P.S.R. ENGINEERING COLLEGE

(An Autonomous Institution & Affiliated to Anna University, Chennai)

B.E. Mechanical Engineering

UG REGULATION-2012

CURRICULUM AND SYLLABI

[I To VIII Semester]

THIS IS THE FINAL VERSION OF THE SYLLABUS AS APPROVED BY THE ACADEMIC COUNCIL OF THE COLLEGE IN THE MEETING HELD ON 1ST JUNE 2013

Vision:

To provide broad-based education and training in mechanical engineering and its applications to enable the graduates to meet the demands in a rapidly changing needs in industry, academia and society.

Mission:

- To impart high quality technical education and training that encompasses both theory and practices with human and social values
- To equip the students to face tomorrows technology embedded global changes
- To create, explore, and develop innovations in mechanical engineering research.

PROGRAM EDUCATIONAL OBJECTIVES OF B.E.-MECHANICAL ENGINEERING:

- Students will be successful in professional career by gaining thorough knowledge in the fundamentals of Mechanical Engineering
- Graduates will be able to analyze real world problems and design the socially accepted and economically feasible mechanical products and systems.
- Students will engage in lifelong learning and professional development by pursuing higher studies and research
- Students will be able to lead a team with good leadership traits and good interpersonal relationship with the members in other engineering teams.

PROGRAM OUTCOMES OF B.E.-MECHANICAL ENGINEERING:

- Ability to apply knowledge of mathematics, science, and engineering
- Ability to design and conduct experiments, as well as to analyze and interpret data
- Ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- Ability to function on multidisciplinary teams
- Ability to identify, formulate, and solve engineering problems
- Understanding of professional and ethical responsibility
- Ability to communicate effectively
- Broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- Recognition of the need for, and an ability to engage in life-long learning
- Knowledge of contemporary issues
- Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- Ability to apply engineering and management principles as a member and leader in a team, to manage projects

REGULATION – 2012
B.E. MECHANICAL ENGINEERING
CURRICULUM I & VIII SEMESTER

S.No.	Sub. Code	Subject Name	Internal Marks	Final Exam Marks	Total Marks	Hrs & Credits			
						L	T	P	C
SEMESTER I									
Theory									
1	12F1Z1	Technical English-I	25	75	100	3	1	0	4
2	12F1Z2	Engineering Mathematics-I	25	75	100	3	1	0	4
3	12F1Z3	Engineering Physics-I	25	75	100	3	0	0	3
4	12F1Z4	Engineering Chemistry-I	25	75	100	3	0	0	3
5	12F1Z5	Fundamentals of Computing and Programming	25	75	100	3	0	0	3
6	12F1Z6	Engineering Graphics	25	75	100	3	1	0	4
Practical									
7	12F1Z7	Physics and Chemistry Laboratory – 1	25	75	100	0	0	3	2
8	12F1Z8	Computer Practice Laboratory -1	25	75	100	0	0	3	2
9	12F1Z9	Engineering Practices Laboratory	25	75	100	0	0	3	2
	Total				900	18	3	9	27

S.No.	Sub. Code	Subject Name	Internal Marks	Final Exam Marks	Total Marks	Hrs & Credits			
						L	T	P	C
SEMESTER II									
Theory									
1	12F2Z1	Technical English-II	25	75	100	3	1	0	4
2	12F2Z2	Engineering Mathematics-II	25	75	100	3	1	0	4
3	12F2Z3	Engineering Physics-II	25	75	100	3	0	0	3
4	12F2Z4	Engineering Chemistry-II	25	75	100	3	0	0	3
5	12F2Y5	Engineering Mechanics (For Non-Circuit branches)	25	75	100	3	0	0	3
6	12F2E5	Circuit Theory (For EEE branch only)	25	75	100	3	1	0	4
7	12F2X5	Electric Circuits and Electron Devices (For ECE,CSE,IT branches)	25	75	100	3	1	0	4
8	12F2X6	Basic Civil and Mechanical Engineering (For Circuit branches)	25	75	100	3	1	0	4
9	12F2Y6	Basic Electrical and Electronics Engineering(For Non-Circuit branches)	25	75	100	3	1	0	4

Practical									
10	12F2Z7	Physics and Chemistry Laboratory – II	25	75	100	0	0	3	2
11	12F2X7	Computer Aided Drafting and Modeling Laboratory (For Non Circuit Branches)	25	75	100	0	0	3	2
12	12F2E7	Electrical Circuit Laboratory (For EEE)	25	75	100	0	0	3	2
13	12F2Z8	Computer Practice Laboratory - II	25	75	100	0	0	3	2
14	12F2X8	Electric Circuits and Electron Devices Laboratory (ECE,CSE,IT)	25	75	100	0	0	3	2
	Total				900	18	4	9	27

S.No	**Subject Code**	**Course Title**	**Internal Marks**	**Final Exam Marks**	**Total Marks**	**Credits**			
						L	**T**	**P**	**C**
SEMESTER - III									
1	12MA31	Transforms and Partial Differential Equation	25	75	100	3	1	0	4
2	12ME31	Manufacturing Technology – I	25	75	100	3	0	0	3
3	12ME32	Engineering Thermodynamics	25	75	100	3	1	0	4
4	12ME33	Engineering Materials and Metallurgy	25	75	100	3	0	0	3
5	12ME34	Fluid Mechanics and Machinery	25	75	100	3	1	0	4
6	12ME35	Electrical Drives and Controls	25	75	100	3	0	0	3
Practicals									
7	12ME36	Manufacturing Technology Laboratory – I	25	75	100	0	0	3	2
8	12ME37	Fluid Mechanics and Machinery Laboratory	25	75	100	0	0	3	2
9	12ME38	Electrical Engineering Laboratory	25	75	100	0	0	3	2
10	12HS31	Professional English – I	25	75	100	0	0	1	1
		Total			1000	18	3	10	28

S.No	Subject Code	Course Title	Internal Marks	Final Exam Marks	Total Marks	Hrs & Credits			
						L	T	P	C
SEMESTER IV									
Theory									
1	12MA44	Statistics and Numerical Methods	25	75	100	3	1	0	4
2	12ME41	Manufacturing Technology – II	25	75	100	3	0	0	3
3	12ME42	Kinematics of Machinery	25	75	100	3	1	0	4
4	12ME43	Engineering Metrology and Measurements	25	75	100	3	0	0	3
5	12ME44	Mechanics of Materials	25	75	100	3	1	0	4
6	12ME45	Electronics and Microprocessors	25	75	100	3	0	0	3
Practicals									
7	12ME46	Manufacturing Technology Laboratory – II	25	75	100	0	0	3	2
8	12ME47	Material Testing and Metallurgical Laboratory	25	75	100	0	0	3	2
9	12ME48	Metrology and Measurements Laboratory	25	75	100	0	0	3	2
10	12HS41	Professional English – II	25	75	100	0	0	1	1
Total					1000	18	3	10	28

S.No	Subject Code	Course Title	Internal Marks	Final Exam Marks	Total Marks	Hrs & Credits			
						L	T	P	C
SEMESTER V									
Theory									
1	12GE31	Environmental Science and Engineering	25	75	100	3	0	0	3
2	12ME51	Dynamics of Machinery	25	75	100	3	1	0	4
3	12ME52	Design of Machine Elements	25	75	100	3	0	0	3
4	12ME53	Thermal Engineering	25	75	100	3	1	0	4
5	12ME54	Applied Hydraulics & Pneumatics	25	75	100	3	0	0	3
6	12ME55	Automobile Engineering	25	75	100	3	0	0	3
Practicals									
7	12ME56	Computer Aided Machine Drawing Laboratory	25	75	100	0	0	3	2
8	12ME57	Dynamics Laboratory	25	75	100	0	0	3	2
9	12ME58	Thermal Engineering Laboratory – I	25	75	100	0	0	3	2
10	12HS51	English for Employment – I	25	75	100	0	0	2	1
Total					1000	18	2	11	27

S.No	Subject Code	Course Title	Internal Marks	Final Exam Marks	Total Marks	Hrs & Credits			
						L	T	P	C
SEMESTER VI									
Theory									
1	12MG61	Principles of Management	25	75	100	3	0	0	3
2	12ME61	Heat and Mass Transfer	25	75	100	3	1	0	4
3	12ME62	Computer Integrated Manufacturing	25	75	100	3	0	0	3
4	12ME63	Finite Element Analysis	25	75	100	3	1	0	4
5	12ME64	Design of Transmission Systems	25	75	100	3	0	0	3
6		Elective – I	25	75	100	3	0	0	3
Practicals									
7	12ME65	Thermal Engineering Laboratory – II	25	75	100	0	0	3	2
8	12ME66	CAD / CAM Laboratory	25	75	100	0	0	3	2
10	12HS61	English for Employment – II	25	75	100	0	0	2	1
		Total			1000	18	3	8	25

S.No	Subject Code	Course Title	Internal Marks	Final Exam Marks	Total Marks	Hrs & Credits			
						L	T	P	C
SEMESTER VII									
Theory									
1	12MG71	Total Quality Management	25	75	100	3	0	0	3
2	12ME71	Mechatronics	25	75	100	3	0	0	3
3	12ME72	Gas Dynamics and Jet Propulsion	25	75	100	3	0	0	3
4	12ME73	Power Plant Engineering	25	75	100	3	0	0	3
5		Elective – II	25	75	100	3	0	0	3
6		Elective – III	25	75	100	3	0	0	3
Practicals									
7	12ME74	Computer Aided Simulation & Analysis Laboratory	25	75	100	0	0	3	2
8	12ME75	Mechatronics Laboratory	25	75	100	0	0	3	2
10	12ME76	Design & Fabrication Project	25	75	100	0	0	3	2
		Total			1000	18	1	9	25

S.No	Subject Code	Course Title	Internal Marks	Final Exam Marks	Total Marks	Hrs & Credits			
						L	T	P	C
SEMESTER VIII									
Theory									
1		Elective – IV	25	75	100	3	0	0	3
2		Elective – V	25	75	100	3	0	0	3
Practicals									
3	12ME82	Project Work	25	75	100	0	0	12	6
		Total			1000	6	0	12	12

List of Electives

S.No	Subject Code	Course Title	Internal Marks	Final Exam Marks	Total Marks	Hrs & Credits			
						L	T	P	C
SEMESTER VI – Elective I									
Theory									
1	12ME6A	Marketing Management	25	75	100	3	0	0	3
2	12ME6B	Quality Control and Reliability Engineering	25	75	100	3	0	0	3
3	12ME6C	Refrigeration and Air conditioning	25	75	100	3	0	0	3
4	12ME6D	Renewable Sources of Energy	25	75	100	3	0	0	3
5	12ME6E	Industrial Tribology	25	75	100	3	0	0	3
6	12ME6F	Vibration and Noise Control	25	75	100	3	0	0	3
	12ME6G	Unconventional Machining Processes	25	75	100	3	0	0	3

S.No	Subject Code	Course Title	Internal Marks	Final Exam Marks	Total Marks	Hrs & Credits			
						L	T	P	C
SEMESTER VII– Elective I									
Theory									
1	12ME7A	Process Planning and Cost Estimation	25	75	100	3	0	0	3
2	12ME7B	Design of Jigs, Fixtures and Press Tools	25	75	100	3	0	0	3
3	12ME7C	Composite Materials	25	75	100	3	0	0	3
4	12ME7D	Robotics	25	75	100	3	0	0	3
5	12ME7E	Thermal Turbo Machines	25	75	100	3	0	0	3
6	12ME7F	Computational Fluid Dynamics	25	75	100	3	0	0	3
	12ME7G	Nuclear Engineering	25	75	100	3	0	0	3

S.No	Subject Code	Course Title	Internal Marks	Final Exam Marks	Total Marks	Hrs & Credits			
						L	T	P	C
SEMESTER VIII - – Elective III & IV									
Theory									
1	12GE61	Fundamentals of Nanoscience	25	75	100	3	0	0	3
2	12GE32	Professional Ethics in Engineering	25	75	100	3	0	0	3
3	12ME8A	Entrepreneurship Development	25	75	100	3	0	0	3
4	12ME8B	Production Planning and Control	25	75	100	3	0	0	3
5	12ME8C	Maintenance Engineering	25	75	100	3	0	0	3
6	12ME8D	Operations Research	25	75	100	3	0	0	3
7	12ME8E	Pressure Vessels and Piping Design	25	75	100	3	0	0	3
8	12ME8F	Advanced I.C. Engines	25	75	100	3	0	0	3
9	12ME8G	Design of Heat Exchangers	25	75	100	3	0	0	3
10	12ME8H	Fireworks Safety	25	75	100	3	0	0	3

12F1Z1	TECHNICAL ENGLISH - I	L	T	P	C
		3	1	0	4

AIM

To enable learners of Engineering and Technology develop their basic communication skills in English.

Course Outcomes

- Relate basic grammar and structure of a language with relevance to technical vocabulary
- Analyze the technical English resources with reading skill
- Develop technical communication skill in writing
- Distinguish the sounds of English with Technical audio resources
- Adapt basic English language skill for effective oral communication

UNIT I FOCUS ON LANGUAGE 10

General Vocabulary- prefix, suffix –Denotative & connotative- Parts of Speech-Types of Sentences-Conditionals Connectors Concord -Tenses- -Active &Passive voice -Phrases & Clauses-Spelling& Punctuation-Cause & Effect-Correct use of words(parts of speech)-Question Tags-'wh'&'Yes/No'Type questions-Rearranging Jumbled Sentences-One-Word Substitution

UNIT II READING 12

Reading for gist/Identifying information/gap filling-Reading different types of text like advertisement, instruction, manuals, report - Reading passage with multiple choice questions/cloze type passage/sentence matching/completing passage-Reading for flow chart completion/matching information/matching headings, Reading for sentence completion

UNIT III WRITING 12

Writing Sentences for Brevity, Clarity and Simplicity-Writing Topic sentences/General Information/Description Paragraph-structuring an Essay-Writing effective conclusions-Writing a Process- Writing formal letter like Requisition letter, Placing an order, Quotation letter, Acknowledgement letter, Enquiry Letter, Complaint Letter, Permission Letter.

UNIT IV LISTENING 12

Listening for Learning-Word Stress and Pronunciation practices-Listening for Specific information-Note taking-Listening to announcements- Listening to News on the radio/TV

UNIT V SPEAKING 12

Introducing oneself–offering Suggestions and recommendations-Expressing opinions suggestions-(agreement/disagreement)-Role play- Purchase Manager& Customer, Customer care executive (voice) & Customer, Bank manager& Employee, Commenting on the basis of Discussion-Using Verbal & Non-verbal cues in speech-Using Familiar Expressions in different situations.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Department of Humanities & Social Sciences, Anna University, '*English for Engineers and Technologists*' Combined Edition (Volumes 1 & 2), Chennai: Orient Longman Pvt. Ltd., 2006.

REFERENCES

1 CambridgeBECPreliminary2Student'sBookwithAnswers: ExaminationpapersfromUniversity ofCambridgeESOL Examinations, Cambridge ESOL, PB, ISBN: 9780521544504
2. Meenakshi Raman and Sangeetha Sharma-"Technical Communication: English skills for Engineers"-Oxford University Press-2008,ISBN:0-19-569574-7

E-MATERIALS

1.www.usingenglish.com
2.www.ego4u.com
3.www.letterwritingguide.com
4.www.randallsenglishlab.com

12F1Z2	ENGINEERING MATHEMATICS – I	L	T	P	C
		3	1	0	4

AIM

The Course is aimed at Developing the basic mathematical skills of Engineering Student

Course Outcomes

The Students will be able to

- Find the inverse of given matrix and reduce matrix equation using Cayley-Hamilton theorem
- Elaborate given function as a power series using Taylor's series
- Apply double integration to find area between two curves
- Make use of Calculus in finding the envelope, Evolutes & Involutes
- Evaluate the shortest distance between two skew-lines and find equation of coplanar planes
- Classify Conic system in Three Dimensional Geometry

UNIT I MATRICES 9+3

Characteristic equation - Eigen Values and Eigen vectors of a real matrix - Properties of Eigen values - Problem solving using Cayley-Hamilton - Similarity Transformation - Orthogonal Transformation of a Symmetric matrix to diagonal form - Quadratic form - Orthogonal reduction to canonical form

UNIT II THREE DIMENSIONAL GEOMETRY 9+3

Introduction – Sphere - Tangent plane - Plane section of a sphere–Lines - Skew lines – Coplanar lines -– Equation of cylinder - Right circular cylinder.

UNIT III DIFFERENTIAL CALCULUS 9+3

Curvature - Radius of curvature - Cartesian and Parametric Coordinates - Circle of Curvature - Involutes and Evolutes – Envelope - Evolutes as Envelope of its normal.

UNIT IV FUNCTIONS OF SEVERAL VARIABLES 9+3

Partial Derivatives - Euler's Theorem for homogeneous function - Total Derivative - differentiation of Implicit function – Jacobian - Taylor's Expansion - Maxima/Minima for function of two variables - Method of Lagrange's multipliers

UNIT V MULTIPLE INTEGRALS 9+3

Double integration - Cartesian and Polar co-ordinates - Change of order of integration - Change of variable between Cartesian and polar co-ordinates - Triple integration - Area as a double integration - Volume as a triple integral

TOTAL: 60 PERIODS

TEXT BOOKS

1. B.S.Grewal, "Higher Engineering Mathematics', Thirty Sixth Edition,Khanna Publishers,Delhi,2005.
2. Kreyszig, E., Advanced Engineering Mathematics, 8th edition, John Wiley Sons, 2001
3. Dr.P.Kandasamy , Dr.K.Thilagavathy , Dr.K.Gunavathy , S. Chand & Company Ltd. Ram nagar, New Delhi.

REFERENCES

1. Greenberg, M.D. Advanced Engineering Mathematics, Second Edition, Pearson Education Inc. (First Indian reprint), 2002
2. Venkataraman.M.K., "Engineering Mathematics", Volume I and II Revised enlarged Fourth Edition, The National ?Publishing Cpompany,Chennai,2004.
3. Veerarajan.T, "Engineering Mathematics", Fourth Edition, Tata McGraw – hill publishing company Ltd, New Delhi,2005.

12F1Z3	ENGINEERING PHYSICS - I	L	T	P	C
		3	0	0	3

AIM

To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology

Course Outcomes

The Students will be able to

- Demonstrate the basic concepts of ultrasonic and their applications
- Summarize the principles of different types of laser and laser characteristics, industrial and medical applications of the laser
- Explain the light propagation in optical fiber and recognize its structures, types and applications such as sensors, endoscope
- Interpret the Planck's theory in quantum phenomena and basic concepts like Compton scattering, Schrodinger equations and its application
- Explain in detail the crystal structure, identification of cubic unit cells (SC, BCC, FCC) and HCP, miller indices and crystal defects

UNIT I ULTRASONICS 9

Introduction – Production – magnetostriction effect - magnetostriction generator- piezoelectric effect - piezoelectric generator- Detection of ultrasonic waves, properties – Cavitations - Velocity measurement – acoustic grating - Industrial applications – drilling, welding, soldering and cleaning – SONAR - Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C –scan displays, Medical applications – Sonograms

UNIT II LASERS 9

Introduction – Principle of Spontaneous emission and stimulated emission. Population inversion, pumping. Einsteins A and B coeffcients - derivation. Types of lasers – He-Ne, CO2 , Nd-YAG, Semiconductor lasers- Qualitative Industrial Applications - Lasers in welding, heat treatment, cutting – Medical applications - Holography and uses.

UNIT III FIBER OPTICS and APPLICATIONS 9

Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – Double crucible technique of fibre drawing - Fibre optical communication system (Block diagram) - Light sources - Detectors - Fibre optic sensors – temperature and displacement - Endoscope.

UNIT IV QUANTUM PHYSICS 9

Black body radiation – Planck's theory (derivation)- Compton effect- Theory and experimental verification – Matter waves – Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box.

UNIT V CRYSTAL PHYSICS 9

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 and HCP structures –Crystal defects – point, line and surface defects- Burger vector

TOTAL: 45 PERIODS

TEXT BOOKS

1. R. K. Gaur and S.C. Gupta, 'Engineering Physics' Dhanpat Rai Publications, New Delhi(2003).
2. M.N. Avadhanulu and PG Kshirsagar, 'A Text book of Engineering Physics', S.Chand and company, Ltd., New Delhi, 2005.
3. K.Rajagopal , " Engineering Physics " Prentice – Hall of India Pvt. Ltd. New Delhi , 2007.

REFERENCES

1. Serway and Jewett, 'Physics for Scientists and Engineers with Modern Physics',6th Edition, Thomson Brooks/Cole, Indian reprint (2007).
2. Rajendran, V and Marikani A, 'Engineering Physics' Tata McGraw Hill PublicationsLtd, III Edition, New Delhi, (2004).
3. Palanisamy, P.K., 'Engineering Physics' Scitech publications, Chennai, (2007).
4. Jayakumar. S, 'Engineering Physics', R.K. Publishers, Coimbatore, (2003).
5. Chitra Shadrach and Sivakumar Vadivelu, 'Engineering Physics', Pearson Education,New Delhi, (2007).

12F1Z4 ENGINEERING CHEMISTRY – I

L	T	P	C
3	0	0	3

AIM

To impart a sound knowledge on the principles of chemistry involving the different Application oriented topics required for all engineering branches

Course Outcomes

The Students will be able to

- The student should be conversant with the principles water characterization and treatment of potable and industrial purposes.
- Principles of polymer chemistry and engineering applications of polymers.
- Industrial applications of surface chemistry.
- Conventional and non-conventional energy sources and energy storage.
- Devices and Chemistry of engineering materials.

UNIT I WATER TECHNOLOGY 9

Characteristics – alkalinity – types of alkalinity and determination – hardness –types and estimation by EDTA method (problems); Domestic water treatment –disinfection methods (Chlorination, ozonation. UV treatment) – Boiler feed water– requirements – disadvantages of using hard water in boilers – internal conditioning (phosphate, calgon and carbonate conditioning methods) – external conditioning – demineralization process – desalination and reverse osmosis

UNIT II POLYMERS AND COMPOSITES 9

Polymers-definition – polymerization – types – addition and condensation Polymerization – free radical polymerization mechanism – Plastics, classification–Preparation, properties and uses of PVC, Teflon, polycarbonate, polyurethane, Nylon-6, 6, PET- Rubber -vulcanization of rubber, synthetic rubbers – buty1Rubber, SBR, Composites – definition, types polymer matrix composites – FRP only.

UNIT III SURFACE CHEMISTRY 9

Adsorption – types – adsorption of gases on solids – adsorption isotherms –Frendlich and Langmuir isotherms – adsorption of solutes from solution – role of adsorbents in catalysis, ion-exchange adsorption and pollution abatement.

UNIT IV NON-CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES 9

Nuclear energy – fission and fusion reactions and light water nuclear reactor for

Power generation (block diagram only) – breeder reactor – solar energy Conversion – Solar cells – wind energy – fuel cells – hydrogen – oxygen fuel cell – Batteries – Alkaline batteries – lead–acid, nickel–cadmium and lithium batteries

UNIT V ENGINEERING MATERIALS 9

Refractories – classification – acidic, basic and neutral refractories – properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) – manufacture of alumina, magnesite and zirconia bricks, Abrasives – natural and synthetic abrasives – quartz, corundum, emery, garnet, diamond, silicon carbide and boron carbide. Lubricants –

mechanism of lubrication, liquid lubricants, - properties – viscosity index, flash and fire points, cloud and pour points, oilyness) – solid lubricants – graphite and molybdenum sulphide. Nanomaterials – introduction to nanochemistry – carbon nanotubes and their Applications

TOTAL: 45 PERIODS

TEXT BOOKS

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2002).
2. Dr.A.Ravikrishnan, "Engineering Chemistry" Sri Krishna Publications, Chennai. (2002)
3. S.S. Dara "A text book of engineering chemistry" S.Chand and Co.Ltd., New Delhi (2006).

REFERENCES

1. B.K.Sharma "Engineering chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).
2. B. Sivasankar "Engineering Chemistry" Tate McGraw-Hill Pub.Co.Ltd, New Delhi (2008).

12F1Z5	FUNDAMENTALS OF COMPUTING AND PROGRAMMING	L	T	P	C
		3	0	0	3

AIM

To provide an awareness to Computing and Programming .

Course Outcomes

The Students will be able to

- Explain the major components of computer and its functionalities
- Summarize evolution of computers generation and their classification
- Solve computing problems using algorithm and flowchart
- Develop small programs related to simple/ moderate mathematical and logical problems in 'C'
- Develop programs in C language using arrays, functions, structures & pointers

UNIT I INTRODUCTION TO COMPUTERS 9

Introduction – Characteristics of Computers – Evolution of Computers - Computer Generations – Classification of Computers – Basic Computer organization – Number Systems- Computer Software –Types of Software – Software Development Steps – Internet Evolution – Basic Internet Terminology- Internet Services

UNIT II PROBLEM SOLVING 9

Problem Solving Using Computers- Planning the Computer Program – Purpose – Algorithm – Flow Charts – Pseudo code.

