3.Dr.A .Singaravelu ,Engineering Mathematics Volume I & Volume II by Meenakshi Publications.

REFERENCE BOOKS

1. Grewal, B.S., "Higher Engineering Mathematics" (36th Edition), Khanna Publishers, Delhi 2001.
2. Kreyszig, E., "Advanced Engineering Mathematics" (8th Edition), John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
3. Kandasamy .P., Thilagavathy. K., and Gunavathy. K., "Engineering Mathematics",Volumes I & II (4th edition), S.Chand & Co., New Delhi., 2001.

SEMESTER	SUBJECT	L	T	P	C
I	**COMPUTER FOUNDATION PROGRAM (COMMON TO ALL BRANCHES)**	3	0	0	3

AIM: To study the basics of Computer, Hardware, Software Applications, Algorithms and Problem solving methodologies

OBJECTIVE: The proposed course exposes the students to IT Essentials. The Core Modules of this paper includes Programming, Database and Operating system and other related topics.

OUTCOMES:

At the end of this course, student shall be able to:

Do Problem Solving using Programming and algorithms, Describe working of Internet based applications, Document artifacts using common quality standards, Design simple data store using DBMS concepts and implement, Develop a working website with all above learning.

UNIT I

Basics of Computer and Information Technology : Digital computer fundamentals-Block diagram of a computer-component of a computer system Hardware and software definitions-Categories of software-Booting-Installing and Uninstalling Software-Software piracy-Software terminologies-Application of Computer-Role of Information Technology-History of Internet-Internet Services. **9**

UNIT II

Problem Solving Methodologies and Techniques : Problems solving Techniques-Program development cycle-Algorithm-Design-Flow chart-Program control structures-Types and generation of programming languages-Development of algorithms for simple problems. Top down and Bottom up approaches of software development. **9**

UNIT III

Basics of Computer Architecture and System Software : Fundamentals of Computer Architecture-Introduction-Organization of a small computer Central Processing Unit-Execution cycle-Instruction categories – measure of CPU performance Memory-Input/output devices-BUS-addressing modes.

System Software-Assemblers-Loaders and linkers-Compilers and interpreters. **9**

UNIT IV

Basics of Operating System and DBMS : Introduction-Basics of memory management schemes-Scheduling-threads. Introduction to File and Database systems- SQL-DDL statements-DML statements-DCL statements.

9

UNIT V

Software Applications : Office Automation: Application Packages-word processing-Spread sheet Application and Basics of HTML. **9**

TOTAL HOURS : 45

TEXT BOOK:

1. Faculties, School of Computer Science, VMKVEC, "An Introduction to Computer Foundation Program".

REFERENCES

1. Ashok N.Kamthane, programming with ANSI and TURBO C, Pearson Education (India) 2005.
2. V.Ramesh babu, fundamental of computing, VRB publisher, 2004.
3. Carl Hamacher, Zvonko Varnesie and Safwat Zaky, 5th Edition "Computer Organization", McGraw-Hill, 2002.
4. Leland L.Beck, "System Software- An Introduction to Systems Programming", 3rd Edition, Pearson Education Asia, 2000.
5. Abraham Silberschatz, Peter Baer Galvin and Greg Gange, "Operating System Concepts", Sixth Edition, John Wiley & Sons Pvt. Ltd,2003.
6. Abraham Silberschatz, Henry F.Korth and S.Sudarshan – "Database Systems Concepts", Fourth Edition, McGraw-Hill, 2002.

SEMESTER	SUBJECT	L	T	P	C
I	**ENVIRONMENTAL SCIENCE AND ENGINEERING (Common to B.E all branches)**	3	0	0	3

AIM: To provide the knowledge about the environmental science.

OBJECTIVE: It is the branch of science which deals with the effects of human activities &modern technology on environment. It creates awareness among the engineering students about environmental pollution and the role of the engineers in conservation of environment.

OUT COME: The students will get the knowledge about environment and they will work their corresponding field with eco -friendly. It will protect our environment from pollution

UNIT – I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 10

Definition, scope and importance – need for public awareness- forest resources: use and over exploitation, deforestation, case studies. Timber extraction, mining, dams and their ground water, floods, drought, conflicts over water, dams-benefits and problems-mineral resources: use effects on forests and tribal people-water resources: use and over-utilization of surface and exploitation, environmental effects if extracting and using mineral resources, case studies-food resources: world food problems, changes caused by agriculture and overgrazing, effects of modem agriculture, fertilizer-pesticide problems, water logging, salinity, case studies-energy resources: growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies – land resources: land as a resource, land degradation, man induced landslides, soil erosion and desertification –role of an individual in conservation of natural resources-equitable use of resources for sustainable lifestyles.

Field study of local area to document environmental assets-river/forest./grassland/ hill/mountain.

UNIT – II ECOSYSTEMS AND BIODIVERSITY 14

Concept of and ecosystem –structure and function of an ecosystem-producers, consumers and decomposers-energy flow in the ecosystem-ecological succession-food chains, food webs and ecological pyramids-introduction, types, characteristic features, structure and function of the (a)forest ecosystem (b). grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)-introduction to biodiversity- definition: genetic, species and ecosystem diversity- biogeographical classification of India-value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values-biodiversity at global, national and local levels-India as a mega-diversity nation-hot-spots of biodiversity-threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts-endangered and endemic species of India –conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT - III ENVIRONMENTAL POLLUTION 8

Definition-causes, effects and control measures of: (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards – solid waste management: caused, effects and control measures of urban and industrial wastes-role of an individual in prevention of pollution-pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site-urban / rural / industrial / agriculture

UNIT - IV SOCIAL ISSUES AND THEIR ENVIRONMENT 7

From unsustainable to sustainable development-urban problems related to energy- water conservation, rain water harvesting, watershed management –resettlement and rehabilitation of people, its problems and concerns, case studies – environmental ethics: issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies – wasteland reclamation-consumerism and waste products-environment protection act-air (prevention and control of pollution) act-water (prevention and control of pollution) act- wildlife protection act-forest conservation act-issues involved in enforcement of environmental legislation-public awareness.

UNIT – V HUMAN POPULATION AND THE ENVRONMENT 6

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 in environment and human health –case studies.

Total Hours : 45

TEXT BOOK:

1. Raman Sivakumar, Environmental Science and Engineering, Vijay Nicole imprints Pvt.Ltd.

REFERENCE BOOKS :

1. Bharucha Erach, The Biodiversity of India, publishing Pvt. Ahmedabad, India,
2. Trivedi R.K. Hand book of Environmental laws, Rules, Guidelines, Compliances and Standards, Vol. and II, Enviro Media.
3. Cunningham, W.P.Cooper, T.H.Gorhani, Environmental Encyclopedia, jaicao., House, Mumbai, 2001.
4. Weger K.D., Environmental Management, W.B. Saunders, Co., Philadelphia, USA., 1998.
5. Gilbert M.Masters, Introduction to Environmental Engineering and science, pearson Education Pvt., Ltd., Second Edition, 2004
6. Miller `T.G. Jr., Environmental Science, Wadsworth Publishing Co.
7. Townsend C., Harper J and Michael Begon, Essentials of Ecology, Blackwell Science
8. Trivedi R.K And P.K. Goel, Introduction to air pollution, Techno-Science publications.

SEMESTER	SUBJECT	L	T	P	C
I	**ENGINEERING PHYSICS (Common to B.E all branches)**	3	0	0	3

AIM: To Strengthens the fundamental knowledge in physics will improve the scientific thinking of students.

OBJECTIVE:

To familiarize students with the basic concepts of Physics and their application in Engineering & Technology

OUTCOME: Students will gain knowledge in the basic concepts of physics which can be applied in Engineering & Technology

UNIT – ILasers

Einstein coefficients (A&B), Nd – YAG laser, CO_2 laser, semiconductor laser (homojunction) – uses of lasers – Holography – construction and reconstruction of a hologram.

UNIT – IIFibre Optics

Principle and propagation of light in optical fibres – numerical aperture and acceptance angle – types of optical fibres (material, refractive index, mode) – Applications: Fibre optic communication system (block diagram only) – fibre optic sensors (displacement sensor and pressure sensor).

UNIT – III Crystal Physics

Lattice – unit cell – Bravais lattice – Lattice planes – Miller indices – 'd' spacing in cubic lattice – calculation of number of atoms per unit cell – atomic radius – coordination number – packing factor for SC, BCC, FCC, HCP structures.

UNIT – IV Acoustics

Classification of sound – characteristics of musical sound – loudness – Weber-Fechner law – decibel – absorption coefficient – experimental determination – reverberation – reverberation time – Sabine's formula (no derivation) – factors affecting acoustics of buildings (reverberation time, loudness, focusing, echo, echolen effect, resonance and noise) and their remedies.

UNIT- V Non – Destructive Testing

Liquid penetrant method – ultrasonic flaw detection – ultrasonic flaw detector (block diagram) – X-ray Radiography: displacement method – X-ray Fluoroscopy – merits and demerits of each method.

TEXT BOOK

1. Gaur R. K. and Gupta S. L., "Engineering Physics", Dhanpat Rai publishers, New Delhi, 2001.
2. Rajendran. V, "Engineering Physics", Tata Mc Graw Hill Publication and Co New Delhi, 2009.

REFERENCE BOOKS

1. Pillai S.O "Solid Sate Physics", New Age International Publication, New Delhi, (2003).
2. Palanisamy P.K. "Physics for Engineers", Scitech publications (India) Pvt. Ltd., Chennai (2005).
3. Rajendran V and Marikani "Physics for Engineers", Tata McGraw Hill Publising Company Ltd, New Delhi(2004).
4. Arumugam M, "Engineering Physics", Anuradha Agencies, Kumbakonam, Second Edition(2005).

SEMESTER	SUBJECT	L	T	P	C
I	**ENGINEERING MECHANICS – STATICS (Common to Mech, Auto, Aero & Civil)**	3	0	0	3

Aim: To provide the knowledge about mechanics and statics

Objective: It is the branch of Engineering Mechanics, which deals with the forces and their effects, while acting upon the bodies at rest.

Outcome: The students would have learned the fundamental of Mechanics systems of forces which are very essential for engineering students to further build up his studies in the mechanical engineering branch.

Unit – I **9**

Fundamentals of Mechanics: Introduction, Basic Dimensions and units of mechanics, Secondary Dimensional Quantities, Law of Dimensional Homogeneity, Dimensional Relation Between Force and Mass, Unit of Mass, Idealizations of Mechanics, Vector and Scalar Quantities, Equality and Equivalence of Vectors, Law of Mechanics.

Element of Vector Algebra: Introduction, Magnitude and Multiplication of a Vector by a Scalar, Addition and Subtraction of Vectors, Resolution of Vectors: Scalar Components, Unit Vectors, Useful Ways of Representing Vectors, Scalar or Dot Product of Two Vectors, Cross product of Two Vectors, Scalar triple Product, Note on Vector Notation.

Unit – II **9**

System of Forces: Position Vector, Moment of a Force About a Point and Axis, Couple and Couple moment, Couple Moment as a Free Vector, Addition and Subtraction of Couples, Moment of a Couple about a Line.

Equivalent Force System: Introduction - Translation of a Force to a Parallel position, Resultant of Special Force Systems, Distributed Force Systems.

Unit – III **9**

Equations of Equilibrium: Introduction, Free Body Diagram, Free Bodies Involving Interior Sections, General Equations of Equilibrium, Problems in Equilibrium I and II, Two Point Equivalent Loading, Problems Arising From Structures, Static Indeterminacy.

Unit-IV **9**

Friction Forces: Introduction, Laws of Coulomb Friction, Simple and Complex Contact Friction Problems, Transmission of Power Through - Belts, Screw Jack, Wedge, Belt Friction, Square Screw Thread.

Unit-V **9**

Properties of Surfaces: Introduction, First Moment of an Area and the Centroid and Other Centers, Theorem of Pappus-Guldinus, Second Moments and the Product of an Area of a Plane Area, Transfer Theorems, Computations Involving Second Moments and Products of Area, Relation Between Second Moments and Products of Area, Polar Moment of Area, Principal Axes.

Moments and Product of Inertia: Introduction, Definition of Inertia Quantities, Relation Between Mass-Inertia Terms and Area-inertia Terms, Translation of Coordinates Axes.

Total: 45 Hours

Text Book:

1. Engineering Mechanics: Statics and Dynamics, Shames Irving H and G.Krishna Mohana Rao., Pearson Education, 2006
2. Engineering Mechanics: Statics and Dynamics, S.Rajasekaran and G.Sankara Subramaniam, Vikas Publishing House Pvt Ltd.,

Reference:

3. Engineering Mechanics, Dr. R.K.Bansal, Lakshmi Publications.
4. Engineering Mechanics, R.S.Khurmi, S.Chand Company Ltd.,

SEMESTER	SUBJECT	L	T	P	C
I	**ENGINEERING PHYSICS LAB** **(Common to all branches of B. E.)**	**0**	**0**	**3**	**2**

Aim: To provide the knowledge about basics of physics

Objective:
To gain the knowledge of taking precise readings from equipments

Outcome: Students will have the knowledge of taking measurements precisely

List of Experiments

1. Young's modulus of a bar - Non-uniform bending
2. Rigidity modulus of a wire - Torsional Pendulum
3. Viscosity of a liquid - Poiseuille's method
4. Velocity of ultrasonic waves in liquids - Ultrasonic Interferometer
5. Particle size determination using Laser
6. Wavelength of spectral lines – grating - Spectrometer
7. Thickness of a wire - Air wedge Method
8. Thermal conductivity of a bad conductor - Lee's disc
9. Band gap determination of a thermistor - Post Office Box
10. Specific resistance of a wire – Potentiometer

SEMESTER	SUBJECT	L	T	P	C
I	**WORKSHOP PRACTICE LAB** **(Common to all departments - Except Bio-Tech & Bio info)**	0	0	3	2

Aim:

The aim of the lab to learn Business fitting, Carpentry and welding technics.

Objective: To learn the experience of practice in basic sections of the workshop namely fitting, Carpentry and welding in order to know the various methods involved in making parts of the various machines.

Outcome: The students would have been completely exposed to the various basic methods that are going to play in the manufacture of even very heavy machines.

FITTING

1. Vee Joint
2. Square Joint
3. Dove Tail Joint

CARPENTRY

1. Planning
2. Half lab
3. Dove Tail Joint

WELDING

1. Arc Welding of butt Joint.
2 Arc Welding of Lap Joint

DEMONSTRATION

1. Sheet Metal – Fabrication of tray and cone
2. Black Smithy – Round to square rod.
3. Foundry – Mould Preparation using single piece and split pattern

Reference:

1. "Basic Workshop Practice ", Department of Mechanical Engineering, VMKV Engineering College, 2008

SEMESTER	SUBJECT	L	T	P	C
I	**COMPUTER FOUNDATION PROGRAM LAB (COMMON TO ALL BRANCHES)**	**0**	**0**	**3**	**2**

AIM: To give the knowledge about computer programs

OBJECTIVE: The proposed course exposes the students to IT Essentials. The Core Modules of this paper includes Programming, Database and Operating system and other related topics.

OUTCOME:
At the end of this course, student shall be able to:
Do Problem Solving using Programming and algorithms, Describe working of Internet based applications, Document artifacts using common quality standards, Design simple data store using DBMS concepts and implement, Develop a working website with all above learning.

I. OFFICE AUTOMATION

1. Create a document with all formatting effects.
2. Create a document to send mails using mail merge option.
3. Create an Excel File to analyze the student's performance. Create a chart for the abovedata to depict it diagrammatically.
4. Create Excel sheet to maintain employee information and use this data to send mailsusing mail merge.
5. Create a Power Point presentation for your personal profile with varying animationeffects with timer.

II. SQL QUERIES

1. Write SQL Commands for Data Definition, Table Creation with constraints.
2. Write SQL Commands for Insert, Select, Update and Delete operations.
3. Write SQL Commands for aggregate functions.

III. HTML

1. Write HTML code to develop a web page having the background in red and title "My First Page" in any other color.
2. Design a page having background color given text color red and using all the attributes of font tab.
3. Create a web page, when user clicks on the link it should go to the bottom of the page.
4. Create a web page, showing an ordered& unordered list of name of your five friends.
5. Create a web page with appropriate content and insert an image towards the left hand side of the page when user clicks on the image. It should open another webpage.
6. Create a web page which should contain a table having two rows and two columns.

SEMESTER	SUBJECT	L	T	P	C
II	**BUSINESS ENGLISH** **(For I year B.E., all branches)**	**3**	**0**	**0**	**3**

Aim: To provide the basic knowledge of business English.

Objectives:

1. To make the students understand the principles of Basic English grammar and use it in their day today life.
2. To make the engineering graduates employable and industry ready.
3. To make our students that they are second to none in the best use of the English language.

Outcome: Outcome of the revised Business English syllabus for the second semester UG Engineering students for the academic year 2012-2013.

1. By teaching this syllabus, it is believed that the UG Engineering graduates will develop their fluency level of using English.
2. Students, who undergo this syllabus, will fulfill the expectations of the industries and find themselves employable in any field.

UNIT – I

Subject and Verb Agreement (Concord) - Impersonal Passive Voice – Preposition - Cause and Effect - Phrasal Verbs - Idioms and Phrases - Question Tags – Vocabulary. Sentence Pattern (SVOCA) -Auxiliary and Modal verbs- Simple, Complex and Compound Sentences.

UNIT – II

Stress (Word Stress and Sentence Stress) – Intonation - Differences Between British and American English – Indianism.

UNIT – III

Understanding Ideas and Making Inferences- Interview Questions (Direct, Open-ended and Closed Questions) - E-mail Netiquette, Sample E-mails- Group Discussion and Mock interview.

UNIT – IV

Instruction - Check-list - Minutes of the Meeting and Writing Agenda - Note making. Rearranging the jumbled sentences- Technical Articles- Project Proposals.

UNIT – V

Skimming - Scanning -Reading Comprehension - Interpreting Tables - Business Letters (Calling for Quotation, Placing Orders and Complaint Letters) - Essay Writing and Developing Hints – Expansion of an Idea.

TEXT BOOK

1. **English for Effective Communication,**
   Departments of English, VMKV & AVIT.
   Erode: SCM Publishers, 2009.

REFERENCE BOOKS

1. M.Ashraf Rizvi, **Effective Technical Communication.**
   New Delhi:Tata McGraw Hill Publications, 2007.
2. Pickett and Laster.**Technical English: Writing, Reading and Speaking.**
   New York: Harper and Row Publications, 2002.
3. Cutts, Martin.**ThePlain English Guide – How to Write Clearly and Communicate Better.**
   New Delhi: OxfordUniversity Press, 1995.
4. Narayanaswami.V.R.**Strengthen Your Writing.** Chennai: Orient Longman Ltd., 1996.
5. Prof.K.R.Lakshmi Narayanan & Dr.T.Murugavel, **Communication Skills for Engineers,** Chennai: SCI Publications, 2002.

SEMESTER	SUBJECT	L	T	P	C
II	**ENGINEERING MATHEMATICS-II (COMMON TO THE BRANCHES MECH, ECE, CSE, CSSE, EEE, EIE,CIVIL,IT,MECHTRONICS, AERONAUCTICAL , ETC, AUTOMOBILE)**	3	1	0	4

Aim: To provide students with mathematical knowledge and skills needed to support their concurrent and subsequent engineering and science studies

Objectives: The syllabus for the Engineering Mathematics II have been framed catering to the needs of the Engineering students. It is purely applications oriented. To mention a few (i) Differential equation plays a vital role in finding the solutions of problems related to oscillations of Mechanical and Electrical systems, bending of beam, conduction of heat, velocity of chemical reaction etc., and as such play an very important role in all modern scientific and engineering studies.(ii)The complex functions are useful in the study of Fluid mechanics, Thermodynamics and electric fields.

Outcome: At the end of this course the students will be in a position to apply the knowledge of Mathematics in the respective Engineering branches.

UNIT I ORDINARY DIFFERENTIAL EQUATIONS 09

Solutions of third and higher order linear ordinary differential equation with constant coefficients– Method of variation of parameters– Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT II MULTIPLE INTEGRALS 09

Double integration –change of order of integration- Cartesian and polar coordinates –Area as a double integral – Triple integration – volume as a triple integral.

UNIT III VECTOR CALCULUS 09

Directional derivatives – Gradient, Divergence and Curl – Irrotational and solenoidal- vector fields – vector integration – Green's theorem, Gauss divergence theorem and Stoke's theorem (excluding proof).

UNIT IV ANALYTIC FUNCTIONS 09

Function of a complex variable –Analytic function – Necessary conditions - Cauchy Riemann equations – Sufficient conditions (excluding proof) – Harmonic conjugate– Constructions of analytic functions-conformal mapping($w=z+c, w=z^2, w=1/z$)-bilinear transformation

UNIT V COMPLEX ANALYSIS 09

Statement and application of Cauchy's integral theorem and integral formula – Taylor's and Laurent's expansions –Residues – Cauchy's residue theorem-contour integration over unit circle.

Tutorial Hours: 15 Lecture Hours: 45 Total hours: 60

TEXT BOOKS

1**. "**Engineering Mathematics**"** by Department of Mathematics, VMU

2. Veerarajan, T., "Engineering Mathematics", Tata McGraw Hill Publishing Co., NewDelhi, 2006.

3.Dr.A .Singaravelu ,Engineering Mathematics Volume I & Volume II by Meenakshi Publications.

REFERENCE BOOKS

1. Grewal, B.S., "Higher Engineering Mathematics" (36^{th} Edition), Khanna Publishers,Delhi 2001.
2. Kreyszig, E., "Advanced Engineering Mathematics" (8^{th} Edition), John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
3. Kandasamy .P., Thilagavathy. K., and Gunavathy. K., "Engineering Mathematics",Volumes I & II (4^{th} edition), S.Chand & Co., New Delhi., 2001

SEMESTER	SUBJECT	L	T	P	C
II	**ENGINEERING CHEMISTRY** (Common to all Branches)	**3**	**0**	**0**	**3**

AIM

To impart in basic knowledge in chemistry so that the student will understand the engineering concept and they can face the competitive examinations effectively

OBJECTIVE

With a solid foundation in basic scientific and engineering principles, while allowing specialization in Engineering chemistry and ability to assess the impact of engineering solutions in a global and societal context.

OUTCOME

The student will come out with the ability to assess the impact of engineering solutions.

UNIT I : WATER TECHNOLOGY & CORROSION 9

Sources of water – impurities – Hardness and its determination (problems to be avoided) – boiler troubles – water softening (zeolite & Demineralisation) – Domestic water treatment – Desalination (Electrodialysis & Reverse Osmosis).
Corrosion – Types – principles – corrosion control methods (Sacrificial and Impressed current method).

UNIT II : ELECTROCHEMISTRY, BATTERIES AND FUEL CELLS 9

Ostwald Law and Debye Huckle's law - Cells – Electrode (SHE, Calomel and Glass) - Electrode potential – Nernst equation – EMF series.
Primary cells – secondary batteries – charging and discharging.

UNIT III : CHEMISTRY OF ADVANCED MATERIALS 9

Portland cement –setting and hardening – RCC – Special cements.
Organic electronic material, solid oxide materials, shape memory alloys, nanomaterials, polymers, fullerenes, ceramics, fibers, lubricants, refractories & composites (definition, classification and applications)

UNIT IV : PHASE EQUILIBRIA & NUCLEAR CHEMISTRY 9

Phase rule: statement and explanation of terms involved – One component system – Condensed phase rule – Two component system.
Nuclear Chemistry – Fission – Fusion – working of nuclear reactor – Radiations and harmful effects.

UNIT V : CHROMATOGRAPHY AND SPECTROSCOPY **9**

Chromatography — classification & principles (Paper, column, thin layer, gas, HPLC). Spectroscopy – Electromagnetic radiation – Beer Lambert's law – UV – Visible – IR (Principle and Instrumentation, block diagram) – Atomic absorption spectroscopy.

Total: 45 hours

REFERENCES:

1. Engineering Chemistry by S.S. Dara.
2. Engineering Chemistry by Jain & Jain.

SEMESTER	SUBJECT	L	T	P	C
II	**PROGRAMMING IN C** (Common to all Branches)	3	0	0	3

AIM:

The aim is to introduce C programming to the students.

OBJECTIVES:

To enable the student to learn programming knowledge in C.

Outcomes:

Do develop the skill of the student to develop the programming in C language.

UNIT I Introduction

Algorithms & flowcharts-Overview of C-Features of C-IDE of C Structure of C program-Compilation & execution of C program-Identifiers, variables, expression, keywords, data types, constants, scope and life of variables, local and global variables. Operators: arithmetic, logical, relational, conditional and bitwise operators- Special operators: size of () & comma (,) operator-Precedence and associativity of operators & Type conversion in expressions.

Basic input/output and library functions

Single character input/output i.e. getch(), getchar(), getche() & putchar()-Formatted input/output: printf() and scanf()-Library Functions: concepts, mathematical and character functions.

UNIT II Control structures

Conditional control-Loop control and Unconditional control structures.

Functions: The Need of a function-User defined and library function- Prototype of a function-Calling of a function-Function argument-Passing arguments to function- Return values-Nesting of function- main()-Command line arguments and recursion. Storage class specifier – auto, extern, static, & register.

UNIT III

Arrays: Single and multidimensional arrays-Array declaration and initialization of arrays-Array as function arguments.

Strings: Declaration-Initialization and string handling functions.

Structure and Union: Defining structure-Declaration of structure variable-Accessing structure members-Nested structures-Array of structures-Structure assignment-Structure as function argument-Function that returns structure- Union.

UNIT IV

Pointers: The '&' and * operators-Pointers expressions-Pointers vs arrays-Pointer to functions-Function returning pointers-Static and dynamic memory allocation in C.

DMA functions: malloc(), calloc(), sizeof(), free() and realloc()-Preprocessor directives.

UNIT V

File management: Defining, opening & closing a file, text file and binary file- Functions for file handling: fopen,fclose, gets, puts, fprintf, fscan, getw, putw, fputs, fgets, fread, fwrite-Random access to files: fseek, ftell, rewind-File name as Command Line Argument.

TEXT BOOKS:

1. Balaguruswami.E, ‘Programming in C’, TMH Publications,1997

REFERENCE BOOKS:

1. Behrouz A. Forouzan & Richard F. Gilberg, “Computer Science A Structured Programming using C”, Cengage Learning, 3rd Edition, 2007
2. Gottfried , ‘Programming with C’, schaums outline series, TMH publications,1997
3. Mahapatra , ‘Thinking in C’, PHI publications, 2nd Edition, 1998.
4. Stevens , ‘Graphics programming in C’, BPB publication, 2006
5. Subbura.R , ‘Programming in C’, Vikas publishing, 1st Edition, 2000

SEMESTER	SUBJECT	L	T	P	C
II	**MATERIAL SCIENCE** **(Common to Mechanical, Auto, Aero & Civil of B. E.)**	**3**	**0**	**0**	**3**

Aim: To provide the knowledge about various materials used in engineering

Objective

To familiarize students with the classical and quantum aspects of materials and their application in Engineering & Technology

Outcome

Students will be enabled in applying their knowledge of materials in Engineering & Technology

UNIT- I Conducting Materials

Classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function

UNIT- II Semiconducting Materials

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – extrinsic semiconductors – carrier concentration derivation in n-type and p-type semiconductor Hall effect –Experimental arrangement and Applications.

UNIT – III Magnetic and Dielectric Materials

Origin of magnetic moment – Bohr magneton – Dia and para magnetism – Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti – ferromagnetic materials – Ferrites – applications

UNIT – IV Dielectric Materials

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss - uses of Dielectric materials

UNIT- V Nano Materials

Synthesis of nanostructured materials – Top-down and Bottom-up methods- Lithography - sol-gel method - carbon nanotubes - synthesis of carbon nanotubes - applications

TEXT BOOKS:

1. Charles Kittel ‘Introduction to Solid State Physics’, John Wiley & sons, Singapore (2007).
2. Pillai S.O ‘Solid Sate Physics’, New Age International Publication, New Delhi, (2003).
3. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.

REFERENCES:

1. Rajendran, V, and Marikani A, ‘Materials science’ TMH publications, New delhi(2004).
2. Jayakumar, S. ‘Materials science’, R.K. Publishers, Coimbatore, (2008).
3. Palanisamy P.K, ‘Materials science’, Scitech publications(India) Pvt. LTd., Chennai, second Edition(2007).
4. Arumugam. M, ‘Materials Science’ Anuradha publications, Kumbakonam, (2006).
5. Rajendran. V, “Engineering Physics”, Tata Mc Graw Hill Publication and Co New Delhi, (2009).

SEMESTER	SUBJECT	L	T	P	C
II	**ENGINEERING MECHANICS – DYNAMICS (Common to Mech, Auto & Aero)**	3	1	0	4

Aim: To study about mechanics and dynamics in engineering.

Objective: It is the branch of Engineering Mechanics, which deals with the forces and their effects, while acting upon the bodies in motion.

Outcome: The students would have learned the fundamental of Mechanics systems of forces Kinematics of particle, Impulse–Momentum Methods for Rigid bodies which are very essential for engineering students to further build up his studies in the mechanical engineering branch.

Unit-I **9**

Kinematics of a Particle – Simple Relative Motion

Introduction, General Notions, Velocity and Acceleration Calculations, Simple, Kinematical Relations and Applications

Particle Dynamics

Introduction, Rectangular Coordinates, Rectilinear Translation, Cylindrical Coordinates, central Force Motion, System of Particles

Unit – II **9**

Energy Method for Particles

Analysis for a Single Particle: Introduction, Conservative Force Field, Conservation of Mechanical Energy, Alternative form of Work-Energy Equation.

System of particles: Work-Energy Equations, Kinetic Energy Expression Based on Center of Mass, Work-Kinetic Energy Expression Based on Center of Mass

Linear Momentum: Impulse and Momentum Relations for a Particle, Linear-Momentum Considerations for a System of Particles, Impulsive Forces, Impact Forces.

Moment of Momentum: Moment of Momentum Equation for a Single and a system of particles.

Unit – III **9**

Kinematics of Rigid Bodies: Relative Motion

Introduction, Translation and Rotation of Rigid Bodies, Chasles' Theorem, Applications of the Fixed-Vector Concept, General Relationships between Time Derivatives of a Vector for Different References, General Relationships between Velocities of a Particle for Different References, Acceleration of a Particle for Different References.

Unit – IV **9**

Kinetics of Plane Motion of Rigid Bodies

Introduction, Moment-of-Momentum Equations, Pure Rotation of a body of Revolution About its Axis of Revolution, Pure Rotation of a body with Two Orthogonal Planes of Symmetry, Pure Rotation of Slab Like Bodies, Rolling Slab Like Bodies, General Plane Motion of a Slab Like Bodies, Pure Rotation of an Arbitrary Rigid Body.

Unit – V **9**

Energy and Impulse–Momentum Methods for Rigid Bodies

Introduction, Energy Method: Kinetic Energy of a Rigid Body, Work – Energy Relations, Impulse–Momentum Methods: Angular Momentum of a Rigid Body about any Point in the Body, Impulse–Momentum Equations, Impulsive Forces and torques, Eccentric-Impact.

Total: 45 PERIODS

Text Book:

1. Engineering Mechanics: Statics and Dynamics, Shames Irving H and G.Krishna Mohana Rao., Pearson Education, 2006
2. Engineering Mechanics: Statics and Dynamics, S.Rajasekaran and G.Sankara Subramaniam, Vikas Publishing House Pvt Ltd.,

Reference:

3. Engineering Mechanics, Dr. R.K.Bansal, Lakshmi Publications.
4. Engineering Mechanics, R.S.Khurmi, S.Chand Company Ltd.,

SEMESTER	SUBJECT	L	T	P	C
II	**PROGRAMMING IN C LAB** **(COMMON TO CSE, IT, CSSE, M.Sc, MECH, AUTO, AERO, CIVIL, BIO-TECH, BIO-INFO)**	**0**	**0**	**3**	**2**

AIM

To practice and develop applications using C Programming languages.

OBJECTIVES:

To enable the student to learn programming knowledge in C.

Outcomes:

Do develop the skill of the student to develop the programming in C language.

Experiments:

1. Implementation of Sine and cosine series.
2. Generation of Fibonacci series.
3. To find the i) Factorial number.
   ii) Sum of n natural numbers.
4. Reversing the digits of an integer
5. Conversion of decimal number to octal number
6. Conversion of character integer to decimal number
7. Finding the square root of a given number by applying algorithm
8. (a) Find GCD of two numbers

(b) Generate Prime numbers between 1 and n.

9. Greatest of three numbers using if statement and conditional operator.
10. Read two numbers and swap those two numbers using temporary variable and without using temporary variable.
11. Quadratic equation for different sets of inputs.
12. Use of switch….Case statements.
13. Matrix operations
    a) Addition b) Transpose c) Multiplication
14. Ascending and Descending order.
15. Given a set of n numbers, find the length of the longest monotone increasing subsequence.
16. Sort by exchange,selection and partitioning method
17. Use of pointers and array of pointers
18. Linear search.
19. Binary search.
20. Files operations.

SEMESTER	SUBJECT	L	T	P	C
II	**ENGINEERING GRAPHICS (Common to MECH, AUTO, AERO, CIVIL, ECE, EIE, EEE, ETC& MECT)**	**0**	**0**	**3**	**2**

Aim: To study about basics of engineering graphics

Objectives: To develop in student's graphic skill for communication of concepts, ideas and designof engineering products and expose them to existing national standards related totechnical drawings.

Outcome: The students would have learned the engineering graphics which is the basic language for an engineer to communicate is idea in manufacturing the various items.

Concepts and conventions (Not for Examination)
Importance of graphics in engineering applications – Use of drafting instruments –BIS conventions and specifications – Size, layout and folding of drawing sheets –Lettering and dimensioning.
Free hand sketching:
Representation of Three Dimensional objects – General principles of orthographicprojection – Need for importance of multiple views and their placement – First angleprojection – layout views – Developing visualization skills through free handsketching of multiple views from pictorial views of objects.

UNIT I PLANE CURVES AND FREE HAND SKETCHING 9
Curves used in engineering practices:
Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method –Construction of cycloid – construction of involutes of squad and circle – Drawing oftangents and normal to the above curves.
UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 9
Projection of points and straight lines located in the first quadrant – Determination oftrue lengths and true inclinations – Projection of polygonal surface and circularlamina inclined to both reference planes.
UNIT III PROJECTION OF SOLIDS 9
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis isinclined to one reference plane by change of position method.
UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 9
Sectioning of above solids in simple vertical position by cutting planes inclined to onereference plane and perpendicular to the other – Obtaining true shape of section.Development of lateral surfaces of simple and truncated solids – Prisms, pyramids,cylinders and cones – Development of lateral surfaces of solids with cylindricalcutouts, perpendicular to the axis.
UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 9
Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones.Perspective projection of prisms, pyramids and cylinders by visual ray method.

Total: 45 PERIODS

TEXT BOOKS:

1. N.D. Bhatt, "Engineering Drawing" Charotar Publishing House, 46th Edition,(2003).
2. K. V. Natrajan, "A text book of Engineering Graphics", DhanalakshmiPublishers, Chennai (2006).

REFERENCES:

1. M.S. Kumar, "Engineering Graphics", D.D. Publications, (2007).
2. K. Venugopal & V. Prabhu Raja, "Engineering Graphics", New AgeInternational (P) Limited (2008).
3. M.B. Shah and B.C. Rana, "Engineering Drawing", Pearson Education(2005).
4. K. R. Gopalakrishnana, "Engineering Drawing" (Vol.I&II), Subhas Publications(1998).
5. Dhananjay A.Jolhe, "Engineering Drawing with an introduction to AutoCAD"Tata McGraw Hill Publishing Company Limited (2008).
6. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw HillPublishing Company Limited, New Delhi, (2008).

Note: 1. Mini drafter is to be used for unit-I&II

2. Free hands sketch and drafting software is to be used for Unit-III, IV&V.

SEMESTER	SUBJECT	L	T	P	C
II	**ENGINEERING CHEMISTRY LAB** (Common to all Branches)	**0**	**0**	**3**	**2**

AIM:

To impart in basic knowledge in chemistry so that the student will understand the engineering concept.

OBJECTIVE

To learn the relevant experience using laboratory experiments

OUTCOME

The student will have the experience in handling the instruments relevant to his/her theory.

1. Estimation of total hardness of water sample by EDTA method.
2. Determination of alkalinity by indicator method.
3. Estimation of ferrous ion by Potentiometry.
4. Titration of strong acid with strong base by Conductometry.
5. Acid base reaction by pH metry.
6. Estimation of copper from its ore.
7. Estimation of iron by spectrophotometer.
8. Estimation of sodium by flame photometer.

SEMESTER	SUBJECT	L	T	P	C
III	**ADVANCED ENGINEERING MATHEMATICS** (Common to CIVIL, MECH, MECT, AUTO, AERO, ECE, EEE, CSE,EIE, IT)	3	1	0	4

Aim	The aim of the subject is to provide knowledge in various methods and techniques to solve the problems.
Objective	1. To study about various methods to solve partial differential equations. 2. To learn the concept of fourier series techniques. 3. To study and analyze various methods for solving boundary value problem. 4. To learn the concepts and applications of fourier transforms and Z transforms.
Outcome	The students would be able to understand the various methods and techniques for solving different types of problems.

UNIT –I PARTIAL DIFFERENTIAL EQUATIONS 9

Formation - Solutions of standard types f(p,q)=0, clairauts form, f(z,p,q)=0,f(p,x)=g(q,y) of first order equations - Lagrange's Linear equation - Linear partial differential equations of second and higher order with constant coefficients.

UNIT –II FOURIER SERIES 9

Dirichlet's conditions - General Fourier series - Half-range Sine and Cosine series - Parseval's identity – Harmonic Analysis.

UNIT –III BOUNDARY VALUE PROBLEMS 9

Classification of second order linear partial differential equations - Solutions of one - dimensional wave equation, one-dimensional heat equation - Steady state solution of two-dimensional heat equation - Fourier series solutions in Cartesian coordinates.

UNIT –IV FOURIER TRANSFORMS 9

Statement of Fourier integral theorem - Fourier transform pairs - Fourier Sine and Cosine transforms – Properties - Transforms of simple functions - Convolution theorem - Parseval's identity.

UNIT –V Z - TRANSFORMS 9

Z-Transform – Elementary Properties – Inverse Z-Transform – Convolution Theorem – Formation of Difference Equations – Solution of Difference Equations using Z-Transform.

TUTORIAL : 15 PERIODS
TOTAL HOURS : 60 PERIODS

TEXT BOOK:

A.Singaravelu,"Transforms and Partial Differential Equations", Meenakshi Agencies, Chennai

REFERENCES:

1**.** T. Veerarajan, "Engineering Mathematics" (for semester III), Third Edition TataMcGraw- Hill Publishing Company limited.

2**.** Grewal, B.S., "Higher Engineering Mathematics" (35th Edition), Khanna Publishers, Delhi, 2000.

3 .Kreyszig, E., "Advanced Engineering Mathematics" (8th Edition), John Wiley and Sons, (Asia)Pvt. Ltd.,Singapore, 2000.

SEMESTER	SUBJECT	L	T	P	C
III	**ENGINEERING THERMODYNAMICS** (Common to MECH,AUTO and AERO)	3	1	0	4

Aim	The aim of the subject is to provide a fundamental knowledge of thermodynamics.
Objective	1. To achieve an understanding of fundamentals of thermodynamic systems and first law of thermodynamics. 2. To provide an in-depth study of availability and second law of thermodynamics. 3. To understand the concept of working fluid and its properties. 4. To provide in-depth study of power cycles applying the different working fluids studied in the previous chapter. 5. To understand the Thermodynamic Relations and also to understand combustion equations.
Outcome	The students would understand the basic fundamentals in thermodynamics and its applications.

UNIT –I BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS 9

Thermodynamic systems, Concepts of continuum, Thermodynamic properties, Equilibrium, Process cycle, Work, temperature, Zeroth law of Thermodynamics.

First law of thermodynamics – Applications to closed and open systems, Internal energy, Specific heats, Enthalpy, Steady and unsteady flow conditions. Problems.

UNIT –II SECOND LAW OF THERMODYNAMICS 9

Statements, Reversibility, Causes of irreversibility, Carnot cycle, Reversed Carnot cycle, Heat engines, refrigerators, Heat pumps.

Clausius inequality, Entropy, Principles of increase in entropy, Carnot theorem, Available energy, Availability. Problems.

UNIT –III WORKING OF PURE SUBSTANCES 9

Definition of working fluid, Thermodynamic properties of pure substances, property diagram, PVT surface of water and other substances, calculation of properties. First law and second law analysis using tables and charts.

Properties of ideal and Real gases, Equation of state, Gas laws, Vanderwaal's equation of state, Compressibility, Compressibility charts, Dalton's law of partial pressures, Internal energy, enthalpy, Heat and molecular weight of gas mixtures. .

UNIT –IV POWER CYCLES 9

Gas Power Cycles – Carnot, Otto, Diesel, Dual, Brayton, Ericsson, Stirling, Lenoir, and Atkinson cycles. Problems on Otto,Diesel, Dual and Brayton Cycles.

Vapour Power Cycles – Rankine, modified rankine, Reheat, Regeneration Cycles, Binary vapour power cycles. Problems.

UNIT –V THERMODYNAMIC RELATIONS AND COMBUSTION OF FUELS 9

Exact differentials, T-Ds relations, Maxwell relations, Clausius Clapeyron equations, Joule-Thomson coefficient. Heat value of fuels, Combustion equations, Theoretical and excess air, Air fuel ratio, exhaust gas analysis, Problems.

TUTORIAL HOURS :15 TOTAL HOURS :60

TEXT BOOKS

1. Nag.P.K. - "Engineering Thermodynamics", IV Edition, Tata McGraw-Hill- New Delhi-2008.
2. Rajput. R.K.,"A Textbook of Engineering Thermodynamics", Third Edition, Laxmi Publications, New Delhi, 2005.
3. Yunus.A.Cengel, Michael A.Boles, Thermodynamics: An Engineering Approach, McGH, 2011.

REFERENCES

1. Spalding & Cole., Engineering Thermodynamics, ELBS.
2. Van Wylen & Sonntag., fundamentals of classical thermodynamics – Tata Mc Graw Hill.
3. Rogers & Mayhew, Engineering Thermodynamics – Addision Wesley.

SEMESTER	SUBJECT	L	T	P	C
III	MANUFACTURING TECHNOLOGY – I	3	0	0	3

Aim	The aim of the subject is to provide a fundamental knowledge in manufacturing sector.
Objective	1. To acquire the knowledge about mould making, metal melting and casting process. 2. To acquire the knowledge about various metal joining processes. 3. To acquire the knowledge about various hot and cold working processes. 4. To acquire the knowledge about various sheet metal forming processes. 5. To acquire the knowledge about various plastic processing.
Outcome	The students would understand the basic working principle of joining and cutting operations and can perform casting and welding process.

UNIT– I METAL CASTING PROCESSES 9

Sand casting – Sand moulds — Types of Moulding sand – Properties – – Methods of Sand testing - Type of patterns – Pattern materials– Moulding machines – Types of moulding machines - Melting furnaces – Working principle of Special casting processes – Shell and investment casting – Pressure die casting – Centrifugal casting. Casting defects and remedies- economics of casting-cost comparison on different methods.

UNIT– II FABRICATION PROCESS 9

Welding processes – Types of welding –Gas welding, Arc welding, TIG ,MIG, GMAW, Submerged arc welding-Electro slag welding–Resistance welding –seam welding – Percussion welding Weld defects and control measures– Brazing and soldering process.

UNIT – III BULK DEFORMATION PROCESSES 9

Hot working and cold working of metals – Forging processes – Open and close die forging – Types of Forging Machines – Typical forging operations- economics of forging.
Rolling of metals – Types and operations, Extrusion – types and operations. Wire drawing &Tube piercing

UNIT – IV SHEET METAL FORMING PROCESSES 9

Sheet metal characteristics – Typical shearing operations- bending and drawing operations – Stretch forming operations – Formability of sheet metal – Test methods – Working principle and application of special forming processes - Hydro forming – Rubber pad forming – Metal spinning – Explosive forming – Magnetic pulse forming – Peen forming – Super plastic forming – Process characteristics

UNIT – V PROCESSING OF PLASTICS 9

Types of plastics - Characteristics of the forming and shaping processes – Moulding of Thermoplastics –Injection moulding-principle and applications – Blow moulding – Rotational moulding;
Thermoforming – Processing of Thermosets - Compression moulding – Transfer moulding – Bonding of Thermoplastics – Fusion and solvent methods – Induction and Ultrasonic methods.

TOTAL HOURS :45 PERIODS

TEXT BOOKS

1. Hajra Choudhury- Elements of Workshop Technology- Vol. I and II- Media Promoters Pvt Ltd.- Mumbai- 2001
2. Serope Kalpajian- Steven R.Schmid- Manufacturing Engineering and Technology- Pearson Education- Inc. 2002(Second Indian Reprint).

REFERENCES

1. Elements of Manufacturing Processes- B.S. Magendran Parashar & R.K. Mittal- Prentice Hall of India- 2003.
2. Manufacturing Technology- P.N. Rao- Tata McGraw-Hill Publishing Limited- II Edition- 2002.
3. A text book of production technology- P.C. Sharma- S. Chand and Company- IV Edition- 2003.

SEMESTER	SUBJECT	L	T	P	C
III	**FLUID MECHANICS AND MACHINERY**(Common to MECH, MECT, AUTO & AERO)	3	0	0	3

Aim	The aim of the subject is to provide a fundamental knowledge in fluid mechanics and machinery.
Objective	1. To learn the fundamentals in Fluid Mechanics 2. To understand the kinematics of the fluid flow. 3. To understand the fluid flow concepts 4. To learn the working principle, applications & design of various hydraulic turbines 5. To learn the working principle, applications &, design of various hydraulic pumps.
Outcome	The students would be able to understand the basic fluid properties and could understand the working principle of pumps.

UNIT –I - BASIC CONCEPTS AND PROPERTIES 9

Fluid – Definition - solid and fluid - Units and dimensions - Properties of fluids – Temperature - Viscosity - Compressibility - Vapour pressure - Capillary and surface tension - Fluid statics: concept of fluid static pressure - Pressure measurements by manometers and pressure gauges. Introduction to CFD, geophysical fluid dynamics. Velocity and density measurement methods.

UNIT –II - FLUID KINEMATICS AND SIMILARITIES 9

Fluid Kinematics - Flow visualization - Lines of flow - Types of flow - Velocity field and acceleration - Continuity equation (one and three dimensional differential forms)- Equation of streamline - Stream function - Velocity potential function - Circulation - Flow net – Fluid dynamics - Equations of motion - Euler's equation along a streamline - Bernoulli's equation – Applications - Venturi meter - Orifice meter - Pitot tube - Dimensional analysis - Buckingham's π theorem- Applications - Similarity laws and models.

UNIT –III - INCOMPRESSIBLE FLUID FLOW 9

Viscous flow - Navier-Stoke's equation - Shear stress - Pressure gradient relationship - Laminar flow between parallel plates - Laminar flow through circular tubes (Hagen poiseulle's) - Hydraulic and energy gradient - Flow through pipes - Darcy - Weisbagh's equation - Pipe roughness -Friction factor- Moody's diagram - Minor losses - Flow through pipes in series and in parallel - Power transmission - Boundary layer flows - Boundary layer thickness - Boundary layer separation - Drag and lift coefficients. Major losses-design aspect in application of drags and lift coefficients. Piping Engineering-Introduction and Applications.