UNIT III INTRODUCTION TO C 9

Overview of C – Constants, Variables and Data Types – Operators and Expressions – Managing Input and Output operators – Decision Making - Branching and Looping .

UNIT IV ARRAYS AND FUNCTIONS 9

Arrays- Handling of Character Strings – User-defined Functions – Definitions – Declarations - Call by reference – Call by value.

UNIT V STRUCTURES AND POINTERS 9

Structures and Unions – Pointers – Arrays – The Preprocessor – Developing a C Program : Some Guidelines

TOTAL: 45 PERIODS

TEXT BOOKS

1. Ashok.N.Kamthane," Computer Programming", Pearson Education (India) (2008).
2. Behrouz A.Forouzan and Richard.F.Gilberg, "A Structured Programming Approach Using C", II Edition, Brooks-Cole Thomson Learning Publications, (2007).

REFERENCES

1. Pradip Dey,Manas Ghoush, "Programming in C", Oxford University Press.(2007).
2. Byron Gottfried, "Programming with C", 2nd Edition, (Indian Adapted Edition), TMH publications, (2006). (Unit II, III, IV, and V).
3. Stephen G.Kochan, "Programming in C", Third Edition, Pearson Education India, (2005).
4. Brian W.Kernighan and Dennis M.Ritchie, "The C Programming Language", Pearson Education Inc., (2005).
5. E.Balagurusamy, "Computing fundamentals and C Programming", Tata McGRaw-Hill Publishing Company Limited, (2008).
6. S.Thamarai Selvi and R.Murugan, "C for All", Anuradha Publishers, (2008).

12F1Z6	ENGINEERING GRAPHICS	L	T	P	C
		3	1	0	4

AIM

To develop Graphic skills of the students.

Course Outcomes

The Students will be able to

- Follow the conventions used in engineering graphics
- Practice plane curves and free hand sketching
- Draw the projections of points, lines and plane
- Draw the projections of simple solids and their sectional views
- Identify the applications of development of surfaces
- Practice isometric and perspective projections

UNIT I PLANE CURVES AND FREE HAND SKETCHING 15

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 of tangents and normal to the above curves.

Free hand sketching:

Representation of Three Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 14

Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT III PROJECTION OF SOLIDS 15

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 15

Sectioning of above solids in simple vertical position by cutting planes inclined to one reference 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 cylindrical cutouts, perpendicular to the axis

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 15

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: 75 PERIODS

TEXT BOOKS

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

REFERENCES

1. M.S. Kumar, "Engineering Graphics", D.D. Publications, (2007).
2. K. Venugopal and V. Prabhu Raja, "Engineering Graphics", New Age International (P) Limited (2008).
3. M.B. Shah and B.C. Rana, "Engineering Drawing", Pearson Education (2005).
4. K. R. Gopalakrishnana, "Engineering Drawing" (Vol.IandII), 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 Hill Publishing Company Limited, New Delhi, (2008).

12F1Z7	PHYSICS LABORATORY I	L	T	P	C
		0	0	3	2

Course Outcomes

The Students will be able to

- Find the wavelength of Laser and velocity of ultrasonic waves
- Determine the thickness of a thin wire and Refractive index of a prism – light experiments
- Experiment with the thermal conductivity and Young's modulus of the materials
- Determine the total hardness of unknown water sample
- Estimate the amount of ferrous ion, HCl, dissolved oxygen and copper ion present in given solutions using various methods

LIST OF EXPERIMENTS

1. (a) Particle size determination using Diode Laser
   (b) Determination of wavelength of the Laser source.
   (c) Determination of acceptance angle and Numerical aperture of an optical fiber.
2. Determination of thickness of a thin wire – Air wedge method
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
4. Spectrometer- Dispersive power of a prism.
5. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
6. Determination of Young's modulus of the material – non uniform bending.

A minimum of FIVE experiments shall be offered.

12F1Z7	CHEMISTRY LABORATORY – I	L	T	P	C
		0	0	3	

LIST OF EXPERIMENTS

1. Estimation of hardness of Water by EDTA
2. Estimation of Copper in brass by EDTA
3. Estimation of ferrous iron by Potentiometric titrations
4. Estimation of hydrochloric acid by P^H metry.

5.Determination of DO in water (Winkler's method)

REFERENCE:

1. Text book of Quantitative Inorganic Analysis,A.I.Vogel, ELBS, London.
2. A.Ravikrishnan,"Practical Engineering Chemistry", Sri Krishna Publications, Chennai(2002)

12F1Z8	COMPUTER PRACTICE LABORATORY-I	L	T	P	C
		0	0	3	2

Course Outcomes

The Students will be able to

- Make use of MS-Office packages like, MS-Word, MS-Excel and PowerPoint
- Develop flowcharts & algorithms for computing problems
- Formulate problems and propose algorithms in C
- Effectively choose programming components that efficiently compute
- Create programs using C language in advance like structures & pointers

LIST OF EXPERIMENTS

1) **Word Processing**

a) Create a word Document using Table creation, Table Formatting and Scientific notations

b) Create Mail Merge

c) Drawing Flowchart for the following

i) To find the largest of three numbers A,B, and C

ii) To find the sum of first 50 Natural numbers

iii) Factorial of given number using Recursion

2) **Spreadsheet**

a) Create Spreadsheet using the following features:

Tables, Charts, Formula, Formula Editor

Sorting, Import/Export Features.

3) **Power-point**

a) Create a Power point Presentation about your college.

"C" Programs

Aim:

To practice C programs for the following concepts:

4) Simple C Programs using Data types, Expression Evaluation
5) Program using Conditional and Looping Statements
6) Program using Arrays
7) Program using functions
8) Program using Switch…case Statement
9) Program using Strings
10) Program using Structures

11) Program using Unions
12) Program using Pointers.

12F1Z9	ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	3	2

AIM

To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

Course Outcomes

The Students will be able to

- Design the pipe connections as per requirements and identify the various components used in plumbing
- Produce simple wooden joints using wood working tools
- Create simple lap, butt and tee joints using arc welding equipments
- Generate the simple components using lathe and drilling machine
- Identify the fitting usage of square joint, L joint and stepped joints
- Facilitate the operation of iron box, fluorescent lamp, fan and regulator wiring circuits
- Analyze the fundamentals of Boolean algebra and digital logic gates

LIST OF EXPERIMENTS

GROUP A (CIVIL and MECHANICAL)

I CIVIL ENGINEERING PRACTICE 9

Buildings:

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.

(b) Study of pipe connections requirements for pumps and turbines.

(c) Preparation of plumbing line sketches for water supply and sewage works.

(d) Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe Connections with different joining components.

(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

(a) Study of the joints in roofs, doors, windows and furniture.

(b) Hands-on-exercise: Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE 13

Welding:

(a) Preparation of arc welding of butt joints, lap joints and tee joints.

(b) Gas welding practice

Basic Machining:

(a) Simple Turning and Taper turning

(b) Drilling Practice

Sheet Metal Work:

(a) Forming and Bending:

(b) Model making – Trays, funnels, etc.

(c) Different type of joints.

Machine assembly practice:

(a) Study of centrifugal pump

(b) Study of air conditioner

Demonstration on:

(a) Smithy operations, upsetting, swaging, setting down and bending. Example Exercise – Production of hexagonal headed bolt.

(b) Foundry operations like mould preparation for gear and step cone pulley.

(c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.

GROUP B (ELECTRICAL and ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE 10

1. Residential house wiring using switches, fuse, indicator, lamp and energymeter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power and power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of electrical equipment.

IV ELECTRONICS ENGINEERING PRACTICE 13

1. Study of Electronic components and equipments – Resistor, colour coding measurement of

AC signal parameter (peak-peak, rms period, frequency) using CR.

2. Study of logic gates AND, OR, EOR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 45 PERIODS

		L	T	P	C
12F2Z1	**TECHNICAL ENGLISH II**	**3**	**1**	**0**	**4**

AIM

To make learners acquire listening and speaking skills in both formal and informal context

Course Outcomes

The Students will be able to

- To Build Vocabularies for an effective communication
- To know the mechanics of Writing for various Situations
- To obtain excellence in Oral Communication

- To Know the basics of Presentation Techniques
- To improve listening skill with all types of audio script.

UNIT I READING 12

Intensive reading and predicting content, Reading and interpretation, Reading comprehension exercises with questions on overall content – Discussions analyzing stylistic features (creative and factual description) – Reading comprehension exercises with texts including graphic communication– Exercises in interpreting non-verbal communication-Reading comprehension exercises with critical questions, multiple choice, Reading comprehension exercises with analytical questions on content – Evaluation of content questions

UNIT II WRITING 12

Writing a Report-Writing a Proposal-Writing a Feasibility Report-Writing Situational Report- Memo-Writing Agenda -Writing Minutes -Writing Manuals-Writing Thesis statements-Writing Recommendation, Checklist, Instruction-Writing Statement of Purpose-Writing Letter of Recommendation-Writing Statement of the Problem-Transcoding Flow Chart, Pie Chart, Bar Diagram, Line Graph.

UNIT III LISTENING 12

Listening to gather Information- Listening to stories- Listening to a conversations/Interviews Listening to a News Report- Listening to a famous speeches, ceremonial speech, awareness programme and technical presentation- Intensive Listening to find exact information-Listening for gist-Listening to identify expressions used in Discussions-Listening to identify tonal Variations in Speeches

UNIT IV SPEAKING 12

Talking about General Contents, localities, home town, ambition in life, Future plan- Introducing others-Describing/Introducing function of a product/ machine, talking about pros and cons of the product-Communication for the Mass-Welcome Address, Special Address, Presidential Address, Vote of thanks -Speaking with good Pronunciation-Famous quotes, speeches- Public Speech-Speaking on the General Topic-Appropriate Communication-Answering to the Question, adding valuable points to the discussion, giving an appropriate reply, appropriate vocabulary according to the audience-Giving a specific information about Statistics used in Bar diagram, Pie Chart -Role-Play-Hr and applicant, Purchase Manager and Customer, Industrialist- Reporter, Employer- Employee, Managing Director-HR

UNIT V FOCUS ON LANGUAGE 12

Synonym-Antonym- Homonym-Tenses-Phrasal Verbs- Acronym- Abbreviations-Foreign words-Confusing Words-Analogy- Numerical Expressions- Purpose Statement- Error Corrections-Direct andIndirect Speech.

TOTAL: 60 **PERIODS**

TEXT BOOKS

1. Department of Humanities and Social Sciences, Anna University, '*English for Engineers and Technologists*' Combined Edition (Volumes 1 and 2), Chennai: Orient Longman Pvt. Ltd., 2006.

REFERENCES

1. Sharan J.Genrson and Steven M.Gerson – "Technical Writing – Process and Product" – Pearson Education – 2000.
2. Raymond V.Lesikar, John D. Pettit and Mary E.Flatley – Lesikass BasicCommunication Tata McGraw Will 8th Edition – 1999.

3. Stevel. E. Pauley, Daniel G.Riordan – Technical Report Writing Today – AITBS Publishing and Distributors, India 5th edition – 2000.
4. Robert L.Shurter, Effective letters in business Third Ed. 1983.
5. Norman Whitby, Business Benchmark – Pre-Intermediate to Intermediate, Students Book, Cambridge University Press, 2006.
6. Cambridge BEC Preliminary 1 : Practice Tests from the University of Cambridge Local ExaminationsSyndicate, University of Cambridge Local Examinations Syndicate, PB, ISBN: 9780521753012.
7. CambridgeBECPreliminary2Student'sBookwithAnswers: ExaminationpapersfromUniversity ofCambridgeESOL Examinations, Cambridge ESOL, PB, ISBN: 9780521544504

12F2Z2 ENGINEERING MATHEMATICS – II

L	T	P	C
3	1	0	4

AIM

To analyse the engineering problems using the techniques and the mathematical skills acquired by studying vector calculus, Laplace transform, complex variables, ordinary differential equations.

Course Outcomes

- Apply Laplace transform to solve first and second order differential equations with elementary forcing function
- Classify Green's theorem to evaluate line integrals along simple closed contours on the plane
- Construct an analytic function using the properties of analytic function
- Make use of Cauchy's residue theorem for applications in Engineering
- Evaluate complicated real integrals using the basics of analytic functions and the complex integration
- Develop a series solution to an ODE, and recognize special functions defined by series

UNIT I LAPLACE TRANSFORM 9+3

Laplace transform – Conditions for existence – Transform of elementary functions –Basic properties – Transform of derivatives and integrals – Transform of unit step function and impulse functions – Transform of periodic functions. Definition of Inverse Laplace transform as contour integral – Convolution theorem (excluding proof) – Initial and Final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

UNIT II VECTOR CALCULUS 9+3

Gradient , Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds.

UNIT III ANALYTIC FUNCTIONS 9+3

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy–Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping : w= z+c, cz, 1/z, and bilinear transformation.

UNIT IV COMPLEX INTEGRATION 9+3

Statement and application of cauchy's theorem and Cauchy's integral formula, Taylor and Laurent expansion, Singularities, Classification, Residues, Cauchy's residue theorem, Contour integration, Unit circle and semi-circular contours (excluding poles on real axis)

UNIT V ORDINARY DIFFERENTIAL EQUATIONS 9+3

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

TOTAL: 60 PERIODS

TEXT BOOKS

1. B.S.Grewal,'Higher Engineering Mathematics', Thirty Sixth Edition,Khanna Publishers, Delhi,2005.
2. Kreyszig, E., Advanced Engineering Mathematics, 8th edition, John Wiley Sons, 2001.

REFERENCES

1. Greenberg, M.D. Advanced Engineering Mathematics, Second Edition, Pearson Education Inc. (First Indian reprint), 2002
2. Venkataraman.M.K.,"Engineering Mathematics",Volume I and II Revised enlarged Fourth Edition The National ?Publishing Cpompany,Chennai,2004.
3. Veerarajan.T"Engineering Mathematics",Fourth Edition,Tata McGraw – hill publishing company Ltd,New Delhi,2005.

12F2Z3	ENGINEERING PHYSICS – II	L	T	P	C
		3	0	0	3

AIM

To enrich the understanding of various types of materials and their applications in engineering and technology.

Course Outcomes

The Students will be able to

- Illustrate the free electron theories (classical and quantum), Fermi Function, carrier concentration in metals
- Analyze the theory of conducting and semiconducting materials, Hall Effect and its applications
- Explain the properties and applications of magnetic materials and super conducting materials
- Summarize the properties of dielectric materials and their applications – Ferro electricity
- Analyze the properties and applications of modern engineering materials
- Extend the acquaintance of nano phase materials

UNIT I CONDUCTING MATERIALS 9

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS 9

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 – variation of Fermi level with temperature and impurity concentration – compound semiconductors – Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9

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 – magnetic recording and readout – storage of magnetic data – tapes, floppy and magnetic disc drives.Superconductivity : properties - Types of super conductors – BCS theory of

superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS 9

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 – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V MODERN ENGINEERING MATERIALS 9

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, advantages and disadvantages of SMA.

Nanomaterials: synthesis –plasma arcing – chemical vapour deposition – sol-gels – electrodeposition – ball milling - properties of nanoparticles and applications. Carbon nanotubes: fabrication – arc method – pulsed laser deposition – chemical vapour deposition - structure – properties and applications.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Charles Kittel ‘ Introduction to Solid State Physics’, John Wiley and sons, 7 edition, Singapore (2007)
2. Charles P. Poole and Frank J.Ownen, ’Introduction to Nanotechnology’, Wiley India(2007) (for Unit V)
3. K.Rajagopal , “Engineering Physics” Prentice Hall of India Pvt.Ltd. New Delhi , 2007

REFERENCES

1. Rajendran, V, and Marikani A, ‘Materials science’Tata McGraw Hill publications, (2004) New delhi.
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. M. Arumugam, ‘Materials Science’ Anuradha publications, Kumbakonam, (2006).

12F2Z4 ENGINEERING CHEMISTRY – II

L	T	P	C
3	0	0	3

AIM

To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches .

Course Outcomes:

The Students will be able to

- Explain the operating principles and the reaction involved in electrochemistry
- Illustrate the principle and applications of different electrodes with their merits and demerits
- Prescribe the principles and application of corrosion control
- Develop the core concepts behind fuels and combustion
- Invent the concepts of fuel purification processes
- Analyze the importance in phase rule and pertain the chemistry of alloys
- Interpret the principles, importance and application of analytical techniques

UNIT I ELECTROCHEMISTRY 9

Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – Single electrode potential – Nernst equation (problem) – reference electrodes –Standard Hydrogen electrode -Calomel electrode – Ion selective electrode – glass electrode and measurement of pH –

electrochemical series – significance – potentiometer titrations (redox - Fe^{2+} vs dichromate and precipitation – Ag^{+} vs CI- titrations) and conduct metric titrations (acid-base – HCI vs, NaOH) titrations

UNIT II CORROSION AND CORROSION CONTROL 9

Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – factors influencing corrosion – corrosion control – sacrificial anode and impressed cathodic current methods – corrosion inhibitors – protective coatings – paints – constituents and functions – metallic coatings – electroplating (Au) and electroless (Ni) plating

UNIT III FUELS AND COMBUSTION 9

Calorific value – classification – Coal – proximate and ultimate analysis metallurgical coke – manufacture by Otto-Hoffmann method – Petroleum processing and fractions – cracking – catalytic cracking and methods-knocking – octane number and cetane number – synthetic petrol – Fischer Tropsch and Bergius processes – Gaseous fuels- water gas, producer gas, CNG and LPG, Flue gas analysis – Orsat apparatus – theoretical air for combustion.

UNIT IV PHASE RULE AND ALLOYS 9

Statement and explanation of terms involved – one component system – water system – condensed phase rule – construction of phase diagram by thermal analysis – simple eutectic systems (lead-silver system only) – alloys – importance, ferrous alloys – nichrome and stainless steel – heat treatment of steel, non-ferrous alloys – brass and bronze.

UNIT V ANALYTICAL TECHNIQUES 9

Beer-Lambert's law (problem) – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (problem) (block diagram only) – estimation of iron by colorimetry – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy.

TOTAL: 45 PERIODS

TEXT BOOKS

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co.,New Delhi (2002).
2. Dr.A.Ravikrishnan, "Engineering Chemistry" Sri Krishna Publications, Chennai. (2002)
3. S.S.Dara "A text book of Engineering Chemistry" S.Chand and Co.Ltd., New Delhi (2006).

REFERENCES

1. B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
2. B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).

		L	T	P	C
12F2Y5	**ENGINEERING MECHANICS**	**3**	**1**	**0**	**4**

AIM

To impart a sound knowledge on the applied physics laws in different engineering applications

Course Outcomes:

The Students will be able to

- Recite the laws of mechanics, Lame's theorem, parallelogram law, triangular law of forces and principle of transmissibility
- Analyze the types of supports and equilibrium of rigid bodies in three dimensions
- Explain the parallel axis theorem and perpendicular axis theorem and polar moment of inertia
- Solve the displacement, velocity and acceleration problems and their relationship with work energy equation of particles

- Explain the various Frictional forces and general plane motion of rigid bodies

UNIT I BASICS & STATICS OF PARTICLES 12

Introduction – Units and Dimensions – Laws of Mechanics – Lame's theorem, Parallelogram and triangular Law of forces – Vectors – Vectorial representation of forces and moments – Vector operations: additions, subtraction, dot product, cross product – Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility – Single equivalent force.

UNIT II EQUILIBRIUM OF RIGID BODIES 12

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions – Examples

UNIT III PROPERTIES OF SURFACES AND SOLIDS 12

Determination of Areas and Volumes – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, - Angle section, Hollow section by using standard formula – second and product moments of plane area – Rectangle, triangle, circle from integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia.

Mass moment of inertia – Derivation of mass moment of inertia for rectangular section, prism, sphere from first principle – Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES 12

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum.

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 12

Frictional force – Laws of Coloumb friction – simple contact friction – Rolling resistance – Belt friction. Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Beer, F.P and Johnson Jr. E.R. "Vector Mechanics for Engineers", Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, (1997).

REFERENCES

1. Rajasekaran, S, Sankarasubramanian, G., "Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt. Ltd., (2000).
2. Hibbeller, R.C., "Engineering Mechanics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., (2000).
3. Palanichamy, M.S., Nagam, S., "Engineering Mechanics – Statics & Dynamics", Tata McGraw-Hill, (2001).
4. Irving H. Shames, "Engineering Mechanics – Statics and Dynamics", IV Edition – Pearson Education Asia Pvt. Ltd., (2003).
    a. Ashok Gupta, "Interactive Engineering Mechanics – Statics – A Virtual Tutor
5. (CDROM)", Pearson Education Asia Pvt., Ltd., (2002).

12F2X6 BASIC CIVIL & MECHANICAL ENGINEERING

L	T	P	C
4	0	0	4

AIM

To study the basic criteria of Civil & Mechanical Engineering

Course Outcomes

The Students will be able to

- To study the types and principles of surveying.
- Learn the properties of construction materials and its applications.
- To ensure the working principle of Power Plant cycle
- To impart the knowledge of basic Pump works.
- To understand the various types of boilers
- To understand the Working Principle of Air conditioner

A – CIVIL ENGINEERING

UNIT I SURVEYING AND CIVIL ENGINEERING MATERIALS 15

Surveying: Objects – types – classification – principles – measurements of distances – angles – leveling – determination of areas – illustrative examples.

Civil Engineering Materials: Bricks : Properties & uses – Manufacturing, stones:Types, Cement: Manufacturing –Properties-Types of use, concrete: Manufacturing, Sand – steel sections.

UNIT II BUILDING COMPONENTS AND STRUCTURES 15

Components of Building with typical cross section sketch

Foundations: Types, Bearing capacity – Requirement of good foundations.

Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – Mechanics – Internal and external forces – stress – strain – elasticity –illustrative examples - Types of Bridges and Dams

30 PERIODS

B – MECHANICAL ENGINEERING

UNIT III POWER PLANT ENGINEERING 10

Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps and turbines – working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

UNIT IV I C ENGINES 10

Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Boiler as a power plant.

UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM 10

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner

30 PERIODS

TOTAL: 60 PERIODS

TEXT BOOKS

1. Shanmugam G and Palanichamy M S, “Basic Civil and Mechanical Engineering”, TMH Publishing Co., New Delhi, (1996).

REFERENCES

1. Ramamrutham. S, “Basic Civil Engineering”, Dhanpat Rai Publishing Co. (P) Ltd. (1999).
2. Seetharaman S. “Basic Civil Engineering”, Anuradha Agencies, (2005).
3. Venugopal K and Prahu Raja V, “Basic Mechanical Engineering”, Anuradha Publishers,
4. Kumbakonam, (2000). Shantha Kumar S R J., “Basic Mechanical Engineering”, Hi-tech Publications, Mayiladuthurai, (2000).

12F2Y6	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	1	0	4

AIM

To Study the Basic Electrical and Electronics Engineering

Course Outcomes

The Students will be able to

- Analyse electrical circuit and measure electrical parameters
- Illustrate various electrical machines and explain its working
- Explain identify various electronic devices and represent its characteristics
- Design digital logic circuits and its applications
- Classify various communication systems and its functioning

UNIT I ELECTRICAL CIRCUITS and MEASUREMENTS 12

Ohm's Law – Kirchhoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase and Three Phase Balanced Circuits. Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Wattmeters and Energy meters.

UNIT II ELECTRICAL MACHINES 12

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS 12

Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation. Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier.

UNIT IV DIGITAL ELECTRONICS 12

Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts)

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING 12

Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations. Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre

TOTAL: 60 PERIODS

TEXT BOOKS

1. N. Mittle "Basic Electrical Engineering", Tata McGraw Hill Edition, New Delhi, 1990.
2. R.S. Sedha, "Applied Electronics" S. Chand and Co., 2006.

REFERENCES

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics and Computer Engineering", Tata McGraw Hill, Second Edition, (2006).
2. Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering", Oxford press (2005).
3. Mehta V K, "Principles of Electronics", S. Chand and Company Ltd, (1994).
4. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, (2002).
5. Premkumar N, "Basic Electrical Engineering", Anuradha Publishers, (2003).

12F2Z7 **PHYSICS LABORATORY-II** **L T P C**
0 0 3 2

LIST OF EXPERIMENTS

1. Determination of Young's modulus of the material – uniform bending.
2. Determination of viscosity of liquid – Poiseuille's method.
3. Determination of wavelength of mercury spectrum- Spectrometer Grating.
4. Torsional pendulum – Determination of rigidity modulus.
5. Determination of Band Gap of a semiconductor material.
6. Determination of specific resistance of a given coil of wire – Carey Foster Bridge**.**

A minimum of FIVE experiments shall be offered.

12F2Z7 **CHEMISTRY LABORATORY – II** **L T P C**
0 0 3 2

LIST OF EXPERIMENTS

1. Estimation of chloride ion in water sample by Argentometric method.
2.Conductometric titration of strong acid vs strong base.
3. Conductometric precipitation titration.
4. Conductometric titration of mixture of acids.
5.Estimation of alkalinity of water sample.

REFERENCE:

1. Text book of Quantitative Inorganic Analysis,A.I.Vogel, ELBS, London.
2. A.Ravikrishnan,"Practical Engineering Chemistry", Sri Krishna Publications, Chennai (2002)

12MA31	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C
		3	1	0	4

(Common to all B.E. / B.Tech Degree Programmes)

AIM

To facilitate the understanding of the principles and to cultivate the art of formulating physical problems in the language of mathematics.

Course Outcomes:

The Students will be able to

- Classify the Fourier series and half range Fourier sine and cosine series
- Explain the Fourier transform with their properties
- Determine Z-inverse transform using convolution theorem and partial fraction method
- Solve the partial differential equation by using Lagrange's linear equation
- Analyze separation of variable to solve linear partial differential equation
- Discuss the formation of partial differential equation

UNIT I FOURIER SERIES 12

Dirichlet's Conditions – General Fourier Series –Odd and even functions- Half range Sine and Cosine series – Complex form of Fourier Series - Parseval's Identity – Harmonic Analysis.

UNIT II FOURIER TRANSFORMS 12

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations – Lagrange's linear equation – Solutions of standard types of first order partial differential equations - Linear partial differential equations of second and higher order with constant coefficients.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded) – Fourier series solutions in cartesian coordinates.

UNIT V TRANSFORMS AND DIFFERENCE EQUATIONS 12

Z-transforms - Elementary properties – Inverse Z-transform – Convolution theorem -Formation of difference equations – Solution of difference equations using Z-transform.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Grewal, B.S, "Higher Engineering Mathematics", 40th Edition, Khanna publishers, Delhi, (2007)

REFERENCE BOOKS

1. Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematic", 7th Edition, Laxmi Publications(P) Ltd. (2007)
2. Ramana.B.V., "Higher Engineering Mathematics", Tata Mc-GrawHill Publishing Company Ltd, New Delhi (2007).
3. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education(2007).
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th edition, Wiley India (2007).

12ME31 MANUFACTURING TECHNOLOGY – I

L	T	P	C
3	0	0	3

AIM

To introduce the basic concepts and methods of the production / fabrication of a component

Course Outcomes

The Students will be able to

- Do sand moulding and casting
- Perform the various types of joining processes used in engineering industries
- Recall the latest welding techniques
- Differentiate between the hot working and cold working process of metals
- Fabricate the various products using sheet metal operations
- Explain different moulding methods of plastics

UNIT I METAL CASTING PROCESSES 9

Sand casting – Sand moulds – Type of patterns – Pattern materials – Pattern allowances – Types of Moulding sand – Properties – Core making – Methods of Sand testing – Moulding machines – Types of moulding machines – Melting furnaces – Working principle of Special casting processes – Shell, investment casting – Ceramic mould – Lost Wax process – Pressure die casting – Centrifugal casting – CO_2 process – Sand Casting defects – Inspection methods

UNIT II JOINING PROCESSES 9

Fusion welding processes – Types of Gas welding – Equipments used – Flame characteristics – Arc welding equipments – Electrodes – Principles of Resistance, Spot/butt, seam, Percusion, Gas, metal arc welding – Flux cored – Submerged arc welding – Electro slag welding – TIG welding – Principle and application of special welding processes – Plasma arc welding – Thermit welding – Electron beam welding – Friction welding – Diffusion welding – Weld defects – Brazing and soldering process – Methods and process capabilities – Filler materials and fluxes – Types of Adhesive bonding.

UNIT III BULK DEFORMATION PROCESSES 9

Hot working and cold working of metals – Forging processes – Open, impression and closed die forging – Characteristics of the process – Types of Forging Machines – Typical forging operations – Rolling of metals – Types of Rolling mills – Flat strip rolling – Shape rolling operations – Defects in rolled parts – Principle of rod and wire drawing – Tube drawing — Principles of Extrusion – Types of Extrusion – Hot and Cold extrusion – Equipments used.

UNIT IV SHEET METAL 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, Rubber pad, Explosive, Magnetic pulse, Peen, and Super plastic forming – Metal spinning

UNIT V MANUFACTURING OF PLASTIC COMPONENTS 9

Types of plastics – Characteristics of the forming and shaping processes – Moulding of Thermoplastics – Working principles and typical applications of – Injection moulding – Plunger and screw machines – Compression, Transfer, Blow, Rotational moulding – Film blowing – Extrusion – Thermoforming – Bonding of Thermoplastics – Typical industrial applications.

TOTAL = 45 PERIODS

TEXT BOOKS

1. Gowri,S., Hariharan, P and Suresh Babu, A., **"Manufacturing Technology I",** Pearson Education, (2008)
2. Hajra Choudhury, **"Elements of Workshop Technology, Vol. I and II",** Media Promotors

Pvt Ltd., Mumbai,(2001)

REFERENCE BOOKS

1. Magendran Parashar, B.S., & Mittal,R.K., **"Elements of Manufacturing Processes",** Prentice Hall of India,(2003)
2. Rao, P.N., **"Manufacturing Technology",** Tata McGraw-Hill Publishing Limited, 2nd Edition, (2002)
3. Sharma, P.C., **"A text book of production technology",** S.Chand and company, 4th edition, (2003)
4. Begman, **"Manufacturing Process",** John Wiley & Sons, 8th Edition, (2005)

12ME32 ENGINEERING THERMODYNAMICS L T P C
3 1 0 4

AIM

To understand the basic concepts of Thermodynamics and its application

Course Outcomes:

The Students will be able to

- Integrate the thermodynamics basic principles and different processes
- Introduce the engines, refrigeration and air conditioning concepts
- Ensure the working principle of Steam power cycles
- Realize the ideal, real gases concepts and thermodynamic relations
- Explain the principles of psychrometric processes and cooling load calculation in Air conditioner

UNIT I BASIC CONCEPT AND FIRST LAW 12

Basic concepts – concept of continuum, macroscopic approach, Thermodynamic systems – closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics – concept of temperature and heat. Concept of ideal and real gases. First law of thermodynamics – application to closed and open systems, internal energy, specific heat capacities, enthalpy, steady flow process with reference to various thermal equipments.

UNIT II SECOND LAW 12

Second law of thermodynamics – Kelvin's and Clausius statements of second law. Reversibility and irreversibility – Carnot theorem, Carnot cycle, reversed carnot cycle, efficiency, COP – Thermodynamic temperature scale, Clausius inequality, concept of entropy, entropy of ideal gas, principle of increase of entropy – availability.

UNIT III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE 12

Properties of pure substances – Thermodynamic properties of pure substances in solid, liquid and vapour phases, phase rule, P-V, P-T, T-V, T-S, H-S diagrams, PVT surfaces, thermodynamic properties of steam. Calculations of work done and heat transfer in non- flow and flow processes – Standard Rankine cycle, Reheat and regenerative cycle.

UNIT IV IDEAL AND REAL GASES AND THERMODYNAMIC RELATIONS 12

Gas mixtures – properties ideal and real gases, equation state, Avagadro's Law, Vander Waal's equation of state, compressability factor, compressability chart – Dalton's law of partial pressure, exact differentials, T-D relations, Maxwell's relations, Clausius Clapeyron equations, Joule – Thomson coefficient.

UNIT V PSYCHROMETRY 12

Psychrometry and psychrometric charts, property calculations of air vapour mixtures. Psychrometric process – Sensible heat exchange processes. Latent heat exchange processes. Adiabatic mixing, evaporative cooling.

TOTAL = 60 PERIODS

TEXT BOOKS

1. Rajput. R.K., **"Thermal Engineering",** S.Chand Publishers, (2000)
2. Nag.P.K., **"Engineering Thermodynamics",** Tata McGraw-Hill,New Delhi, (1998)

REFERENCE BOOKS

1. Holman.J.P., **"Thermodynamics",** 3rd Edition, McGraw-Hill, (1995)
2. Cengel, **"Thermodynamics – An Engineering Approach",** 3rd Edition, Tata McGraw Hill, New Delhi (2003)
3. Arora C.P, **" Thermodynamics",** Tata McGraw-Hill, New Delhi, (2003)
4. Merala, C. Pother, Craig, W, Somerton, **"Thermodynamics for Engineers",** Schaum Outline Series, Tata McGraw-Hill, New Delhi, (2004)

12ME33	ENGINEERING MATERIALS AND METALLURGY	L	T	P	C
		3	0	0	3

AIM

To impart the knowledge on properties and their applications of materials

Course Outcomes:

The Students will be able to

- Construct a phase diagram and identify the material in various phases
- Illustrate the various types of heat treatment processes
- Explain the plastic deformation and testing of materials
- Learn the properties and applications various ferrous and non ferrous metals
- 5. Recognize the properties and applications of non metallic materials

Review (Not for Exam):

Crystal structure – BCC, FCC and HCP structure – unit cell – crystallographic planes and directions, miller indices – crystal imperfections, point, line, planar and volume defects – Grain size, ASTM grain size number.

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 9

Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectoid, eutectic, peritectic, and peritectroid reactions, Iron – Iron carbide equilibrium diagram – Classification of steel and cast Iron, microstructure, properties and applications.

UNIT II HEAT TREATMENT 9

Definition – Full annealing, stress relief, recrystallisation and spheroidizing – normalising, hardening and tempering of steel – Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram, CCR – Hardenability, Jominy end quench test – Austempering, martempering – case hardening – carburising, nitriding, cyaniding, carbonitriding, flame and induction hardening.

UNIT III MECHANICAL PROPERTIES AND TESTING 9

Mechanism of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), Impact test – Izod and Charpy, Fatigue and creep tests, fracture toughness tests.

UNIT IV FERROUS AND NON FERROUS METALS 9

Effect of alloying elements on steel (Mn, Si, Cr, Mo, V, Ti & W) - stainless and tool steels – HSLA –maraging steels – Cast Irons – Grey, White malleable, spheroidal – Graphite, Alloy cast irons, Copper and Copper alloys – Brass, Bronze and Cupronickel – Aluminum and Al-Cu alloy – precipitation hardening – Bearing alloys.

UNIT V NON-METALLIC MATERIALS 9

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE Polymers – Urea and Phenol Formaldehydes – Engineering Ceramics – Introduction to Fibre reinforced plastics.

TOTAL = 45 PERIODS

TEXT BOOKS

1. Khanna,O.P., **"A text book of Materials Science and Metallurgy",** Khanna Publishers, (2003)
2. Kenneth G.Budinski and Michael K.Budinski **"Engineering Materials",** Prentice-Hall of India Private Limited, 4th Indian Reprint (2002)

REFERENCE BOOKS

1. William D Callister **"Material Science and Engineering",** John Wiley and Sons, (2007)
2. Raghavan.V **"Materials Science and Engineering",** Prentice Hall of India Pvt., Ltd., (2007)
3. Sydney H.Avner **"Introduction to Physical Metallurgy"** McGraw Hill Book Company, (2007)
4. Dieter, G. E., **"Mechanical Metallurgy",** McGraw Hill Book Company, (1988)

12ME34 FLUID MECHANICS AND MACHINERY L T P C
3 1 0 4

AIM

To understand the characteristics of fluids and working of hydraulic machines

Course Outcomes

The Students will be able to

- List the various fluid properties and to apply control volume analysis to fluid mechanics problems
- Apply the concepts of mass and momentum conservation and the Bernoulli equation to solve problems
- Differentiate the various losses that occur in fluid flow through pipes and to estimate the head losses
- Construct the hydraulic gradient and total energy lines for flow through pipes
- Manipulate dimensional analysis for various fluid parameters and complex problems
- Explain the various types of rotodynamic machines
- Illustrate the various types, principle and working of positive displacement machines.

UNIT I INTRODUCTION 12

Units & Dimensions. Properties of fluids – Specific gravity, specific weight, viscosity, compressibility, vapour pressure and gas laws – capillarity and surface tension. Flow characteristics: concepts of system and control volume. Application of control volume to continuity equation, energy equation, momentum equation and moment of momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS 12

Laminar flow though circular conduits and circular annuli – Boundary layer concepts – Boundary

layer thickness – Hydraulic and energy gradient – Darcy, Weisbach equation. Friction factor and Moody diagram – Commercial pipes – Minor losses – Flow though pipes in series and in parallel.

UNIT III DIMENSIONAL ANALYSIS 12

Dimension and units – Buckingham's Π theorem – Discussion on dimensionless parameters – Models and similitude – Applications of dimensionless parameters.

UNIT IV ROTO DYNAMIC MACHINES 12

Homologous units – Specific speed – Elementary cascade theory – Theory of turbo machines – Euler's equation – Hydraulic efficiency – Velocity components at the entry and exit of the rotor – Velocity triangle for single stage radial flow and axial flow machines – Centrifugal pumps, turbines, performance curves for pumps and turbines.

UNIT V POSITIVE DISPLACEMENT PUMPS 12

Reciprocating pumps, Indicator diagrams, Work saved by air vessels – Rotary pumps – Classification – Working principles and performance curves.

TOTAL = 60 PERIODS

TEXT BOOKS

1. Bansal,R.K., **"A text book of Fluid Mechanics and Hydraulics Machines",** Laxmi Publication, Bhubaneswar, Orissa, (2010)
2. Kumar. K.L., **"Engineering Fluid Mechanics"** (VIII Ed.) S.Chand Publishing (P) Ltd., New Delhi, (1995)

REFERENCE BOOKS

1. Streeter. V. L., and Wylie, E.B., **"Fluid Mechanics",** McGraw Hill, (1983)
2. Rathakrishnan. E, **"Fluid Mechanics",** Prentice Hall of India 2nd Edition, (2007)
3. Ramamritham. S, **"Fluid Mechanics, Hydraulics and Fluid Machines",** Dhanpat Rai & Sons, New Delhi, (1988)
4. Agrawal.S.K. **"Fluid Mechanics and Machinery",** Tata McGraw Hill publication, (2001)

12ME35 ELECTRICAL DRIVES AND CONTROLS L T P C
3 0 0 3

AIM

To provide sound knowledge in the basic concepts of electrical drives, their performance and control

Course Outcomes:

The Students will be able to

- Identify suitable electrical drives for load requirements
- Represent the characteristics of electrical drives
- Choose a starter for a particular electrical motor drive
- Explain various speed control methods of DC Drives
- Suggest suitable speed control method for AC Drives

UNIT I INTRODUCTION 8

Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors.

UNIT II DRIVE MOTOR CHARACTERISTICS 9

Mechanical characteristics – Speed-Torque characteristics of various types of load and drive motors – Braking of Electrical motors – DC motors: Shunt, series and compound – single phase and three phase

induction motors.

UNIT III STARTING METHODS **8**

Types of D.C Motor starters – Typical control circuits for shunt and series motors – Three phase squirrel cage and slip ring induction motors **.**

UNIT IV CONVENTIONAL AND SOLID STATE SPEED CONTROL OF D.C. DRIVES **10**

of DC series and shunt motors – Armature and field control, Ward – Leonard control system – Using controlled Speed control rectifiers and DC choppers – applications.

UNIT V CONVENTIONAL AND SOLID STATE SPEED CONTROL OF A.C. DRIVES **10**

Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Using inverters and AC voltage regulators – applications

TOTAL = 45 PERIODS

TEXT BOOKS

1. Vedam Subrahmaniam, **"Electric Drives (concepts and applications)",** Tata McGraw-Hill,(2001)
2. Nagrath .I.J. & Kothari .D.P, **"Electrical Machines",** Tata McGraw-Hill, (1998)

REFERENCE BOOKS

1. Pillai.S.K **"A first course on Electric drives",** Wiley Eastern Limited, (1998)
2. Singh,M.D., Khanchandani,K.B., **"Power Electronics",** Tata McGraw-Hill, (1998)
3. Partab, H., **"Art and Science and Utilization of electrical energy",** Dhanpat Rai and Sons, (1994)
4. Werner Leonhard, **"Control of Electrical Drives",** Springer, (2001).

12ME36 MANUFACTURING TECHNOLOGY LABORATORY – I

L	T	P	C
0	0	3	2

LATHE

Facing, plain turning and step turning
Taper turning using compound rest, Tailstock set over, etc
Single and Multi-start V thread, cutting and knurling
Boring and internal thread cutting

WELDING EXCERCISES

Horizontal, Vertical and Overhead welding
Gas Cutting, Gas Welding - for demonstration purpose
Brazing - for demonstration purpose

SHEET METAL WORK

Fabrication of sheet metal tray
Fabrication of a funnel

PREPARATION OF SAND MOULD

Mould with solid, split patterns
Mould with loose-piece pattern
Mould with Core

LIST OF EQUIPMENTS

Centre Lathe with accessories	15
Welding	
Arc welding machine	04
Brazing machine	01

Sheet Metal Work facility

Hand Shear 300mm	01
Bench vice	05
Standard tools and calipers for sheet metal work	05

Sand moulding Facility

Moulding Table	05
Moulding boxes, tools and patterns	05

TOTAL: 45 PERIODS

12ME37	FLUID MECHANICS AND MACHINERY LABORATORY	L	T	P	C
		0	0	3	2

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturimeter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump / submergible 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.

LIST OF EQUIPMENTS

1. Orifice meter setup
2. Venturi meter setup
3. Rotameter setup
4. Pipe Flow analysis setup
5. Centrifugal pump/submergible pump setup
6. Reciprocating pump setup
7. Gear pump setup
8. Pelton wheel setup
9. Francis turbine setup
10. Kaplan turbine setup

Quantity: one each.

TOTAL: 45 PERIODS

12ME38	ELECTRICAL ENGINEERING LABORATORY	L	T	P	C
		0	0	3	2

LIST OF EXPERIMENTS

1. Load test on DC Shunt & DC Series motor
2. O.C.C & Load characteristics of DC Shunt and DC Series generator
3. Speed control of DC shunt motor (Armature, Field control)
4. Load test on single phase transformer
5. O.C & S.C Test on a single phase transformer
6. Regulation of an alternator by EMF & MMF methods.
7. V curves and inverted V curves of synchronous Motor
8. Load test on three phase squirrel cage Induction motor
9. Speed control of three phase slip ring Induction Motor
10. Load test on single phase Induction Motor.
11. Study of DC & AC Starters.

LIST OF EQUIPMENTS

(for batch of 30 students)

EQUIPMENT	-	NO.
1. DC Shunt motor	-	2
2. DC Series motor	-	1
3. DC shunt motor-DC Shunt Generator set	-	1
4. DC Shunt motor-DC Series Generator set	-	1
5. Single phase transformer	-	2
6. Three phase alternator	-	2
7. Three phase synchronous motor	-	1
8. Three phase Squirrel cage Induction motor	-	1
9. Three phase Slip ring Induction motor	-	1
10. Single phase Induction motor	-	1

TOTAL: 45 PERIODS

12HS31	PROFESSIONAL ENGLISH-I	L	T	P	C
		0	0	1	1

AIM

To create an Environment to improve learner's communication skill using Professional English module

Course Outcomes

The Students will be able to

- Employ appropriate syntax and words
- Understand the text and its structure to respond any queries
- Improve technical communication
- Respond oral communication at work place
- Develop coherence in oral presentation and Initiate discussion with the mass

A. Language & Grammar **2**

1 Use of Verb,Article,Adjectives,Adverbs,Preposition,Conjunction,Comparative Superlative,

2 Noun –Antecedent & Precedent
3 Spelling &Punctuation
4 Concord
5 Use of Active & Passive voice
6 Use of Conditional Sentence & Reported speech

B. Reading **4**

1 Reading technical reports for Gist
2 Reading Technical Article, Graphs, Charts, Adverts, Notices & Proposals for Structure and detail

C. Writing **3**

1 Writing E-mails for giving Instruction/ Summarizing/Persuading/Giving assurance/asking a comment
2 Writing an Introduction to Report/Proposal/Technical Description
3 Writing Instructions & Recommendations for User manuals/Equipments/devices/New Inventions

D. Listening **3**

1 Listening to Technical News for Gist
2 Listening to Technical Interviews for gathering information
3 Listening to a Presentation for inferring meaning

E. Speaking **6**

1 Self-Introduction
2 Have your say- Recent gadgets/Technical Innovations/ Scientific Inventions

TOTAL = 18 PERIODS

TEXT BOOKS

1. Technical Writing: Process and Product, Gerson, Pearson Education India, 2007 ISBN: 8131709280, 9788131709283
2. Business Benchmark Pre-Intermediate to Intermediate: Student's Book BEC Preliminary Edition, Norman Whitby, PB + 2 Audio CDs, ISBN: 9780521759397

Examination Guideline

Internal and External Examinations should be considered only from The BUSINESS ENGLISH oriented Articles/Extracts/Clips/Illustrations/Audio scripts.

12MA44	STATISTICS AND NUMERICAL METHODS	L	T	P	C
		3	1	0	4

AIM

To achieve high accuracy, many separate operate operation must be carried out

Course Outcomes

The Students will be able to

- Statistical hypothesis testing and confidence interval estimation of parameters are the fundamental methods used at the data analysis stage of a comparative experiment
- Designed experiments play a very important role in engineering design and development in the improvement of manufacturing process
- A main advantage is that a numerical answer can be obtained when a problem has no analytical solution
- It is used to fill in the gaps in the statistical data for the sake of continuity of information
- The subject of ordinary differential equations in an essential tool for modeling many physical situations

UNIT I TESTING OF HYPOTHESIS 12

Sampling distributions – Tests for single mean, Proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – chi-square test for goodness of fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS 12

Completely randomized design – Randomized block design – Latin square design – 2^2 – factorial design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12

Newton-Raphson method – Gauss Elimination method – Pivoting – Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel – Matrix Inversion by Gauss-Jordan method – Eigen values of a matrix by Power method .

UNIT IV DIFFERENTIATION AND NUMERICAL INTERGRATION INTERPOLATION, NUMERICAL 12

Lagrange's and Newton's divided difference interpolation – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal and Simpson's 1/3 rules.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 12

Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge- Kutta method for solving first and second order equations – Milne's predictor-corrector methods for solving first order equations – Finite difference methods for solving second order equation.

TOTAL = 60 PERIODS

TEXT BOOKS

1. Johnson, R.A and Gupta, C.B, "**Miller and Freund's Probability and Statistics for Engineers**", Pearson Education, Asia, 7th edition, 2007
2. Grewal, B.S. and Grewal,J.S., **"Numerical methods in Engineering and Science",** 6th Edition, Khanna Publishers, New Delhi, (2004)

REFERENCE BOOKS

1. Walpole,R.E., Myers,R.H., Myers,S.L., and KYe,**"Probability and Statistics for Engineers and Scientists",** Pearson Education, Asia, 8th edition, (2007)
2. Spiegel,M.R., Schiller,J., and Srinivasan,R.A., **"Schaum's Outlines Probability and Statistics",** Tata McGraw Hill edition, (2004)
3. Chapra, S.C., and Canale, R.P., **"Numerical Methods for Engineers",** 5th Edition, Tata

McGraw-Hill, New Delhi, (2007)
4. Gerald, C.F., and Wheatley, P.O., **"Applied Numerical Analysis",** 6th Edition, Pearson Education Asia, New Delhi, (2006)

12ME41	MANUFACTURING TECHNOLOGY – II	L	T	P	C
		3	0	0	3

AIM

To Understand the Basic Principles and Working of various Machine Tools

Course Outcomes

The Students will be able to

- Illustrate the theories of metal cutting process
- Explain the various types the lathe and special purpose lathe
- Identify the Reciprocating machine tools
- Illustrate the various methods of grinding operations.
- Do the various gears cutting process
- Realization of Computer using Numerical Control (NC) machine tools

UNIT I THEORY OF METAL CUTTING 9

Introduction: material removal processes, types of machine tools – theory of metal cutting: chip formation, orthogonal cutting, cutting tool materials, tool wear, tool life, surface finish, cutting fluids.

UNIT II CENTRE LATHE AND SPECIAL PURPOSE LATHES 9

Centre lathe, constructional features, cutting tool geometry, various operations, taper turning methods, thread cutting methods, special attachments, machining time and power estimation – Capstan and turret lathes – automats – single spindle, Swiss type, automatic screw type, multi spindle – Turret Indexing mechanism, Bar feed mechanism.

UNIT III OTHER MACHINE TOOLS 9

Reciprocating machine tools: shaper, planer, slotter – Milling : types, milling cutters, operations – Hole making : drilling – Quill mechanism , Reaming, Boring, Tapping – Sawing machine: hack saw, band saw, circular saw; broaching machines: broach construction – push, pull, surface and continuous broaching machines.