UNIT –IV - HYDRAULIC TURBINES 9

Fluid machines: definition and classification - Exchange of energy - Euler's equation for turbo machines - 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. Energy saving design requirements for turbine.

UNIT –V - HYDRAULIC PUMPS 9

Pumps: definition and classifications - Centrifugal pump: classifications - Working principle- velocity triangles - Specific speed - Efficiency and performance curves - Reciprocating pump:

classification - Working principle - Indicator diagram -Work saved by air vessels and performance curves - Cavitations in pumps - Rotary pumps- Applications.

TOTAL HOURS : 45 PERIODS

TEXT BOOKS

1. Bansal- R.K. - "Fluid Mechanics and Hydraulics Machines"- (5^{th} edition) - Laxmi publications (P) Ltd- New Delhi- 2005.
2. Modi.P.N. & Seth.S.M., a Textbook on Fluid Mechanics, Standard Publishers Ltd.

REFERENCES

1. White- F.M. - "Fluid Mechanics"- Tata McGraw-Hill- 5^{th} Edition- New Delhi- 2003.
2. Ramamurtham. S- "Fluid Mechanics and Hydraulics & Fluid Machines"-Dhanpat Rai & Sons, Delhi- 2003.

SEMESTER	SUBJECT	L	T	P	C
III	ELECTRICAL MACHINES AND DRIVES	3	0	0	3

Aim	The aim of the subject is to provide basic knowledge in electrical machines and drives.
Objective	• To study the basic concept of D.C. and A.C. circuits and to learn the concept of transformers and do simple problems. • To study the performance characteristics of D.C. motors, three phase induction motor and single phase induction motor. • To study the methods of speed control of D.C. and A.C. motors and methods of starting of D.C. and A.C. motors. • To study the basics of selection of drive for a given application. • To study the concept of controlling the speed of D.C. and A.C. motors using solid state devices.
Outcome	The students would be able to understand the working principle of various drives.

UNIT I CIRCUITS AND TRANSFORMERS 6

D.C. Voltage, current, power – Ohms law – series, parallel circuits – Kirchoff's laws – mesh analysis – A.C. voltage – sinusoidal waves, Phasor representation – power factor – complex power – basic idea of transformers – simple problems.

UNIT II ELECTRICAL MOTORS 12

Constructional details, principle of operation and performance characteristics of D.C. motors, single phase induction motor, three phase induction motor, synchronous motors, universal motors, stepper motors and reluctance motor.

UNIT III SPEED CONTROL AND STRATING **9**

Speed control of D.C. motors – three phase induction motors – starting methods of D.C. motor and three phase induction motor – electrical braking – simple problems.

UNIT IV ELECTRICAL DRIVES **9**

Type of Electrical Drives – Selection & factors influencing the selection – heating and cooling curves – loading condition and classes of duty – determination of power rating – simple problems.

UNIT V SOLID STATE DRIVES(QUALITATIVE TREATMENT ONLY) **9**

Advantages of solid state drives – D.C. motor control using rectifiers and choppers – control of induction motor by V, V/f and slip power recovery scheme using inverters and A.C. power regulators.

TOTAL: 45 PERIODS

TEXT BOOK

1. I.J.Nagrath, T.P. Kothari., "Basic Engineering", McGraw – Hill Publishing company Ltd., Second edition, 2002.
2.G.K. Dubey "Fundamental Electrical Drives" second edition 2002, Narosa Publications, Second edition, 2002.

REFERENCES

1. S.K. Bhattacharya "Electrical Machines", second edition 1999, Tata McGraw – Hill Pvt. Company Ltd., Second edition, 1999.
2. N.K.De.,P.K.Sen "Electric Drives", Prentice Hall, First edition 1999.
3. Pillai, S.K., " A First course on Electrical Drives", Wiley Eastern Ltd., New Delhi, 1982.

SEMESTER	SUBJECT	L	T	P	C
III	KINEMATICS OF MACHINERY (Common to MECH & MECHAT)	3	1	0	4

Aim	The aim of the subject is to provide a fundamental knowledge in kinematics of machines
Objective	1. To learn the basic mechanisms of kinematics. 2. To learn to calculate the velocity and acceleration of links using graphical and vectorial approach. 3. To study about Cams and to draw their profiles. 4. To learn about Gear terminology and types of gear trains 5. To study about effect of friction in Transmission devices
Outcome	The students would understand the basic link mechanisms and would draw cam profiles

UNIT –I -BASICS OF MECHANISMS **9**

Terminology and Definitions-Degree of Freedom -Mobility-Kutzbach criterion-Grashoff's law-Kinematic Inversions of 4-bar chain and slider crank chains-Mechanical Advantage-Transmission angle-Description of common Mechanisms-Single - Double and offset slider mechanisms - Quick return mechanisms - Ratchets and escapements - Indexing Mechanisms - Rocking Mechanisms - Straight line generators - Design of Crank-rocker Mechanisms.

UNIT –II -KINEMATICS OF LINKS **9**

Displacement- velocity and acceleration - analysis in simple mechanisms - Graphical Method-velocity and acceleration polygons - Vector Approach- Computer applications in the kinematic analysis of simple mechanisms-Coincident points- Coriolis Acceleration.

UNIT –III -KINEMATICS OF CAM **9**

Classifications - Displacement diagrams-parabolic- Simple harmonic and Cycloidal motions - Layout of plate cam profiles - Derivatives of Follower motion - High speed cams - circular arc and tangent cams - Standard cam motion - Pressure angle and undercutting.

UNIT –IV -GEARS **9**

Spur gear Terminology and definitions - Fundamental Law of toothed gearing and involute gearing-Interchangeable gears - Gear tooth action – Terminology - Interference and undercutting-Non standard gear teeth- Helical- Bevel- Worm- Rack and Pinion gears (Basics only)-Gear Trains: Simple gear trains, Compound gear trains, Epicyclic gear trains, Algebraic method & Tabular method, Problems on gear trains.

UNIT –V –FRICTION **9**

Surface contacts-Sliding and Rolling friction - Friction drives – Friction in screw threads - Friction clutches - Belt and rope drives- Friction aspects in Brakes – Friction in vehicle propulsion and braking

TOTAL HOURS: 45 PERIODS

TEXT BOOKS

1. Rattan S.S, “Theory of Machines”, Tata McGraw-Hill Publishing Company Ltd. New Delhi,2009.
2.Khurmi.R.S. - Gupta, “Theory of Machines”.S.Chand& Co., 2011

REFERENCES

1. Thomas Bevan, “Theory of Machines”, CBS Publishers and Distributors, 2005.
2. Ghosh A and A.K.Mallick, “Theory of Mechanisms and Machines”, Affiliated East-West Pvt. Ltd., New Delhi.
3 Shigley J.E and Vickes J.J, “Theory of Machines & Mechanism”, McGraw Hill, 2009.

STANDARDS

1. IS 2458: 2001- Vocabulary of Gear Terms – Definitions Related to Geometry.
2. IS 3756: 2002- Method of Gear correction – Addendum modifications for External CylindricalGears with Parallel Axes.
3. IS 5267 : 2002 Vocabulary of Gear Terms – Definitions Related to Worm Gear Geometry.
4. IS 12328 : Part 1: 1988 Bevel Gear Systems Part – 1 Straight Bevel Gears.
5. IS 12328 : Part 2: 1988 Bevel Gear Systems Part – 2 Spiral Bevel Gears.

SEMESTER	SUBJECT	L	T	P	C
III	MACHINE DRAWING LAB	1	0	3	2

Aim	The aim of the subject is to provide a fundamental knowledge in Drawing Sotwares
Objective	• To study about fits and tolerances and enable students apply them in assembly of components. • To make students assemble simple machine components, measure and create assembly drawings on A2 Sheets using Mini Drafter or using Computer Aided Drafting software.
Outcome	The students would be enable to learn the basic drafting procedures, allowances, 2D and 3D drawings.

UNIT I:LIMITS, FITS AND TOLERANCES

Limits and Tolerances - introduction, tolerances – Grades, Values and deviation. Selection of tolerance zones. Problems on computing fundamental deviations, methods of indicating tolerances on drawing.
Fits - Terminology, classification, basic systems, selection of fits, Methods of indicating fits on drawing. Geometrical Tolerances.

UNIT II: ASSEMBLY DRAWING
Preparation of assembled views of given parts details - conventional symbols and standards- couplings: flange- universal - Bearing: footstep-Plummer block-Lathe tailstock-Stop valves - etc.

UNIT III: COMPUTER AIDED DRAWING - 2-D drawing:
Orthographic Views, Isometric Views, 2-D Sectional Views, Part Drawing, Assembly Drawing, Broken views, Detailed Drawing. Dimensioning, Annotations, Symbols - Welding, Surface Finish, Threads. Text, Bill of Materials, Title Block. Exercises - Knuckle Joint, Gib and Cotter Joint, Screw Jack, Foot Step Bearing.

Some Machine components of Interest are:

1. Lathe Chuck
2. Gear Reducer
3. Gear Pump
4. Steam Stop Valve
5. Centrifugal pump assembly
6. I.C.Engine Cylinder - Piston- Connection rod and Crankshaft assembly
7. Automobile Gear Box
8. Clutch Assembly

TOTAL HOURS: 45

Note: The end semester examination will be conducted by using mini-drafter or by using CAD software.

TEXT BOOKS

1.Bhatt-N.D.-"Machine Drawing"-Published by R.C.Patel-Chartstar Book Stall- Anand- India- 2003.
2. P.S.G. Design Data Book.

REFERENCES

1. Sidheswar- N. - Kanniah- P. and Sastry- V.V.S. -“Machine Drawing ". TMH.

SEMESTER	SUBJECT	L	T	P	C
III	FLUID MECHANICS AND MACHINERY LAB	0	0	4	2

Aim	The aim of the subject is to provide make the students to understand the basic mechanism in hydraulics.
Scope	To understand the concepts of fluid mechanics and performances of various pumps .
Outcome	The students can perform operations in hydraulic machineries and test various pumps.

LIST OF EXPERIMENTS:

1. Determination of the Coefficient of discharge of Orifice meter.
2. Determination of the Coefficient of discharge of Venturimeter.
3. Calculation of the rate of flow using Roto meter.
4. Determination of coefficient of friction for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump / submersible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

SEMESTER	SUBJECT	L	T	P	C
IV	NUMERICAL METHODS (COMMON TO MECH,AERO,AUTO,MECT, CIVIL & EEE)	3	1	0	4

Aim	The aim of the subject is to provide knowledge in various methods and techniques to solve the problems.
Objective	5. To study about various methods to solve eigen value problems. 6. To learn interpolation and approximation techniques. 7. To study the conceptsof numerical differentiation and integration. 8. To study and analyze various methods for solving initial value problems. 9. To study and analyze various methods for solving boundary value problem.
Outcome	The students would be able to understand the various methods and techniques for solving different types of problems.

UNIT-1. SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 9

Method of false position, Newton-Raphson method for single variable, Solutions of a linear system by Gaussian, Gauss-Jordan, Jacobian and Gauss- Seidel methods. Inverse of a matrix by Gauss-Jordan method. Eigen value of a matrix by Power Method.

UNIT-2. INTERPOLATION AND APPROXIMATION 9

Interpolation with Newton's divided differences, Lagrange's polynomial, Newton forward and backward differences, central difference Formula (Stirling's and Bessel's).

UNIT-3. NUMERICAL DIFFERENTIATION AND INTEGRATION 9

Numerical differentiation with interpolation polynomials, Numerical integration by Trapezoidal and Simpson's (both $1/3^{rd}$ and $3/8^{th}$) rules. Rombergs rule, two and three point Gaussian quadrature formula. Double integrals using Trapezoidal and Simpson's rule.

UNIT-4. INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS9

Single Step Methods - Taylor Series, Euler and Modified Euler, Runge-Kutta method of fourth order first and second order differential equations. Multistep Methods - Milne and Adam's-Bash forth predictor and corrector methods.

UNIT-5. BOUNDARY VALUE PROBLEMS FOR ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9

Finite difference solution for the second order ordinary differential equations, Finite difference solution for one dimensional heat equation (both implicit and explicit). One dimensional wave equation and two dimensional Laplace and Poisson equations.

Tutorial: 15

Total hours: 60

TEXT BOOK

1. A. Singaravelu,"Numerical Methods", Meenakshi Agency, Chennai

REFERENCES

1. Sastry, S.S., "Introductory Methods of Numerical Analysis (Third Edition) ", Printice Hall of India, New Delhi, 1998.
2. T.Veerarajan, T.Ramachandran, "Numerical Methods with Programs in C and C++", Tata McGraw-Hill (2004).
3. Grewal, B.S. and Grewal, J.S., Numerical Methods in Engineering and Science Khanna Publishers, New Delhi, 1999.
4. N.Subramanian, Numerical Methods, SCM Publishers, Erode.

SEMESTER	SUBJECT	L	T	P	C
IV	DYNAMICS OF MACHINERY (Common to MECH & MECHAT)	3	1	0	4

Aim	The aim of the subject is to provide knowledge in various mechanisms, vibrations and balancing of masses
Objective	10. To study about forces acting on various parts of mechanisms. 11. To learn static and dynamic balancing of masses. 12. To study the characteristics of free and forced vibrations. 13. To study and analyze various types of Governors and effect of gyroscopic forces. 14. To learn about Cam Dynamics - velocity and displacement and acceleration.
Outcome	The students would be able to understand the operations of governors, cam dynamics and vibrations.

UNIT 1 Force Analysis **9**

Relation between members disregarding friction. Analysis of engine mechanism, four-bar mechanism and mechanisms having more than four links. Rigid Body dynamics in general plane motion – Equations of motion - Dynamic force analysis - Inertia force and Inertia torque – D'Alemberts principle - The principle of superposition - Dynamic Analysis in Reciprocating Engines – Gas Forces - Equivalent masses - Bearing loads - Crank shaft Torque - Turning moment diagrams - Fly wheels –Engine shaking Forces

UNIT –II BALANCING **9**

Static and dynamic balancing - Balancing of rotating masses - Balancing a single cylinder Engine - Balancing Multi-cylinder Engines - Partial balancing in locomotive Engines - Balancing linkages - balancing machines.

UNIT -III FREE VIBRATIONS **9**

Basic features of vibratory systems - idealized models - Basic elements and lumping of parameters - Degrees of freedom - Single degree of freedom - Free vibration - Equations of motion - natural frequency - Types of Damping - Damped vibration- critical speeds of simple shaft - Torsional vibration - Natural frequency of two and three rotor systems.

UNIT –IV FORCED VIBRATIONS **9**

Response to periodic forcing – Harmonic Forcing - Forcing caused by unbalance - Support motion – Force transmissibility and amplitude transmissibility. - Vibration isolation.

UNIT – V MECHANISMS FOR CONTROL **9**

Governors; Force analysis of Porter, Proel and spring controlled governors.Controlling force, stability, sensitiveness, effort and power of governors. Characteristics - Effect of friction.

Gyroscopic Forces: Gyroscopic couple, Effect of Gyroscopic couple on vehicle; Applicatons of Gyroscopic forces. - Ships and airplanes

TUTORIAL :15
TOTAL HOURS :60

TEXT BOOKS

1. Rattan S.S, “Theory of Machines”, Tata McGraw-Hill Publishing Company Ltd. New Delhi, 2009.
2.Khurmi.R.S. - Gupta, “Theory of Machines”.S.Chand & Co., 2011

REFERENCES

1. Thomas Bevan, “Theory of Machines”, CBS Publishers and Distributors, 2005.
2. Ghosh A and A.K.Mallick, “Theory of Mechanisms and Machines”, Affiliated East-West Pvt. Ltd., New Delhi.
3 Shigley J.E and Vickes J.J, “Theory of Machines & Mechanism”, McGraw Hill, 2009.

SEMESTER	SUBJECT	L	T	P	C
IV	MANUFACTURING TECHNOLOGY II	3	0	0	3

Aim	The aim of the subject is to provide knowledge in cutting process of manufacturing sector.
Objective	1. To understand the metal cutting processes. 2. To understand the types, construction and operations of lathes. 3. To gain the knowledge of different operations on special machines 4. To understand the types and operations of sawing, broaching and gear cutting machines. 5. To learn the various machining processes that uses abrasives.
Outcome	The students would be able to operate lathe machines and special machines perform operations.

UNIT – I THEORY OF METAL CUTTING 8

Introduction: metal cutting methods - mechanics of metal machining –chip formation – types of chips-chip breaker- Merchant Circle Diagram-cutting force calculation- Single point cutting tool nomenclature-Cutting tool materials –Tool wear - Tool life - cutting fluids.

UNIT – II CENTRE LATHE AND SPECIAL PURPOSE LATHES 10

Centre lathe- constructional features and various operations- taper turning methods- thread cutting methods- special attachments- machining time and power estimation.
Capstan and turret lathes - automats – Swiss type–automatic screw type.

UNIT – III SHAPER, PLANNER, MILLING AND DRILLING MACHINES 9

Shaper– planer– slotting Machines – quick return mechanism – Milling Machines–milling cutters–operations; Drilling- reaming– boring– tapping.

UNIT – IV SAWING - BROACHING AND GEAR CUTTING 9

Sawing machine: hack saw- band saw- circular saw; broaching machines –types-working principle-nomenclature.Gear Generation: forming- shaping- hobbing.

UNIT – V ABRASIVE PROCESSES 9

Abrasive processes: grinding wheel – specifications and selection- types of grinding machines.
Honing- lapping- super finishing- polishing and buffing.

TOTAL HOURS :45

TEXT BOOKS

1. Serope Kalpajian- Steven R.Schmid- Manufacturing Engineering and Technology- Pearson Education- Inc. 2002 (Second Indian Reprint).
2. Rao- P.N. "Manufacturing Technology"- Metal Cutting and Machine Tools- TMH- 2003.
3. Hajra Choudhury- Elements of Workshop Technology- Vol. I and II- Media Promoters Pvt Ltd.- Mumbai- 2001

REFERENCES

1. Richerd R. Kibbe- John E. Neely- Roland O. Merges and Warren J. White- "Machine Tool Practices"- Prentice Hall of India- 2003.
2. P.C. Sharma- "A Text Book of Production Engineering"- S. Chand and Co. Ltd- IV edition, 2002.
3. Hajra Choudry, "Elements of Work Shop Technology – Vol. II"- Media Promoters. 2002.

SEMESTER	SUBJECT	L	T	P	C
IV	PHYSICAL METALLURGY	3	0	0	3

Aim	The aim of the subject is to provide basic knowledge in materials behavior and metallurgy.
Objective	1. To understand the classification, properties and application of various engineering materials. 2. To learn the heat treatment methodologies and mechanical treatment methodologies. 3. To understand the various deformation mechanisms, failure modes and phase diagram. 4. To understand the various forms of corrosion, protection methods. 5. To understand the basic concepts in powder metallurgy, composite materials and working of SEM.
Outcome	The students would be able to understand the behavior of materials, their heat and mechanical treatment.

UNIT I BEHAVIOR OF MATERIALS **9**

Introduction to plastic deformation - Slip and twinning – Types of fracture-brittle, ductile, creep & fatigue. Phase diagrams- Iron – Iron carbide equilibrium diagram-TTT & CCT curve

UNIT II MATERIAL TREATMENT **9**

Heat treatment- annealing, Normalizing- hardening and Tempering, Case hardening, Hardenability - Jominy end quench test

Mechanical Treatment-strengthening mechanisms-strain hardening, solid solution hardening, grain size reduction

UNIT III METALLIC & NON-METALLIC MATERIALS **9**

Classification-Metallic Materials-Ferrous-steel, types, effects of alloying elements in steel, cast iron-types; Non-Ferrous-aluminium, copper and alloys. Non-Metallic Materials-polymers, ceramics; Properties and applications.

UNIT IV CORROSION **9**

Introduction-forms of corrosion-pitting, intergranular, stress corrosion, corrosion fatigue, dezincification, erosion-corrosion, Crevice Corrosion, Fretting-Protection methods-PVD, CVD.

UNIT V ADVANCED MATERIALS & CHARACTERIZATION **9**

Powder metallurgy -Manufacturing-compaction-sintering-applications

Composites-MMC, PMC, CMC-properties & applications

SEM-working principle, set-up, sample preparation method-evaluation mode-EDAX

TOTAL HOURS :45

TEXT BOOKS

1. William D Callister “Material Science and Engineering”, John Wiley and Sons 2005.
2. Sydney H.Avner “Introduction to Physical Metallurgy” McGraw Hill Book Company.

REFERENCE BOOKS

1. Kenneth G.Budinski and Michael K.Budinski “Engineering Materials” Prentice-Hall of India Private Limited- 4th Indian Reprint 2002.
2. George E.Dieter, “Mechanical Metallurgy”

SEMESTER	SUBJECT	L	T	P	C
IV	**STRENGTH OF MATERIALS**(Common To MECH,MECT, AERO&AUTO)	3	1	0	4

Aim	The aim of the subject is to provide a fundamental knowledge in strength of materials
Objective	1. To understand basic mechanical forces acting on rigid and deformable bodies. 2. To learn to draw shear force and bending moment diagram for various types of beams. 3. To learn the torsional effects on circular bars, shafts, helical spring. 4. To learn the deflection equations of beams and columns for different end conditions. 5. To learn the two dimensional stresses and deformation of cylinders and spherical shells.
Outcome	The students would understand the basic properties of materials and their testing methodologies.

UNIT –I -STRESS- STRAIN AND DEFORMATION OF SOLIDS 9

Properties of material, Concept of Stress and Strain, Hook's Law, Stress Strain Diagram for structural steel and Non-ferrous materials. Poisson's Ratio & principles of superposition, Total elongation of tapering bars of circular and rectangular cross-sections. Elongation due to self-weight, volumetric strain. Expression for Volumetric strain, Elastic constants, relationship among elastic constants, compound bars Rigid and Deformable bodies – Strength- Stiffness and Stability – Stresses; Tensile- Compressive and Shear – Elastic constants – Strain energy and unit strain energy – Strain energy in uniaxial loads.

UNIT –II -BEAMS - LOADS AND STRESSES 9

Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever- Simply supported and Overhanging beams – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Shear stresses in beams.

UNIT –III –TORSION 9

Analysis of torsion of circular bars – Shear stress distribution – Bars of Solid and hollow circular section – Stepped shaft – Twist and torsion stiffness – Compound shafts – Fixed and simply supported shafts – Application to close-coiled helical springs – Maximum shear stress in spring section including Wahl Factor – Deflection of helical coil springs under axial loads – Design of helical coil springs.

UNIT –IV -DEFLECTION OF BEAMS 9

Elastic curve of Neutral axis of the beam under normal loads – Evaluation of beam deflection and slope: Double integration method- Macaulay Method- and Moment-area Method –Columns – End conditions – Equivalent length of a column – Euler equation – Slenderness ratio – Rankine formula for columns – Introduction to curved beams.

UNIT –V -ANALYSIS OF STRESSES IN TWO DIMENSIONS 9

Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point – Stresses on inclined plane – Principal planes and

stresses – Mohr's circle for biaxial stresses – Maximum shear stress - Strain energy in bending and torsion.

TUTORIAL : 15
TOTAL HOURS : 60

TEXT BOOKS

1. Ramamrutham.S- Strength of Materials- S.Chand &B Co. - New Delhi-2007.
2. Beer F. P. and Johnston R- "Mechanics of Materials"- McGraw-Hill Book Co- Third Edition- 2008.

REFERENCES

1.Nash W.A- "Theory and problems in Strength of Materials"- Schaum Outline Series-, McGraw-Hill Book Co- New York- 2005
2. Ryder G.H- "Strength of Materials"- Macmillan India Ltd.- Third Edition- 2007
3. Ray Hulse- Keith Sherwin & Jack Cain- "Solid Mechanics"- Palgrave ANE Books- 2006.
4. Singh D.K "Mechanics of Solids" Pearson Education 2009.

SEMESTER	SUBJECT	L	T	P	C
IV	COMPUTER AIDED DESIGN AND COMPUTER AIDED MANUFACTURING	3	0	0	3

Aim	The aim of the subject is to provide knowledge in computer aided design and computer aided manufacturing.
Objective	1. To understand the importance of CAD/CAM, basic computer graphics and modelling techniques. **2.** To learn about the basics of CNC machines 3. To gain knowledge about CNC programming techniques.
Outcome	The students would be able to understand the various concepts viz. basics of CAD/CAM, computer graphics and fundamentals of CNC machines and their programming.

UNIT 1 INTRODUCTION TO CAD/CAM 9

The design process Morphology of design, Product cycle Computer Aided Design, Benefits of CAD. Role of computers - principles of computer graphics - Current trends in manufacturing engineering - - Design for Manufacturing and Assembly - Sequential and concurrent engineering,- Rapid prototyping

UNIT 2 INTERACTIVE COMPUTER GRAPHICS 9

Analytic curves and surfaces, Hidden line elimination ,2D and 3D homogenous transformations-translation, rotation, reflection, scaling, shearing and combined transformation .3D viewing transformation – panning, rotation, reflection, shearing and zooming.

UNIT 3 SOLID MODELING 9

Graphic software: coordinate representation- graphic functions, software standards. Graphical Kernel system (GKS) - Initial graphics exchange system (IGES) -Graphic packages. Geometric Modeling - Wire frame, Surface and Solid models - Constructive Solid Geometry (CSG) and Boundary Representation (B-REP) Techniques - Features of Solid Modeling Packages.

UNIT 4 FUNDAMENTALS OF CNC MACHINES 9

CNC Technology - Functions of CNC Control in Machine Tools - Classification of CNC systems - Contouring System - Interpolators, open loop and closed loop CNC systems - CNC Controllers, Direct Numerical Control (DNC Systems). - Work holding devices and tool holding devices - Automatic Tool changers. Feedback devices - Principles of Operation-Machining Centres - Tooling for CNC machines

UNIT 5 PART PROGRAMMING FOR CNC MACHINES 9

Numerical control codes - Standards - Manual Programming - Canned cycles and subroutines - Computer Assisted Programming, CAD / CAM approach to NC part programming - APT language, machining from 3D models.

TOTAL HOURS :45

TEXT BOOKS:

1. Ibrahim Zeid "CAD/Cam Theory and Practice", TMH, 2002.
2. Chris McMohan and Jimmi Browne, "CAD/CAM Principles, Practice and Manufacturing Management", Pearson Education Asia, Ltd., 2000.

REFERENCE BOOKS

1. Donald Hearn and Pauline Baker M. "Computer Graphics", Prentice Hall, Inc., 2009.
2. Khandare S.S., "Computer Aided Design", Charotar Publishing House, India, 2001.
3. Newman, William M., & Sproull, Robert F., "Principles of Interactive Computer Graphics", 2nd Ed., McGraw Hill.
4. Foley, J.D. & Van dam, A., "Fundamentals of Interactive Computer Graphics", Addison – Wesley, 1982.

SEMESTER	SUBJECT	L	T	P	C
IV	COMPUTER AIDED DESIGN LAB	0	0	4	2

Aim	The aim of the subject is to provide a fundamental knowledge in Drawing Sotwares and 3D Modelling techniques.
Objective	• To study about the various solid modeling techniques. • To make students assemble simple machine components, measure and create assembly drawings using Computer Aided Drafting software.
Outcome	The students would be enable to learn the basic drafting procedures, allowances, 2D and 3D modeling techniques and assembly of parts.

Objective:
To learn the methodologies to use the Mechanical Design softwares to build parametric models of parts and make assembly drawings of those parts.

3D MODELING

Isometric Drawing's of simple blocks by using solid commands- Extrusion – revolve- Modify commands- extrude, extrude cut, revolve cut, hole wizard, fillet, chamfer, mirror, rib, sweep, draft, Pattern, Shell etc- View commands – render- wire frame- Shade- View ports- Generating Orthographic view from Isometric View.

Part modeling- Suggested Exercises Plummer block,Cotter with Sleeve joint, Knuckle joint, – - Screw jack- Lathe Tailstock –Connecting rod -Piston and crank shaft- Multi plate clutch-Machine Vice- safety Valves - Non-return valves-etc.

Introduction to SURFACE MODELLING
Creation of plane, spline, Ruled, Tabulated, Bezier, Revolved surfaces.
Editing of surfaces-converting into solid models
Suggested exercises :Models- Pipe Elbow, Tee joint-Hat-Springs-aircraft wings

DRAWINGS AND DETAILING
Preparing and printing- Drawing sheets and views, Dimensions, Annotations, Bill of materials and Tables.

Assembly of Parts

Assembly of previously Modeled components

Note:
Use of standard CAD application packages is recommended from the point of view of requirement by industries. Students may be encouraged to work with any open source software like "CollabCAD Software", developed by:National Informatics Centre (CAD Group), Govt. of India, A-Block, C.G.O. Complex, Lodhi Road, NewDelhi 110003, 2003" www.collabcad.com

SEMESTER	SUBJECT	L	T	P	C
IV	STRENGTH OF MATERIALS LAB	0	0	4	2

Aim	The aim of the subject is to provide make the students to understand the basic mechanism in strength of materials.
Objective	To get hands on experience to conduct testing of materials.
Outcome	The students can performance test on various materials.

List of Experiments:

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs

SEMESTER	SUBJECT	L	T	P	C
IV	a. MANUFACTURING TECHNOLOGY LAB – I b. METALLURGY LAB	0	0	4	2

A. MANUFACTURING TECHNOLOGY LAB – I

Aim	The aim of the subject is to provide make the students to understand the basic operations of lathe machine and drilling machine
Objective	To practice the various operations in lathe and drilling machine
Outcome	The students can perform operations in lathe and drilling machine.

LIST OF EXPERIMENTS

1. Exercise on plain turning and facing of given cylindrical MS specimen.
2. Exercise on step turning and chamfering.
3. Exercise on taper turning of given specification on a cylindrical specimen.
4. Manufacture of external or internal threads of given specification on a cylindrical Specimen.
5. Exercise on step turning with knurling of given specification on a cylindrical specimen
6. Exercise on drilling, boring and reaming on the given MS plate.
7. Exercise on eccentric turning in lathe on a given specimen.
8. Exercise on drilling with internal thread on a given specimen.

TOTAL : 30

B.METALLURGY LAB

Aim	The aim of the subject is to provide basic knowledge in physical metallurgy - metallography
Objective	1. To get a basic understanding of microstructures of specimens of different materials 2. To understand the process of heat treatment.
Outcome	The students would be able to understand the characteristics, applications of various metals and also about the heat treatment processes.

LIST OF EXPERIMENTS

1. Introduction to Metallography
2. Preparation of Metallographic specimen
3. Identification of Ferrous specimens (minimum 4)
4. Identification of Non-Ferrous specimens (minimum 2)
5. Heat treatment – Annealing- comparison between annealed and un heat treated specimen
6. Heat treatment – Normalizing- comparison between normalized and un heat treated specimen
7. Heat treatment – Hardening- comparison between hardened and un heat treated specimen
8. Heat treatment -Tempering- comparison between hardened and un heat treated specimen (For heat treatment experiments low carbon steel could be used)

SEMESTER	SUBJECT	L	T	P	C
V	DESIGN OF MACHINE ELEMENTS	3	1	0	4

(Use of approved Design Data Book is permitted in the University examination)

Aim	The aim of the subject is to provide basic knowledge in designing various machine elements.
Objective	1. To understand basic design procedures, steady and variable stresses, failure Theories. 2. To study the design concepts of shafts and couplings. 3. To study the design parameters of fasteners and welded joints. 4. To learn the design parameters of different types of springs and levers. 5. To understand the design concepts of bearings and flywheel.
Outcome	The students would be able to design any machine elements with standard procedures and formulae.

UNIT 1:STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 9

Introduction to the design process - factor influencing machine design- Direct- Bending and torsional stress equations – Impact and shock loading – Calculation of principal stresses for various load combinations- eccentric loading – Design of curved beams – crane hook and 'C' frame - Factor of safety - theories of failure – stress concentration – design for variable loading – Soderberg- Goodman and Gerber relations

UNIT 2:DESIGN OF SHAFTS AND COUPLINGS 9

Design of solid and hollow shafts based on strength- rigidity and critical speed – Design of rigid and flexible couplings **–** design of knuckle joints.

UNIT 3:DESIGN OF FASTENERS AND WELDED JOINTS 9

Threaded fasteners - Design of bolted joints including eccentric loading – Design of welded Joints for pressure vessels and structures - Theory of bolted joints.

UNIT 4 :DESIGN OF SPRINGS AND LEVERS 9

Design of helical- leaf- disc and torsional springs under constant loads and varying loads – Concentric torsion springs - Belleville springs – Design of Levers.

UNIT 5: DESIGN OF BEARINGS AND FLYWHEELS 9

Design of bearings – sliding contact and rolling contact types– Design of journal bearings calculation of bearing dimensions – Design of flywheels involving stresses in rim and arm.

TUTORIAL :15
TOTAL HOURS :60

TEXT BOOKS

1. Shigley, Mischke, Mechanical Engineering Design, Tata Mc Graw Hill.
2. Bhandari V.B, "Design of Machine Elements", Tata McGraw-Hill Book Co,2003.

REFERENCES

1. Juvinall R.C- and Marshek K.M- "Fundamentals of Machine Component Design"- John Wiley & Sons- Third Edition- 2002.
2. Norton R.L- "Design of Machinery"- Tata McGraw-Hill Book Co- 2004.
3. Orthwein W- "Machine Component Design"- Jaico Publishing Co- 2003.
4. Spotts M.F.- Shoup T.E "Design and Machine Elements" Pearson Education- 2004.
5. Md.Jalaludeen- Machine Design- Anuradha Publicatiions,Chennai.

SEMESTER	SUBJECT	L	T	P	C
V	THERMAL ENGINEERING	3	1	0	4

Aim	To integrate the basic laws of thermodynamics into thermal systems towards applications.
Objective	1. To provide thorough knowledge on internal combustion engines. 2. To inculcate advanced topics of internal combustion engines. 3. To understand the function and applications of air compressors and steam turbines. 4. To provide an in-depth knowledge of refrigeration systems functioning and applications. 5. To provide details of air conditioning methodologies available for domestic and industrial applications.
Outcome	The students would be able to understand the working principle of IC Engines, refrigeration systems.

UNIT –I INTERNAL COMBUSTION ENGINES 9

Review of construction and working of two stroke and four stroke engines.SI engines – fuel systems – simple carburetor, various compensation arrangements, Simple calculations involved in carburetors, Ignition systems and combustion, Detonation – Factors and remedies, types of combustion chambers. CI Engines – Fuel injection systems, Fuel pump, Combustion, knocking - Factors and remedies, types of combustion chambers. Rating of fuels, cooling and lubrication of IC engines.

UNIT –II -I C ENGINES ADVANCED TOPICS AND PERFORMANCE 9

Supercharging, Turbo charging of IC engines and their effects on various parameters, Stratified charge engines, Multipoint and electronic fuel injection systems, measurement of power- brake indicated, Fuel consumption, Air consumption, Heat carried away by exhaust gases. Performance test – Heat balance test 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 –III AIR COMPRESSORS and STEAM NOZZLES & TURBINES 9

AIR COMPRESSORS– Types – Rotary and reciprocating Compressors, Construction and working, performance calculations and simple problems. Industrial Applications.

STEAM NOZZLES &TURBINES: Steam Nozzles – Types, Steady Flow Calculations **–** simple problems and applications. Steam Turbines – Function, Types, Performance Calculations – Impulse and Reaction turbine – Simple Problems.

UNIT –IV REFRIGERATION 9

Reverse Carnot cycle, Bell-Coleman cycle, aircraft refrigeration cycles, Vapour compression refrigeration cycle – components – working, p-h and T-s diagrams, calculation of COP, effect of sub cooling and superheating, ideal and actual cycle, properties of refrigerants.Vapour absorption refrigeration cycles – COP, heat pumps and heat transformers. Problems.

Cryogenic engineering – Introduction, Application and liquefaction of gases.

UNIT –V AIR-CONDITIONING **9**

Introduction to Psychometrics – Psychrometric chart – Psychometric process – summer and winter air- conditioning, cooling load calculations, SHF, RSHF, GSHF, EHSF components used in air conditioners – Types of air-conditioning units. Problems.

TUTORIAL HOURS :15
TOTAL HOURS :60

TEXT BOOKS

1. MATHUR and METHA, Thermal Engineering – Jain Brothers – 1998
2. HOLMAN. J.P. - "Thermodynamics"- McGraw-Hill- 1985.
3 DOMKUNDWAR, "A Course in THERMAL ENGINEERING", Dhanpat Rai & Co, 6th Edition

REFERENCES

1. Mc KONEY and EASTOP, Applied Thermodynamics – Addison Wesley, 1999.
2. GANESAN .V, Internal Combustion Engines – Tata McGraw Hill, 1995
3. Arora.C.P. - "Refrigeration and Air conditioning"- TMH- 1994.
4. GILL. SMITH and ZURYA, Fundamentals of Internal Combustion Engines – ford & IBH.
5. MANOHAR PRASAD, Refrigeration and Air-conditioning – New Age International (P) Ltd, 1995
6. RAMALINGAM, International Combustion Engines – Scitech Publications India (P) Ltd

SEMESTER	SUBJECT	L	T	P	C
V	HYDRAULICS AND PNEUMATICS	3	0	0	3

Aim	The aim of the subject is to provide knowledge about various fluid power systems
Objective	1. To study about basics of fluid power systems 2. To gain knowledge about components used in hydraulic and pneumatic systems 3. To learn various valves and actuators 4. To learn about different hydraulic circuits 5. To learn about different pneumatic circuits
Outcome	The students would be able to understand the applications of hydraulics and pneumatic systems .

UNIT –I BASICS OF FLUID POWER 9

Introduction of fluid power - Advantages of fluid power - Applications of fluid power system. A brief comparison - Electrical system – Hydraulic system – Pneumatic system. Pascal's law - Boyle's law. Types of fluid power system - Properties of hydraulic fluids - Properties of air. Hydraulic and Pneumatic symbols.

UNIT – II HYDRAULIC SYSTEMS 9

Hydraulic pumps: Pump classification – Gear pump- Vane pump - Piston pump - construction and working of pumps – Variable displacement pumps. Hydraulic actuators: Classification – Linear hydraulic actuators – Types of hydraulic cylinders – single acting - Double acting and telescopic – Cushioning mechanism. Rotary actuators - Fluid motors - Gear - Vane and Piston motors. Hydraulic valves: Classification – Pressure – Flow – Direction controls.

UNIT –III HYDRAULIC CIRCUITS 9

Hydraulic circuits – Reciprocating - Quick return – Sequencing – Synchronizing – Intensifier circuit - Accumulator circuits – Safety circuits –Milling Machine circuits - Press – Planner – Fork lift. Electro hydraulic circuits.

UNIT –IV PNEUMATIC SYSTEMS 9

Fundamentals of Pneumatics - Pneumatic control valves: Direction control valves- Basic construction of valves, Impulse valve, Flow regulators, Use of memory valve, Quick exhaust valve, Time delay valve, Shuttle valve and Solenoidoperated. Control Elements - Logic Circuits - Position - Pressure Sensing - Switching – Electro Pneumatic Circuits, hydro-pneumatic systems

Pneumatic Actuators: Linear cylinders – Types, end position cushioning, seals, mounting arrangements and applications

UNIT –V PNEUMATIC CIRCUITS 9

Design of Pneumatic circuits - Classic-Cascade-Step counter - Combination -Methods –Uses of PLC and Microprocessors - Selection criteria for Pneumatic components - Installation and Maintenance of Hydraulic and Pneumatic power packs - Faultfinding-Principles of Low Cost Automation and Applications

TOTAL HOURS : 45

TEXT BOOKS:

1. Andrew Parr- “Hydraulics and Pneumatics (HB) "- Jaico Publishing House- 2005
2. Anthony Esposito- “Fluid Power with Applications”- Pearson Education 2008

REFERENCES:

1. Dudleyt- A. Pease and John J. Pippenger- “Basic Fluid Power "- Prentice Hall- 1987.
2. Anthony Esposite- “Fluid Power with Applications "- Prentice Hall- 1980.
3. Majumdar S.R.- “Oil Hydraulics”- Tata McGraw-Hill- 2000.
4. Majumdar S.R.- “Pneumatic systems – Principles and maintenance”- Tata McGraw Hill- 1995
5. Anthony Lal- “Oil hydraulics in the service of industry”- Allied publishers- 1982.
6. Dudelyt- A. Pease and John T. Pippenger- “Basic Fluid Power”- Prentice Hall- 1987.

SEMESTER	SUBJECT	L	T	P	C
V	COMPUTER INTEGRATED MANUFACTURING	3	0	0	3

Aim	The aim of the subject is to provide knowledge in computer integrated manufacturing
Objective	4. To understand the importance of CIM and business aspects **5.** To gain knowledge about GT and CAPP **6.** To enable student to learn about FMS and SFC **7.** To understand about architecture and network concepts 8. To learn about automation protocol and database
Outcome	The students would be able to understand the various concepts viz. group technology, CAPP,FMS.

UNIT I INTRODUCTION 8

The meaning and origin of CIM- the changing manufacturing and management scene - External communication - islands of automation and software-dedicated and open systems-manufacturing automation protocol - product related activities of a company- marketing engineering - production planning - plant operations - physical distribution- business and financial management.

UNIT II GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING 10

History of group technology- role of G.T. in CAD/CAM integration - part families - classification and coding - DCLASS and MICLASS and OPITZ coding systems-facility design using G.T. - benefits of G.T. - cellular manufacturing.Process planning - role of process planning in CAD/CAM integration - approaches to computer aided process planning - variant approach and generative approaches - CAPP and CMPP process planning systems.

UNIT III SHOP FLOOR CONTROL AND INTRODUCTION OF FMS 9

Shop floor control-phases -factory data collection system -automatic identification methods- Bar code technology-automated data collection system. MS-components of FMS - types -FMS workstation -material handling and storage systems- FMS layout -computer control systems-application and benefits.

UNIT IV CIM IMPLEMENTATION AND DATA COMMUNICATION 10

CIM and company strategy - system modeling tools -IDEF models - activity cycle diagram CIM open system architecture (CIMOSA) - manufacturing enterprise wheel-CIM architecture- Product data management-CIM implementation software. Communication fundamentals- local area networks -topology -LAN implementations - network management and installations.

UNIT V OPEN SYSTEM AND DATABASE FOR CIM 8

Open systems-open system inter connection - manufacturing automations protocol and technical office protocol (MAP /TOP)Development of databases -database terminology- architecture of database systems-data modeling and data associations -relational data bases - database operators - advantages of data base and relational database.

Total Hours : 45

TEXT BOOKS

1. Mikell.P.Groover "Automation, Production Systems and Computer Integrated manufacturing", Pearson Education 2001.
2. Radhakrishnan P, Subramanyan S.and Raju V., "CAD/CAM/CIM", 2nd Edition New Age International (P) Ltd., New Delhi, 2000.

REFERENCES

1. Yorem koren, "Computer Integrated Manufacturing System", McGraw-Hill, 1983.
2. Ranky, Paul G., "Computer Integrated Manufacturing", Prentice Hall International, 1986.
3. David D.Bedworth, Mark R.Hendersan, Phillip M.Wolfe "Computer Integrated Design and Manufacturing", McGraw-Hill Inc.
4. Roger Hanman "Computer Integrated Manufacturing", Addison – Wesley, 1997.
5. Mikell.P.Groover and Emory Zimmers Jr., "CAD/CAM", Prentice Hall of India Pvt. Ltd., New Delhi-1, 1998.
6. Kant Vajpayee S, "Principles of Computer Integrated Manufacturing", Prentice Hall India, 2003.

SEMESTER	SUBJECT	L	T	P	C
V	INDUSTRIAL ENGINEERING	3	0	0	3

Aim	The aim of this subject is study the basic concepts of Industrial Engineering
Objective	1. To understand the importance of work study methods and its importance in various fields. 2. To develop the skills of selection of a plant and also material handling equipment required. 3. To learn PPC and its functions. 4. To learn the skills of purchasing materials and their management. 5. To learn the awareness on various labour acts and management principles.
Outcome	The students would be able to understand the various functions and concepts of industrial engineering.

UNIT-I WORK STUDY 9

Evolution and importance of industrial engineering –Production-Classification-Productivity-Factors influencing productivity, Work study - Definition-Procedure and benefits of work study – Method study-Charting techniques-Time study-Procedure and techniques of work measurement – Stop watch time study-Motion study –SIMO chart.

UNIT-II PLANT LAYOUT AND MATERIALS HANDLING 9

Plant location-Factors influencing the location-selection of site-Plant layout- Types of layout-Plant layout procedure- Material handling –Scope and Principles of Material Handling-Types of Material Handling equipment–Relationship to plant layout.

UNIT-III: PRODUCTION PLANNING AND CONTROL 9

Introduction-Advantages of PPC-Functions of PPC-Demand Forecasting- Types of Forecasting-Routing-Objectives and procedure of routing-Scheduling-purpose and preparation of schedules-Scheduling techniques like CPM and PERT-Functions and types of dispatching-

UNIT-IV: MATERIAL MANAGEMENT 9

Procurement of materials-codification of materials-Inventory control-Objectives of inventory control-EOQ-Inventory models-ABC analysis-Material requirements planning (MRP)-Enterprise resource planning (ERP)-supply chain Management (SCM)-Inspection and quality control-SQC-control charts-sampling procedures-Bench marking.

UNIT-V: INDUSTRIAL LEGISLATION AND MANAGEMENT CONCEPTS 9

Importance and necessity of Labour acts-principles of labour legislation-various acts-Industrial Ownership and various types-Functions of management-Manpower Planning-Recruitment and Selection-Break Even Analysis-Managerial applications of breakeven point-Decision making - Techniques of decision making.

TOTAL HOURS :45

TEXT BOOKS:

1. M.L.Khan-"Industrial Engineering"-New Age international (p) ltd. New Delhi,-2007.
2. O.P. Khanna- "Industrial Engineering. & Management", Dhanpat Rai Publications(P)Ltd

REFERENCES:

1. H.Koontz& C.O. Donnel–"Principles of management. An analysis of managerial functions"-Tata McGrawHill Co.1972.
2. GavrielSalvendy-"A Hand book of Industrial Engineering-Technology operations and Management"-3rd edition, Institute of Industrial engineers, USA.
3. Vijay Seth-"Industrial Engineering-methods and practices"-Pernam International publishing,Mumbai-2005
4. Buffa, E.S ,Sarin R.K-"Modern production/ operations Management-8thedition. John Wiley&sons, Inc. UK-1987.
5. I.L.O –"Introduction to Work Study", 3rd Revised Edn. 1986.

SEMESTER	SUBJECT	L	T	P	C
V	COMPUTER AIDED MANUFACTURING LAB	0	0	4	2

Aim	The aim of the subject is to provide basic knowledge in working of CNC machines.
Objective	1. To gain knowledge about CNC programming 2. To get the hands on training in CNC trainer machines 3. To simulate various CNC maching and generate codes using CAM software
Outcome	The students would be able to operate CNC machine using part programming.