UNIT IV ABRASIVE PROCESSES AND GEAR CUTTING 9

Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centreless grinding – honing, lapping, super finishing, polishing and buffing, abrasive jet machining – Gear cutting, forming, generation, shaping, hobbing.

UNIT V CNC MACHINE TOOLS AND PART PROGRAMMING 9

Numerical control (NC) machine tools – CNC: types, constructional details, special features – design considerations of CNC machines for improving machining accuracy – structural members – slide ways –linear bearings – ball screws – spindle drives and feed drives. Part programming fundamentals – manual programming – computer assisted part programming**.**

TOTAL = 45 PERIODS

TEXT BOOKS

1. Hajra Choudry, **"Elements of Work Shop Technology – Vol. II",** Media Promoters, (2002)
2. Sharma,P.C., **"A Text Book of Production Engineering",** S. Chand and Co. Ltd, 4th edition, (1993)

REFERENCE BOOKS

1. Rao,P.N. **"Manufacturing Technology",** Metal Cutting and Machine Tools, Tata McGraw–Hill, New Delhi, (2003)
2. Shrawat N.S. and Narang J.S, **'CNC Machines',** Dhanpat Rai & Co., (2002)
3. Rao,P.N., **'CAD/CAM Principles and Applications',** Tata Mc Graw Hill, (2007)
4. Milton C.Shaw, **'Metal Cutting Principles',** Oxford University Press, 2nd Edition, (2005)

12ME42	KINEMATICS OF MACHINERY	L	T	P	C
		3	1	0	4

AIM

To impart knowledge of motion characteristics of mechanisms and machines and to make the students to develop new mechanisms

Course Outcomes

The Students will be able to

- Explain the concepts of machines, mechanisms and related terminologies
- Recognize friction and its effects in mechanical components
- Analyze planar mechanism for displacement, velocity and acceleration graphically
- Analyze various motion transmission elements like gears, gear trains, cams, belt drive and rope drive
- Utilize analytical, mathematical and graphical aspects of kinematics of machines for effective design
- Perform the kinematic analysis of a given mechanism

UNIT I BASICS OF MECHANISMS 7

Definitions – Link, Kinematic pair, Kinematic chain, Mechanism, and Machine – Degree of Freedom – Mobility – Kutzbach criterion (Gruebler's equation) – Grashoff's law – Kinematic Inversions of four –bar chain and slider crank chain – Mechanical Advantage – Transmission angle – quick return mechanisms, Pantograph, Straight line generators, Steering gear for automobile, Hooke's joint, Toggle mechanism, Ratchets and pawl mechanisms – Indexing Mechanisms.

UNIT II KINEMATIC ANALYSIS 15

Analysis of simple mechanisms (Single slider crank mechanism and four bar mechanism) – Graphical Methods for displacement, velocity and acceleration; Shaping machine mechanism – Coincident points – Coriolis acceleration – Analytical method of analysis of slider crank mechanism and four bar mechanism. Approximate analytical expression for displacement, velocity and acceleration of piston of reciprocating engine mechanism.

UNIT III KINEMATICS OF CAMS 11

Classifications – Displacement diagrams – Parabolic, Simple harmonic and Cycloidal motions – Graphical construction of displacement diagrams and layout of plate cam profiles – circular arc and tangent cams – Pressure angle and undercutting.

UNIT IV GEARS 14

Classification of gears – Gear tooth terminology – Fundamental Law of toothed gearing and involute gearing – Length of path of contact and contact ratio – Interference and undercutting – Gear trains – Simple, compound and Epicyclic gear trains – Differentials.

UNIT V FRICTION 13

Dry friction – Friction in screw jack – Pivot and collar friction – Plate clutches – Belt and rope drives – Block brakes, band brakes.

TOTAL = 60 PERIODS

TEXT BOOKS

1. Rattan S.S. **"Theory of Machines",** 3rd Edition, Tata McGraw-Hill, (2010)
2. Khurmi R.S., Gupta J.K., **"Theory of Machines",** Eurasia Publishing House, (2008)

REFERENCE BOOKS

1. Ramamurti,V., **"Mechanism and Machine Theory",** Second Edition, Narosa Publishing House, (2005)
2. Thomas Bevan, **"Theory of Machines",** CBS Publishers and Distributors, (1984)
3. Ambekar A. G., **"Mechanism and Machine Theory",** Prentice Hall of India, New Delhi (2007)
4. Uicker, J.J., Pennock G.R., Shigley J.E**., "Theory of Machines and Mechanisms" (**Indian Edition), Oxford University Press, (2003)

12ME43 ENGINEERING METROLOGY AND MEASUREMENTS

L	T	P	C
3	0	0	3

AIM

To understand the principles, methods and applications of measurements

Course Outcomes:

The Students will be able to

- Memorize the basic concepts of measurements
- Classify the various linear, angular measuring equipments
- Compare the working principles of various form measuring equipments
- Explain the applications of laser and coordinate measuring instruments
- Analyze the methods of measuring power, torque, flow and temperature

UNIT I CONCEPT OF MEASUREMENT **9**

General concept – Generalized measurement system – Units and standards – measuring instruments – sensitivity, stability, range, accuracy and precision – static and dynamic response – repeatability – systematic and random errors – correction, calibration – Introduction to Dimensional and Geometric Tolerance – interchangeability.

UNIT II LINEAR AND ANGULAR MEASUREMENT **9**

Definition of metrology – Linear measuring instruments – Vernier, micrometer, Slip gauges and classification – Tool Makers Microscope – interferometery, optical flats – Comparators – limit gauges – Mechanical, pneumatic and electrical comparators, applications – Angular measurements – Sine bar, Sine center, bevel protractor and angle Decker.

UNIT III FORM MEASUREMENT **9**

Measurement of screw threads – Thread gauges, floating carriage micrometer – measurement of gear tooth thickness – constant chord and base tangent method – Gleason gear testing machine – radius measurements – surface finish – equipment and parameters, straightness, flatness and roundness measurements.

UNIT IV LASER AND ADVANCES IN METROLOGY **9**

Precision instruments based on laser – Principles – laser interferometer – application in measurements and machine tool metrology – Coordinate measuring machine – need, construction, types, applications – Computer aided inspection.

UNIT V PARAMETERS 9

strip, thermocouples Force, torque, power – Mechanical, pneumatic, hydraulic and electrical **MEASUREMENT OF MECHANICAL** type – Pressure measurement –Flow – Venturimeter, orifice, rot meter, pitot tube – Temperature – bimetallic, pyrometer, electrical resistance thermistor.

Total = 45 Periods TOTAL = 60 PERIODS

TEXT BOOKS

1. Jain R.K., **"Engineering Metrology",** Khanna Publishers, (2005)
2. Alan S. Morris, **"The Essence of Measurement",** Prentice Hall of India, (1997)

REFERENCE BOOKS

1. Gupta S.C, **"Engineering Metrology",** Dhanpat rai Publications, (2005)
2. Jayal A.K, **"Instrumentation and Mechanical Measurements",** Galgotia Publications, (2000)
3. Beckwith, Marangoni, Lienhard, **"Mechanical Measurements",** Pearson Education, (2006)
   Donald Deckman, **"Industrial Instrumentation",** Wiley Eastern,(1985).

12ME44 MECHANICS OF MATERIALS

L	T	P	C
3	1	0	4

AIM

To obtain the knowledge about behavior of members subjected to various type of forces

Course Outcomes:

The Students will be able to

- Explain the elastic constants and strain energy
- Analyze the stress and strain relationship
- Explain the biaxial stress, deformation and stress on an inclined plane
- Predict the principal stress and principal strain by Mohr's circle
- Recognize the shapes of beam when the stress is acted
- Calculate the stress and deflections on the springs

UNIT I STRESS STRAIN DEFORMATION OF SOLIDS 12

Rigid and Deformable bodies – Strength, Stiffness and Stability – Stresses – Tensile, Compressive and Shear – Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants – Strain energy and unit strain energy – Strain energy in uniaxial loads.

UNIT II ANALYSIS OF STRESSES IN TWO DIMENSIONS 12

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.

UNIT III BEAMS – LOADS AND STRESSES 12

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 – Effect of shape of beam section on stress induced – Shear stresses in beams – Shear flow.

UNIT IV BEAM DEFLECTION 12

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.

UNIT V TORSION 12

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 – stresses in helical coil springs under torsion loads.

TOTAL = 60 PERIODS

TEXT BOOKS

1. Ramamrutham.S, **"Strength of Materials",** Dhanpatrai Publishing company, (2008)
2. Bansal R.K. **"A Text book of strength of material",** Laxmi publication, New Delhi, (2010)

REFERENCE BOOKS

1. Popov E.P,**"Engineering Mechanics of Solids",** Prentice-Hall of India, New Delhi,(1997)
2. Beer F.P. and Johnston R, **"Mechanics of Materials",** McGraw-Hill Book Co, 3rd Edition, (2002)
3. Nash.W.A. **"Theory and Problems in Strength of Material",** Schaum Outline Series, McGraw-Hill Book Co, New York, (1995)
4. Ryder G.H. **"Strength of Materials",** MacMillan India Ltd., 3rd Edition, (2002).

12ME45 ELECTRONICS AND MICROPROCESSORS

L	T	P	C
3	0	0	3

AIM

To instruct the importance of electronics fields to the mechanical industry and its utilization for developing a small applications using passive and active components

Course Outcomes

The Students will be able to

- Analyze the characteristics and application of PN junction diode
- Design and develop the BJT and FET model in different configuration
- Estimate the characteristics of thyristor family and its application
- Implementation of Boolean functions using logic gates
- Demonstrate the assembly language program and interfacing technique of 8085 Microprocessor
- Examine the real time implementation of microprocessor based applications

UNIT I SEMICONDUCTORS AND RECTIFIERS 12

Classification of solids based on energy band theory – Intrinsic semiconductors – Extrinsic semiconductors – P type and N type – PN junction – Zenor effect – Zenor diode characteristics – Half wave and full wave rectifiers – Voltage regulation.

UNIT II TRANSISTORS AND AMPLIFIER 12

Bipolar junction transistor – CB, CE, CC configuration and characteristics – Biasing circuits – Class A, B and C amplifiers – Field effect transistor – Configuration and characteristic of FET amplifier – SCR, Diac, Triac, UJT – Characteristics and simple applications – Switching transistors – Concept of feedback –Negative feedback – Application in temperature and motor speed control.

UNIT III DIGITAL ELECTRONICS 12

Binary number system – AND, OR, NOT, NAND, NOR circuits – Boolean algebra – Exclusive OR gate – Flip flops – Half and full adders – Registers – Counters – A/D and D/A conversion.

UNIT IV 8085 MICROPROCESSOR 12

Block diagram of microcomputer – Architecture of 8085 – Pin configuration – Instruction set – Addressing modes – Simple programs using arithmetic and logical operations.

UNIT V INTERFACING AND APPLICATIONS OF MICROPROCESSOR 12

Basic interfacing concepts – Interfacing of Input and Output devices – Applications of microprocessor Temperature control, Stepper motor control and traffic light control.

TOTAL = 60 PERIODS

TEXT BOOKS

1. Milman and Halkias, **"Integrated Electronics",** Tata McGraw-Hill publishers, (1995)
2. Ramesh Goankar, **"Microprocessor Architecture, Programming and Applications with 8085",** Wiley Eastern, (1998).

REFERENCE BOOKS

1. Malvino and Leach, **"Digital Principles and Applications",** Tata McGraw-Hill, (1996)
2. Mehta V.K, **"Principles of Electronics",** S. Chand and Company Ltd., (1994)
3. Dougles V.Hall, **"Microprocessor and Interfacing",** Programming and Hardware, Tata McGraw-Hill, (1999)
4. Salivahanan S, Suresh Kumar N, Vallavaraj A, **"Electronic Devices and Circuits"**, 1st Edition, Tata McGraw-Hill, (1999)

12ME46	**MANUFACTURING TECHNOLOGY LAB II**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**2**

LIST OF EXPERIMENTS

1. Two or More Measurements in Metal Cutting Experiment (Example: Shear Angle, Cutting Force, Tool Wear etc.)
2. One or More Exercises in Shaper, Slotter, Planner, Drilling, Milling Machines (Example: Round to Square, Dovetail in shaper, Internal keyway cutting in Slotter, Round to square in Planner, Drilling, reaming and tapping in Drilling machine, Gear Milling and Keyway milling in Milling machine.)
3. Two or More Exercises in Grinding / Abrasive machining (Example: Surface Grinding, Cylindrical Grinding.)
4. Two or More Exercises in Assembly of Machined Components for different fits. (Example: Parts machined using Lathes, Shapers, Drilling, Milling, and Grinding Machines etc.)
5. One or More Exercises in Capstan or Turret Lathes.
6. One or More Exercises in Gear Machining (Example: Gear Milling, Gear Hobbing etc.)

LIST OF EQUIPMENTS

(For a batch of 30 students)

1.	Centre Lathes	2 Nos.
2.	Turret and Capstan Lathes	1 No.
3.	Horizontal Milling Machine	1 No.
4.	Vertical Milling Machine	1 No.
5.	Surface Grinding Machine	1 No.
6.	Cylinderical Grinding Machine	1 No.
7.	Shaper	2 Nos.

8.	Slotter	1 No.
9.	Planner	1 No.
10.	Radial Drilling Machine	1 No.
11.	Tool Dynamometer	1 No.
12.	Gear hoping machine	1 No.

12ME47 MATERIAL TESTING AND METALLURGICAL LABORATORY

L	T	P	C
0	0	3	2

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
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Tempering- Improvement Mechanical properties Comparison
    (i) Unhardened specimen
    (ii) Quenched Specimen and
    (iii) Quenched and tempered specimen.
11. Microscopic Examination of

a. Hardened samples and Hardened and tempered samples.

LIST OF EQUIPMENTS
(For a batch of 30 students)

Universal Tensile Testing machine with double shear attachment – 40 Ton Capacity
Torsion Testing Machine (60 N/M Capacity)
Impact Testing Machine (300 J Capacity)
Brinell Hardness Testing Machine
Rockwell Hardness Testing Machine
Spring Testing Machine for tensile and compressive loads (2500 N)

Metallurgical Microscopes

Muffle Furnace (800^0C)

12ME48	METROLOGY AND MEASUREMENT LABORATORY	L T P 0 0 3	C 2

LIST OF EXPERIMENTS

1. Calibration of Vernier / Micrometer / Dial Gauge
2. Checking Dimensions of part using slip gauges
3. Measurements of Gear Tooth Dimensions
4. Measurement of Angle using sine bar / sine center / tool makers microscope
5. Measurement of straightness and flatness
6. Measurement of thread parameters
7. Setting up of comparators for inspection (Mechanical / Pneumatic / Electrical)
8. Measurement of Temperature using Thermocouple / Pyrometer
9. Measurement of Displacement
10. Measurement of Force Measurement of Torque Measurement of Vibration / Shock

TOTAL = 45 PERIODS

LIST OF EQUIPMENTS

(For a batch of 30 students)

Micrometer	–	5 Nos.
Vernier Caliper	–	5 Nos.
Vernier Height Gauge	–	2 Nos.
Vernier depth Gauge	–	2 Nos.
Slip Gauge Set	–	1 No.
Gear Tooth Vernier	–	1 No.
Sine Bar	–	1 No.
Sine Center	–	1 No.
Bevel Protractor	–	1 No.
Floating Carriage Micrometer	–	1 No.
Profile Projector / Tool Makers Microscope	–	1 No.
Mechanical Comparator	–	1 No.
Temperature Measuring Setup	–	1 No.
Displacement Measuring Setup	–	1 No.
Force Measuring Setup	–	1 No.
Torque Measuring Setup	–	1 No.
Vibration / Shock Measuring Setup	–	1 No.

12HS41	PROFESSIONAL ENGLISH-II (Common to All B.E./B.Tech Degree programmes)	L	T	P	C
		0	0	1	1

AIM

To Create an Environment to experiment Professional English communication module with Intermediate resources

Course Outcomes:

The Students will be able to

- Improve grasping and comprehending skill
- Create effective technical communication
- Recognize sounds of English to respond any queries
- Identify vocabulary for effective communication
- Evaluate the topic and Present personal opinion using suitable verbal and non-verbal cues

A. Reading **4**

1. Reading Technical Articles, Reports, Proposals for gathering information
2. Reading Technical Journals, User manuals, annual reports for matching information

B. Writing **6**

1. Writing E-mail to inform/respond/Insist/Convince/comment
2. Writing Technical Report (Format, Types, Abstract)
3. Writing Project Introduction/Website/Product
4. Writing User Manuals/Guidelines
5. Writing Product Reviews
6. Writing Useful Expressions for Persuading, Summarizing, gathering information

C. Listening **2**

1. Listening to Telephonic conversation for filling the gaps
2. Listening to Group discussion to gather information
3. Listening to Interviews for writing short answers
4. Listening to Technical Presentation for evaluation

D. Speaking **6**

1. Mini-Presentation on Technical Themes:
   a) Cloud computing b) 4g c) Mission to Mars
   d) Water Resource e) Sixth Sense Technology
2. Group Discussion on Social and Technical issues

TOTAL = 18 PERIODS

TEXT BOOKS

1. Technical Communication: Principles and Practice, 2e, MEENAKSHI RAMAN; SANGEETA SHARMA ISBN: 0198065299, 9780198065296
2. Business Benchmark Pre-Intermediate to Intermediate: Student's Book BEC Preliminary Edition, Norman Whitby, PB + 2 Audio CDs, ISBN: 9780521759397

Examination Guideline

Internal and External Examinations should be considered only from The BUSINESS ENGLISH oriented Articles/Extracts/Clips/Illustrations/Audio scripts.

12GE31	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
		3	0	0	3

AIM

The aim of this course is to create awareness in every engineering graduate about the importance of environment, the effect of technology on the environment and ecological balance and make them sensitive to the environment problems in every professional endeavor that they participates.

Course Outcomes

The Students will be able to

- Recall the importance of environment and ecological systems
- Determine the causes of environmental pollution
- Explain the various disaster managements
- Illustrate the equitable use of resources for lifestyles
- Interrelate population growth with environmental pollution
- Recognize the role of Individuals, Government and Technology in environmental protection and human health

UNIT I **ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY** **14**

Definition, scope and importance of environment – need for public awareness – concept of an 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 II **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 – soil waste management – causes, effects and control measures of municipal solid 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 / Agricultural.

UNIT III **NATURAL RESOURCES** **10**

Forest resources: Use and over – exploitation, deforestation, case studies – timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern 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 IV **SOCIAL ISSUES AND THE 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 – role of non- governmental organization – 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 production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation – central and state pollution control boards – Public awareness.

UNIT V **HUMAN POPULATION AND THE ENVIRONMENT** **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: 45 PERIODS

TEXT BOOKS

1. Gilbert M.Masters, **"Introduction to Environmental Engineering and Science",** 2nd edition, Pearson Education (2004)
2. Benny Joseph, **"Environmental Science and Engineering",** Tata McGraw-Hill, New Delhi, (2006)

REFERENCES

1. Trivedi, R.K., **"Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards",** Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, **"Environmental Encyclopedia",** Jaico Publ., House, Mumbai, (2001)
3. Dharmendra S. Sengar, **"Environmental law",** Prentice Hall of India PVT LTD, New Delhi, (2007)
4. Rajagopalan, R, **"Environmental Studies-From Crisis to Cure",** Oxford University Press (2005)

12ME51	DYNAMICS OF MACHINERY	L	T	P	C
		3	1	0	4

AIM

To understand the method of static and dynamics force analysis of mechanisms and to study the undesirable effects of unbalances in rotors, engines and the principles of governors and gyroscopes.

Course Outcomes

The Students will be able to

- Recall the knowledge of force analysis in both static and dynamics
- Analyze the balancing concepts of both reciprocating and rotating parts
- Justify the single and two rotor system
- List the application of forced vibration in various mechanical components
- Revise through the knowledge of controlling mechanisms in machinery
- Compute the various problems in governors and gyroscope effects

UNIT I **FORCE ANALYSIS AND FLYWHEELS** **9 + 3**

Static force analysis – D ' Alemberts principle – Inertia force and Inertia torque – Dynamic force analysis – Dynamic Analysis in Reciprocating Engines – Gas Forces – Equivalent masses – Bearing loads – Crank shaft Torque – Engine shaking Forces – Turning moment diagrams – Flywheels of engines and punch press.

UNIT II **BALANCING** **9 + 3**

Static and dynamic balancing – Balancing of rotating masses – Balancing a single cylinder Engine – Primary and secondary unbalanced forces – Balancing Multi – cylinder Engines – Firing order – Pivoted cradle balancing machines.

UNIT III **FREE VIBRATION** **9 + 3**

Basic features of vibratory systems – Basic elements and lumping of parameters – Degrees of freedom – Single degree of freedom – Free vibration – Equations of motion – natural frequency – Types of Damping – Damped free vibration – Whirling of shafts and critical speed – Torsional systems – Natural frequency of two and three rotor systems.

UNIT IV **FORCED VIBRATION** **9 + 3**

Response to periodic forcing – Harmonic Forcing – Forced vibration - damping ratio – logarithmic decrement - Support motion – Force transmissibility and amplitude transmissibility – Vibration isolation.

UNIT V **MECHANISMS FOR CONTROL** **9 + 3**

Governors – Types – Centrifugal governors – Gravity controlled and spring controlled centrifugal governors – Characteristics – Effect of friction – Controlling Force – Quality of governors – hunting – Gyroscopes – Gyroscopic couple – Gyroscopic stabilization – Gyroscopic effects in Automobiles, air crafts and ships.

Total : 45 + 15 = 60 Periods

TEXT BOOKS

1. Khurmi,R.K., Gupta,J.K., **"Theory of Machines",** Eurasia Publishing House, New Delhi, 30th Edition, (2008)
2. Singh,V.P., **"Theory of Machines",** Dhanpat Rai Publishing Company (P) Limited, (2004)

REFERENCES

1. Ambekar A.G., **"Mechanism and Machine Theory",** Prentice Hall of India, New Delhi, (2007)
2. Thomas Bevan, **"Theory of Machines",** CBS Publishers and Distributors, (1984)
3. Shigley, J.E., and Uicker, J.J., **"Theory of Machines and Mechanisms",** McGraw-Hill, Inc., (1995)
4. Rao J.S. and Dukkipati R.V., **"Mechanism and Machine Theory ",** Wiley-Eastern Limited, New Delhi, (1992)

12ME52	DESIGN OF MACHINE ELEMENTS	L	T	P	C
		3	0	0	3

AIM

To study the design principles and procedures of Machine Elements

Course outcomes

The Students will be able to

- Select the design process, suitable materials and analyze the various load conditions of machine elements
- Analyze the suitable types of shaft, key & coupling to design machine elements
- Compare and select the best fastening method in joints
- Model helical & leaf springs for the real time applications
- Design & develop the model of flywheel
- Illustrate the design procedure of bearings

UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 9

Introduction to the basic design process – factor influencing machine design, selection of materials based on mechanical properties – Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – Factor of safety – theories of failure – stress concentration – Soderberg, Goodman and Gerber relations

UNIT II DESIGN OF SHAFTS AND COUPLINGS 9

Design of solid and hollow shafts based on strength, rigidity and critical speed – Design of keys, key ways and splines – Design of crankshafts – Design of rigid and flexible couplings.

UNIT III DESIGN OF TEMPORARY AND PERMANENT JOINTS 9

Threaded fasteners – Design of bolted joints including eccentric loading, Knuckle joints, Cotter joints – Design of welded joints, riveted joints for structures – theory of bonded joints – Deign for variable loading.

UNIT IV DESIGN OF ENERGY STORING ELEMENTS 9

Design of various types of spring, optimization of helical springs – rubber springs – Design of flywheels considering stresses in rims and arms, for engines and punching machines.

UNIT V DESIGN OF BEARINGS AND MISCELLANEOUS ELEMENTS 9

Sliding contact and rolling contact bearings – Design of hydrodynamic journal bearings, McKee's Equation, Sommerfield Number, Raimondi & Boyd graphs – Selection of Rolling Contact bearings – Design of Seals and Gaskets – Design of Connecting Rod.