Introduction:

1. Study of G and M codes
2. Manual Part Programming for CNC Machines using Stand G and M Code.
3. Machining practice on Trainer Type CNC Machines-
4. Simulation of tool path using any CAM Software

Part programmingin CNC Milling:

1. Point to point motions
2. Linear motions
3. Circular interpolations
4. Contour motions
5. Rectangular pocketing
6. Mirroring
7. Circular Pocketing
8. Fixed /canned cycles
9. Subroutines

Part programming for CNC Turning :

1. Turning and facing
2. Step turning, Taper Turning
3. Grooving
4. Fixed/Canned Cycles :
5. Thread cutting Cycles
6. Peek Drilling Cycles

SEMESTER	SUBJECT	L	T	P	C
V	MANUFACTURING TECHNOLOGY LAB-II	0	0	4	2

Aim	The aim of the subject is to provide knowledge in special machines.
Objective	To understand about opeating principle of various special machines.
Outcome	The students would be able to get hands on training of the operations in shaper ,grinder, milling machine, etc

LIST OF EXPERIMENTS

1. Study of different machineries of special machines lab.
2. To shape a square rod from a round bar.
3. To manufacture a V- Groove in a given specimen.
4. To manufacture a hexagonal block from a given round stock.
5. To mill plain surfaces on the given specimen.
6. To manufacture a spur gear from the given blank in a Universal Milling Machine.
7. To manufacture a groove in a given rectangular bar stock and also do letter sink on it in a vertical milling machine.
8. To manufacture a keyway on a given specimen in a vertical slotting machine.
9. To grind a machined surface to the given specification in a universal cylindrical grinder.
10. To drill holes as per given dimensions and locations on the given specimen in a radial drilling machine and tap the hole for given thread dimension.

TOTAL HOURS : 30

SEMESTER	SUBJECT	L	T	P	C
V	THERMAL ENGINEERING LAB	0	0	4	2

Aim	The aim of the subject is to provide knowledge in performance characteristics of internal combustion engine.
Objective	i).To understand about characteristics of conventional fuels ii). To learn about the valve timing diagram and port timing diagrams of four stroke and two stroke engines. iii).To know about the various tests performed on the Petrol engines, Diesel engines, Air compressor and Refrigeration unit.
Outcome	The students would be able to understand the importance of fuels and their capabilities, performance characteristics of engines, air compressor and refrigeration unit.

LIST OF EXPERIMENTS:

1. Determination of Viscosity of the given specimen oil by using Red Wood Viscometer.
2. Determination of Flash Point and Fire Point of the given fuel sample.
3. Construction of actual valve timing diagram of a four stroke engine and comparison with Theoretical valve timing diagram.
4. Construction of actual port timing diagram of a two stroke engine and comparison with Theoretical port timing diagram.
5. To conduct a performance test on a four stroke single/ twin cylinder diesel engine.
6. To conduct a heat balance test on a four stroke single / twin cylinder diesel engine.
7. To determine frictional power of a four cylinder petrol engine by conducting a Morse test.
8. To conduct a retardation test and determine frictional power in a diesel engine.
9. To conduct a load test on an air compressor.
10. To determine coefficient of performance of a refrigeration test rig.

SEMESTER	SUBJECT	L	T	P	C
VI	AUTOMOBILE ENGINEERING	3	0	0	3

Aim	The aim of the subject is to provide an overview of a complete automobile engineering.
Scope	1. To study construction and working of different engine components. 2. To study about the different auxiliary systems of an automobile. 3. To study about the transmission system of an automobile. 4. To understand the different types of steering, brakes and suspension systems of an automobile. 5. To study the various modern alternate technologies of automobiles.
Outcome	The students would be able to understand the various parts of automobiles and mechanisms.

UNIT I VEHICLE STRUCTURE AND ENGINES 9

Types of automobiles, vehicle construction and different layouts, chassis, frame and body, resistances to vehicle motion and need for a gearbox, components of engine-their forms, functions and materials

UNIT II ENGINE AUXILIARY SYSTEMS 9

Electronically controlled gasoline injection system for SI engines. Electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system ,Turbo chargers, Engine emission control by three way catalytic converter system .

UNIT III TRANSMISSION SYSYTEMS 9

Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, over drive, transfer box, fluid flywheel –torque converter, propeller shaft, slip joints, universal joints, Differential, and rear axle, Hotchkiss Drive and Torque Tube Drive.

UNIT IV STEERING, BRAKES AND SUSPENSION SYSTEMS 9

Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock. Braking System and Traction Control

UNIT V ALTERNATIVE TECHNOLOGIES 9

Use of Natural Gas, Liquefied Petroleum Gas. Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required –Performance, Combustion and Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell.

TOTAL HOURS :45

TEXT BOOKS

1. R.B. Gupta- “Automobile Engineering "- SatyaPrakashan- 1993.
2. Kirpal Singh, “ Automobile Engineering Vol 1 & 2 “, Standard Publishers, Seventh Edition, 1997, New Delhi
3. Jain, K.K., and Asthana .R.B, “Automobile Engineering” Tata McGraw Hill Publishers, New Delhi, 2002

REFERENCES:

1. William Crouse- “Automobile Engineering Series "- McGraw-Hill- 1988.
2. Newton and Steeds- “Motor Vehicles "- ELBS- 1985
3. Duffy Smith- “Auto Fuel Systems "- The Good Heat Willcox Company Inc. - 1987
4. Osamu Hirao and Richard K. Pefley- “Present and Future Automotive Fuels "- John Wiley and Sons- 1988.

SEMESTER	SUBJECT	L	T	P	C
VI	HEAT AND MASS TRANSFER	3	1	0	4

(Use of approved Design Data Book is permitted in the University examination)

Aim	The aim of the subject is to provide knowledge in heat and mass transfer
Objective	1. To study about conduction mode of heat transfer. 2. To study about transient mode of heat transfer. 3. To study about convection mode of Heat transfer 4. To study about radiation mode of heat transfer and heat exchanger 5. To study heat transfer with mass transfer
Outcome	The students would be able to understand the basic concepts in heat power systems, integration of thermodynamics in heat power systems.

UNIT –I CONDUCTION - I 9

Fourier law of conduction, General equation in Cartesian, Cylindrical and Spherical coordinates one dimensional steady state conduction across plane wall- composite wall – Composite cylinder – Composite sphere with convection boundaries, overall heat transfer coefficients, and critical thickness of insulation, conduction with generation, thermal contact resistance, and variable conductivity.

UNIT –II CONDUCTION - II 9

Fins or extended surfaces- Pin fins, annular fins, longitudinal fins.

Unsteady state conduction – lumped capacity system, semi – infinite solids and multi dimensional systems, numerical solutions of two-dimensional steady and unsteady conduction.

UNIT –III CONVECTION 9

Hydrodynamic and thermal boundary layers – Principles and governing equations, forced convection – external flow over a Flat plate, cylinder, sphere and non-circular ducts, internal flow through pipes – annular spaces and noncircular conducts. Natural convection from vertical, inclined and horizontal surfaces. Problems.

Boiling – Pool Boiling and regimes flow boiling through horizontal and vertical pipes. Condensation – Film and dropwise - derivation of the basic equations.

UNIT –IV RADIATION AND HEAT EXCHANGERS 9

Electromagnetic spectrum, black body emission, Emissive power, Laws of radiation, radiation shape factor, electrical analogy, Radiation shields, gas radiation.

Heat exchangers – types of derivation of LMTD and NTU – effectiveness equation, Fouling factor, Compact heat exchangers.

UNIT –V MASS TRANSFER AND HEAT PIPES 9

Fick's law, Equimolar diffusion, Stefan's law, mass transfer coefficient, non-dimensional number used in mass transfer, atmospheric evaporation. Problems.

Heat pipes – Introduction, Types and applications.

TUTORIAL HOURS : 15
TOTAL HOURS : 60

TEXT BOOKS

1. KOTHANDARAMAN C.P "Fundamentals of Heat and Mass Transfer" New Age International- New Delhi- 1998
2. SACHDEVA R C- "Fundamentals of Engineering Heat and Mass Transfer" New Age International- 1995

REFERENCES

1. OZISIK M.N- "Heat Transfer"- McGraw-Hill Book Co. - 1994.
2. NAG P.K- "Heat Transfer"- Tata McGraw-Hill- New Delhi- 2002
3. HOLMAN J.P "Heat and Mass Transfer" Tata McGraw-Hill- 2000.
4. INCROPRA and DEWITE, Heat Transfer – John Wiley.

SEMESTER	SUBJECT	L	T	P	C
VI	DESIGN OF TRANSMISSION SYSTEMS	3	1	0	4

(Use of approved Design Data Book is permitted in the University examination)

Aim	The aim of the subject is to provide knowledge in various transmission system design principle.
Objective	1. To study the design procedure for power transmission by belt, ropes and pulleys. 2. To study the design procedure for spur and helical gears. 3. To study the design procedure for bevel, worm and cross helical gears. 4. To study the design procedure for various types of gear box. 5. To study the design procedure for clutches and brakes.
Outcome	The students would be able to understand the design of belts, gears and gear boxes.

6.

UNIT – I - DESIGN OF TRANSMISSION SYSTEMS FOR FLEXIBLE ELEMENTS 9

Selection of V belts and pulleys – selection of Flat belts and pulleys - Wire ropes and pulleys – Selection of Transmission chains and Sprockets. Design of pulleys and sprockets.

UNIT – II -SPUR GEARS AND PARALLEL AXIS HELICAL GEARS 9

Gear Terminology-Factor of safety - Gear materials -power rating calculations based on strength and wear considerations - Parallel axis Helical Gears**.** Estimating the size of the helical gears. Simple gear design procedure.

UNIT – III -BEVEL, WORM AND CROSS HELICAL GEARS 9

Straight bevel gear: Tooth terminology. Estimating the dimensions of pair of straight bevel gears. Simple gear design procedure. Worm Gear- terminology. -Forces and stresses- efficiency- estimating the size of the worm gear pair. Simple gear design procedure.

UNIT – IV -DESIGN OF GEAR BOXES 9

Geometric progression - Standard step ratio - Ray diagram- kinematics layout -Design of sliding mesh gear box -Constant mesh gear box. – Design of multi speed gear box, simple gear box design problems.

UNIT – V -DESIGN OF CLUTCHES AND BRAKES 9

Design of plate clutches –axial clutches-cone clutches- internal and external shoe brakes-simple problems.

TUTORIAL : 15
TOTAL HOURS :60

TEXT BOOKS

1. Bhandari- V.B. - "Design of Machine Elements"- TMH Publishing Company Ltd. - 1994
2. Prabhu. T.J. - "Design of Transmission Elements"- Mani Offset- Chennai- 2000-

REFERENCES

1. Maitra G.M. - Prasad L.V. - "Hand book of Mechanical Design"- II Edition- Tata McGraw-Hill- 1985.
2. Shigley J.E and Mischke C. R. - "Mechanical Engineering Design"- McGraw-Hill International Editions- 1989.
3. Norton R.L- "Design of Machinery"- McGraw-Hill Book co- 2004.
4. Hamrock B.J. - Jacobson B. - Schmid S.R.- "Fundamentals of Machine Elements"- McGraw-Hill Book Co.- 1999.
5. Juvinall R. C. - Marshek K.M. - "Fundamentals of Machine component Design"- – John Wiley & Sons Third Edition- 2002.

SEMESTER	SUBJECT	L	T	P	C
VI	ENGINEERING METROLOGY AND MEASUREMENTS	3	0	0	3

(Common TO MECH & MECT**)**

Aim	The aim of the subject is to provide basic knowledge in instrumentation and measurements
Objective	1. To understand the basic measurement system. 2. To understand the various instruments used for linear and angular measurement. 3. To understand the various instruments used for form measurement and surface finish. 4. To understand the principle, applications and advancements of laser. 5. To understand the various instruments to acquire the data and store in computer
Outcome	The students would be able to understand the working principle of various measuring instruments.

1.

1. CONCEPT OF MEASUREMENT 9

General concept – Measurement system - Units and standards - Measuring instruments – Sensitivity- Readability - Range of accuracy - Precision - Static and dynamic response –Repeatability - Systematic and random errors – Correction - Calibration - Interchangeability.

2. LINEAR AND ANGULAR MEASUREMENT 9

Definition of metrology - Linear measuring instruments: Vernier – micrometer - interval measurement - Slip gauges and classification - optical flats - limit gauges - Comparators: mechanical - pneumatic and electrical types - applications.

Angular measurements: -Sine bar - optical bevel protractor - Autocollimator- Angle Decker – Taper measurements.

3. FORM MEASUREMENT 9

Measurement of screw threads - thread gauges - Floating carriage micrometer-measurement of gears-tooth thickness-constant chord and base tangent method-Gleason gear testing machine – radius measurements-surface finish - Straightness- Flatness and roundness measurements.

4. LASER AND ADVANCES IN METROLOGY 9

Precision instruments based on laser – principles - Laser interferometer - application in linear and angular measurements and machine tool metrology

Coordinate measuring machine (CMM) - Constructional features – Types - Applications – Digital devices - Computer aided inspection.

5. DATA LOGGING AND ACQUISITION 9

Data logging and acquisition, use of intelligent instrument for error reduction, elements of micro-Computer interfacing, intelligent instruments in use.

TOTAL HOURS :45

TEXTBOOKS:

1. Jain R.K. - “Engineering Metrology”- Khanna Publishers- 1994
2. Gupta S.C- “Engineering Metrology”- Dhanpat rai Publications- 1984

REFERENCES;

1. Alan S. Morris- “The Essence of Measurement”- Prentice Hall of India- 1997
2. Jayal A.K- “Instrumentation and Mechanical Measurements”- Galgotia Publications 2000
3. Beckwith T.G- and N. Lewis Buck- “Mechanical Measurements”- Addison Wesley- 1991
4. Donald D Eckman- “Industrial Instrumentation”- Wiley Eastern-1985.

SEMESTER	SUBJECT	L	T	P	C
VI	GAS DYNAMICS AND JET PROPULSION	3	0	0	3

Aim	The aim of the subject is to provide knowledge in gas dynamics and jet propulsion.
Objective	1. To understand the basics of compressible flow and its significance. 2. To understand flow through variable areas ducts and the significance of flow through nozzles and diffusers. 3. To understand flow through constant area ducts and its significance. 4. To provide a basic understanding of normal shock behavior. 5. To provide an overview of jet propulsion technology and its basics.
Outcome	The students would be able to understand the gas dynamics and various propulsion systems.

1. COMPRESSIBLE FLOW – FUNDAMENTALS 8

Energy and momentum equations for compressible fluid flows - various regions of flows - reference velocities - stagnation state - velocity of sound - critical states - Mach number - critical Mach number - types of waves - Mach cone - Mach angle - effect of Mach number on flow.

2. FLOW THROUGH VARIABLE AREA DUCTS 8

Isentropic flow through variable area ducts- T-s and h-s diagrams for nozzle and diffuser flows - Area ratio as a function of Mach number - Mass flow rate through nozzles and diffusers - Effect of friction in flow through nozzles.

3. FLOW THROUGH CONSTANT AREA DUCTS 9

Flow in constant area ducts with friction (Fanno flow) – Fanno curves and Fanno flow equation - variation of flow properties - variation of Mach number with duct length.

Isothermal flow with friction in constant area ducts. Flow in constant area ducts with heat transfer (Rayleigh flow) - Rayleigh line and Rayleigh flow equation - variation of flow properties - Maximum heat transfer.

4. **NORMAL SHOCK 10**

Governing equations - Variation of flow parameters like static pressure, static temperature , static density, stagnation pressure and entropy across the normal shock - Prandtl-Meyer equation - impossibility of shock in subsonic flows - flow in convergent and divergent nozzle with shock - normal shock in Fanno and Rayleigh flows, flow with oblique shocks.

5. PROPULSION 10

Jet Propulsion: Aircraft propulsion – types of jet engines – energy flow through jet engines- performance of turbo jet engines – thrust - thrust power - propulsive and overall efficiencies - thrust augmentation in turbo jet engine - ram jet and pulse jet engines

Space Propulsion: Types of rocket engines - Propellants - Ignition and combustion - Theory of rocket propulsion –Terminal and characteristic velocity - Applications - Space flights.

TOTAL HOURS :45

TEXTBOOKS

1. YAHYA. S.M. - “Fundamental of compressible flow”- New Age International (p) Ltd. - New Delhi- 1996.
2. PATRICH.H. OOSTHVIZEN- WILLIAM E.CARSCALLEN- “Compressible fluid flow”- McGraw-Hill- 1997

REFERENCES

1. COHEN. H. - ROGERS R.E.C AND SRAVANAMUTOO- “Gas turbine theory”- Addison Wesley Ltd. - 1987.
2. GANESAN. V. - “Gas Turbines”- Tata McGraw-Hill- New Delhi- 1999
3. RATHAKRISHNAN.E- “Gas Dynamics”- Prentice Hall of India- New Delhi- 2001
4. HILL.D and PETERSON .C, Mechanics & Thermodynamics of propulsion – Adisson Wesley Publishing Company, 1999.
5. G.P.Sutton- “Rocket Propulsion Elements "- John Wiley- 1986- New York.
6. ZUCROW N.J Aircraft and Missile Propulsion, Vol II – John Wiley Newyork, 1975
7. ZUCROW N.J Principles of Jet Propulsion and Gas Turbines – John Wiley Newyork, 1970

SEMESTER	SUBJECT	L	T	P	C
VI	A. DYNAMICS LAB B. METROLOGY LAB	0	0	4	2

A. DYNAMICS LAB

Aim	The aim of the subject is to provide knowledge in mechanisms related to machine dynamics.
Objective	To understand about governors, Gyroscopes, Speed measurement, spring mass system and compound pendulum
Outcome	The students would be able to understand the working principle of vibrations, balancing of masses.

Experiments:

1. Determination of sensitivity & effort- Governors.
2. Determination of gyroscopic couple -Motorized Gyroscope.
3. Determination of critical speed of shaft with concentrated loads- Whirling of shaft
4. Determination of damping co-efficient of single degree of freedom system-Spring Mass System
5. Determination of damping co-efficient of multi degree of freedom system - Bifilar & Trifilar Suspension System.
6. Determination of Radius of Gyration-Compound Pendulum.
7. Study of four bar mechanism

B METROLOGY LAB

Aim	The aim of the subject is to provide basic knowledge in working principles of various measuring instruments.
Objective	To expose the students the measurement systems and its procedures.
Outcome	The students would be able to understand the working principle of various equipments and their applications.

Experiments:

1. Measurement of linear parameters using precision measuring instruments like micrometer, vernier caliper and vernier height gauge.
2. Measurement of angle using bevel protractor
3. Checking dimensions of a part using slip gauge**.**
4. Use of sine bar for measuring angles and taper.
5. Fundamental dimension of a gear using contour projector.
6. Testing squareness of a try square using slip gauge.
7. Checking straightness of a surface plate using autocollimator.
8. Study of CMM

SEMESTER	SUBJECT	L	T	P	C
VI	HEAT TRANSFER LAB	0	0	4	2

Aim	The aim of the subject is to provide basic knowledge in heat transfer systems..
Objective	To gain knowledge in various heat transmissions systems and modes viz, conduction, convection and radiation.
Outcome	The students would be able to understand the modes of heat transfer with hands on training..

LIST OF EXPERIMENTS

1. To determine the thermal conductivity of an insulating powder.
2. To determine the thermal conductivity of a solid by the guarded hot plate method.
3. To determine the heat transfer through composite wall apparatus.
4. To find the effectiveness of a pin fin in a rectangular duct natural convective condition and plot temperature distribution along its length.
5. To find the effectiveness of a pin fin in a rectangular duct under forced convective and plot temperature distribution along its length.
6. To determine the surface heat transfer coefficient for a heated vertical tube under natural convection and plot the variation of local heat transfer coefficient along the length of the tube. Also compare the results with those of the correlation.
7. To determine average heat transfer coefficient for an externally heated horizontal pipe under forced convection & plot Reynolds and Nusselt numbers along the length of pipe. Also compare the results with those of the correlations.
8. To measure the emissivity of the gray body (plate) at different temperature and plot the variation of emissivity with surface temperature.
9. To find overall heat transfer coefficient and effectiveness of a heat exchange under parallel flow conditions. Also plot the temperature distribution in both the cases along the length of heat of heat exchanger.
10. To find overall heat transfer coefficient and effectiveness of a heat exchange under counter flow conditions. Also plot the temperature distribution in both the cases along the length of heat of heat exchanger.
11. To verify the Stefan-Boltzmann constant for thermal radiation.
12. Determine the COP by using LPG refrigerant test rig.
13. Study and demonstration of boiler.

SEMESTER	SUBJECT	L	T	P	C
VI	AUTOMOBILE ENGINEERING LAB	0	0	4	2

Aim	The aim of the subject is to provide overall knowledge about automobile engineering.
Objective	To study about the various parts of an automobile.
Outcome	The students would be able to understand the assembly and disassembly of various automobile Parts and also about other mechanisms.

List of Experiments :

The Students have to dismantle and assemble the following items

a. Multi-cylinder: Diesel and Petrol Engines.
b. Engine starting system
c. Cooling and Lubrication system
d. Carburetors
e. Synchromesh and constant mesh Gear Box
f. Front and rear suspension system

The students have to study the following items

a. Manual Steering Systems, e.g. Pitman –arm steering, Rack & Pinion steering.
b. Power steering Systems, e.g. Rack and Pinion Power Steering System.
c. Hydraulic & Pneumatic Brake systems, Drum Brake System, Disk Brake System,Antilock Brake System.
d. Differntials and rear wheel drives

SEMESTER	SUBJECT	L	T	P	C
VII	TOTAL QUALITY MANAGEMENT	3	0	0	3

UNIT –I INTRODUCTION **9**

Definition of Quality- Dimensions of Quality- Quality Planning- Quality costs – Analysis Techniques for Quality Costs- Basic concepts of Total Quality Management- Historical Review- Principles of TQM- Leadership – Concepts- Role of Senior Management- Quality Council- Quality Statements- Strategic Planning- Deming Philosophy- Barriers to TQM Implementation.

UNIT –II - TQM PRINCIPLES **9**

Customer satisfaction – Customer Perception of Quality- Customer Complaints- Service Quality- Customer Retention- Employee Involvement – Motivation- Empowerment- Teams- Recognition and Reward- Performance Appraisal- Benefits- Continuous Process Improvement – Juran Trilogy- PDSA Cycle- 5S- Kaizen-Basic Concepts- Strategy- Performance Measure.

UNIT –III - STATISTICAL PROCESS CONTROL (SPC) **9**

The seven tools of quality- Statistical Fundamentals – Measures of central Tendency and Dispersion- Population and Sample- Normal Curve- Control Charts for variables and attributes- Process capability- Concept of six sigma- New seven Management tools.

UNIT –IV - TQM TOOLS **9**

Benchmarking – Reasons to Benchmark- Benchmarking Process- Quality Function Deployment (QFD) – House of Quality- QFD Process- Benefits- Taguchi Quality Loss Function- Total Productive Maintenance (TPM) – Concept- Improvement Needs- FMEA – Stages of FMEA.

UNIT –V - QUALITY SYSTEMS **9**

Need for ISO 9000 and Other Quality Systems- ISO 9000:2000 Quality System – Elements- Implementation of Quality System- Documentation- Quality Auditing- QS 9000- ISO 14000 – Concept- Requirements and Benefits.

Total Hours : 45

TEXT BOOK:

1. Dale H.Besterfiled- et at. - Total Quality Management- PHI-1999. (Indian reprint 2002).
2. Feigenbaum.A.V. "Total Quality Management- McGraw-Hill- 1991.

REFERENCES:

1. James R.Evans & William M.Lidsay- The Management and Control of Quality- (5th Edition)- South-Western (Thomson Learning)- 2002 (ISBN 0-324-06680-5).
2. Oakland.J.S. "Total Quality Management Butterworth – Hcinemann Ltd.- Oxford. 1989.
3. Narayana V. and Sreenivasan- N.S. Quality Management – Concepts and Tasks- New Age International 1996.