TOTAL: 45 PERIODS

TEXT BOOKS

1. *Sundararajamoorthy T.V, Shanmugam. N, "**Machine Design**", Khanna Publications, Chennai, (2003)*
2. *Khurmi,R.K., Gupta,J.K., **"Machine Design"**, Eurasia Publishing House, (2005)*

REFERENCES

1. *Bhandari V.B, **"Design of Machine Elements"**, 2nd Edition, Tata McGraw-Hill Book Co, (2007)*
2. *Orthwein W, **"Machine Component Design"**, Jaico Publishing Co, (2003)*
3. *Ugural A.C, **"Mechanical Design – An Integral Approach"**, McGraw-Hill Book Co, (2004)*
1. *Spotts M.F., Shoup T.E **"Design and Machine Elements"**, Pearson Education, (2004)*

12ME53	THERMAL ENGINEERING	L	T	P	C
		3	1	0	4

AIM

To acquire the knowledge, capability of analyzing and solving any concept or problem associated with heat energy dynamics and utilization

Course Outcomes

The Students will be able to

- Formulate the air standard efficiency and the concepts of PV diagram of four stroke and two stroke engines
- Examine about the performance calculation of petrol and diesel engine
- Analyze the flow of steam through nozzles and to draw the velocity diagram
- Calculate the isentropic efficiency of multistage compressor
- Demonstrate the principle and practice of thermal comfort and alternate refrigerants

UNIT I GAS POWER CYCLES 8 + 3

Otto, Diesel, Dual, Brayton cycles, Calculation of mean effective pressure, and air standard efficiency –comparison of cycles.

UNIT II INTERNAL COMBUSTION ENGINES 10 + 3

Classification – Components and their function – Valve timing diagram and port timing diagram – Actual and theoretical PV diagram of four stroke and two stroke engines - Comparison of two stroke and four stroke engines – Carburetor system, Diesel pump and injector system – Comparison of petrol and diesel engine – Lubrication system and Cooling system – Battery and Magneto Ignition System – Performance calculation.

UNIT III STEAM NOZZLES AND TURBINES 9 + 3

Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow, Impulse and Reaction principles, compounding, velocity diagram for simple and multi-stage turbines, speed regulations – Governors.

UNIT IV AIR COMPRESSOR 9 + 3

Classification and working principle of various types of compressors, work of compression with and without clearance, Volumetric efficiency, Isothermal efficiency and Isentropic efficiency of reciprocating compressors, Multistage air compressor and inter cooling – work of multistage air compressor – Operating principle of rotary compressor

UNIT V REFRIGERATION AND AIR CONDITIONING 9 + 3

Vapour compression refrigeration cycle – super heat, sub cooling – Performance calculations – working principle of vapour absorption system, Ammonia – Water, Lithium bromide – water systems (Description only) – Alternate refrigerants – Comparison between vapour compression and absorption systems – Air conditioning system: Types, Working Principles – Psychrometry, Psychrometric chart – Cooling Load calculations.

Total : 45 + 15 = 60 Periods

TEXT BOOKS

1. Rajput. R.K., **"Thermal Engineering",** S.Chand Publishers, (2000)
2. Kothandaraman.C.P., Domkundwar.S, Domkundwar.A.V., **"A Course in Thermal Engineering",** Dhanpat Rai & sons, 5th edition, (2002)

REFERENCES

1. Ballaney P.L, **"Thermal Engineering"**, Khanna Publishers, (1985)
2. Arora.C.P, **"Refrigeration and Air Conditioning",** Tata McGraw-Hill Publishers (1994)
3. Ganesan V. **"Internal Combustion Engines",** 3rd Edition, Tata McGraw-Hill (2007)
4. Rudramoorthy, R, **"Thermal Engineering",** Tata McGraw-Hill, New Delhi,(2003)

12ME54 APPLIED HYDRAULICS AND PNEUMATICS

L	T	P	C
3	0	0	3

AIM

To know the advantages and applications of Fluid Power Engineering and to learn the Applications of Fluid Power System in automation of Machine Tools and others Equipments.

Course Outcomes

The Students will be able to

- Ability to demonstrate the basic principles of hydraulics and pneumatics
- Identify proper control valves and cylinder for a specific application
- Design the circuits using pneumatic / hydraulic components for a small scale industrial application
- Explain the nature of laminar and turbulent flow
- Illustrate the speed, sequential and pneumo hydraulic circuits
- Utilize schematics to construct hydraulic circuits

UNIT I FLUID POWER SYSTEMS AND FUNDAMENTALS 9

Introduction to fluid power, Advantages and Application – Types of fluid power systems, Properties of hydraulic fluids – General types of fluids – Symbols – Basics of Hydraulics – Applications of Pascal's Law – Laminar and Turbulent flow – Reynold's number – Darcy's equation – Losses in pipe, valves and fittings.

UNIT II HYDRAULIC SYSTEM & COMPONENTS 9

Pumping theory – classification – Gear, Vane, piston pump, construction and working – performance – Variable displacement pumps – Fluid Power Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting special cylinders like tanden, Rodless, Telescopic, Cushioning mechanism, Construction of double acting cylinder, Rotary actuators – Fluid, Gear, Vane and Piston motors.

UNIT III DESIGN OF HYDRAULIC CIRCUITS 9

Construction of Control Components: Directional control valve – 3/2 way valve – 4/2 way valve – Shuttle valve – check valve – pressure control valve – pressure reducing valve, sequence valve, Flow control valve – Fixed and adjustable, electrical control solenoid valves, Relays, ladder diagram – Types of accumulators – Accumulators circuits, sizing of accumulators, intensifier – Applications of Intensifier – Intensifier circuit.

UNIT IV PNEUMATIC SYSTEMS AND COMPONENTS 9

Properties of air – Compressors – Filter, Regulator, Lubricator Unit – Air control valves, Quick exhaust valves, pneumatic actuators – Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, Penumo hydraulic circuit, Sequential circuit design for simple applications using cascade method.

UNIT V DESIGN OF PNEUMATIC CIRCUITS 9

Servo systems – Hydro Mechanical, Electro hydraulic servo systems and proportional valves – Introduction to fluidic devices, simple circuits – Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control – Fluid power circuits – failure and troubleshooting.

Total : 45 Periods

TEXT BOOKS

1. Anthony Esposito, **"Fluid Power with Applications",** Pearson Education (2005)
2. Srinivasan.R, **"Hydraulic and Pneumatic controls",** Vijay Nicole, (2006)

REFERENCES

1. Majumdar S.R., **"Oil Hydraulics Systems–Principles and Maintenance",** Tata

McGraw-Hill, (2001)
2. Shanmugasundaram.K, **"Hydraulic and Pneumatic controls",** Chand & Co, (2006)
3. Majumdar S.R., **"Pneumatic systems – Principles and maintenance",** Tata McGraw Hill, (1995)

Anthony Lal, **"Oil hydraulics in the service of industry",** Allied publishers, (1982)

		L	T	P	C
12ME55	**AUTOMOBILE ENGINEERING**	**3**	**0**	**0**	**3**

AIM

To understand the construction and working principle of various parts of an automobile and practice assembling and dismantling of engine parts and transmission system

Course Outcomes

The Students will be able to

- Construct vehicle chassis, frame, body and engine components
- Explain electronically controlled gasoline, diesel injection systems and auxiliary systems and also engine emission control techniques
- Illustrate the transmission systems
- Demonstrate the concepts of steering, suspension and braking systems
- Classify the various types of alternative fuels used in automobiles and engine modifications required

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 SYSTEMS 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 ENERGY SOURCES 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.

Note: *Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.*

Total : 45 Periods

TEXT BOOKS

1. Kirpal Singh, **"Automobile Engineering Vol 1 & 2",** Standard Publishers, 7th Edition, New Delhi, (2002)
2. Ganesan V. **" Internal Combustion Engines",** 3rd Edition, Tata McGraw-Hill, (2007)

REFERENCES

1. Newton ,Steeds and Garet, **" Motor Vehicles",** Butterworth Publishers, (1989)
2. Joseph Heitner, **"Automotive Mechanics",** 2nd Edition ,East-West Press,(1999)
3. Martin W. Stockel and Martin T Stockle , **"Work book for Auto Mechanics Fundamentals",** The Goodheart –Will Cox Company Inc, USA ,(1990)
4. Heinz Heisler, **"Advanced Engine Technology",** SAE International Publications, USA, (1998)

		L	T	P	C
12ME56	**COMPUTER AIDED MACHINE DRAWING LABORATORY**	**0**	**0**	**3**	**2**

LIST OF EXPERIMENTS

DRAWING STANDARDS

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

2-D DRAWINGS

Limits, Fits – Tolerance of individual dimensions – Specification of Fits – Manual Preparation of production drawings and reading of part and assembly drawings.

CAD PRACTICE (USING APPLICATION PACKAGES)

Drawing, Editing, Dimensioning, Plotting Commands, Layering Concepts, Hatching, Detailing, Assembly, basic principles of GD&T (geometric dimensioning & tolerance)

ASSEMBLY DRAWING (MANUAL & USING APPLICATION PACKAGES)

Manual parts drawing and preparation of assembled views given part details for components followed by practicing the same using CAD packages.

Suggested Assemblies:

Shaft couplings – Plummer block – Screw jack- Lathe Tailstock – Universal Joint – Machine Vice – Stuffing box – safety Valves – Non-return valves – Connecting rod – Piston and crank shaft – Multi plate clutch – Preparation of Bill of materials and tolerance data sheet

SYSTEM REQUIREMENTS (FOR A BATCH OF 30 STUDENTS)

1. **Computer System** **30 Nos.**
   17" Graphics Terminal
   Pentium IV Processor
   80 GB HDD
   512 MB RAM
   Advanced graphics accelerator
2. **Laser Printer** **1 No.**

SOFTWARE

30 seats of latest/recent versions of AUTO CAD/CATIA/SOLID WORKS/SOLID EDGE/NX/PRO-E/COLLABCAD or equivalent software

REFERENCE BOOKS

1. Bhatt.N.D. and Panchal.V.M., **"Machine Drawing",** Charotar Publishing House, 388001, 38th Edition, (2003)
2. Gopalakrishna K.R., "**Machine Drawing in First Angle Projection",** Subhas store (2002)
3. P.S.G. Design Data Book
4. Luzadder,Warren.J., and Duff, Jon.M. "**Fundamentals of Engineering Drawing",** Prentice Hall India Pvt. Ltd., Eastern Economy Edition, 11th Edition

Total: 45 + 15 = 60 Periods

		L	T	P	C
12ME57	**DYNAMICS LABORATORY**	**0**	**0**	**3**	**2**

LIST OF EXPERIMENTS

1. a) Study of gear parameters.
   b) Experimental study of velocity ratios of simple, compound, Epicyclic and differential gear trains.
2. a) Kinematics of Four Bar, Slider Crank, Crank Rocker, Double crank, Double rocker, Oscillating cylinder Mechanisms.
   b) Kinematics of single and double universal joints.
3. a) Determination of Mass moment of inertia of Fly wheel and Axle system.
   b) Determination of Mass Moment of Inertia of axisymmetric bodies using Turn Table apparatus.
   c) Determination of Mass Moment of Inertia using bifilar suspension and compound pendulum.
5. Motorized gyroscope – Study of gyroscopic effect and couple.
6. Governor – Determination of range sensitivity, effort etc., for Watts, Porter, Proell, and Hartnell Governors.
7. Cams – Cam profile drawing, Motion curves and study of jump phenomenon
8. a) Single degree of freedom Spring Mass System – Determination of natural Frequency and verification of Laws of springs – Damping coefficient determination.
   b) Multi degree freedom suspension system – Determination of influence coefficient.
9. a) Determination of torsional natural frequency of single and Double Rotor systems.- Undamped and Damped Natural frequencies.
   b) Vibration Absorber – Tuned vibration absorber.
10. Vibration of Equivalent Spring mass system – undamped and damped vibration.
11. Whirling of shafts – Determination of critical speeds of shafts with concentrated loads.
12. a) Balancing of rotating masses
    b) Balancing of reciprocating masses.
13. a) Transverse vibration of Free-Free beam – with and without concentrated masses.
    b) Forced Vibration of Cantilever beam – Mode shapes and natural frequencies.
    c) Determination of transmissibility ratio using vibrating table.

LIST OF EQUIPMENTS

Sl. No.	Description of Equipment	Quantity required
1.	Cam analyzer.	1 No.
2.	Motorized gyroscope	1 No.

3.	Governor apparatus - Watt, Porter, Proell and Hartnell governors.	1 No.
4.	Whirling of shaft apparatus	1 No.
5.	Static and dynamic balancing machine.	1 No.
6.	Vibrating table	1 No.
7.	Vibration test facilities apparatus	1 No.
8.	Gear Model	1 No.
9.	Kinematic Models to study various mechanisms	1 No.

Total: 45 Periods

12ME58	THERMAL ENGINEERING LABORATORY – I	L	T	P	C
		0	0	3	2

LIST OF EXPERIMENTS

I.C. ENGINE LAB AND FUELS LABORATORY **30**

Valve Timing and Port Timing Diagrams.
Performance Test on 4-stroke Diesel Engine.
Heat Balance Test on 4-stroke Diesel Engine.
Morse Test on Multicylinder Petrol Engine.
Retardation Test to find Frictional Power of a Diesel Engine.
Determination of Viscosity – Red Wood Viscometer.
Determination of Flash Point and Fire Point.

STEAM LABORATORY **15**

Study of Steam Generators and Turbines.
Performance and Energy Balance Test on a Steam Generator.
Performance and Energy Balance Test on Steam Turbine.

LIST OF EQUIPMENTS
(for a batch of 30 Students)

I.C. Engine – 2 stroke and 4 stroke model	1set
Red Wood Viscometer	1No.
Apparatus for Flash and Fire Point	1No.
4-stroke Diesel Engine with mechanical loading	1No.
4-stroke Diesel Engine with hydraulic loading	1No.
4-stroke Diesel Engine with electrical loading	1No.
1 No. Multi-cylinder Petrol Engine	1No.
Single cylinder Petrol Engine	1No.
Data Acquisition system with any one of the above engines	1No.

Total: 45 Periods

12HS51	ENGLISH FOR EMPLOYMENT – I	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS

AIM

To get proficiency in business communication at work place. To develop students accuracy in communication and to improve learners ability to understand any kind of text.

Task: 1	Verbal Reasoning	8
Task: 2	Resume and Covering Letter	5
Task: 3	Channel Conversations	4
Task: 4	Group Discussions	13
Task: 5	Debate	12
Task: 6	Mock Interview	18

Total: 60 Periods

E-MATERIAL

www.indiabix.com/verbal-reasoning

RECORD-LAYOUT

Record for the 12HS51 ENGLISH FOR EMPLOYMENT should comprise the following,

1. *Bonafide Certificate with the sign of the HOD, Staff-in-Charge/Trainer, Internal and External examiners*
2. *Contents*
3. *Six Test Question paper and answers scripts for Verbal Reasoning*
4. *Copy of Resume with Covering letter*
5. *Materials used for the Group Discussion & Debate-Resources shall be used from Dailies/Internet/Magazine*

******Note: Contents for the Internal and External Examinations should be considered only from "The BUSINESS ENGLISH" oriented Articles/Extracts/Clips/Illustrations/Audio scripts.***

MODE OF EVALUATION

Internal Assessment	**(100 Marks to be converted to 25)**
Verbal Reasoning	*10*
Channel Conversion	*10*
Group Discussion / Debate	*40*
Mock Interview	*40*

External Assessment	**(100 Marks to be converted to 75)**
Verbal Reasoning	*10*
Channel Conversion	*10*
Group Discussion / Debate	*40*
Mock Interview	*40*

L T P C

12MG61 PRINCIPLES OF MANAGEMENT 3 0 0 3

AIM

To have a clear understanding of the managerial functions like planning, organizing, staffing, leading and controlling and also gain some basic knowledge on international aspect of management

Course Outcomes:

The Students will be able to

- Predict the structure of the management and to list the different strategies
- Realize the purpose and steps involved in planning and decision making process
- Construct the organizational structure, selection process, appraisal process and the skills by the organization
- Identify the motivational and leadership theory and realize the importance of effective communication
- Summarize the process of controlling and the management information system

UNIT I OVERVIEW OF MANAGEMENT 9

Organization – Management – Role of managers – Evolution of Management thought – Organization and the environmental factors – Managing globally – Strategies for International Business.

UNIT II PLANNING 9

Nature and Purpose planning – Planning process – Types of plans – Objectives – Managing by objective (MBO) – Strategies – Types of strategies – Policies – Decision Making – Types of decision – Decision Making Process – Rational Decision Making Process – Decision Making under different conditions.

UNIT III ORGANISING 9

Nature and purpose of organizing – Organization structure – Formal and informal groups/organization – Line and Staff authority – Departmentation – Span of Control – Centralization and Decentralization – Delegation of authority – Staffing – Selection and Recruitment – Orientation Career Development – Career stages – Training – Performance Appraisal.

UNIT IV DIRECTING 9

Creativity and Innovation – Motivation and Satisfaction – Motivation Theories Leadership – Leadership theories – Communication – Hurdles to effective communication – Organization Culture – Elements and types of culture – Managing cultural diversity.

UNIT V CONTROLLING 9

Process of controlling – Types of control – Budgetary and non-budgetary control techniques – Managing Productivity – Cost Control – Purchase Control – Maintenance Control – Quality Control – Planning operations.

Total : 45 Periods

TEXT BOOKS

1. Charles W.L. Hill, Steven L. McShane, **"Principles of Management",** Mcgraw Hill Education, Special Indian Edition, (2007)
2. Joseph L. Massie **"Essentials of Management",** Prentice Hall of India, (Pearson) Fourth Edition, (2003)

REFERENCES

1. Tripathy P.C., and Reddy P.N., **"Principles of Management",** Tata McGraw-Hill, (1999)
2. Harold Koontz, Heinz Weihrich and Mark V. Cannice, **"Management – A global & Entrepreneurial Perspective",** Tata Mcgraw Hill, 12th edition, (2007)
3. Hellriegel, Slocum & Jackson, **"Management – A Competency Based Approach",** Thomson South Western, 10th edition, (2007)
4. Harold Koontz & Heinz Weihrich **"Essentials of Management",** Tata McGraw-Hill, (1998)

L T P C

12ME61 HEAT AND MASS TRANSFER 3 1 0 4

AIM

To understand the basic concepts of Heat and Mass Transfer and its application.

Course Outcomes:

The Students will be able to

- Illustrate the different types of Heat Transfer modes
- Explain the basic principles of Convection Heat Transfer and its Boundary Layer concepts
- Ensure the working principle of Heat Exchangers
- Impart the knowledge of basic Radiation Shield element works
- Categorize the principles of Mass Transfer

UNIT I CONDUCTION 11 + 3

Basic Concepts – Mechanism of Heat Transfer – Conduction, Convection and Radiation – Fourier Law of Conduction – General Differential equation of Heat Conduction – Cartesian and Cylindrical Coordinates – One Dimensional Steady State Heat Conduction – Conduction through Plane Wall, Cylinders and Spherical systems – Composite Systems – Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Use of Heislers Chart.

UNIT II CONVECTION 10 + 3

Basic Concepts – Heat Transfer Coefficients – Boundary Layer Concept – Types of Convection – Forced Convection – Dimensional Analysis – External Flow – Flow over Plates, Cylinders and Spheres – Internal Flow – Laminar and Turbulent Flow – Combined Laminar and Turbulent – Flow over Bank of tubes – Free Convection – Dimensional Analysis – Flow over vertical Plate, Horizontal Plate, Inclined Plate, Cylinders and Spheres.

UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS 9 + 3

Nusselts theory of condensation – pool boiling, flow boiling, correlations in boiling and condensation – Types of Heat Exchangers – Heat Exchanger Analysis – LMTD Method and NTU – Effectiveness – Overall Heat Transfer Coefficient – Fouling Factors.

UNIT IV RADIATION 8 + 3

Basic Concepts, Laws of Radiation – Stefan Boltzman Law, Kirchoffs Law – Black Body Radiation – Grey body radiation – Shape Factor Algebra – Electrical Analogy – Radiation Shields – Introduction to Gas Radiation.

UNIT V MASS TRANSFER 7 + 3

Basic Concepts – Diffusion Mass Transfer – Fick's Law of Diffusion – Steady state Molecular Diffusion – Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy – Convective Mass Transfer Correlations.

Total : 45 + 15 = 60 Periods

TEXT BOOKS

1. *Sachdeva, R.C., **"Fundamentals of Engineering Heat and Mass Transfer",** New Age International, (2009)*

*Kothandaraman, C.P **"Fundamentals of Heat and Mass Transfer",** New Age International, New Delhi, (2006)*

REFERENCES

1. *Yadav, R **"Heat and Mass Transfer",** Central Publishing House, (1995)*
2. *Ozisik, M.N, **"Heat Transfer",** McGraw-Hill Book Co., (1994)*
3. *Nag, P.K, **"Heat Transfer",** Tata McGraw-Hill, New Delhi, (2002)*
4. *Holman, J.P **"Heat and Mass Transfer",** Tata McGraw-Hill,(2000)*

12ME62	COMPUTER INTEGRATED MANUFACTURING	L	T	P	C
		3	0	0	3

AIM

To gain the knowledge about the Advanced and computerized Manufacturing Techniques followed in the Shop floor of the Industries

Course Outcomes

The Students will be able to

- Originate the various CAD command structure and how the drawing entities were formed
- Outline about the components of CIM
- Explain the various steps involved in GT, Process planning techniques and CAPP
- Realize the different phases of FMS and SFC
- Illustrate the Lean and Agile manufacturing techniques

UNIT I COMPUTER AIDED DESIGN 9

Concept of CAD as drafting and designing facility, desirable features of CAD package, drawing features in CAD – Scaling, rotation, translation, editing, dimensioning, labeling, Zoom, pan, redraw and regenerate, typical CAD command structure, wire frame modeling, surface modeling and solid modeling (concepts only) in relation to popular CAD packages.

UNIT II COMPONENTS OF CIM 9

CIM as a concept and a technology, CASA/SME model of CIM, CIM II, benefits of CIM, communication matrix in CIM, fundamentals of computer communication in CIM – CIM data transmission methods – serial, parallel, asynchronous, synchronous, modulation, demodulation, simplex and duplex. Types of communication in CIM – point to point (PTP), star and multiplexing. Computer networking in CIM – the seven layer OSI model, LAN model, MAP model, network topologies – star, ring and bus, advantages of networks in CIM.

UNIT III GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING 9

History Of Group Technology – role of G.T. in CAD/CAM Integration – part families – classification and coding – DCLASS and MCLASS and OPTIZ 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 systems.

UNIT IV SHOP FLOOR CONTROL AND INTRODUCTION TO FMS 9

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

UNIT V COMPUTER AIDED PLANNING AND CONTROL AND COMPUTER MONITORING 9

Production planning and control – cost planning and control – inventory management – material requirements planning (MRP) – shop floor control. Lean and Agile Manufacturing. Types of production monitoring systems – structure model of manufacturing – process control and strategies – direct digital control.

Total : 45 Periods

TEXT BOOKS

1. Mikell P. Groover, **"Automation, Production Systems and Computer Integrated Manufacturing",** Pearson Education (2013)
2. Mikell P. Groover and Emory Zimmers Jr., **"CAD/CAM",** Prentice Hall of India Pvt. Ltd., (2006)

REFERENCES

1. James A. Regh and Henry W.Kreabber, **"Computer Integrated Manufacturing",** Pearson Education 2nd edition, (2005)
2. Chris McMahon and Jimmie Browne, **"CAD CAM Principles, Practice and Manufacturing Management",** Pearson Education 2nd edition, (2005)
3. Ranky Paul G., **"Computer Integrated Manufacturing",** Prentice Hall of India Pvt. Ltd., (2005)
4. Yorem Koren, **" Computer Integrated Manufacturing",** McGraw Hill, (2005)

		L	T	P	C
12ME63	**FINITE ELEMENT ANALYSIS**	**3**	**1**	**0**	**4**

AIM

To introduce the concepts of Mathematical Modeling of Engineering Problems and to appreciate the use of FEM to a range of Engineering Problems

Course Outcomes:

The Students will be able to

- Express the various approximation and elimination methods to find the solution
- Solve various numerical engineering problems in 1D, 2D & Axi-symmetric
- Compile the applications of various types of elements
- Recognize the basic concept of dynamic analysis using FEA
- Elucidate the numerical engineering problems in dynamic analysis
- Realize the various applications involved in 1D, 2D heat transfer

5

UNIT I FINITE ELEMENT FORMULATION OF BOUNDARY VALUE PROBLEMS 5 + 3

Weighted residual methods – general weighted residual statement – weak formulation of the weighted residual statement – comparisons – piecewise continuous trial functions – example of a bar finite element – functional and differential forms – principle of stationary total potential – Rayleigh Ritz method – piecewise continuous trial functions – finite element method – application to bar element.

UNIT II ONE DIMENSIONAL FINITE ELEMENT ANALYSIS 8 + 4

General form of total potential for 1-D applications – generic form of finite element equations – linear bar element – quadratic element –nodal approximation – development of shape functions – element matrices and vectors – example problems – extension to plane truss– development of element equations – assembly – element connectivity – global equations – solution methods – beam element – nodal approximation – shape functions – element matrices and vectors – assembly – solution – example problems.

UNIT III TWO DIMENSIONAL FINITE ELEMENT ANALYSIS 10 + 4

Introduction – approximation of geometry and field variable – 3 noded triangular elements – four noded rectangular elements – higher order elements – generalized coordinates approach to nodal approximations – difficulties – natural coordinates and coordinate transformations – triangular and quadrilateral elements – iso-parametric elements – structural mechanics applications in 2-dimensions – elasticity equations – stress strain relations – plane problems of elasticity – element equations – assembly – need for quadrature formule – transformations to natural coordinates – Gaussian quadrature – example problems in plane stress, plane strain and axisymmetric applications.

UNIT IV DYNAMIC ANALYSIS USING FINITE ELEMENT METHOD 8 + 4

Introduction – vibrational problems – equations of motion based on weak form – longitudinal vibration of bars – transverse vibration of beams – consistent mass matrices – element equations – solution of eigen value problems – vector iteration methods – normal modes – transient vibrations – modeling of damping – mode superposition technique – direct integration methods.

UNIT V APPLICATIONS IN HEAT TRANSFER & FLUID MECHANICS 6 + 3

One dimensional heat transfer element – application to one-dimensional heat transfer problems – scalar variable problems in 2-Dimensions – Applications to heat transfer in 2-Dimension – Application to problems in fluid mechanics in 2-D.

Total : 45 + 15 = 60 Periods

TEXT BOOKS

1. Seshu.P, **"Text Book of Finite Element Analysis",** Prentice-Hall of India Pvt. Ltd. New Delhi,(2007)
2. Desai.Y.M., Eldho.T.I., Shah.A.H., **"Finite Element Method with application in Engineering",** Pearson Education in South Asia, (2011)

REFERENCES

1. Reddy.J.N., **"An Introduction to the Finite Element Method",** McGraw-Hill International Editions (Engineering Mechanics Series), (1993)
2. Chandrupatla & Belagundu, **"Introduction to Finite Elements in Engineering",** Prentice-Hall of India, Eastern Economy Editions (2003)
3. David V.Hutton, **"Fundamentals of Finite Element Analysis",** Tata McGraw-Hill Edition (2005)
4. Cook Robert, D., et al, **"Concepts and Applications of Finite Element Analysis",** Wiley Student Edition, (2004)

12ME64	DESIGN OF TRANSMISSION SYSTEMS	L	T	P	C
		3	0	0	3

AIM

To study the design procedures of power transmission systems

Course Outcomes:

The Students will be able to

- Classify the flexible transmission elements
- Explain the design procedures of spur gears and parallel axis helical gears
- Estimating the size of the pair of bevel, worm and cross helical gears
- Explain the kinematics layout of the gear boxes
- Study the design of cam, clutches and brakes

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 – Speed ratios and number of teeth – Force analysis – Tooth stresses – Dynamic effects – Fatigue strength – Factor of safety – Gear materials – Module and Face width – power rating calculations based on strength and wear considerations – Parallel axis Helical Gears – Pressure angle in the normal and transverse plane – Equivalent number of teeth – forces and stresses – Estimating the size of the helical gears.

UNIT III BEVEL, WORM AND CROSS HELICAL GEARS 9

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth – Estimating the dimensions of pair of straight bevel gears – Worm Gear: Merits and demerits – terminology – Thermal capacity, materials – forces and stresses, efficiency, estimating the size of the worm gear pair – Cross helical: Terminology – helix angles – Estimating the size of the pair of cross helical gears.

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.

UNIT V DESIGN OF CAM CLUTCHES AND BRAKES 9

Cam Design: Types – pressure angle and under cutting base circle determination – forces and surface stresses – Design of plate clutches – axial clutches – cone clutches – internal expanding rim clutches – internal and external shoe brakes.

Total : 45 Periods

TEXT BOOKS

1. Khurmi, R.S., Gupta, J.K., **"Machine Design",** Eurasia Publications, (2005)
2. Sundararajamoorthy T.V and Shanmugam N., "**Machine Design",** Anuradha Publications,(2003)

REFERENCES

1. Maitra, G.M., Prasad, L.V., **"Hand book of Mechanical Design",** 2nd Edition, Tata McGraw-Hill,(1985)
2. Bhandari, V.B., **"Design of Machine Elements",** Tata McGraw-Hill Publishing Company Ltd., (1994)
3. Prabhu, T.J., **"Design of Transmission Elements",** Mani Offset, Chennai, (2000)
4. Hamrock, B.J., Jacobson, B., Schmid, S.R., **"Fundamentals of Machine Elements",** McGraw-Hill Book Co.,(1999)

12ME65	THERMAL ENGINEERING LABORATORY – II	L	T	P	C
		0	0	3	2

LIST OF EXPERIMENTS

HEAT TRANSFER **30**

Thermal conductivity measurement by guarded plate method
Thermal conductivity of pipe insulation using lagged pipe apparatus
Natural convection heat transfer from a vertical cylinder
Forced convection inside tube
Heat transfer from pin-fin (natural & forced convection modes)
Determination of Stefan-Boltzmann constant
Determination of emissivity of a grey surface
Effectiveness of Parallel/counter flow heat exchanger

REFRIGERATION AND AIR CONDITIONING **15**

Determination of COP of a refrigeration system
Experiments on air-conditioning system
Performance test on single/two stage reciprocating air compressor

LIST OF EQUIPMENTS
(for a batch of 30 Students)

Guarded plate apparatus	1set
Lagged pipe apparatus	1No.
Natural convection-vertical cylinder apparatus	1No.
Forced convection inside tube apparatus	1No.
Pin-fin apparatus	1No.
Stefan-Boltzmann apparatus	1No.
Emissivity measurement apparatus	1No.
Parallel/counter flow heat exchanger apparatus	1No.
Single/two stage reciprocating air compressor.	1No.
Refrigeration test rig	1No.
Air-conditioning test rig	1No.

Total: 45 Periods

12ME66	CAD/CAM LABORATORY	L	T	P	C
		0	0	3	2

LIST OF EXPERIMENTS

3D GEOMETRIC MODELING

Creation of 3D Models – Wire Frame, Surface, Solid modeling Techniques using CAD Packages – CSG, B-Rep Approaches in Solid Modeling – Feature based Modeling Technique – Assembly

– Detailing – Exposure to Industrial Components – Application of GD&T.

STL FILE GENERATION – REVERSE ENGINEERING

Manual CNC Part Programming Using Standard G and M Codes – Tool Path Simulation – Exposure to Various Standard Control Systems – Machining simple components by using CNC machines.

COMPUTER AIDED PART PROGRAMMING

CL Data Generation by Using CAM Software – Post Process Generation for Different Control System – Machining of Computer Generated Part Program by Using Machining Center and Turning Center.

STUDY OF EXPERIMENTS

Multi-axial Machining in CNC Machining Center – EDM – EDM Wire Cut – Rapid Prototyping

SYSTEM REQUIREMENTS
(For a batch of 30 Students)

Description of Equipment	Quantity Required
HARDWARE	
Computer Server	1 No.
Computer nodes or systems (High end CPU with atleast 1 GB main memory) networked to the server	30 Nos.
Laser Printer	1 No.
Trainer CNC Lathe	1 No.
Trainer CNC milling	1 No.
SOFTWARE	
CAD/CAM software (Pro-E or IDEAS or Unigraphics or CATIA)	15 licenses
CAM Software (CNC Programming and tool path simulation for FANUC/Sinumeric and Heiden controller)	15 licenses
Licensed operating system	Adequate

Total: 45 Period

12HS61	ENGLISH FOR EMPLOYMENT – II	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS

Course Outcomes

The Students will be able to

- Develop analytical skill and vocabulary
- Improve job prospects
- Brainstorm the topic and use verbal cues
- Hone negotiation and convincing skill
- Employ Documentation methodology and verbal & non-verbal cues

Unit-I Reading **10**

1.1 Reading for Gist
1.2 Reading for Structure and detail
1.3 Understanding General Points
1.4 Reading-Vocabulary and Texture
1.5 Structure and Discourse features
1.6 Understanding sentence structure

Unit –II Writing **10**

2.1 Describing figure from graphic input
2.2 Deriving conclusion from illustrations
2.3 Writing a Report-Describing/Summarizing
2.4 Explaining a context
2.5 Writing Apologies
2.6 Complaint letter
2.7 Writing for giving assurance

Unit-III Listening **10**

3.1 Listening for Specific Information
3.2 Listening to Identify topic
3.3 Listening to a context
3.4 Listening to opinions expressed in a debate
3.5 Listening for Gist
3.6 Listening for making Inferences

Unit-IV Speaking **15**

4.1 Introducing yourself
4.2 Have your say
4.3 'Mini-Presentation' on the given topic
4.4 Group Discussion
4.5 Expressing personal opinion about the Social Issues

Total: 45 Periods

Text Book:

1) *Business Benchmark Advanced Audio Cassettes BEC Higher, Guy Brook-Hart, 2 Audio cassettes, ISBN: 9780521672986*
2) *Business Benchmark Upper Intermediate Personal Study Book BEC and BULATS Edition, Guy Brook-Hart, PB, ISBN: 9780521672917*

Total: 60 Periods

12MG71	TOTAL QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

AIM

To understand the various principles, practices of TQM to achieve quality and to learn the various statistical approaches for Quality control**.**

Course Outcomes

The Students will be able to

- Analyze the various Industrial practices to achieve Quality
- Develop Managerial and Entrepreneurial Skills
- Select suitable tools to audit quality standards
- Develop strategy for achieving quality using FMEA and Benchmarking
- Summarize the ISO auditing and documentation process

UNIT I INTRODUCTION 9

Introduction – Need for quality – Evolution of quality – Definition of quality – Dimensions of manufacturing and service quality – Basic concepts of TQM – Definition of TQM – TQM Framework – Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT II TQM PRINCIPLES 9

. Leadership – Strategic quality planning, Quality statements – Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal – Continuous process improvement – PDSA cycle, 5s, Kaizen – Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS &TECHNIQUES I 9

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking– Reason to bench mark, Bench marking process – FMEA – Stages, Types.

UNIT IV TQM TOOLS & TECHNIQUES II 9

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000–ISO 9000:2000 Quality System – Elements, Documentation, Quality auditing– QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Dale H.Besterfiled, et at., **"Total Quality Management",** Pearson Education Asia, 3rd Edition, Indian Reprint, (2006)
2. Shridhara Bhat K, **"Total Quality Management – Text and Cases",** Himalaya Publishing House, 1st Edition, (2002)

REFERENCES

1. James R. Evans and William M. Lindsay, **"The Management and Control of Quality",** 6th Edition, South-Western (Thomson Learning), (2005)
2. Oakland, J.S. **"TQM – Text with Cases",** Butterworth – Heinemann Ltd., Oxford, 3rd Edition,(2003)
3. Suganthi, L and Anand Samuel, **"Total Quality Management",** Prentice Hall (India) Pvt. Ltd., (2006)
4. Janakiraman, B and Gopal, R.K., **"Total Quality Management – Text and Cases",** Prentice Hall (India) Pvt. Ltd., (2006)

12ME71	MECHATRONICS	L	T	P	C
		3	0	0	3

AIM

To understand the interdisciplinary applications of Electronics, Electrical, Mechanical and Computer Systems for the Control of Mechanical and Electronic Systems.

Course Outcomes

The Students will be able to

- Explain about basics of Mechatronics systems
- Classify various sensors, transducers with their properties
- Operate Hydraulic, Pneumatic, Electrical and Mechanical Systems
- Develop solution for various types of system models and controller
- Illustrate the basic concept and structure of PLC
- Realize various Mechatronics Systems design

UNIT I **MECHATRONICS, SENSORS AND TRANSDUCERS** **9**

Introduction to Mechatronics Systems – Measurement Systems – Control Systems – Microprocessor basedControllers–Sensors and Transducers– Performance Terminology–Sensors for Displacement, Position and Proximity; Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature,Light Sensors – Selection of Sensors.

UNIT II **ACTUATION SYSTEMS** **9**

Pneumatic and Hydraulic Systems – Directional Control Valves – RotaryActuators–Electrical Actuation Systems – Mechanical Switches – Solid State Switches – Solenoids – Construction and working principle of DC and AC Motors– speed control of AC and DC drives, Stepper Motors– switching circuitries for stepper motor – AC & DC Servo motors.

UNIT III **SYSTEM MODELS AND CONTROLLERS** **9**

Building blocks of Mechanical, Electrical, Fluid and Thermal Systems, Rotational – Transnational Systems, Electromechanical Systems – Hydraulic – Mechanical Systems– Continuous and discrete process Controllers – Control Mode – Two Step mode – Proportional Mode – Derivative Mode – Integral Mode – PID Controllers – Digital Controllers – Velocity Control – Adaptive Control – Digital Logic Control – Micro Processors Control.

UNIT IV **PROGRAMMING LOGIC CONTROLLERS** **9**

Programmable Logic Controllers – Basic Structure – Input / Output Processing – Programming – Mnemonics – Timers, Internal relays and counters – Shift Registers – Master and Jump Controls – Data Handling – Analogs Input / Output – Selection of a PLC.

UNIT V **DESIGN OF MECHATRONICS SYSTEM** **9**

Stages in designing Mechatronics Systems – Traditional and Mechatronic Design – Possible Design Solutions– Case studies of Mechatronics systems – Pick and place Robot – Autonomous mobile robot– Wireless suriviellance balloon– Engine Management system– Automatic car park barrier.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Bolton, W., **"Mechatronics",** Pearson education, 2nd edition, 5th Indian Reprint,(2003)
2. Rajput, R.K., **"A textbook of Mechatronics",** S. Chand & Co., (2007)

REFERENCES

1. Smaili, A., and Mrad, F., **"Mechatronics integrated technologies for intelligent machines",** Oxford university press, (2008)
2. Michael B. Histand and David G. Alciatore, **"Introduction to Mechatronics and Measurement Systems",** McGraw-Hill International Editions, (2000)
3. Bradley, D. A., Dawson , D., Buru, N.C. and Loader A.J., **"Mechatronics",** Chapman and Hall, (1993)

4. Lawrence J. Kamm, **"Understanding Electro – Mechanical Engineering",** An Introduction to Mechatronics, Prentice Hall of India Pvt., Ltd., (2000)

12ME72 GAS DYNAMICS AND JET PROPULSION L T P C

3 1 0 4

AIM

To understand the basic difference between incompressible and compressible flow and to understand the phenomenon of shock waves and its effect on flow. To gain some basic knowledge about jet propulsion and Rocket Propulsion.

Course Outcomes

The Students will be able to

- Explain the classification of compressible fluid flow and to describe the isentropic flow through ducts, nozzle, and diffusers
- Analyze the flow through heat transfer for Rayleigh flow and fanno flow
- Formulate the governing equation using normal and oblique shocks to analyze the Mayer relation and its applications
- List the jet engines and to determine the propulsive efficiency
- Prescribe about the rocket propulsion and explain the different types of rocket engines

UNIT I BASIC CONCEPTS AND ISENTROPIC FLOWS 9 +3

Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers – Use of Gas tables.

UNIT II FLOW THROUGH DUCTS 9 +3

Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties – Use of tables and charts – Generalised gas dynamics.

UNIT III NORMAL AND OBLIQUE SHOCK 9 +3

Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl – Meyer relations – Use of table and charts – Applications

UNIT IV JET PROPULSION 9 +3

Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency – Operation principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines.

UNIT V SPACE PROPULSION 9 +3

Types of rocket engines – Propellants–feeding systems – Ignition and combustion – Theory of rocket propulsion – Performance study – Staging – Terminal and characteristic velocity – Applications – space flights.

TOTAL:45 + 15 = 60 PERIODS

TEXT BOOKS

1. Yahya, S.M., **"Fundamentals of Compressible Flow",** New Age International (P) Limited, New Delhi, (2003)
2. Rathakrishnan E., **"Gas Dynamics",** Prentice Hall India Publication, (2013)

REFERENCES

1. Anderson, J.D., **"Modern Compressible flow",** McGraw Hill, 3rd Edition, (2003)
2. Cohen, H, G.E.C. Rogers and Saravanamutto, **"Gas Turbine Theory",** Longman Group Ltd., (1980)
3. Hill. P and C. Peterson, **"Mechanics and Thermodynamics of Propulsion",** Addison – Wesley Publishing company, (1992)
4. Sutton. G.P., **"Rocket Propulsion Elements",** John Wiley, New York,(1986

12ME73	POWER PLANT ENGINEERING	L	T	P	C
		3	0	0	3

AIM

To understand the various components, operations and applications of different types of power plants.

Course Outcomes

The Students will be able to

- Demonstrate the various power plants and boilers
- Identify the handling equipments and different types of condenser
- Choose the various types of reactor and selection of turbines
- List the application of gas turbine power plants and inter-cooling of combined cycle
- Compute the operating cost and tariffs using the various power plants

UNIT I **INTRODUCTION TO POWER PLANTS AND BOILERS** **9**

Layout of Steam, Hydel, Diesel, MHD, Nuclear and Gas turbine Power Plants Combined Power cycles – comparison and selection , Load duration Curves Steam boilers and cycles – High pressure and Super Critical Boilers – Fluidised Bed Boilers.

UNIT II **STEAMPOWERPLANT** **9**

Fuel and ash handling,Combustion Equipment for burning coal, Mechanical Stokers – Pulveriser, Electrostatic Precipitator, Draught– Different Types, Surface condenser types, cooling towers.

UNIT III **NUCLEAR AND HYDEL POWER PLANTS** **9**

Nuclear Energy–Fission, Fusion Reaction, Types of Reactors, Pressurized water reactor,Boiling water reactor, Waste disposal and safety Hydel Powerplant–Essentialelements, Selection of turbines, governing of Turbines– Micro hydel developments.

UNIT IV **DIESEL AND GAS TURBINE POWER PLANTS** **9**

Types of diesel plants, components, Selection of Engine type, applications–Gas turbine power plant– Fuels– Gas turbine material – open and closed cycles– reheating – Regeneration and intercooling – combines cycle.

UNIT V **OTHER POWER PLANTS AND ECONOMICS OF POWER PLANTS** **9**

Geo thermal– OTEC– Tidel– Pumped storage –Solar central receiver system cost of electric Energy– Fixed and operating costs–Energy rates– Types tariffs– Economics of load sharing, comparison of various power plants.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Arora S.C and Domkundwar S, **"A Course in Power Plant Engineering",** Dhanpat Rai,(2001)
2. Nag P.K , **"Power Plant Engineering",** 3rd edition Tata McGraw- Hill, (2007)

REFERENCES

1. EI-Wakil M.M , **"Power Plant Technology",** Tata McGraw-Hill, (1985)
2. Ramalingam K.K., **"Power Plant Engineering",** Scitech Publications,(2002)
3. Nagpal G.R., **"Power Plant Engineering",** Khanna Publishers, (1998)
4. Rai G.D., **"Introduction to Power Plant technology",** Khanna Publishers,(1995)

12ME74 **COMPUTER AIDED SIMULATION AND ANALYSIS LABORATORY**

L	T	P	C
0	0	3	2

LIST OF EXPERIMENTS

A. SIMULATION **8**

1. Simulation of Air conditioning system with condenser temperature and evaporator temperatures as input to get COP using C/MATLAB
2. Simulation of Hydraulic/Pneumatic cylinder using C/MATLAB
3. Simulation of cam and follower mechanism using C/MATLAB

B. ANALYSIS(SIMPLETREATMENTONLY) **37**

1. Stress analysis of a plate with a circular hole.
2. Stress analysis of rectangular L bracket.
3. Stress analysis of an axi-symmetric component.
4. Stress analysis of beams (cantilever, simply supported, fixed ends).
5. Mode frequency analysis of a 2Dcomponent.
6. Mode frequency analysis of beams (cantilever, simply supported, fixed ends).
7. Harmonic analysis of a 2D component.
8. Thermal stress analysis of a 2D component.
9. Conductive heat transfer analysis of a 2D component.
10. Convective heat transfer analysis of a 2D component.

SYSTEM REQUIRMENTS
(for a batch of 30 Students)

Description of Equipment	Quantity Required
HARDWARE	
Computer Server	1 No.
Computer System	30 Nos.
30 17" VGA Color Monitor	
Laser Printer	1 No.
SOFTWARE	
Suitable analysis software	30licenses

PERIODS **TOTAL: 45**

12ME75	MECHATRONICS LABORATORY	L	T	P	C
		0	0	3	2

LIST OF EXPERIMENTS

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. Circuits with multiple cylinder sequences in Electro pneumatic using PLC.
5. Speed Control of AC & DC drives.
6. Servo controller interfacing for DC motor.
7. PID controller interfacing.
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 LABVIEW.
10. Computerized data logging system with control for process variables like
    (i) pressure flow (ii) temperature.

LIST OF EQUIPMENTS

(For a batch of 30 students)

1.	Basic Pneumatic Trainer Kit with manual and electrical controls/PLC Control each	1 No.
2.	Hydraulics and Pneumatics Systems Simulation Software / Automation studio sets	10 Nos.
3.	8051 - Microcontroller kit with stepper motor and drive circuit sets	2 Nos.
4.	LAB VIEW software with Sensors to measure Pressure, Flow rate, direction, speed, velocity and force.	2 Nos.

TOTAL:45PERIODS

12ME76	DESIGN AND FABRICATION PROJECT	L	T	P	C
		0	0	3	2

The objective of this project is to provide opportunity for the students to implement their skills acquired in the previous semesters to practical problems.

The students in convenient groups of not more than 4 members have to take one small item for design and fabrication. Every project work shall have a guide who is the member of the faculty of the institution and if possible with an industry guide also.

The item chosen shall be small machine elements (Example-screw jack, coupling, machine vice, cam and follower, governor etc), attachment to machine tools, tooling (jigs, fixtures etc), small gear box, automotive appliances, agricultural implements, simple heat exchangers, small pumps, hydraulic /pneumatic devices etc.

The students have to design and fabricate the chosen item in the college and demonstrate its working apart from submitting the project report. The report should contain assembly drawing, parts drawings, process charts relating to fabrication.

TOTAL:60PERIODS

12ME82	PROJECT WORK	L	T	P	C
		0	0	12	6

- ✓ The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study.
- ✓ Every project work shall have a guide who is the member of the faculty of the institution.
- ✓ Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical

seminars on the progress made in the project.

- ✓ The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.
- ✓ The progress of the project is evaluated based on a minimum of three reviews.
- ✓ The review committee may be constituted by the Head of the Department.
- ✓ Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion.
- ✓ This final report shall be typewritten form as specified in the guidelines.

ELECTIVE SUBJECTS

12ME6A	MARKETING MANAGEMENT	L	T	P	C
		3	0	0	3

AIM

To understand the various processes involved in Marketing and its Philosophy and to learn the Psychology of consumers

Course Outcomes

The Students will be able to

- Express key marketing concepts, theories and techniques for analyzing a variety of marketing situations
- Identify the use of different strategies for effective marketing in various context
- Demonstrate the ability to carry out a research project that explores marketing planning and strategies for a specific marketing situation
- Analyze the relevance of marketing concepts and theories in evaluating the impacts of environmental changes on marketing planning, strategies and practices
- Identify the various managerial/technical issues and can work in multi-disciplinary teams

UNIT I MARKETING PROCESS 9

Definition, Marketing process, dynamic, needs, wants and demands, marketing concepts, environment, mix,types–Philosophies,sellingversus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy.

UNIT II BUYING BEHAVIOUR AND MARKET SEGMENTATION 9

Cultural, demographic factors, motives, types, buying decisions, segmentation factors – demographic –Psycho graphic and geographic segmentation, process, patterns.

UNIT III PRODUCT PRICING AND MARKETING RESEARCH 9

Objectives, pricing, decisions and pricing methods, pricing management – Introduction, uses, process of marketing research

UNIT IV MARKETINGPLANNINGANDSTRATEGYFORMULATION 9

Components of marketing plan –strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

UNIT V ADVERTISING, SALES PROMOTION AND DISTRIBUTION 9

Characteristics, impact, goals, types, and sales promotions– point of purchase– unique selling proposition – Characteristics, wholesaling, retailing, channel design, logisticsand modern trends in retailing.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Govindarajan. M, **"Marketing management – concepts, cases, challenges and trends",** Prentice Hall of India, second edition (2007)
2. Philip Kolter, Koshy Jha **"Marketing Management",** Pearson Education, Indian adapted edition, (2007)

REFERENCES

1. Ramasamy and Nama kumari, **"Marketing Environment: Planning, implementation and control the Indian context",** (1990)
2. Czinkota&Kotabe, **"Marketing management",** Thomson learning, Indian edition, (2007)
3. Adrain palmer, **"Introduction to marketing theory and practice",** Oxford university press IE (2004)
4. Donald S. Tull and Hawkins, **"Marketing Reasearch",** Prentice Hall of Inida (1997)

12ME6B	QUALITY CONTROL AND RELIABILITY ENGINEERING	L	T	P	C
		3	0	0	3

AIM

To understand process control and acceptance sampling procedure and their application and to learn the concept of reliability.