SEMESTER	SUBJECT	L	T	P	C
VII	MECHATRONICS	3	0	0	3

Aim	The aim of the subject is to provide knowledge about mechatronics system- an integeration.
Objective	1. To study about basic electronic components and to design circuits for mechanical applications. 2. To study about sensors and transducers and their significant applications in mechanical engineering applications. 3. To study about the microprocessor and microcontroller architecture and its important applications in machineries and automotives. 4. To study about programmable logic controller and to develop applications for mechanical systems. 5. To study designing of Mechatronic systems for automotive, electronic appliances etc.
Outcome	The students would be able to understand the automation principle, sensors, relays and their applications.

6. .

UNIT – I - INTRODUCTION **9**

Introduction to Digital electronics, components, general electronic circuits, logical gates, registers; flip flops, microprocessors and applications – Design of electronic circuits for mechanical applications - Measurement Systems-Control Systems**.**

UNIT – II - SENSORS AND TRANSDUCERS **9**

Sensors – Types and Functions - Position , Proximity, Velocity and Motion, Fluid Pressure, Temperature Sensors, Light Sensors, Emission Gas Sensors - Performance parameters - Selection of Sensors.

Transducers – Classification, selection, resistive, capacitive and inductive transducers, piezo-electric transducers, optical and digital transducers. Transducers for Measurement - displacement, temperature, level, flow, pressure, velocity, torque, speed,

UNIT – III - MICROPROCESSOR AND MICROCONTROLLERS **9**

8085 Microprocessor – Architecture, Pin Configuration, Instruction set, Programming. Interfacing input and output devices, Interfacing D/A converters and A/D converters, Applications- Temperature control, Stepper motor control, Traffic light controller. Introduction to 8086, microprocessors.

8051 Microcontroller – Signals, Operational features, Memory and I/O addressing, Interrupts, serial communication, and instruction set. Applications in cutting machinery and automotives.

UNIT – IV - PROGRAMMABLE LOGIC CONTROLLERS **9**

Introduction-Basic structure-Input/Output Processing-Programming-Mnemonics-Timers- Internal relays and counters-Data handling-Analog Input/Output-Selection of a PLC. SCADA , Industrial applications of PLC in conveyor systems, product line automations etc.

UNIT – V - DESIGN OF MECHATRONICS SYSTEMS **9**

Stages in designing mechatronic systems, traditional and mechatronic design, possible design solutions. Design of following mechatronic systems - Pick and place robot, automatic car park system, engine management system, machinery automation.

TOTAL HOURS :45 PERIODS

TEXT BOOK:

1. W.Bolton- Mechatronics-Longman-Second Edition- 2010.
2. K.Ram- “Fundamentals of Microprocessors and Microcomputers "- Dhanpat Rai Publications- Fourth Revised Edition- 2005.

REFERENCES:

1. Michael B. Histand and David G.Alciatore- “Introduction to Mechatronics and Measurement Systems "- McGraw Hill International Editions- 1999.
2. HMT Ltd. -“Mechatronics "- Tata McGraw Hill Publishing Co. Ltd. - 1998.
3. D.A.Bradley- D.Dawson- N.C.Buru and A.J.Loader- “Mechatronics "- Chapman and Hall- 1993.
4. Ramesh S. Gaonkar- “Microprocessor Architecture "- Programming and Applications- Wiley Eastern- 1997.
5. Dan Necsulescu- "Mechatronics"-Pearson Education Asia-2002(Indian reprint).

SEMESTER	SUBJECT	L	T	P	C
VII	FINITE ELEMENT ANALYSIS	3	1	0	4

Aim	The aim of the subject is to provide knowledge in finite element analysis.
Objective	1. To understand the basics of Finite element techniques and 1D element equation formulation 2. To gain knowledge about 2D problems in structural and Thermal 3. To enable student to learn about Natural coordinates and Iso-Parametric Elements 4. To understand about Elasticity concepts and Virtual work 5. To study about dynamic analysis
Outcome	The students would be able to understand the basic concepts in mathematical problem analysis.

UNITI 1 DFINITEELEMENT ANALYSIS 12

Historical Background – Weighted Residual Methods – Basic Concepts of FEM – Variational Formulation of B.V.P – Ritz Method – Finite Element Modeling – Element Equations – Linear and Quadratic Shape functions -Bar, Beam Elements – Applications to Heat Transfer.

UNIT II FEAOF2DPROBLEMS 12

Basic Boundary Value Problems in 2 Dimensions – Triangular, quadrilateral, higher order elements – Poissons and Laplace Equations – Weak Formulation – Elements Matrices and Vectors – Application to Solid mechanics, Heat transfer, Fluid Mechanics.

UNIT III SOPARAMETRIC FORMULATION 12

Natural Co-ordinate System – Lagrangian Interpolation Polynomials – Iso-parametric Elements – Formulation – Numerical Integration – 1D -2D Triangular elements – rectangular elements – Illustrative Examples.

UNIT IV SOLUTION TOPLANE ELASTICITYPROBLEMS 12

Introduction to Theory of Elasticity – Plane Stress – Plane Strain and Axisymmetric Formulation – Principle of virtual work – Element matrices using energy approach

UNIT V: DYNAMIC ANALYSIS 12

Dynamic Analysis – Equation of Motion – Mass Matrices – Free Vibration analysis – Natural frequencies of Longitudinal – Transverse and torsional vibration – Introduction to transient field problems. Non linear analysis. Use of software – h & p elements – special element formulation.

TUTORIAL HOURS :15
TOTAL HOURS :60

Text Books:

1. Chandrupatla & Belagundu, “Finite Elements in Engineering”, Prentice Hall of India Private Ltd., 1997.
2. Rao S.S., “Finite Element Method in Engineering” , Pergamon Press, 1989

REFERENCE BOOKS:

1. Reddy J.N. “An Introduction to the Finite Element Method”, Mc Graw Hill, International Edition, 1993.
2. Segerlind L.J., “Applied Finite Element Analysis”, John Wiley, 1984.

SEMESTER	SUBJECT	L	T	P	C
VII	POWER PLANT ENGINEERING	3	0	0	3

Aim	The aim of the subject is to provide knowledge about different types of power plants and their functions.
Objective	1. To study about basic components and their functions of different types of conventional power plants.. 2. To study about basic components and their functions of different types of non conventional power plants. 3. To learn about the basic concepts of direct energy conversion systems
Outcome	The students would be able to understand the functions of different power plants and their economics and functions of direct energy conversion systems.

UNIT I

Introduction: Energy resources and their availability, types of power plants, selection of the plants, review of basic thermodynamic cycles used in power plants.
Hydro Electric Power Plants : Rainfall and run-off measurements and plotting of various curves for estimating stream flow and size of reservoir, power plants design, construction and operation of different components of hydro-electric power plants, site selection, comparison with other types of power plants.

Unit II
Steam Power Plants: Layout and working of modern-thermal power plants, super critical pressure steam stations, site selection, coal storage, preparation, coal handling systems, feeding and burning of pulverized fuel, ash handling systems, dust collection-mechanical dust collector and electrostatic precipitator.
Gas Turbine and Combined Cycle Power Plants : Constant pressure gas turbine power plants, Arrangements of combined plants (steam & gas turbine power plants), re-powering systems with gas production from coal using PFBC systems, with organic fluids, parameters affecting thermodynamic efficiency of combined cycles.

Unit III
Nuclear Power Plants: Principles of nuclear energy, basic nuclear reactions, nuclear reactors-PWR, BWR, CANDU, Sodium graphite, fast breeder, homogeneous; gas cooled. Advantages and limitations, nuclear power station, waste disposal.
Non-Conventional Power Generation: Solar radiation estimation, solar energy collectors, Low, medium & high temperature power plants, OTEC, wind power plants, tidal power plants, geothermal power plants.

Unit IV
Power Plant Economics: Load curve, different terms and definitions, cost of electrical energy, tariffs methods of electrical energy, performance & operating characteristics of power plants-incremental rate theory, input-out put curves, efficiency, heat rate, economic load sharing, Problems.

Unit V

Direct Energy Conversion Systems: Fuel cell, MHD power generation-principle, open & Closedcycle's systems, thermoelectric power generation, thermionic power generation.

TOTAL HOURS :60

Text Books:

1. Power station Engineering and Economy by Bernhardt G.A. skrotzki and William A. Vopat – Tata Mc Graw Hill Publishing Company Ltd., New Delhi
2. Power Plant Engineering: P.K. Nag Tata McGraw Hill second Edition 2001.

Reference Books:

1. Power Plant Engg. : M.M. El-Wakil McGraw Hill 1985.

SEMESTER	SUBJECT	L	T	P	C
VII	FINITE ELEMENT ANALYSIS LAB	0	0	4	2

Aim	The aim of the subject is to provide hands on experience in finite element analysis software
Scope	To gain knowledge in various procedures in drafting and analysing a component using FEA software.
Outcome	The students would be able to understand and analyse any component using software.

LIST OF EXPERIMENTS:

1. Study of analysis and its benefits
2. Application of distributed loads
3. Nonlinear analysis of a cantilever beam
4. Buckling analysis
5. Stress analysis of cantilever beam
6. Stress analysis of axi-symmetry vessels
7. Stress analysis of two dimensional truss
8. Transient thermal conduction
9. Simple conduction
10. Plane stress bracket
11. Modal analysis of a cantilever beam
12. Harmonic analysis of a cantilever beam

SEMESTER	SUBJECT	L	T	P	C
VII	MECHATRONICS LAB	0	0	4	2

Aim	*The aim of the subject is to provide overall knowledge about automation sector.*
Scope	*To train the students with hands on experience in fluid power systems and automation.*
Outcome	*The students would be able to understand the operation of various logical sequence with software.*

LIST OF EXEPRIMENTS:

1. Design and testing of fluid power circuits to control
   (i) Velocity (ii) direction and (iii) force of single and double acting actuators
2. Design of circuits with logic sequence using Electro pneumatic trainer kits.
3. Simulation of basic Hydraulic, Pneumatic and Electric circuits using software
4. Design and Testing of Circuits with multiple cylinder sequences in Electro pneumatic using PLC.
5. Conduct speed control of AC & DC drives.
6. To design a Servo controller interfacing for DC motor and test its performance.
7. To design a PID controller interfacing and test its performance.
8. Stepper motor interfacing with 8051 Micro controller
   (i) Full step resolution (ii) half step resolution
9. Modeling and analysis of basic electrical, hydraulic and pneumatic systems
   Using commercial instrumentation package
10. Computerized data logging system with control for process variables like
    Pressure flow and temperature.

SUBJECT	L	T	P	C
REFRIGERATION AND AIRCONDITIONING	3	0	0	3

Objectives:

1. To understand the importance of refrigeration cycle.
2. To know about various refrigerants.
3. To explain the principles of psychrometry.
4. To understand various AC systems.
5. To understand various new and unconventional refrigeration systems.

UNIT I REFRIGERATION CYCLE 7

Review of thermodynamic principles of refrigeration. Carnot refrigeration cycle – Vapour compression refrigeration cycle – use of P-H charts – multistage and multiple evaporator systems – cascade system – COP comparison. Air Refrigeration cycles.

UNIT II REFRIGERANTS AND SYSTEM COMPONENTS 10

Compressors – reciprocating and rotary. Types of condensers, evaporators, cooling towers – functional aspects. Refrigerants – properties – selection of refrigerants – impact on environment. Alternate Refrigerants - Cycling controls.

UNIT III PSYCHROMETRY 10

Psychometric processes use of psychometric charts – Grand and Room Sensible Heat Factors – bypass factor – air washers. Requirements of comfort air conditioning - summer and winter air conditioning.

UNIT IV AIR CONDITIONING SYSTEMS 9

Cooling load calculation - working principles of centralized air conditioning systems, split, ductable split, packaged air conditioning, VAV & VRV Systems. Duct Design by equal friction method, Indoor Air quality concepts.

UNIT V UNCONVENTIONAL REFRIGERATION CYCLES 9

Vapor Absorption system – Ejector jet, Steam jet refrigeration, and Thermo electric refrigeration - applications. Ice plant – food storage plants – milk – chilling plants.

TOTAL HOURS :45

TEXT BOOKS:

1. Manohar Prasad, “Refrigeration and Air Conditioning”, Wiley Eastern Ltd., 1983.
2. Arora C.P., “Refrigeration and Air Conditioning”, Tata McGraw Hill, New Delhi, 1988.
3. Lang Paul, Principles of Air Conditioning, CBS Publishers, 2003.

REFERENCES:

1. Roy. J. Dossat, “Principles of Refrigeration”, Pearson Education 1997.
2. Jordon and Priester, “Refrigeration and Air Conditioning”, Prentice Hall of India Pvt. Ltd., 1985.
3. Stoecker N.F. and Jones, “Refrigeration and Air Conditioning”, TMH, 1981.
4. Marsh and Olivo, Principles of Refrigeration, CBS Publishers, 2005.

SUBJECT	L	T	P	C
TURBOMACHINERY	3	0	0	3

Objectives:

1. To learn the principles of fluid machinery.
2. To understand various fans and blowers.
3. To understand the concept of compressors.
4. To learn the concept of axial flow compressors.
5. To understand the concept of various turbines.

UNIT I PRINCIPLES 9

Energy transfer between fluid and rotor-classification of fluid machinery,-dimensionless Parameters-specific speed-applications-stage velocity triangles-work and efficiency.

UNIT II CENTRIFUGAL FANS AND BLOWERS 9

Types- stage and design parameters-flow analysis in impeller blades-volute and Diffusers, losses, characteristic curves and selection, fan drives and fan noise.

UNIT III CENTRIFUGAL COMPRESSOR 9

Construction details, impeller flow losses, slip factor, diffuser analysis, losses and Performance curves.

UNIT IV AXIAL FLOW COMPRESSOR 9

Stage velocity diagrams, enthalpy-entropy diagrams, stage losses and efficiency, work Done simple stage design problems and performance characteristics.

UNIT V AXIAL AND RADIAL FLOW TURBINES 9

Stage velocity diagrams, reaction stages, losses and coefficients, blade design Principles, testing and performance characteristics.

TOTAL HOURS :45

TEXT BOOK:

1. Yahya, S.H., Turbines, Compressors and Fans, Tata McGraw-Hill Publishing Company, 1996.

REFERENCES:

1. Bruneck, Fans, Pergamom Press, 1973.
2. Earl Logan, Jr., Hand book of Turbo machinery, Marcel Dekker Inc., 1992.
3. Dixon, S.I., Fluid Mechanics and Thermodynamics of Turbo machinery, Pergamon Press, 1990.
4. Shepherd, D.G., Principles of Turbo machinery, Macmillan, 1969.
5. Stepanpff, A.J., Blowers and Pumps, John Wiley and Sons Inc. 1965.
6. Ganesan, V., Gas Turbines, Tata McGraw Hill Pub. Co., 1999.
7. Gopalakrishnan .G and Prithvi Raj .D, A Treatise on Turbomachines, Scifech Publications (India) Pvt. Ltd., 2002.

SUBJECT	L	T	P	C
INDUSTRIAL ROBOTICS	3	0	0	3

Objectives:

1. To learn the basics about Robotics and Robot manipulation in space.
2. To understand the controlling of Robots and devices system.
3. To learn the Sensor technology
4. To learn the knowledge of Robot programming and Expert system.
5. To understand about Robot cell design, applications and economics

UNIT I FUNDAMENTALS OF ROBOT 7

Robot – Definition – Robot Anatomy – Co-ordinate Systems, Work Envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and Functions – Need for Robots – Different Applications.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS 10

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C.Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of Drives. End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT III ROBOT SENSORS 9

Transducers and sensors – Sensors in robot – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image processing and analysis – Image segmentation – Pattern recognition – Training of vision system

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING 10

Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional) – Deviations and Problems. Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End Effectors commands and simple programs.

UNIT V CELL DESIGN APPLICATIONS AND ECONOMICS OF ROBOTICS 9

Robot work cell design and control – Safety in Robotics – Robot cell layouts – Multiple robots and machine interference – Robot cycle time analysis – Industrial applications of robots.
Economic Analysis of Robots – Pay back Method, EUAC Method, and Rate of Return Method.

TOTAL HOURS : 45
Text Books:

1. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey “Industrial Robotics Technology, Programming and Applications”, Mc Graw Hill, Int., 1986.
2. Fu. K.S., Cgonzalez R. and Lee C.S.G., “Robotics Control, Sensing, Vision and Intelligence” Mc Graw hill , 1987

Reference Books:

1. Richar. D., Klafter, Thomas, A, Chmielewski, “Machine Negin Robotics Engineering – An Integrated Approach”, Prentice Hall of India Pvt., Ltd., 1984.
2. Kozyrey, Yu. “Industrial Robotics” MIR Publishers Moscow, 1985.
3. Deb, S.R. “Robotics Technology and Flexible Automation”, Tata McGraw Hill, 1994.
4. Timothy Jordonides etal, “Expert Systems and Robotics”, Springer – Verlag, New York, May 1991.

SUBJECT	L	T	P	C
ADVANCED I.C ENGINES	3	0	0	3

Objectives:

1. To learn about SI engines.
2. To learn about CI engines.
3. To learn to control various pollutants.
4. To know about various alternative fuels.
5. To know various latest trends in automobiles.

1. SPARK IGNITION ENGINES **9**

Spark ignition Engine mixture requirements - Feedback Control Carburetors -Fuel - Injection systems - Monopoint and Multipoint injection - Stages of combustion - Normal and Abnormal combustion-Factors affecting knock - Combustion Chambers - Introduction to Thermodynamic analysis S.I. Engine combustion

2. COMPRESSION IGNITION ENGINES **9**

States of combustion in C.I. Engine - Direct and indirect injection systems - Combustion chambers - Fuel spray behaviour - spray structure- spray penetration and evaporation - Air motion - Turbocharging - Introduction to Thermodynamic Analysis of C.I. Engine combustion.

3. POLLUTANT FORMATION CONTROL **9**

Pollutant - Sources and types - formation of NOx - Hydro-carbon Emission Mechanism - Carbon Monoxide Formation - Particulate emissions - Methods of controlling Emissions- Catalytic converters and Particulate Traps -Methods of measurements and Driving cycles.

4. ALTERNATIVE FUELS **9**

Alcohol- Hydrogen- Natural Gas and Liquefied Petroleum Gas - Properties- Suitability- Engine Modifications- Merits and Demerits as fuels.

5. RECENT TRENDS **9**

Learn Burn Engines - Stratified charge Engines - Gasoline Direct Injection Engine - Homogeneous charge compression Ignition - Plasma Ignition - Measurement techniques.

TOTAL HOURS : 45

TEXT BOOK:

1. John B. Heywood- "Internal Combustion Engine Fundamentals"- McGraw Hill- 1988.

REFERENCES:

1. R.B.Mathur and R.P.Sharmal- “Internal Combustion Engines ".
2. Rowland S.Benson and N.D.Whitehouse- " Internal combustion Engines "- Vol.I and II- Pergamon Press- 1983.
3. Duffy Smith- “Auto fuel Systems "- The Good Heart Willox Company- Inc. - 1987.

SUBJECT	L	T	P	C
OPERATIONS RESEARCH	3	0	0	3

Objectives:

- **Linear Programming is useful in finding either maximum or minimum of an expression subject to given constraints**
- **To minimize the cost of transporting items from various sources to different destinations**
- **When number of activities are to be carried out most economical way with less time consumptions can be found**
- **Inventory is essential to provide flexibility in operating a system or organization.**
- **Decision making is an integral part of any business organization. It uses to select the best among several decisions through a proper evaluation of the parameters of each decision environment**

1. Linear programming **9**

Linear programming problem – Graphical method - Simplex method – Big M method – Duality principle.

2. Transportation model **9**

Transportations problem – Assignment problem – Under Assignment -Traveling salesman problem

3. Network model **9**

Project Network – CPM and PERT Networks – Critical path scheduling – Sequencing Models.

4. Inventory Models **9**

Inventory Model – Economic Order Quantity Model – Purchasing Model (with and without shortages) – Manufacturing Model (with and without shortages) - Stochastic Inventory Model (Stock in discrete and continuous units).

5. Decision Model **9**

Decision Model – Game theory – Two Person Zero sum game – Algebraic solutions Graphical solutions – Replacement model – Model based on Service life – Economic life single / multivariable search technique.

TUTORIAL HOURS :15
TOTAL HOURS :60

TEXT BOOK

1.Sundarasen.V, Ganapathy subramaniyam . K.S. Ganesan.K. "Operations Research" ,A.R. Publications.

RFERENCES:

1. Premkumar Gupta, Hira, "Operations Research" Chand & company New Delhi.
2. H.A.Taha, "Operations Research",Prentice Hall of India , 1999, Six Edition.
3. Kanti Swarup,P.K.Gupta,Man Mohan, SultanChand& Sons, New Delhi(2010)

SUBJECT	L	T	P	C
INDUSTRIAL TRIBOLOGY	3	0	0	3

Objectives:

1. To gain knowledge about surfaces and to study the different types of friction in materials.
2. To gain knowledge in wear mechanisms, types of wear for different environment and materials.
3. To study the properties of fluid film for bearing applications.
4. To have a theoretical understanding of the film lubrication theory.
5. To learn the various ways of modifying the surface of the materials for bearing.

UNIT I SURFACES AND FRICTION 9

Topography of Engineering surfaces- Contact between surfaces - Sources of sliding friction – Adhesion-Ploughing- Energy dissipation mechanisms Friction Characteristics of metals - Friction of non metals. Friction of lamellar solids - friction of Ceramic materials and polymers - Rolling Friction - Source of Rolling Friction – Stick slip motion - Measurement of Friction.

UNIT II WEAR 9

Types of wear - Simple theory of Sliding Wear Mechanism of sliding wear of metals - Abrasive wear – Materials for Adhesive and Abrasive wear situations - Corrosive wear - Surface Fatigue wear situations - Brittle Fracture - wear - Wear of Ceramics and Polymers - Wear Measurements.

UNIT III LUBRICANTS AND LUBRICATION TYPES 9

Types and properties of Lubricants - Testing methods - Hydrodynamic Lubrication – Elasto-hydrodynamic lubrication- Boundary Lubrication - Solid Lubrication - Hydrostatic Lubrication.

UNIT IV FILM LUBRICATION THEORY 9

Fluid film in simple shear - Viscous flow between very close parallel plates - Shear stress variation Reynolds Equation for film Lubrication - High speed unloaded journal bearings - Loaded journal bearings – Reaction torque on the bearings - Virtual Co-efficient of friction - The Sommerfield diagram/.

UNIT V SURFACE ENGINEERING AND MATERIALS FOR BEARINGS 9

Surface modifications - Transformation Hardening, surface fusion - Thermo chemical processes – Surface coatings - Plating and anodizing - Fusion Processes – Vapour Phase processes - Materials for rolling Element bearings - Materials for fluid film bearings - Materials for marginally lubricated and dry bearings.

TOTALHOURS : 45

TEXT BOOK:

1. A.Harnoy “Bearing Design in Machinery “Marcel Dekker Inc, New York, 2003

REFERENCES:

1. M.M.Khonsari & E.R.Booser, “Applied Tribology”, John Willey &Sons, New York, 2001
2. E.P.Bowden and D.Tabor. "Friction and Lubrication ", Heinemann Educational Books Ltd., 1974.
3. A.Cameron, “Basic Lubrication theory ", Longman, U.K.., 1981.
4. M.J.Neale (Editor), “Tribology Handbook ", Newnes. Butter worth, Heinemann, U.K.,

SUBJECT	L	T	P	C
COMBUSTION ENGINEERING	3	0	0	3

Objectives:

1. To know about the combustion process.
2. To explain about the thermo chemistry.
3. To explain about the kinetics of combustion.
4. To explain about various flames.
5. To know the combustion process in an engine.

UNIT I COMBUSTION OF FUELS 9

Combustion equations- Theoretical air- excess air- air fuel ratio- equivalence ratio- exhaust gas composition- Air- fuel ratio from exhaust gas composition- heating value of fuels.