Course Outcomes

The Students will be able to

- Illustrate the concepts of process control for variables and attributes
- Explain the various types of sampling
- Interpret the failure data
- Formulate strategy for the maintainability and availability
- Devise methods for reliability improvements
- Summarize the product development and life cycle

UNITI INTRODUCTION AND PROCESS CONTROL FOR VARIABLES 10

Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance,Quality control: Quality cost–Variation in process– causesof variation – Theory of control chart –uses of control chart – Control chart for variables – X chart, R chart and σ chart –process capability – process capability studies and simple problems–Six sigma concepts.

UNITII PROCESS CONTROL FOR ATTRIBUTES 8

Control chart for attributes –control chart for non-conforming – p chart and np chart – control chart for nonconformities– C and U charts, State of control and process out of control identification in charts, pattern study.

UNITIII ACCEPTANCE SAMPLING 9

Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – O.C. curves – producer's Risk and consumer's Risk – AQL, LTPD, AOQL concepts– standard sampling plans for AQL and LTPD– uses of standard sampling plans.

UNITIV LIFE TESTING – RELIABILITY 9

Life testing – Objective – failure data analysis, Mean failure rate, mean time to failure, mean time between failure, hazard rate – Weibullmodel,systemreliability, series, parallel and mixed configuration – simple problems –Maintainability and availability – simple problems– Acceptance sampling based on reliability test – O.C Curves.

UNIT V QUALITY AND RELIABILITY 9

Reliability improvements – techniques– use of Pareto analysis – design for reliability – redundancy unit

and standby redundancy – Optimization in reliability – Product design – Product analysis – Product development – Product life cycles.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Douglas.C.Montgomery, **"Introduction to Statistical quality control",** John wiley 4th edition, (2001)
2. Srinath L.S., **"Reliability Engineering",** Affiliated East west press, (1991)

REFERENCES

1. John.S. Oakland. **"Statistical process control",** Elsevier, 5th edition, (2005)
2. Connor, P.D.T.O., **" Practical Reliability Engineering",** John Wiley, (1993)
3. Gupta R.C., **"Statistical Quality control",** Khanna Publishers, (1997)

4. Sharma S.C., **"Inspection Quality Control and Reliability",** Khanna Publishers, (1998)

12ME6C	REFRIGERATION AND AIR CONDITIONING	L	T	P	C
		3	0	0	3

AIM

To provide knowledge on various refrigeration cycles, system components and refrigerants and to provide knowledge on design aspects of Refrigeration &Air conditioning systems

Course Outcomes

The Students will be able to

- Construct the fundamentals of air conditioning & refrigeration cycle and C.O.P.
- Distinguish the types of compressor and classifications of refrigerants
- Relate the psychrometric processes using psychrometric charts
- Analyze the performance of summer and window air conditioning and cooling load calculation of Air conditioning system
- Determine the duct design using friction method, air quality concept and application about the storage plants

UNITI REFRIGERATIONCYCLE 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.

UNITII REFRIGERANTS AND SYSTEM COMPONENTS 10

Compressors – reciprocating and rotary (elementary treatment), Types of condensers, evaporators, cooling towers – Functional aspects– Refrigerants – properties – selection of refrigerants, Alternate Refrigerants, Cycling controls.

UNITIII PSYCHROMETRY 10

Psychrometric processes use of psychrometric 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, Ductablesplit, Packaged Air conditioning, VAV & VRV Systems –Duct Design by equal friction method, Indoor Air quality concepts.

UNITV 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: 45 PERIODS

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)*

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., New Delhi, (1985)*
3. *Stoecker N.F. and Jones, **"Refrigeration and Air Conditioning",** TMH, New Delhi, (1981)*
4. *Jones, **"Air Conditioning Engineering",** Edward Amold pub.(2001)*

12ME6D	RENEWABLE SOURCES OF ENERGY	L	T	P	C
		3	0	0	3

AIM

To study the renewable energy resources and its economics of the utilization and environmental merits

Course Outcomes

The Students will be able to

- Clarify the different renewable energy sources and its applications
- Explain the wind energy systems with hybrid systems
- Group the bio energy sources and its environmental merits
- Illustrate the various power plants and their environmental issues
- Propose the new power generation systems and the economical advantages

UNITI SOLAR ENERGY 9

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

UNITII 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.

UNITIV OTEC, TODAL, GEOTHERMAL AND HYDEL ENERGY 9

Tidal energy – Wave energy – Data, Technology options – Open and closed OTEC Cycles – Smallhydro, turbines – Geothermal energy sources, power plant and environmental issues.

UNITV NEW ENERGY SOURCES 9

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

TOTAL: 45 PERIODS

TEXT BOOKS

1. Rai G.D., **"Non Conventional Energy Sources",** Khanna Publishers, New Delhi, (1999)
2. Sukhatme S.P., **"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. Tiwari G.N., **"Solar Energy – Fundamentals Design, Modelling and applications",** Narosa Publishing House, New Delhi, (2002)
4. Freris L.L., **"Wind Energy Conversion systems",** Prentice Hall, UK, (1990)

12ME6E	INDUSTRIAL TRIBOLOGY	L	T	P	C
		3	0	0	3

AIM

To study about the friction, theory of lubrication and its measurement

Course Outcomes

The Students will be able to

- Explain the topography of surfaces and categorize different types of friction characteristics
- Classify the types of wear and its mechanisms
- Identify the properties of lubrications and point out the kinds of lubrications
- Use the Reynold's and sommerfield equations and to design the unloaded and loaded journal bearings
- List the various friction and wear measurement techniques
- Categorize the bearing performance and bearing vibration measurement techniques

UNITI SURFACES AND FRICTION 9

Topography of Engineering surfaces– Contact between surfaces – Sources of sliding Friction – Adhesion– Ploug11hing –Energydissipationmechanisms–Friction Characteristicsof 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.

UNITIII LUBRICANTS AND LUBRICATION TYPES 9

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

UNITIV 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 journalbearings – Reaction torque on the bearings – Virtual Co-efficient of friction –Sommerfield diagram.

UNITV TRIBO MEASUREMENT IN INSTRUMENTATION 9

Surface topography measurements – Electron microscope and friction and wear measurements – Laser method – Instrumentation – Instrumental standards – Bearings performance measurements – Bearing vibration measurement.

TOTAL: 45 PERIODS

TEXT BOOKS

1. A.Cameron, **"Basic Lubrication theory",** Longman, U.K.., (1981)
2. Sushil Kumar Srivastava, **"Tribology in industries",** S.Chand Limited, (2004)

REFERENCES

1. A.Harnoy, **"Bearing Design in Machinery",** Marcel Dekker Inc, NewYork, (2003)
2. M.M.Khonsari & E.R.Booser, **"Applied Tribology",** John Willey & Sons, New York, (2001)
3. E.P.Bowden and Tabor.D., **"Friction and Lubrication",** Heinemann Educational Books Ltd., (1974)
4. M.J.Neale (Editor), **"Tribology Handbook",** Newnes Butter worth, Heinemann, U.K., (1995)

12ME6F	VIBRATION AND NOISE CONTROL	L	T	P	C
		3	0	0	3

AIM

To understand the sources of vibration and noise, make design modifications to reduce the vibration and noise to improve the life of the automotive components.

Course Outcomes

The Students will be able to

- Formulate the physical characteristics of noise and vibrations in the working environment
- Invent the measurement and analysis of noise level
- Interpret the sources of noise in Automobiles
- Demonstrate the various methods of controlling the noise of automotive components
- Apply the knowledge and various technologies to control noise and vibration control for sustainable built environments
- Explain the automotive noise control principles

UNITI BASICS OF VIBRATION 9

Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and non linear 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.

UNITII 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.

UNITIII 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.

UNITIV 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.

UNITV 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: 45 PERIODS

TEXT BOOKS

1. Singiresu S.Rao **"Mechanical Vibrations",** Pearson Education, (2010)
2. Kewal Pujara, **"Vibrations and Noise for Engineers",** Dhanpat Rai & Sons, (1992)

REFERENCES

1. Bernard CHallen and Rodica Baranescu **"Diesel Engine Reference Book",** 2nd edition, SAE International (1999)
2. Julian Happian, Smith **"An Introduction to Modern Vehicle Design",** Butterworth Heinemann, (2004)
3. John Fenton **"Handbook of Automotive body Construction and Design Analysis",** Professional Engineering Publishing, (1998)
4. Thomson W.T., Marie Dillon Dahleh, **"Theory of Vibrations with Applications",** Prentice Hall, (1997)

12ME6G	UNCONVENTIONAL MACHINING PROCESSES	L	T	P	C
		3	0	0	3

AIM

To enable the students to understand the various unconventional machining processes, their advantages and applications in diverse areas of production and manufacturing such as tool room and die working, aerospace, nuclear and electronics industries.

Course Outcomes

The Students will be able to

- Understand the basic techniques of machining processes
- Ability to extend, through modeling techniques, the single point, multiple point and abrasive machining processes
- Estimate the material removal rate and cutting force, in an industrially useful manner, for practical machining processes
- Selection of the tool material and machining process parameters and the practical aspects of tool wear and tool life, and their influence on economics
- Explain the tool and work piece temperatures and their effect on quality

UNIT I MECHANICAL ENERGY BASED PROCESSES 9

Unconventional machining Process – Need – classification – Brief overview - Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining –Ultrasonic Machining (AJM, WJM, AWJM and USM) – Working Principles – equipment used – Process parameters – MRR –Variation in techniques used – Applications.

UNIT II ELECTRICAL ENERGY BASED PROCESSES 9

Electric Discharge Machining (EDM) –workingPrinciple–equipments–Process Parameters–Surface Finish and MRR – electrode / Tool – Power and control Circuits–Tool Wear – Dielectric – Flushing – Wire cut EDM – Applications.

UNIT III CHEMICAL ENERGY BASED PROCESSES 9

Chemical machining and Electro-Chemical machining (CHM and ECM)–Etchants– maskant–techniquesof applyingmaskants–Process Parameters – Surface finish and MRR – Applications

UNIT IV ELECTRO-CHEMICAL ENERGY BASED PROCESSES 9

Principlesof ECM –equipments–Surface Roughness and MRR –Electricalcircuit–Process Parameters–ECG and ECH – Applications.

UNIT V THERMAL ENERGY BASED PROCESSES 9

Laser Beam machining and drilling (LBM), plasma Arc machining (PAM) and Electron Beam Machining (EBM) – Principles – Equipment –Types – Beam control techniques – Applications.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Vijay.K. Jain, **"Advanced Machining Processes",** Allied Publishers Pvt. Ltd., New Delhi, (2007)

2. Mishra P.K., **"Non Conventional Machining",** The Institution of Engineers – India, (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)

12ME7A	PROCESS PLANNING AND COST ESTIMATION	L	T	P	C
		3	0	0	3

AIM

To impart knowledge in process planning, cost estimation and budgeting.

Course Outcomes

The Students will be able to

- Demonstrate the importance of Work study and Ergonomics
- Express the different approaches of Process Planning and illustrate manufacturing logic and knowledge
- Point up the elements of cost and also to find the profit or loss of every product
- Explain the cost estimation and also its methods with real time application
- Illustrate about the allowances and to solve problems
- Calculate the labour cost and to Solving real time problems in different types of jobs

UNITI WORK STUDY AND ERGONOMICS 10

Method study – Definition – Objectives–Motion economy– Principles – Tools and Techniques– Applications – Work measurements– purpose – use – procedure – tools and techniques– Standard time –Ergonomics – principles – applications.

UNITII PROCESS PLANNING 10

Definition – Objective – Scope – approaches to process planning– Process planning activities – Finished part requirements–operating sequences– machine selection – material selection parameters– Set of documents for process planning– Developing manufacturing logic and knowledge– production time calculation – selection of cost optimal processes.

UNITIII INTRODUCTION TO COST ESTIMATION 7

Objective of cost estimation– costing – cost accounting– classification of cost– Elements of cost.

UNITIV COST ESTIMATION 8

Types of estimates – methods of estimates – data requirements and sources– collection of cost– allowances in estimation.

UNITV PRODUCTION COST ESTIMATION 10

Estimation of material cost, labour cost and over heads, allocation of overheads – Estimation for different types of jobs.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Sinha B.P., **"Mechanical Estimating and Costing",** Tata McGraw-Hill, Publishing Co.,(1995)
   Khanna O.P., **"Industrial Engineering and Management",** 7th edition, Dhanpat Rai & Sons, (1985

REFERENCES

1. Russell R.S and Tailor, B.W, **"Operations Management",** PHI, 4th Edition, (2003)
2. Chitale A.V. and Gupta.R.C., **"Product Design and Manufacturing",** PHI, 2nd Edition, (2002)
3. Tailor B., Willip.F Ostwalal and Jairo Munez., **"Manufacturing Processes and Systems",** John wiley, 9th edition (1998)
4. Nadha Muni Reddy. C., **"Industrial Engineering and Management",** New Age International (P) Limited, New Delhi, (2002)

12ME7B	DESIGN OF JIGS, FIXTURES AND PRESS TOOLS	L	T	P	C
		3	0	0	3

AIM

To study the design principles of Jigs, fixtures and press tools

Course Outcomes

The Students will be able to

- Explain the different locating, clamping devices and actuation system
- Compile the use of jigs and fixtures in mechanical operations
- Demonstrate the types and operations of presses
- Discover the design and development of drawing, forming and bending dies
- Explain the computer aided operations in die design

UNITI LOCATING AND CLAMPING PRINCIPLES 8

Objectives of tool design– Function and advantages of Jigs and fixtures – Basic elements– principles of location – Locating methods and devices – Redundant Location – Principles of clamping – Mechanical actuation – pneumatic and hydraulic actuation Standard parts – Drill bushes and Jig buttons –Tolerances and materials used.

UNITII JIGS AND FIXTURES 10

Design and development of jigs and fixtures for given component – Types of Jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs – Indexing jigs – General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems – Quick change fixtures.

UNITIII PRESS WORKING TERMINOLOGIES AND ELEMENTS OF CUTTING DIES 10

Press Working Terminologies – operations – Types of presses – press accessories – Computation of press capacity – Strip layout – Material Utilization – Shearing action – Clearances – Press Work Materials – Center of pressure– Design of various elements of dies – Die Block – Punch holder, Die set, guide plates – Stops – Strippers – Pilots – Selection of Standard parts – Design and preparation of four standard views of simple blanking, piercing, compound and progressive dies.

UNITIV BENDING FORMING AND DRAWING DIES 10

Difference between bending, forming and drawing – Blank development for above operations – Types of Bending dies – Press capacity – Spring back – knockouts – direct and indirect – pressure pads – Ejectors – Variables affecting Metal flow in drawing operations – draw die inserts – draw beads – ironing – Design and development of bending, forming, drawing reverse re-drawing and combination dies–Blank development for axi-symmetric, rectangular and elliptic parts – Single and double action dies.

UNITV MISCELLANEOUS TOPICS 7

Bulging, Swaging, Embossing, coining, curling, hole flanging, shaving and sizing, assembly, fine Blanking dies – recent trends in tool design–computer Aids for sheet metal forming Analysis – basic introduction –tooling for numerically controlled machines – setup reduction for work holding – Single minute exchange of dies – Poka Yoke – Course should be supplemented with visits to industries.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Joshi, P.H. **"Jigs and Fixtures",** 2nd Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi, (2004)
2. Donaldson, Lecain and Gold **"Tool Design",** 3rd Edition Tata McGraw Hill, (2000)

REFERENCES

1. Venkataraman . K, **"Design of Jigs Fixtures & Press Tools",** Tata McGraw Hill, New Delhi, (2005)
2. Kempster, **"Jigs and Fixture Design",** Hoddes and Stoughton, 3rd Edition (1974)
3. Joshi, P.H. **"Press Tools – Design and Construction",** Wheels publishing, (1996)
4. Hoffman **"Jigs and Fixture Design",** Thomson Delmar Learning, Singapore, (2004)

12ME7C COMPOSITE MATERIALS L T P C

3 0 0 3

AIM

To understand the fundamentals of composite material strength and its mechanical behavior Understanding the analysis of fiber reinforced Laminate design for differentcombinations of plies with different orientations of the fiber.

Course Outcomes

The Students will be able to

- Familiarize the advanced composite materials and their applications
- Point out the basic mechanical principles that describe the stiffness and strength optimization to design laminated composite materials
- Explain the failure criterion for composite laminates and Explicit the prediction of failures
- Identify the fundamental relationships for predicting the mechanical and thermal response of multi layered materials and structures
- Solve the equilibrium equations of motion and explain bending vibration analysis of laminates

UNIT I INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS & MANUFACTURING 12

Definition –Need – General Characteristics, Applications– Fibers – Glass, Carbon, Ceramic and Aramid fibers– Matrices – Polymer, Graphite, Ceramic and Metal Matrices– Characteristics of fibers and matrices– LaminaAssumptions – Macroscopic Viewpoint – Generalized Hooke's Law– Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case, Orthotropic Stiffness matrix, Typical Commercial material properties, Rule of Mixtures– Generally Orthotropic Lamina – Transformation Matrix, Transformed Stiffness–Bag Moulding – Compression Moulding – Pultrusion – Filament Winding – Other Manufacturing Processes.

UNIT II FLAT PLATE LAMINATE CONSTITUTE EQUATIONS 10

Definition of stress and Moment Resultants– Strain Displacement relations– Basic Assumptions of Laminated anisotropic plates– Laminate Constitutive Equations – Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates – Laminate Structural Moduli– Evaluation of Lamina Properties from Laminate Tests – Quasi-Isotropic Laminates– Determination of Lamina stresses within Laminates.

UNIT III **LAMINA STRENGTH ANALYSIS** **5**

Introduction – Maximum Stress and Strain Criteria– Von-Misses Yield criterion for Isotropic Materials– Generalized Hill's Criterion for Anisotropic materials– Tsai-Hill's Failure Criterion for Composites–Tensor Polynomial (Tsai-Wu) Failure criterion– Prediction of laminate Failure.

UNIT IV **THERMAL ANALYSIS** **8**

Assumption of Constant C.T.E's–Modification of Hooke's Law – Modification of Laminate Constitutive Equations– Orthotropic Lamina C.T.E's – C.T.E's for special Laminate Configurations – Unidirectional, off-axis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi-Isotropic Laminates.

UNIT V **ANALYSIS OF LAMINATED FLAT PLATES** **10**

Equilibrium Equations of Motion– Energy Formulations– Static Bending Analysis– BucklingAnalysis– Free Vibrations – Natural Frequencies.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Gibson, R.F., **"Principles of Composite Material Mechanics",** McGraw-Hill, 2nd Edition - CRC press in progress (1994)
2. Hyer, M.W., **"Stress Analysis of Fiber – Reinforced Composite Materials",** McGraw-Hill, (1998)

REFERENCES

1. Issac M. Daniel and Ori Ishai, **"Engineering Mechanics of Composite Materials",** Oxford University Press Edition (2007)
2. Mallick, P.K., **"Fiber Reinforced Composites: Materials, Manufacturing and Design",** Maneel Dekker Inc, (1993)
3. Halpin, J.C., **"Primer on Composite Materials, Analysis",** Techomic Publishing Co., (1984)
4. Agarwal, B.D., and Broutman L.J., **"Analysis and Performance of Fiber Composites",** John Wiley and Sons, New York, (1990)

12ME7D	**ROBOTICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

AIM

To understand the basic concepts associated with the design and functioning and applications of Robots and robot programming

Course Outcomes

The Students will be able to

- Explain the robot anatomy, robot parts and functions
- Define robot drive systems and end effectors
- Identify the concept of sensors and actuators required for specific applications
- Demonstrate programming principles for robot control
- Illustrate the implementation and robot economics

UNITI **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.

UNITII **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.

UNITIII SENSORS AND MACHINE VISION 10

Requirements of a sensor – Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors), Range Sensors (Triangulation Principle, Structured, Lighting Approach, Time of Flight Range Finders, Laser Range Meters), Proximity Sensors (Inductive, Hall Effect, Capacitive, Ultrasonic and Optical Proximity Sensors), Touch Sensors, (Binary Sensors, Analog Sensors), Wrist Sensors, Compliance Sensors, Slip Sensors– Camera, Frame Grabber, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques– Image Processing and Analysis – Data Reduction–Edge detection, Segmentation Feature Extraction and Object Recognition – Algorithms – Inspection, Identification, Visual Serving and Navigation.

UNITIV ROBOT KINEMATICS AND ROBOT PROGRAMMING 10

Forward Kinematics, Inverse Kinematics and Differences– Forward Kinematics andReverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional) – Deviations and Problems– TeachPendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effector commands, and Simple programs.

UNITV IMPLEMENTATION AND ROBOT ECONOMICS 8

RGV, AGV–Implementation of Robots inIndustries –Various Steps–Safety Considerations for Robot Operations– Economic Analysis of Robots – Pay back Method, EUAC Method, Rate of Return Method.

TOTAL: 45 PERIODS

TEXT BOOKS

1. M.P.Groover, **"Industrial Robotics – Technology,Programming and Applications",** McGraw-Hill, (2001)
2. Fu. K.S., Gonzalz. R.C., and Lee C.S.G., **"Robotics Control, Sensing, Vision and Intelligence",** McGraw-Hill Book Co., (1987)

REFERENCES

1. Deb,S.R., **"Robotics Technology and Flexible Automation",** Tata McGraw-Hill Publication, 8th edition, (2008)
2. Yoram Koren, **"Robotics for Engineers",** McGraw-Hill Book Co., (1992)
3. Janakiraman.P.A., **"Robotics and Image Processing",** Tata McGraw-Hill, (1995)
4. Saha, S., "**Introduction to Robotics",** Tata McGraw-Hill Publication, (2008)

12ME7E	THERMAL TURBO MACHINES	L	T	P	C
		3	0	0	3

AIM

To understand the various systems, principles, operations and applications of different types of turbo machinery components.

Course Outcomes

The Students will be able to

- Explain the working principles of turbo machines and apply it to various types of machines
- Illustrate the flow analysis and design parameter of impeller blades

- Know the differences, types, and classifications of centrifugal compressors
- Determine the performance characteristic and work done for axial flow compressor
- Use stage velocity diagram in axial flow compressor

UNITI PRINCIPLES 9

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

UNITII 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.

UNITIII CENTRIFUGAL COMPRESSOR 9

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

UNITIV AXIAL FLOW COMPRESSOR 9

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

UNITV AXIAL AND RADIAL FLOW TURBINES 9

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

TOTAL: 45 PERIODS

TEXT BOOKS

1. Yahya, S.H., **"Turbines, Compressor and Fans",** Tata McGraw Hill Publishing Company, (1996)
2. Shepherd, D.G., **"Principles of Turbomachinery",** Macmillan, (1969)

REFERENCES

1. Dixon, S.I., **"Fluid Mechanics and Thermodynamics of Turbomachinery",** Pergamon Press, (1990)
2. Stepanpff, A.J., **"Blowers and Pumps",** John Wiley and Sons Inc. (1965)
3. Ganesan, V., **"Gas Turbines",** Tata McGraw Hill Pub. Co., (1999)
4. Gopalakrishnan .G and Prithvi Raj, D, **"A Treatise on Turbo machines",** Scifech Publications (India) Pvt. Ltd., (2002)

12ME7F COMPUTATIONAL FLUID DYNAMICS L T P C

3 0 0 3

AIM

To study about the friction, theory of lubrication and its measurement

Course Outcomes

The Students will be able to

- Explain the governing equations of fluid dynamics and various types of boundary conditions
- Apply the finite difference method and explicit and implicit schemes on FDM
- Make the Finite volume method for conduction
- Summarize the Crank Nicolson and fully implicit schemes
- Compute the Finite volume method for convection
- Formulate the Conservativeness, Boundedness and Trasnportiveness, staggered grid and the Turbulence models

UNITI GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 8

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 behaviour of PDEs on CFD – Elliptic, Parabolic and Hyperbolic equations.

UNITI FINITE DIFFERENCE METHOD 8

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.

UNITIII 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.

UNITIV FINITE VOLUME METHOD FOR CONVECTION DIFFUSION 10

Steady one-dimensionalconvection 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 PERIODS

TEXT BOOKS

1. Versteeg, H.K., and Malalasekera, W., **"An Introduction to Computational Fluid Dynamics: The finite volume Method",** Longman, (1998)
2. Ghoshdastidar, P.S., "C**omputer Simulation of flow and heat transfer",** Tata McGraw Hill Publishing Company Ltd., (1998)

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, NewDelhi, (1995)
3. Ghoshdastidar P.S., **"Heat Transfer,** Oxford Unversity Press, (2005)
4. Anil W. Date **"Introduction to Computational Fluid Dynamics",** Cambridge University Press, (2005)

12ME7G NUCLEAR ENGINEERING L T P C

3 0 0 3

AIM

To gain some fundamental knowledge about nuclear physics, nuclear reactor, nuclear fuels, reactors and safe disposal of nuclear wastes.