UNIT II THERMODYNAMICS OF COMBUSTION 9

Thermo-chemistry- First law analysis of reacting systems- Adiabatic combustion temperature- Second law analysis of reacting systems- criterion for chemical equilibrium- Equilibrium constant for gaseous mixtures- Evaluation of equilibrium composition- chemical availability.

UNIT III KINETICS OF COMBUSTION 9

Rates of reaction- Reaction order and molecularity complex reactions- chain reactions- Arrhenius rate equation- Collection theory- activated complex theory- Explosive and general oxidative characteristics of fueled.

UNIT IV FLAMES 9

Laminar and Turbulent flames- Premixed and Diffusion flames- Burning velocity and its determination- Factors affecting burning velocity- Quenching- Flammability and Ignition- Flame stabilization in open burners.

UNIT V ENGINE COMBUSTION 9

Combustion in SI and CI engines- stages of combustion in SI and CI engines- Normal combustion and abnormal combustion- Emissions from premixed combustion- Emission from Nonpremixed combustion- Control of emissions

TOTAL HOURS : 45

TEXT BOOK:

1. Stephen R.Turns-"An Introduction to Combustion"-McGraw Hill, 1996.

REFERENCES:

1. Irwin Glassman- “Combustion "- Third Edition- Academic Press, 1996.
2. S.P. Sharma and Chandra Mohan- “Fuels and Combustion "- Tata McGraw Hill Book Co. - 1984.
3. Samir Sarkar- “Fuels and Combustion "- Orient Longman- 1984.
4. K.K.Kuo- “Principles of Combustion "- John Wiley & Sons- 1984.
5. J.B. Heywood- “Internal Combustion Engine Fundamentals "- Mcc Graw Hill Book Co. - 1988.

SUBJECT	L	T	P	C
CRYOGENIC ENGINEERING	3	0	0	3

Objectives:

1. To introduce the importance of cryogenic engineering.
2. To study the low temperature refrigeration system.
3. To study the gas separation systems.
4. To know the vacuum technology.
5. To understand about cryogenic storage.

UNIT 1 CONSTRUCTION DETAILS AND HEAT TRANSFER 9

Introduction to Cryogenic Systems Low Temperature properties of Engineering Materials. Cryogenic fluids and their properties. Applications in space- Food Processing- super Conductivity- Electrical Power- Biologyedicine- Electronics and Cutting Tool Industry.

UNIT II LIQUEFACTION AND LOW TEMPERATURE REFRIGERATION 9

Liquefaction systems ideal system- Joule Thomson expansion- Adiabatic expansion- Linde Hampson a Cycle- Claude & Cascaded System- Magnetic Cooling- Stirling Cycle Cryo Coolers.

UNIT 1II SEPARATION AND PURIFICATION SYSTEMS 9

General characteristics of mixtures-composition diagrams. Gas separation-principles of rectification-flash calculations - Rectification column analysis- Flash calculations.

UNIT IV INSULATION AND VACUUM TECHNOLOGY 9

Thermal insulation and their performance at cryogenic temperatures- Super Insulations- Vacuum insulation- Powder insulation- Cryo pumping Applications.

UNIT V STORAGE AND INSTRUMENTATION 9

Cryogenic Storage vessels and Transportation- Transfer devices. Pressure flow-level and temperature measurements.

TOTAL HOURS :45

TEXT BOOK:

1. Klaus D.Timmerhaus and Thomas M.Flynn- “Cryogenic Process Engineering “Plenum Press- New York- 1989.

REFERENCES:

1. Randal Barron- “Cryogenic Systems "- McGraw Hill- 1986.
2. R.B.Scoott- “Cryogenic engineering "- Van Nostrand Company Inc. - 1985.
3. J.H.Bell- “Cryogenic Engineering "- Prentice Hall Inc. - 1963.

SUBJECT	L	T	P	C
EMERGING MATERIALS	3	0	0	3

Objective:

1. To understand the classification of Engineering Materials and their relevant applications.
2. To understand the powder metallurgy concepts, process techniques, applications.
3. To understand the basics in composites, fabrication methods, types and applications.
4. To understand the various forms of Smart Materials, applications.
5. To understand the various types of Nano-material's, production & applications.

UNIT 1: ENGINEERING MATERIALS CLASSIFICATION, PROPERTIES & APPLICATIONS **9**

Classification of engineering materials- Metallic materials-ferrous materials-steel & cast iron and non ferrous materials –aluminium and copper. Non-Metallic materials – glasses , ceramics ,Polymer and plastics – their characteristics and unique properties- Material for structural applications - Light weight structural materials for automobiles and aero plane applications – Structural materials for high temperature applications

UNIT 2: POWDER METALLURGY **9**

Powder Metallurgy – Near net shaping process methods and principles - chemical methods – electro-chemical methods - atomization – mechanical alloying – rapid solidification – processing – Nano size powders. Powder physical and chemical characterization – process characteristics - Applications – Tools – Contact materials – Structural parts and others.

UNIT 3: COMPOSITES **9**

Composites – Types of composites - Naturally occurring, synthetic & engineered composites - MMC – CMC – PMC - Fibre and whisker reinforced composites (continuous and discontinuous) - particulate composites layered or sheet composites, composite coating or thin fibre, inter metallic composites - properties and characteristics of composites – commercially important components and their applications

UNIT 4: SMART MATERIALS **9**

Introduction to intelligent/smart materials, shape memory alloys-types, NiTiNol-origin, properties, martensitic transformation, Memorization process- applications-medical, satellite etc.

UNIT 5: NANO MATERIALS **9**

Nanomaterials-Definition, Classification of Nanostructured materials, causes of interest in nanomaterials, some present and future applications of nanomaterials. Processes for producing ultrafine powders-mechanical grinding, wet chemical synthesis of nanomaterials. Gas phase synthesis of Nano materials, gas condensation processes, chemical vapour condensation, laser ablation. Carbon nanotubes, Nano composites.

TEXTBOOKS:

1. Budinski, Kenneth G, Budinski, Michael K, Engineering Materials: Properties and Selection, 9th Edition, PHI.
2. M.V.Gandhi., Thomson - Smart Materials and Structures- Chapman and Hall
3. A.K.Bandhopadyay-Nanomaterials-New Age

REFERENCES:

1. Srinivasan.K, Composite Materials, Narosa Publishing House, 2009.
2. Ramesh, Nanomaterials: Mechanics and Mechanisms, Springer Verlag, EPZ, Paperback edition.
3. Angelo P.C., Subramanian R., Powder Metallurgy, Science, Technology and Applications, Prentice Hall of India, 2012.

SUBJECT	L	T	P	C
NANO TECHNOLOGY	3	0	0	3

Objectives:

1. To understand the basic fundamentals of Nanotechnology and applications.
2. To understand the basic fundamentals of Nanoparticles and applications.
3. To understand the various properties of nanomaterials.
4. To understand the basic fundamentals of Nanopowders.
5. To understand the recent developments in Nanotechnology and latest applications.

UNIT I INTRODUCTION AND DEFINITION OF NANOTECHNOLOGY 9

Introduction, Definition, Length scales, Importance of Nanoscale and Technology, History of Nanotechnology, Future of Nanotechnology: Nanotechnology Revolution, Silicon based Technology, Benefits and challenges in Molecular manufacturing, The Molecular assembler concept, Controversies and confusions, Understanding advanced capabilities, Visions and Objective of Nanotechnology, Nanotechnology in Different Fields: Automobile, Electronics, Nano biotechnology, Materials, Medicine, Dental care, Nano computers, Power storage, Nanotechnology products.

UNIT-II NANO PARTICLES 9

Introduction, Types of Nanoparticles, Pure Metal, Gold, Silicon, Silver, Cobalt, Metal Oxides, Silica, Zinc oxide, Iron oxide, Alumina, Titania, Techniques to Synthesize Nanoparticles, Characterization of Nanoparticles, Applications, Toxic effects of Nanomaterials, Significance of Nanoparticles.

UNIT-III PROPERTIES 9

Mechanical properties: Strength of Nano crystalline SiC, Preparation for strength measurements, Mechanical properties, Magnetic properties. Electrical properties: Switching glasses with nanoparticles, Electronic conduction with nanoparticles. Optical properties: Optical properties, special properties and the coloured glasses

UNIT-IV NANO-POWDERS 9

Process of synthesis of Nano powders, Electro deposition, Important Nanomaterials

UNIT -V LATEST DEVELOPMENTS IN NANOTECHNOLOGY & APPLICATIONS 9

Introduction, Current situation, Future Assumptions, Latest Developments, Nano copters, Nanotubes, Biosensors, Nano structure fluid, Computers, Plastic electronics, Light emitting diodes, Solar cells, Nanotechnology in Mechanical Industries, Nanotechnology in Health and Life Sciences, Nanotechnology in Smart Materials, Nanotechnology in Defense, Nanotechnology in Optics, Optical industry, Metrology, Nanotechnology in Environment.

TEXT BOOKS:

1. Nano Materials- A.K.Bandyopadhyay, New Age Publishers
2. Nano Essentials- T.Pradeep, TMH
3. Springer Handbook of Nanotechnology - Bharat Bhusan

SUBJECT	L	T	P	C
AUTOMOTIVE INFOTRONICS	3	0	0	3

Objectives:

1. To impart about automotive components.
2. To know various ignition systems and emission.
3. To know how to use various instruments.
4. To know about the use of electronics in brakes and clutches.
5. To know about the engine management system.

UNIT– I: INTRODUCTION TO AUTOMOTIVE SYSTEMS 9

Introduction to Electronic – "Intensive automobile"
Use of electronic in vehicles today – communications networks and protocols – software applications – control of engine and transmission – Electronic controls in "Electric – Drive Vehicles" – Vehicle starting and charging systems navigation and communications partially and fully automated vehicle.

UNIT – II: IGNITION SYSTEMS AND EMISSION 9

Ignition systems: Ignition fundamental, Electronic ignition systems, Programmed ignition, Distribution less ignition, direct ignition, Spark plugs.
Electronic Fuel Control: fuelling and exhaust. Electronic Petrol fuel injection and Diesel fuel injection.

UNIT – III: INSTRUMENTATION SYSTEMS 9
Instrumentation Systems: Introduction to instrumentation systems-application of various sensors-Driver instrumentation systems – Dash board instrumentation - vehicle condition monitoring-different types of visual Display.

UNIT – IV:ELECTRONIC BRAKING CLUTCHES AND STEERING 9
Traction and stability control – Adoptive cruise control - Electronic control of Automatic Transmission:
Introduction and description Control of gear shift and torque converter lockup-Break power assistance and lockup control – Breaking and stability control in Electric vehicle – suspension control – power steering assist.

UNIT V. VEHICLE MANAGEMENT SYSYEM 9
Combined ignition and fuel management systems-Exhaust emission control - Artificial intelligence and Engine management - Lighting and Security Systems: Vehicles lighting Circuits, - Central locking and electric windows- security systems - Alarm occupant protection system – self diagnostics – event data recorders – next generation systems: - Steering – by wire and break – by – wire – vehicle to vehicle and vehicle to infrastructure communications – (V_2V) & (V_2I).

TOTAL HOURS: 45

TEXT BOOKS:

1. Human factors in the design of automotive electronics systems, Lane departure warning and keeping parallel packing assistance.
2. DON KNOWLES, Automotive Electronic and Computer controlled Ignition Systems, Don Knowles, Prentice Hall, Englewood Cliffs, and New Jersey 1988.
3. WILLIAM, T.M., Automotive Mechanics, McGraw Hill Book Co.,3.WILLIAM, T.M., Automotive Electronic Systems, Heinemann Ltd., London, 1978.
4. Ronald K Jorgen, Automotive Electronics Handbook, McGraw Hill, Inc, 1999.

REFERENCES:

1. The Safety promise and challenge of automotive electronics national research council of the national academics TRB Washington DC 2012.

2. TOM DENTON, Automobile Electrical and Electronic Systems, Edward Arnold PB. 1995.

SUBJECT	L	T	P	C
COMPUTATIONAL FLUID DYNAMICS	3	0	0	3

Objectives:

1. To understand the basics of governing equations and boundary conditions
2. To gain knowledge about finite difference method
3. To enable student to learn about FVM – Diffusion.
4. To inherit knowledge about FVM-Convection diffusion.
5. To elaborate about FVM flow field calculation

UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 9

Basics of computational fluid dynamics – Governing equations of fluid dynamics –continuity, Momentum and Energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for Turbulent Flow – Turbulent–Kinetic Energy Equations – Mathematical behavior of PDEs on CFD - Elliptic, Parabolic and Hyperbolic equations.

UNIT II FINITE DIFFERENCE METHOD 9

Derivation of finite difference equations – Simple Methods – General Methods for first and second order accuracy – solution methods for finite difference equations – Elliptic equations – Iterative solution Methods – Parabolic equations – Explicit and Implicit schemes – Example problems on elliptic and parabolic equations.

UNIT III FINITE VOLUME METHOD (FVM) FOR DIFFUSION 9

Finite volume formulation for steady state One, Two and Three -dimensional diffusion problems. One dimensional unsteady heat conduction through Explicit, Crank – Nicolson and fully implicit schemes.

UNIT IV FINITE VOLUME METHOD FOR CONVECTION DIFFUSION 9

Steady one-dimensional convection and diffusion – Central, upwind differencing schemes-properties of discretization schemes – Conservativeness, Boundedness, Trasnportiveness, Hybrid, Power-law, QUICK Schemes.

UNIT V CALCULATION FLOW FIELD BY FVM 9

Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, simple algorithm and its variants. Turbulence models, mixing length model, two equation (k-Є) models – High and low Reynolds number models

TOTAL :45

TEXT BOOKS:

1. T.J. Chung, Computational Fluid Dynamics, Cambridge University, Press, 2002.
2. Versteeg, H.K., and Malalasekera, W., An Introduction to Computational Fluid Dynamics: The finite volume Method, Longman, 1998.
3. Ghoshdastidar , P.S., Computer Simulation of flow and heat transfer, Tata McGraw

REFERENCES:

1. Patankar, S.V. Numerical Heat Transfer and Fluid Flow, Hemisphere Publishing Corporation, 2004.
2. Muralidhar, K., and Sundararajan, T., computational Fluid Flow and Heat Transfer, Narosa Publishing House, New Delhi, 1995.
3. Ghoshdastidar P.S., Heat Transfer, Oxford University Press, 2005.
4. Prodip Niyogi, Chakrabarty .S.K., Laha .M.K. Introduction to Computational Fluid Dynamics, Pearson Education, 2005.
5. Introduction to Computational Fluid Dynamics Anil W. Date Cambridge University Press, 2005.

SUBJECT	L	T	P	C
UNCONVENTIONAL MANUFACTURING PROCESSES	3	0	0	3

Objectives:

1. To gain knowledge and understanding of basic concepts of unconventional machining processes
2. To impart the knowledge and understanding of various mechanical methods
3. To impart the knowledge and understanding of electrical energy based processes
4. To impart the knowledge and understanding of chemical and hybrid processes
5. To impart the knowledge and understanding of thermal energy based processes

UNIT I INTRODUCTION 6

Unconventional machining Process – Need – classification – Brief overview–merits –demerits– Applications

UNIT II MECHANICAL ENERGY BASED PROCESSES 9

Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining - Ultrasonic Machining. Working Principles & Applications – equipment used – process parameters – MRR - Variation in techniques used.

UNIT III ELECTRICAL ENERGY BASED PROCESSES 10

Electric Discharge Machining - working principle and applications – equipments - process parameters - surface finish and MRR- Power and control circuits–Wire cut EDM – working principle and Applications.

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UNIT IV CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES

Chemical machining and Electro-Chemical Machining- Electro Chemical Grinding and Electro chemical Honing-working principle and applications-Process Parameters -Surface finish and MRR - Etchants–Maskants.

UNIT V THERMAL ENERGY BASED PROCESSES 10

Laser Beam Machining and drilling, Plasma Arc Machining and Electron Beam Machining Working principles & Applications – Equipment –Types - Beam control techniques. Micromachining and Nanofabrication Techniques

TOTAL HOURS :45

TEXT BOOKS:

1. Vijay.K. Jain “Advanced Machining Processes” Allied Publishers Pvt. Ltd., 2007
2. P.K.Mishra , " Non Conventional Machining "- - The Institution of Engineers (India) Text Books: Series- 1997.

REFERENCES:

1. Benedict. G.F. “Nontraditional Manufacturing Processes” Marcel Dekker Inc., New York (1987).
2. Pandey P.C. and Shan H.S. “Modern Machining Processes” Tata McGraw-Hill, New Delhi (2007).
3. Mc Geough, “Advanced Methods of Machining” Chapman and Hall, London (1998).
4. Paul De Garmo, J.T.Black, and Ronald.A.Kohser, “Material and Processes in Manufacturing” Prentice Hall of India Pvt. Ltd., New Delhi, 8th Edition, 2001.

SUBJECT	L	T	P	C
LEAN MANUFACTURING SYSTEMS	3	0	0	3

Objectives:

1. To gain the knowledge and understanding of basic concepts of lean manufacturing process
2. To understand the various quality improvement methods in lean manufacturing.
3. To gain the knowledge and understanding of basic concepts of scheduling systems.
4. To gain the knowledge and understanding of basic concepts of JIDOKA
5. To gain the knowledge and understanding of basic concepts of employee involvement and systematic planning

UNIT I INTRODUCTION 9

The mass production system – Origin of lean production system – Necessity – Lean revolution in Toyota – Systems and systems thinking – Basic image of lean production – Customer focus – Muda (waste).

UNIT II STABILITY OF LEAN SYSTEM 9

Standards in the lean system–5S system–Total Productive Maintenance–standardized work–Elements of standardized work–Charts to define standardized work–Man power reduction–Overall efficiency–standardized work and Kaizen–Common layouts.

UNIT III JUST IN TIME 9

Principles of JIT – JIT system – Kanban rules – Expanded role of conveyance – Production leveling – Pull systems – Value stream mapping.

UNIT IV JIDOKA (AUTOMATION WITH A HUMAN TOUCH) 9

Jidoka concept – Poka-Yoke (mistake proofing) systems – Inspection systems and zone control – Types and use of Poka-Yoke systems – Implementation of Jidoka.

UNIT V WORKER INVOLVEMENT AND SYSTEMATIC PLANNING METHODOLOGY 9

Involvement – Activities to support involvement – Quality circle activity – Kaizen training - Suggestion Programmes – Hoshin Planning System (systematic planning methodology) – Phases of Hoshin Planning – Lean culture.

TOTAL HOURS : 45

TEXTBOOKS:

1. Pascal Dennis, Lean Production Simplified: A Plain-Language Guide to the
2. World's Most Powerful Production System, (Second edition), Productivity Press, New York, 2007.
3. Mike Rother and John Shook, Learning to See: Value Stream Mapping to Add
4.Value and Eliminate MUDA, Lean Enterprise Institute, 1999.

REFERENCES:

1. Jeffrey Liker, the Toyota Way: Fourteen Management Principles from the World's Greatest Manufacturer, McGraw Hill, 2004.
2. Michael L. George, Lean Six SIGMA: Combining Six SIGMA Qualities with Lean Production Speed, McGraw Hill, 2002.
3. Taiichi Ohno, Toyota Production System: Beyond Large-Scale Production, Taylor & Francis, Inc., 1988.

SUBJECT	L	T	P	C
ENVIRONMENTAL POLLUTION	3	0	0	3

Objectives:

1. To study the air pollution from automobiles , industries and their measuring systems
2. To study water pollution and alternative treatments
3. To study the soil pollution and controlling systems
4. To have knowledge on the hazardous solid waste and controlling measures
5. To know the industrial disasters, pollutions and remedial measures

UNIT- IStructure of the atmosphere, Sources and Classification of Air Pollutants. 9
Transport and Diffusion of Pollutants. Plume behavior and stack dispersion, Reactions of hydroxyl radical with O2, N2, CO2 and Oxides of Nitrogen, Sulphur and Carbon. Sinks of Air pollutants – Acid rain: Ozone depletion – Montreal protocol; Global warming – Kyoto protocol; Gaseous pollution control measures; photo chemical smog; Automobile pollution in India; Zero emission standards; Noise pollution – Sensing, Measurement, Abatement measures.

UNIT – II Properties of water 9

Characteristics of water bodies; Heavy metals, Speciation and Complexation, water quality. DO, BOD, COD, acidity, alkalinity, salinity, hardness; drinking Water quality standards; Water pollution; Classification of water pollutants, Ground water Pollution, Sources and sinks, Eutrophication. Purification of water by adsorption, flocculation, ion exchange and reverse osmosis methods. Alternatives of end of pipe treatments, Radioactive Pollution and control measures.

UNIT – III Soil pollution; 9

Sources, sinks and broad classification, movement and sorption mechanisms of Organic and inorganic contaminants and their impacts on physio-chemical and biological Properties of soil and plants, Sediment Pollution – Black carbon – formation and fate, Black Carbons as adsorbents for organics, Soil pollution control measures – Physical-chemical and Biological methods.

UNIT – IV Hazardous Solid Wastes 9

Hospital Wastes, Radioactive Wastes - Sources, Transport, Disposal. Municipal solid wastes - hazards, disposal and energy production- Case studies; Light pollution And control measures; and Thermal pollution and control measures.

UNIT V Industrial Disasters and Pollution 9

Remedial measures – Case studies-Chemical Industries –Pesticide Industries, Bhopal Disaster, Chernobyl accident, Love canal Disaster, Oil Disasters –Exxon, British Petroleum- Gulf of Mexico; e-wastes, Impact and Remedial Measures.

Total Hours :45

TEXT BOOK:

1. Howard S. Peavy- Donald R.Rowe- and George Tchobanoglous- “Environmental Engineering "- (1985) - McGraw-Hill-New Delhi.

REFERENCES:

1. Chemistry for Environmental Engineering and Science, Sawyer C.N., Mc Carty P.L., and Parkin, G.F (2003), Tata McGraw-Hill Publishing Company Ltd., New Delhi.
2. A text book of environmental chemistry and pollution control, Dara S S, (1998), S. Chand & Company Ltd, New Delhi
3. An Introduction to Soils and Plant Growth, 5th Ed, Roy I Donalue, Raymond W Miller and John C Shiekluna (1987) Prentice Hall of India.
4. Environmental Engineering, Howard S Peavy (2003), Tata McGraw Hill Publishing Company Ltd., New Delhi.
5. Environmental Chemistry, A.K. De (2001), New Age International Publishers, New Delhi.
6. Environmental Chemistry, S. E. Manahan (2000), CRC Press, USA.

SUBJECT	L	T	P	C
ENTREPRENEURIAL SKILLS DEVELOPMENT FOR ENGINEERS	**3**	**0**	**0**	**3**

Objectives:

1. To understand the importance of entrepreneurship for engineering students.
2. To inculcate entrepreneurship skills for engineering students.
3. To create awareness of business and train in preparing the project report and crate awareness for engineering students
4. To understand the importance of finance and its transactions.
5. To develop the skills of consequences of business sickness and take corrective measures.

UNIT I ENTREPRENEURSHIP 9

Entrepreneur –Definition-Evolution and importance of entrepreneurship-Views and Theories of Entrepreneurship-Traits of Entrepreneurs- Types of Entrepreneurs – Risks and Rewards-Entrepreneur -Technocrat –Manager -Comparison–Role of Entrepreneurship in Economic Development- Factors affecting Entrepreneurial Growth-Engineers as Entrepreneurs-Ten commandments for the beginning entrepreneur.

UNIT 2 MOTIVATION 9

Motivation-Definition and objectives-Types of motivation-Theories of Motivation- Achievement Motivation Training- Self Rating- Business games- Thematic Apperception Test - Stress Management. Entrepreneurship Development Programmes - Need- objectives.

UNIT 3 BUSINESS AND ENTERPRISE MANAGEMENT 9

Business-definition- Classification –Small Enterprises- Characteristics- ownership structure-Various types of ownership-Project Formulation – Steps involved in setting up a Business - Market survey and Research- Techno economic Feasibility Report - Preliminary Project Report-Importance of Project Appraisal-Sources of information-Classification of needs and Agencies – Intellectual Property Rights.

UNIT 4 FINANCIAL MANAGEMENT 9

Need and objectives of financial management for engineers-Sources of Finance- Term Loans-Capital structure- Financial Institutions- Management of working capital- Costing - Break Even Analysis- Managerial uses of Breakeven analysis-Network analysis Techniques –Problems on PERT &CPM – Taxation

UNIT 5 BUSINESS SICKNESS AND GROWTH STRATEGIES 9

Sickness in small Business –Definition of sick unit- Symptoms of Sickness- Magnitude- Causes and Consequences-Preventive and Corrective measures - Institutional Support to Entrepreneurs-Government Policy for small Enterprises - Growth strategies in small Industry - Expansion-Diversification- Joint venture- Merger- sub-contracting.

TOTAL HOURS :45

TEXT BOOKS:

1. S.S. Khanka- Entrepreneurial Development- Chand & Co. Ltd- Ram Nagar - New Delhi-2005.
2. BhramarbarBadhai-"Entrepreneurship for Engineers"-DhanpatRai&co (P) ltd, Delhi-2001.

REFERENCES:

1. EDII - "A manual for Entrepreneurs"- Entrepreneurship Development Institute of India, Ahmedabad- Tata McGrawHill-2006...
2. MSME-'A guide book for new entrepreneurs'-2nd edition-2010.
3. Lawrence R.Jauch, Rajiv Gupta,William F.Glueck-"Business Policy & Strategic Management"- 7th edition-Frank Bros&co.(publishers) ltd,.2007
4. Robert DHisrich, Michael P Peters &Dean A Shepherd-"Entrepreneurship"-TataMcGrawHill, 2008.
5. Mary K Coulter, "Entrepreneurship in Action", Prentice Hall-2006.

SUBJECT	L	T	P	C
MARKETING TECHNIQUES FOR ENGINEERS	3	0	0	3

Objectives:

1. To learn marketing skills for engineering students.
2. To understand the behaviourial pattern of customers
3. To learn marketing research and develop skills of sales forecasting.
4. To learn the skills of developing a market plan and formulation of strategies.
5. To understand various promotion mix details.

UNIT I MARKETING ENGINEERING APPROACH 9

Definition and introduction to Marketing Process- The emerging marketing decision environment-Trends that favour marketing engineering-Examples of Marketing success- Tools for marketing engineering-Business values of marketing engineering-B2B marketing-Dynamics- Selling Vs. Marketing- Marketing segmentation and targeting-Positioning approach.

UNIT II BUYING BEHAVIOUR & MARKET SEGMENTATION 9

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Customer value assessment and valuing customers- Understanding customer needs and wants-Customer Buying behavior- Motives- types- Buying decisions- segmentation factors- Demographic-Psychographic & Geographic Segmentation- Buying Patterns-Social and Ethical considerations .

UNIT III MARKETING RESEARCH& SALES FORECASTING 9

Objectives and Process of Marketing Research-Forecasting Methods-Judgment Methods-Time series-Product Life cycle-Forecasting methods for new products –Models.

UNIT IV MARKETING PLANNING & STRATEGY FORMULATION 9

Components of a marketing plan- strategy formulation –New Product and Service Design-New product development process-Models for idea generation and evaluation-implementation- Portfolio analysis-Marketing Mix- Pricing Decisions and Pricing methods- Pricing Management. Introduction- Uses.

UNIT V POSITIONING AND PROMOTION MIX 9

Characteristics- Impact- goals- types- Sales promotion-Brand Positioning- Brand Management-Distribution channels. Characteristics- Wholesaling- Retailing- channel design- logistics- Modern Trends in retailing.

TOTAL HOURS :45

TEXT BOOKS:

1. Gary. L. Lillian, Arvind Rangaswamy, Arnaud DeBrriyn-"Principles of Marketing Engineering"-2nd edition-Decision Pro.inc. PA16801.
2. Patric Forsyth-"Demystifying Marketing-A Guide to the fundamentals for Engineers",-The institution of engineering and technology, London, UK-2007.

REFERENCES:

1. Brian Richardson-"Marketing for Architects and Engineers-A New Approach"-Chapman and Hall India-1996.
2. Ramaswamy.V.S. and S.Namakumari- " Marketing Environment: Planning- Implementation and Control the Indian Context "- 1990.
3. Jean Plerre Jannet Hubert D Hennessey Global Marketing Strategies.
4. Govindarajan.M. 'Modern Marketing Management'- Narosa Publishing House- New Delhi-1999.
5. Philip Kotler- " Marketing Management: Analysis- Planning- Implementation and Control "- 1998.

SUBJECT	L	T	P	C
RENEWABLE SOURCES OF ENERGY	3	0	0	3

Objectives:

1. To understand the importance of solar energy.
2. To learn the importance of wind energy.
3. To know the importance of bio energy.
4. To know various renewable energy power plants.
5. To learn the necessity of latest and modern energy sources.

UNIT I SOLAR ENERGY 9

Solar Radiation – Measurements of solar Radiation – Solar Thermal Collectors – Flat Plate and Concentrating Collectors – Solar Applications – fundamentals of photo Voltaic Conversion – solar Cells – PV Systems – PV Applications.

UNIT II WIND ENERGY 9

Wind Data and Energy Estimation – wind Energy Conversion Systems – Wind Energy-Generators and its performance – Wind Energy Storage – Applications – Hybrid systems.

UNIT III BIO – ENERGY 9

Biomass, Biogas, Source, Composition, Technology for utilization – Biomass direct Combustion – Biomass gasifier – Biogas plant – Digesters – Ethanol production – Bio Diesel production and economics.

UNIT IV OTEC, TIDAL, GEOTHERMAL AND HYDEL ENERGY 9

Tidal energy – Wave energy –Open and closed OTEC Cycles – Small hydro plant turbines – Geothermal energy sources- environmental issues.

UNIT V NEW ENERGY SOURCES 9

Hydrogen generation, storage, transport and utilization, Applications - power generation- transport – Fuel cells – technologies, types – economics and the power generation

TOTAL HOURS :45

TEXT BOOKS:

1. G.D. Rai, Non-Conventional Energy Sources, Khanna Publishers, New Delhi, 1999.
2. S.P. Sukhatme, Solar Energy, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.

REFERENCES:

1. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K., 1996.
2. Twidell, J.W. & Weir, A., Renewable Energy Sources, EFN Spon Ltd., UK, 1986.
3. G.N. Tiwari, solar Energy – Fundamentals Design, Modelling and applications, Narosa Publishing House, New Delhi, 2002.
4. L.L. Freris, Wind Energy Conversion systems, Prentice Hall, UK, 1990.

SUBJECT	L	T	P	C
RAPID PROTOTYPING AND TOOLING	3	0	0	3

Objectives:

1. To understand Rapid prototyping history and its development.
2. To gain knowledge about liquid and powder based RP process
3. To enable student to learn about solid based RP process
4. To inherit knowledge about Rapid Tooling
5. To elaborate about principles of reverse engineering

UNIT I INTRODUCTION 9

Need - Development of RP systems – RP process chain - Impact of RapidPrototyping on Product Development –Digital prototyping - Virtual prototyping-Data Processing forRapid Prototyping: CAD model preparation, Part orientation and support generation, Support structure design, Model Slicing and contour data organization, direct and adaptive slicing, Tool path generation.

UNIT II LIQUID AND POWDER BASED RP PROCESSES 9

Liquid based process: Principles of STL and typical processes such as the SLA process, solid ground curing and others - Powder based process: Principles and typical processes such as selective laser sintering and some 3D printing processes.

UNIT III SOLID BASED RP PROCESSES 9

Principles and typical processes such as fused deposition modeling laminated object modeling and others.

UNIT IV RAPID TOOLING 9

Principles and typical processes for quick batch production of plastic and metal parts though quick tooling.

UNIT V REVERSE ENGINEERING 9

3D scanning, 3D digitizing and Data fitting, high speed machining- Hardware and software - Applications: Evaluation, bench marking and various case studies.

TOTAL HOURS: 45

Text Books:

1. Chua. C.K, “Rapid Prototyping”, Wiley, 1997.
2. Hilton. P.D. et all, “Rapid Tooling”, Marcel, Dekker 2000.

REFERENCES:

1. Burns. M, “Automated Fabrication”, PHI, 1993.
2. Beaman J.J et all, “Solid freeform fabrication”, Kluwer, 1997.
3. Jacohs P.F., “Stereolithography and other Rapid Prototyping and Manufacturing Technologies”, ASME, 1996.
4. Pham D.T. and Dimov S.S., “Rapid Manufacturing; the technologies and application of RPT and Rapid tooling”, Springer, London 2001.
5. Rafiq I. Noorani, Rapid Prototyping – Principles and Applications, Wiley & Sons, 2006.

SUBJECT	L	T	P	C
INTRODUCTION TO AIRCRAFT INDUSTRY AND AIRCRAFT SYSTEMS	**3**	**0**	**0**	**3**

At the end of this elective, student shall be able to:

1. Get an exposure to the Aerospace Industry.
2. Understand the Basics of Aircraft Systems and Aircraft Structures.

Chapter-1 –Aircraft industry overview, Duration- 3 hours

Evolution and History of Flight, Types Of Aerospace Industry, Key Players in Aerospace Industry, Aerospace Manufacturing, Industry Supply Chain, Prime contractors, Tier 1 Suppliers, Key challenges in Industry Supply Chain, OEM Supply Chain Strategies, Mergers and Acquisitions, Aerospace Industry Trends, Advances in Engineering/CAD/CAM/CAE Tools and Materials technology, Global and Indian Aircraft Scenario

Chapter-2 –Introduction to Aircrafts, Duration- 5 hrs

Basic components of an Aircraft, Structural members, Aircraft Axis System, Aircraft Motions, Control surfaces and High lift Devices. Types of Aircrafts - Lighter than Air/Heavier than Air Aircrafts Conventional Design Configurations based on Power Plant Location, Wing vertical location, intake location, Tail Unit Arrangements, Landing Gear Arrangements. Unconventional Configurations-Biplane, Variable Sweep, Canard Layout, Twin Boom Layouts, Span loaders, Blended Body Wing Layout, STOL and STOVL Aircraft, Stealth Aircraft. Advantages and disadvantages of these Configurations.

Chapter-3-Introduction to Aircraft Systems, Duration- 16 hrs

Types of Aircraft Systems.Mechanical Systems.Electrical and Electronic Systems.Auxiliary systems. Mechanical Systems: Environmental control systems (ECS), Pneumatic systems, Hydraulic systems, Fuel systems, Landing gear systems, Engine Control Systems, Ice and rain protection systems, Cabin Pressurization and Air Conditioning Systems, Steering and Brakes Systems Auxiliary Power Unit, Electrical systems: Avionics, Flight controls, Autopilot and Flight Management Systems, Navigation Systems, Communication, Information systems, Radar System

Chapter-4-Basic Principles of Flight, Duration- 10 hrs

Significance of speed of Sound, Air speed and Ground Speed, Properties of Atmosphere, Bernoulli's Equation, Forces on the airplane, Airflow over wing section, Pressure Distribution over a wing section, Generation of Lift, Drag, Pitching moments, Types of Drag, Lift curve, Drag Curve, Lift/Drag Ratio Curve, Factors affecting Lift and Drag, Center of Pressure and its effects. Aerofoil Nomenclature, Types of Aerofoil, Wing Section- Aerodynamic Center, Aspect Ratio, Effects of lift, Drag, speed, Air density on drag,

Chapter-5-Basics of Flight Mechanics , Duration 6 hrs

Mach Waves, Mach Angles, Sonic and Supersonic Flight and its effects

Stability and Control

Degree of Stability- Lateral, Longitudinal and Directional Stability and controls of Aircraft. Effects of Flaps and Slats on Lift Coefficients, Control Tabs, Stalling, Landing, Gliding Turning, Speed of Sound, Mach Numbers, Shock Waves

Aircraft Performance and Maneuvers

Power Curves, Maximum and minimum speeds of horizontal flight, Effects of Changes of Engine Power, Effects of Altitude on Power Curves, Forces acting on aAeroplane during a Turn, Loads during a Turn, Correct and incorrect Angles of Bank, Aerobatics, Inverted Maneuvers, Maneuverability

Reference Books:

1. Flight without Formulae by A.C Kermode, Pearson Education,10th Edition
2. Mechanics of Flight by A.C Kermode, Pearson Education,5th Edition
3. Fundamentals Of Flight, Shevell, Pearson Education, 2nd Edition
4. Introduction to Flight by Dave Anderson
5. Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration by Ian moir, Allan Seabridge
6. An Introduction to Aircraft Certification; A Guide to Understanding Jaa, Easa and FAA by Filippo De Florio, Butterworth-Heinemann

SUBJECT	L	T	P	C
DESIGN OF AIRCRAFT STRUCTURES	**3**	**0**	**0**	**3**

At the end of this elective, student shall be able to:

1. Industry Practices on Design of Aircraft Structures.
2. Understand the applicability of Design aspects in Aircraft Design.
3. Relate the theoretical knowledge with the design of Aircraft Structures.

Chapter-1-Overview of the Aircraft Design Process, Duration- 2hrs

Introduction, Phases of Aircraft Design, Aircraft Conceptual Design Process, Conceptual Stage, Preliminary Design, Detailed Design, Design Methodologies

Chapter 2-Fundamentals of Structural Analysis, Duration 2 hrs

Review of Hooke's Law, Principal stresses, Equilibrium and Compatibility, Determinate Structures, St Venant's Principle, Conservation of Energy, Stress Transformation, Stress Strain Relations

Chapter 3-Introduction to Aircraft Structures, Duration 3 hrs

Types of Structural members of Fuselage and wing section Ribs, Spars, Frames, Stringers, Longeron, Splices, Sectional Properties of structural members and their loads, Types of structural joints, Type of Loads on structural joints

Chapter-4 Aircraft Loads, Duration- 4 hrs

Aerodynamic Loads, Inertial Loads, Loads due to engine, Actuator Loads, Maneuver Loads, VN diagrams, Gust Loads, Ground Loads, Ground conditions, Miscellaneous Loads

Chapter-5-Aircraft Materials and Manufacturing processes Duration- 4 hrs

Material selection criteria, Aluminum Alloys, Titanium Alloys, Steel Alloys, Magnesium Alloys, copper Alloys, Nimonic Alloys, Non Metallic Materials, Composite Materials, Use of Advanced materials Smart materials, Manufacturing of A/C structural members, Overview of Types of manufacturing processes for Composites, Sheet metal Fabrication ,Machining, Welding, Super-plastic Forming And Diffusion Bonding

Chapter-6-Structural Analysis of Aircraft Structures Duration-20

Theory of Plates- Analysis of plates for bending, stresses due to bending, Plate deflection under different end conditions, Strain energy due to bending of circular, rectangular plates, Plate buckling, Compression buckling, shear buckling, Buckling due to in plane bending moments, Analysis of stiffened panels in buckling, Rectangular plate buckling, Analysis of Stiffened panels in Post buckling, Post buckling under shear. **Sample Exercises**.

Theory of Shells-Analysis of Shell Panels for Buckling, Compression loading, Shear Loading / Shell Shear Factor, Circumferential Buckling Stress, **sample exercises**

Theory of Beams-Symmetric Beams in Pure Bending, Deflection of beams, Unsymmetrical Beams in Bending, Plastic Bending of beams,Shear Stresses due to Bending in Thin Walled Beams, Bending of Open Section Beams, Bending of Closed Section Beams, Shear Stresses due to Torsion in Thin Walled Beams. **Sample Exercises**.

Theory of Torsion - Shafts of Non-Circular Sections, Torsion in Closed Section Beams, Torsion in Open Section Beams, Multi Cell Sections, **Sample Exercises**.

Chapter-7 Airworthiness and Aircraft Certification, Duration- 4 hrs
Definition, Airworthiness Regulations, Regulatory Bodies, Type certification, General Requirements, Requirements Related to Aircraft Design Covers, Performance and Flight Requirements, Airframe Requirements, Landing Requirements, Fatigue and Failsafe requirements, Emergency Provisions, Emergency Landing requirements

Chapter-8 Aircraft Structural Repair, Duration- 3 hrs
Types of Structural damage, Nonconformance, Rework, Repair, Allowable damage Limit, Repairable Damage Limit, Overview of ADL Analysis, Types of Repair, Repair Considerations and best practices

Reference Books:

1. Aircraft Design-A Conceptual Approach by Daniel P.Raymer, AIAA education series,6th Edition
2. Airframe Structural Design by Michael Niu, Conmilit Press, 1988,2nd Edition
3. Airframe Stress Analysis and Sizing by Michael Niu, Conmilit Press, 1999,3rd Edition
4. The Elements of Aircraft Preliminary Design – Roger D. Schaufele, Aries Publications, 2000
5. Aircraft Structural Maintenance by Dale Hurst, Avotek publishers, 2nd Edition, 2006
6. Aircraft Maintenance & Repair by Frank Delp, Michael J. Kroes& William A. Watkins, Glencoe &McGraw-Hill,6th Edition, 1993

SUBJECT	L	T	P	C
FUNDAMENTALS OF PIPING ENGINEERING	**3**	**0**	**0**	**3**

Objectives:

1. To understand the basics of pipes and their material's selection.
2. To understand the various pipeline accessories and fittings.
3. To know about various valves and their selection.
4. To know about various special piping elements.
5. To understand about various flows of fluids and frictional losses through pipes due to the flow.

UNIT 1: FUNDAMENTALS OF PIPING 9

Introduction and Scope of Piping – Definition and Application of Pipes –Pipe networks-Selection of Materials-Codes and Standards.

UNIT 2: ACCESORIES AND FITTINGS 9

Selection – Standards - Dimensions – Types of Fittings - Pipe Bends –Connection – Reducers – Couplings-Pipe Flanges–Types-Facings-Gaskets.

UNIT 3: VALVES 9

Definition – Types – Functions – Operators- Valves Layout Considerations – Valve Data Sheet - Valve Selection

UNIT 4: PIPING SPECIAL ELEMENTS 9

Strainers – Expansion joints/Bellows – Rupture Disc – Spectacle Blind – Blanks – Spacers – Spray Nozzles – Steam trap – Flame Arrestor – Vortex Breaker

UNIT 5: **FLOW THROUGHPIPES 9**

Types of Flow- visualization of Flow-losses in Pipes-Darcy Weisbachs Equation – Pipe Roughness – Friction – Moody's Diagram – Minor Losses - Flow through Pipe in Parallel and Series

TOTAL HOURS :45

BOOKS:

1. Piping and valves – Frank R. Spellman, Joanne.E.Drinan-CRC pressLLC, Florida-2001.
2. Fundamentals of pipeline engineering – Jacques Vincent-Genod-Editions Technip, Paris-1984.

REFERRENCES:

1. Piping handbook -Mohinder L. Nayyar-McGrawHil-2000.
2. Valves, Piping& Pipelines Hand book-Elsevier science ltd. – 3rd edition, 2001.
3. Fluid mechanics –Frank kreith-CRC Press-2000.
4. A Text Book of Fluid Mechanics – Dr. R.K .Bansal-Laxmi Publications (p) ltd.,-1st edition-2008.
5. Piping and pipeline calculations manual - Construction, Design Fabrication and Examination – Philip Ellenberger-BH (Elsevier Inc.)-2010.

SUBJECT	L	T	P	C
ADVANCED CERAMIC TECHNOLOGY	3	0	0	3

Objectives:

1. To make the students to understand the importance of ceramics in various advanced fields.
2. The application of ceramic in bio and medical field will help the students to gain knowledge in those fields.
3. To familiarize the ceramics applications in electronic industries.
4. To understand the application of ceramics in special and precious items
5. To enable students to understand about the Nano technology in ceramic field.

UNIT 1: CERAMICS USED IN ADVANCED APPLICATIONS: 9

Ceramics used in Nuclear energy - Magneto- hydrodynamic generation - Gas turbine blades - Abrasives – Aerospace - Diesel engines – Heat Exchangers - Cutting Tools Applications.

UNIT 2: CERAMICS FOR MEDICAL AND SCIENTIFIC PRODUCTS: 9

Tissue attachment mechanism- Bio- active materials-Nearly inert crystalline ceramics- Porous ceramics- bioactive glass and glass ceramics- calcium phosphate ceramics- carbonbased implants materials- ceramics for dental applications.

UNIT 3: CERAMICS FOR OPTICAL APPLICATIONS: 9

CRT and TV picture tubes - Telecommunication and related uses - Information display - Laser – Fibre optics - Electromagnetic windows.

UNIT 4: MAGNETIC CERAMICS: 9

Spinel Ferrites - Hexagonal Ferrites - Garnet - Processing -Single crystal ferrite -Applications.

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UNIT 5: CERAMIC SUPERCONDUCTORS AND NANOCERAMICS: 9

High Tc Superconductors - Structure of Y-Ba-Cu oxide system - Powder synthesis - Theory of Superconductivity - Nano Ceramics - Applications.

Total Hours :45

BOOKS:-

1. FREDERICK HARWOOD NORTAN-"ELEMENTS OF CERAMICS"-Addison-Wesley Longman, incorporated, 1974.
2. CB Carter, MGNorton-'Ceramic Materials-Science and Engineering"-Springer.

REFERENCES:

1. Philip Raw son-"Ceramics"-Pennsylvania press-1984.
2. The ceramic society of Japan-"Advanced ceramic technologies & Products"-Springer.
3. LL Hench, JK West-"Principles of electronic ceramics-1990.
4. Laurent sedal,ChristianRey-"Bio ceramics"-volume 10,proceedings of ceramics in medicine,1997
5. Philippe Boach,Jean-claude niepce-"Ceramic Materials-Processes, Properties and Applications"-ISTE ltd. London-2007.

SUBJECT	L	T	P	C
VIBRATIONS AND NOISE CONTROL	3	0	0	3

Objectives:

1. To understand the various types of vibration and analyses.
2. To understand the basics of Noise and the relevant parameters.
3. To understand the noise sources relevant to automotives.
4. To understand the various vibration control techniques.
5. To understand the various noise control techniques.

UNIT I BASICS OF VIBRATION 9

Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and nonlinear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, determination of natural frequencies-Vibration Analyses.

UNIT II BASICS OF NOISE 9

Introduction, amplitude, frequency, wavelength and sound pressure level, addition, subtraction and averaging decibel levels, noise dose level, legislation, measurement and analysis of noise, measurement environment, equipment, frequency analysis, tracking analysis, sound quality analysis.

UNIT III AUTOMOTIVE NOISE SOURCES 9

Noise Characteristics of engines, engine overall noise levels, assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine accessory contributed noise, transmission noise, aerodynamic noise, tyre noise, brake noise.

UNIT IV CONTROL TECHNIQUES 9

Vibration isolation, tuned absorbers, untuned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.

UNIT V SOURCE OF NOISE AND CONTROL 9

Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers

Total Hours : 45

TEXT BOOKS :

1. Singiresu S.Rao - “Mechanical Vibrations” - Pearson Education, ISBM –81-297- 0179-0 - 2004.
2. Kewal Pujara “Vibrations and Noise for Engineers”, Dhanpat Rai & Sons, 1992.

REFERENCES:

1. Bernard Challen and Rodica Baranescu - “Diesel Engine Reference Book” - Second Edition - SAE International - ISBN 0-7680-0403-9 – 1999.
2. Julian Happian-Smith - “An Introduction to Modern Vehicle Design”- Butterworth-Heinemann, ISBN 0750-5044-3 - 2004
3. John Fenton - “Handbook of Automotive body Construction and Design Analysis - Professional Engineering Publishing, ISBN 1-86058-073- 1998.