Course Outcomes

The Students will be able to

- Compare the history of Nuclear Power and Nuclear Engineering
- Identify nuclear forces and nuclear units
- Differentiate the process of nuclear fission and nuclear fusion

- List the uranium production and purification
- Analyze the radiation hazards and their prevention

UNITI NUCLEAR PHYSICS 9

Nuclear model of an atom–Equivalence of mass and energy –binding– radio activity–half life –neutron interactions–cross sections.

UNITII NUCLEAR REACTIONS AND REACTION MATERIALS 9

Mechanism of nuclear fission and fusion – radio activity–chain reactions–critical mass and composition– nuclear fuel cycles and its characteristics–uranium production and purification– Zirconium, thorium, beryllium.

UNITIII REPROCESSING 9

Nuclear fuel cycles–spent fuel characteristics–role of solvent extraction in reprocessing –solvent extraction equipment.

UNITIV NUCLEAR REACTOR 9

Types of fast breeding reactors–design and construction of fast breeding reactors –heat transfer techniques in nuclear reactors– reactor shielding –Fusion reactors.

UNITV SAFETY AND DISPOSAL 9

Nuclear plant safety –safety systems –changes and consequences of accident –criteria for safety– nuclear waste–types of waste and its disposal–radiation hazards and their prevention–weapons proliferation.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Thomas J.Cannoly, **"Fundamentals of nuclear Engineering",** John Wiley publication, (1978)
2. Dan Gabriel Cacuci (Editor), **"Handbook of Nuclear Engineering",** Volume-I, Springer, (2010)

REFERENCES

1. Collier J.G., and Hewitt G.F, **"Introduction to Nuclear power",** Hemisphere publishing, New York. (1987)
2. Wakil M.M.El., **"Power Plant Technology",** McGraw-Hill International, (1984)
3. Ian Hore-Lacy, Stephen Tarlton, Brigita Praznik and Raf Damiaens, **"**Nuclear Energy in the 21st Century: World Nuclear University Primer**"**, Springer (2012)
4. Martin, Harbison, Beach and Cole **"**An Introduction to Radiation Protection 6E**",** Springer, (2012)

12GE61 FUNDAMENTALS OF NANOSCIENCE L T P C

3 0 0 3

AIM

To study about the friction, theory of lubrication and its measurement

Course Outcomes

The Students will be able to

- Identify various properties of nanostructured materials
- Recall the bottom up and top down synthesis
- Explain the lithography of nanoscale devices
- Demonstrate the relations of nanomaterials and environmental applications

- Illustrate the different characterization techniques

UNITI INTRODUCTION 10

Nanoscale Science and Technology – Implications for Physics, Chemistry, Biology and Engineering– Classifications of nanostructured materials– nano particles – quantum dots, nanowires –ultrathinfilms– multilayered materials– Length Scales involved and effect on properties: Mechanical,Electronic,Optical, Magnetic and Thermal properties – Introduction to properties and motivation for study (qualitative only).

UNITII PREPARATION METHODS 10

Bottom-up Synthesis–Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, MolecularBeam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNITIII PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES 5

Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wet etching, dry (Plasma /reactive ion) etching, Etch resists –dip pen lithography.

UNITIV PREPARATION ENVIRONMENTS 10

Clean rooms: specifications and design, air and water purity, requirements for particular processes, Vibration free environments: Services and facilities required– Working practices,samplecleaning, Chemical purification,chemical and biological contamination, Safety issues, flammable and toxic hazards, biohazards.

UNITV CHARECTERISATION TECHNIQUES 10

X-ray diffraction technique, Scanning Electron Microscopy – environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques –AFM, SPM, STM, SNOM, ESCA, SIMS –Nanoindentation.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Edelstein, A.S., and Cammearata, R.C., **"Nanomaterials: Synthesis, Properties and Applications",** Institute of Physics Publishing, Bristol and Philadelphia, (1996)
2. John Dinardo, N., **"Nanoscale charecterisation of surfaces & Interfaces",** 2nd Edition, Weinheim Cambridge, Wiley-VCH, (2000)

REFERENCES

1. Timp, G., (Editor), **"Nanotechnology",** AIP press/Springer, (1999)
2. Akhlesh Lakhtakia (Editor), **"The Hand Book of Nano Technology, Nanometer Structure",** Theory, Modeling and Simulations", Prentice-Hall of India (P) Ltd, New Delhi, (2007)
3. Pradeep. T., **"NANO: The Essentials: Understanding Nanoscience and Nanotechnology",** Tata McGraw-Hill Publishing Company Limited : New Delhi, (2007)
4. Dupas, Claire, Lahmani, Marcel (Eds.), **"Nanoscience-Nanotechnologies and Nanophysics",**Original French edition published by Éditions Belin, springer, (2007)

12GE71 PROFESSIONAL ETHICS IN ENGINEERING L T P C

3 0 0 3

AIM

To create an awareness on Engineering Ethics and human values.To instill moral and social values and loyalty and to appreciate the rights of others

Course Outcomes

The Students will be able to

- Summarize the various concepts and theories of Ethics
- Illustrate the role of Engineers in experimentation
- Estimate risk factors and analyze the various ways of reducing the risk
- Outline the rights and responsibility of engineers in bargaining and conflict Management
- Analyze the ethical issues in global level

UNITI ENGINEERING ETHICS 9

Senses of Engineering Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories.

UNITII ENGINEERING ASSOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics – Codes of Ethics – Industrial Standards – A Balanced Outlook on Law – The Challenger Case Study.

UNITIII ENGINEER'S RESPONSIBILITY FOR SAFETY 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk – Chernobyl Case Studies and Bhopal.

UNITIV RESPONSIBILITIES AND RIGHTS 9

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality– Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNITV GLOBAL ISSUES 9

Multinational Corporations – Business Ethics – Environmental Ethics – Computer Ethics – Role in Technological Development – Weapons Development – Engineers as Managers– Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, **"Ethics in Engineering",** McGraw Hill, New York (2005)
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, **"Engineering Ethics Concepts and Cases",** Thompson Learning, (2000)

REFERENCES

1. Charles D. Fleddermann, **"Engineering Ethics",** Prentice Hall, New Mexico, (1999).
2. John R. Boatright, **"Ethics and the Conduct of Business",** Pearson Education, (2003)
3. Edmund G. Seebauer and Robert L. Barry, **"Fundamentals of Ethics for Scientists and Engineers",** Oxford University Press, (2001)
4. David Ermann and Michele S. Shauf, **"Computers, Ethics and Society",** Oxford University Press, (2003)

12ME8A ENTREPRENEURSHIP DEVELOPMENT L T P C

3 0 0 3

AIM

To understand the scope of an entrepreneur, key areas of development, financial assistance by the institutions, methods of taxation and tax benefits,etc.

Course Outcomes

The Students will be able to

- Summarize the roles and responsibilities of an entrepreneur in economic development
- Familiarize with various motivation tools
- Outline the preparation of project report
- Estimate the various components of costing and sources of finance and taxation procedure
- Discover the best source of support for the entrepreneurs

UNITI ENTREPRENEURSHIP 9

Entrepreneur – Types of Entrepreneurs –Difference between Entrepreneur and Intrapreneur – Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurical Growth.

UNITII MOTIVATION 9

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, self rating, Business Game, ThematicApperception Test – Stressmanagement, Entrepreneurship Development Programs.

UNITIII BUSINESS 9

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

UNITIV FINANCING AND ACCOUNTING 9

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, management of working capital, Costing, Break Even Analysis, Network AnalysisTechniques of PERT/CPM – Taxation – Income Tax, Excise Duty – Sales Tax.

UNITV SUPPORT TO ENTREPRENEURS 9

Sickness in small Business – Concept, Magnitude, causes and consequences, Corrective Measures – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Khanka S.S., **"Entrepreneurial Development",** S.Chand & Co. Ltd. Ram Nagar New Delhi, (1999)
2. Kuratko & Hodgetts, **"Enterprenuership – Theory, process and practices",** Thomson learning 6th edition

REFERENCES

1. Hisrich, R.D. and Peters, M.P., **"Entrepreneurship",** 5th Edition Tata McGraw-Hill, (2002)
2. Mathew J Manimala, **"Enterprenuership theory at cross roads: paradigms and praxis",** Dream tech 2nd edition (2006)
3. Rabindra N. Kanungo **"Entrepreneurship and innovation",** Sage Publications, New Delhi, (1998)
4. EDII **" Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development",** Institute of India, Ahmadabad, (1986)

12ME8B	PRODUCTION PLANNING AND CONTROL	L	T	P	C
		3	0	0	3

AIM

To understand the various components and functions of production planning and control such as work study, product planning, process planning, production scheduling, Inventory Control and to know the recent trends like manufacturing requirement Planning andEnterprise Resource Planning.

Course Outcomes

The Students will be able to

- Illustrate the production planning activities
- Explain the importance of Work study and Time study
- Classify product planning and process planning activities
- Match production scheduling procedure with real time examples
- Realize the Kanban system, JIT

UNITI INTRODUCTION 9

Objectives and benefits of planning and control–Functions of production control–Types of production––Product development and design–Marketing, Functional, Operational, aesthetic, Durability and dependability aspect –Profit consideration–Standardization, Simplification & specialization– Break even analysis–Economics of a new design.

UNITII WORKSTUDY 9

Method study, basic procedure –Selection –Recording of process – Critical analysis, Development – Implementation – Micro motion and memo motion study – work measurement –Techniques of work measurement – Time study –Production study – Work sampling – Synthesis from standard data – Predetermined motion time standards.

UNITIII PRODUCT PLANNING AND PROCESS PLANNING 9

Product planning –Extending the original product information –Value analysis–Problems in lack of product planning–Process planning and routing –Pre requisite information needed for process planning –Steps in process planning–Quantity determination in batch production– Machine capacity, balancing–Analysis of process capabilities in a multi product system.

UNITIV PRODUCTION SCHEDULING 9

Production Control Systems –Loading and scheduling–Master Scheduling –Scheduling rules–Gantt charts –Perpetual loading–Basic scheduling problems – Line of balance – Flow production scheduling–Batch production scheduling–Product sequencing – Production Control systems – Periodic batch control–Material requirement planning–kanban – Dispatching–Progress reporting and expediting–Manufacturing lead time –Techniques for aligning completion times and due dates.

UNITV INVENTORY CONTROLANDRECENTTRENDSINPPC 9

Inventory control –Purpose of holding stock–Effect of demand on inventories– Ordering procedures – Two bin system – Ordering cycle system –Determination of Economic order quantity and economic lot size– ABC analysis –Recorder procedure –Introduction to computer integrated productionplanning systems –elements of JUST IN TIME SYSTEMS – Fundamentals of MRP II and ERP.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Martand Telsang, **"Industrial Engineering and Production Management",** S. Chand and Company,1st edition, (2000)
2. James.B.Dilworth, **"Operations management – Design, Planning and Control for manufacturing and services",** Mcgraw Hill International, (1992)

REFERENCES

1. Samson Eilon, **"Elements of production planning and control",** Universal Book Corpn.(1984)
2. Elwood S.Buffa, and Rakesh K.Sarin,**"Modern Production/Operations Management",** 8th Edition, John Wiley and Sons, (2000)
3. Kanishka Bedi, **"Production and Operations management",** Oxford university press, 2nd Edition (2007)
4. K.C.Jain & L.N. Aggarwal, **"Production Planning Control and Industrial Management",** Khanna Publishers, (1990)

12ME8C MAINTENANCE ENGINEERING L T P C

3 0 0 3

AIM

To enable the student to understand the principles, functions and practices adapted in industry for the successful management of maintenance activities and to explain the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.

Course Outcomes

The Students will be able to

- Interrelate in depth study of basic principles
- Identify the preventive maintenance concept and the working principle of repair method
- Summarize the various processes involved in condition monitoring
- Measure the knowledge of basic machine element works
- Compute the principles of material handling equipment and the use of computers in maintenance

UNITI PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING 9

Basic Principles of maintenance planning – Objectives and principles of planned maintenance activity – Importance and benefits of sound Maintenance systems – Reliability and machine availability – MTBF, MTTR and MWT – Factors of availability – Maintenance organization – Maintenance economics.

UNITII MAINTENANCE POLICIES–PREVENTIVE MAINTENANCE 9

Maintenance categories – Comparative merits of each category – Preventive maintenance, maintenance schedules, repair cycle – Principles and methods of lubrication – TPM.

UNITIII CONDITION MONITORING 9

Condition Monitoring – Cost comparison with and without CM – On-load testing and off- load testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear-debris analysis.

UNITIV REPAIR METHODS FOR BASIC MACHINE ELEMENTS 10

Repair methods for beds, slideways, spindles, gears, lead screws and bearings – Failure analysis – Failures and their development – Logical fault location methods – Sequential fault location.

UNITV REPAIR METHODS FOR MATERIAL HANDLING EQUIPMENT 8

Repair methods for Material handling equipment – Equipment records –Job order systems –Use of computers in maintenance.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Srivastava S.K., **"Industrial Maintenance Management",** - S. Chand and Co., (1981)
2. Bhattacharya S.N., **"Installation, Servicing and Maintenance",** S. Chand and Co., (1995)

REFERENCES

1. White E.N., **"Maintenance Planning",** I Documentation, Gower Press, (1979)
2. Garg M.R., **"Industrial Maintenance",** S. Chand & Co., (1986)
3. Higgins L.R., **"Maintenance Engineering Hand book",** McGraw Hill, 5th Edition, (1988)
4. Davies, **"Handbook of Condition Monitoring",** Chapman &Hall, (1996)

12ME8D OPERATIONS RESEARCH L T P C

3 0 0 3

AIM

To create awareness about optimization in utilization of resources and to understand and apply operations research techniques to industrial operations.

Course Outcomes

The Students will be able to

- Formulate and solve linear programming model
- Apply CPM and PERT in the production flow problems
- Describe various inventory models used in industries
- Apply replacement models in production environment
- Apply the sequencing problem in production shop
- Realize the queuing theory in production

UNITI LINEAR MODEL 10

The phases of OR study – formation of an L.P. model – graphical solution – simplex algorithm – artificial variables technique– Big M method, two phase method, Duality in LPP – Transportation problems– VAM – MODI technique.

UNITII NETWORK MODELS 8

Shortest route – minimal spanning tree – maximum flow models – project network – CPM and PERT network –critical path scheduling.

UNITIII INVENTORY MODEL 9

Types of Inventory – EOQ –ERL– Deterministic inventory problems – Price breaks – Stochastic inventory problems– selective inventory control techniques.

UNITIV REPLACEMENT MODELS 9

Replacement of items that deteriorate with time – value of money changing with time – not charging with time – optimum replacement policy – individual and group replacement– Sequencing problem – models with n jobs with 2 machines – problem with n jobs with m machines.

UNITV QUEUING THEORY 9

Queuing models – queuing systems and structures – notation –parameter – single server and multiserver models – Poisson input – exponential service – constant rate service – infinite population.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Wayne.L.Winston, **"Operations research applications and algorithms",** Thomson learning,4th edition, (2007)
2. Taha H.A, **"Operation Research",** Pearson Education 6th edition, (2003)

REFERENCES

1. J.K.Sharma, **"Operations research theory and applications",** Macmillan India, 3rd edition (2007)
2. Hira and Gupta **"Problems in Operations Research",** S.Chand and Co, (2002)
3. Panneerselvam, **"Operations Research",** Prentice Hall of India, (2003)
4. Wagner, **"Operations Research",** Prentice Hall of India, (2000)

12ME8E PRESSURE VESSELS AND PIPING DESIGN L T P C

3 0 0 3

AIM

To understand the different types of stresses and their effects in pressure vessel and to understand the piping layout and the stresses acting on it.

Course Outcomes

Upon the successful completion of the course, the students should be able to

- Understand the CylindricalShell and stresses in vessel
- Explain the Stress concentration in plates
- Design the base plate and support lugs
- Study the buckling in vessels
- Describe the Piping layout and piping stress analysis

UNITI CYLINDRICAL SHELL AND VARIOUS CLOSURES 9

Membrane theory for thin shells, stresses in cylindrical, spherical and conical shells, dilation of above shells, general theory of membrane stresses in vessel under internal pressure and its application to ellipsoidal and torispherical end closures – Bending of circular plates and determination of stresses in simply supported and clamped circular plate – Introduction to ASME code and formulae.

UNITII JUNCTION STRESSES, OPENING AND REINFORCEMENTS 9

Discontinuity stresses – Stress concentration in plate having circular hole due to bi-axial loading– Theory of reinforced opening and reinforcement limits.

UNITIII SUPPORT DESIGN 9

Supports for vertical & horizontal vessels – Design of base plate and support lugs– Types of anchor bolt, its material and allowable stresses– Design of saddle supports.

UNITIV BUCKLING IN VESSELS 9

Buckling of vessels under external pressure– Elastic buckling of long cylinders, buckling modes, Collapse under external pressure– Design for stiffening rings– Buckling under combined external pressure and axial loading.

UNITV PIPING STRESS ANALYSIS 9

Flow diagram, Piping layout and piping stress analysis– Flexibility factor and stress intensification factor– Design of piping system as per B31.1 piping code– Piping components – bends, tees, bellows and valves– Types of piping supports and their behaviour.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Harvey J.F., **"Pressure vessel design",** CBS publication, (1985)
2. Brownell L.E., & Young E.D., **"Process equipment design",** Wiley Eastern Ltd., India, (1991)

REFERENCES

1. ASME Pressure Vessel and Boiler code, Section VIII Div 1 & 2, (2003)
   American standard code for pressure piping, B 31.1
2. Henry H. Bednar, **"Pressure vessel Design Hand book",** CBS publishers and distributors
3. Stanley M. Wales, **"Chemical Process equipment, selection and design",** Butterworths, series in Chemical Engineering, (1988)
4. William J. Bees, **"Approximate methods in the Design and Analysis of pressure vessels and piping",** ASME Pressure vessels and piping conference, (1997)

12ME8F	ADVANCED I.C. ENGINES	L	T	P	C
		3	0	0	3

AIM

To understand the basic concepts of advanced I.C. Engines and its application.

Course Outcomes

The Students will be able to

- Explain the design and operating parameters of an engine

- Analyze different stages of combustion in SI and CI engines
- Differentiate among different internal combustion engine designs
- Develop an ability to optimize future engine designs for specific sets of constraints
- Know the physical properties & their performance of alternative fuels
- Explain the formation of different pollutants, their affect and their treatment

UNITI SPARK IGNITION ENGINES 9

Air-fuel ratio requirements, Design of carburetor –fuel jet size and venture size, Stages of combustion–normal and abnormal combustion, Factors affecting knock, Combustion chambers, Introduction to thermodynamic analysis of SI Engine combustion process.

UNITII COMPRESSION IGNITION ENGINES 9

Stages of combustion–normal and abnormal combustion – Factors affecting knock, DirectandIndirect injection systems, Combustion chambers,Turbocharging, Introduction to Thermodynamic Analysis of CI Engine Combustion process.

UNITIII ENGINE EXHAUST EMISSION CONTROL 9

Formation of NOX, HC/CO mechanism, Smoke and Particulate emissions, Green House Effect, Methods of controlling emissions, Three way catalytic converter and Particulate Trap, Emission (HC,CO, NO and NOX) measuring equipment, Smoke and Particulate measurement, Indian Driving Cycles and emission norms.

UNITIV ALTERNATE FUELS 9

Alcohols, Vegetable oils and bio-diesel, Bio-gas, Natural Gas, Liquefied Petroleum Gas,Hydrogen, Properties, Suitability,Engine Modifications, Performance, Combustion and Emission Characteristics of SI and CI Engines using these alternate fuels.

UNITV RECENT TRENDS 9

Homogeneous Charge Compression Ignition Engine, Lean Burn Engine, Stratified Charge Engine, Surface Ignition Engine, Four Valve and Overhead cam Engines, Electronic Engine Management, Common Rail Direct Injection Diesel Engine, Gasoline Direct Injection Engine, Data Acquisition System –pressure pick up, charge amplifier PC for Combustion and Heat release analysis in Engines.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Heinz Heisler, **"Advanced Engine Technology",** SAE International Publications, USA, (1998)
2. Ganesan V. **"Internal Combustion Engines",** 3rd Edition, Tata Mcgraw-Hill, (2007)

REFERENCES

1. John B. Heywood, **"Internal Combustion Engine Fundamentals",** Tata McGraw-Hill, (1988)
2. Patterson, D.J. and Henein, N.A,**"Emissions from combustion engines and their control",** Ann Arbor Science publishers Inc, USA, (1978)
3. Gupta, H.N, **"Fundamentals of Internal Combustion Engines",** Prentice Hall of India, (2006)
4. Ultrich Adler, **"Automotive Electric / Electronic Systems",** Published by Robert Bosh GmbH, (1995)

12ME8G	DESIGN OF HEAT EXCHANGERS	L	T	P	C
		3	0	0	3

AIM

To learn the sizing of heat exchangers, thermal and mechanical stress analysis for various heat exchange applications

Course Outcomes

The Students will be able to

- Explain the different classification of heat exchangers
- Generate the various processes of design of heat exchangers
- Design of shell and tube type heat exchangers
- Design of compact heat exchangers, plate heat exchangers
- Familiarize the design of condensers and cooling towers

UNITI DIFFERENT CLASSIFICATION OF HEAT EXCHANGERS 9

Parallel flow, Counter flow and cross flow – shell and tube and plate type – single pass and multipass– once through stream generators etc.

UNITII PROCESS DESIGN OF HEAT EXCHANGERS 9

Heat transfer correlations, Overall heat transfer coefficient, LMTD, sizing of finned tube heat exchangers, U tube heat exchangers, fouling factors, pressure drop calculations.

UNITIII MECHANICAL DESIGN OF SHELL AND TUBE TYPE 9

Thickness calculations, Tubesheet design using TEMA formula, Concept of equivalent plate foranalyzing perforated analysis, flow induced vibration risks including acoustic issue and remedies, tube to tube sheet joint design, buckling of tubes, thermal stresses.

UNITIV COMPACT AND PLATE HEAT EXCHANGERS 9

Types –Merits and Demerits – Design of Compact heat exchangers, plate heat exchangers, performance influencing parameters, limitations.

UNITV CONDENSERS AND COOLING TOWERS 9

Design of surface and evaporative condensers – cooling tower – performance characteristics.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Taborek, T., Hewitt, G.F. and Afgan, N., **"Heat Exchangers, Theory and practice",** McGraw-Hill Book Co. (1980)
2. Walkers, **"Industrial Heat Exchangers – A Basic Guide",** McGraw Hill Book Co. (1980)

REFERENCES

1. Gupta, J.P., **"Fundamentals of Heat exchanger and pressure vessels technology",** Hemisphere publishing corporation, springer, (1986)
2. Donald Q. Kern and Alban D. Karus,**"Extended surface heat transfer",** McGraw Hill Book Co., (1972)
3. Nicholas Cheremistoff, **"Cooling Tower",** Ann Arbor Science Pub (1981)
4. Arthur, P. Frass, **"Heat Exchanger Design",** John Wiley and Sons,(1988)

12ME8H FIRE WORKS SAFETY

L	T	P	C
3	0	0	3

AIM

To learn the properties, preparation of fireworks chemicals and safety in fireworks industry

Course Outcomes

The Students will be able to

- Choose the properties of various chemicals used in fireworks industry
- Recall the concepts of earthing and legal requirements
- Categorize the various pollution and preventions

- Improve the process safety in fireworks industry
- Use the proper material handling techniques / equipments
- Control the wastes and ensure the human safety in fireworks

UNITI PROPERTIES OF FIREWORKS CHEMICALS 9

Fire properties – potassium nitrate (KN03), potassium chlorate (KCl03), barium nitrate (BaNO3),calcium nitrate (CaNO3), Sulphur (S), Phosphorous (P), antimony (Sb), Pyro Aluminum (A1) powder- Reactions-metal powders, Borax, ammonia (NH3) – Strontium Nitrate, Sodium Nitrate, Potassium per chloride - Fire and explosion - impact and friction sensitivity.

UNITII STATIC CHARGE AND DUST 9

Concept – prevention – earthing - copper plates - dress materials - static charge meter lightning,- causes effects- hazards in fireworks factories – concept, installation and maintenance of lightning arrestor - legal requirements – size of dust - non-respirable - biological barriers – hazards - personal protective equipments - pollution prevention

UNITIII PROCESS SAFETY 9

Safe - quantity, mixing – filling - fuse cutting – fuse fixing – finishing – drying at various stages - packing storage - hand tools-materials, layout: building-distances- factories act – explosive act and rules – fire prevention and control – risk related fireworks industries

UNITIV MATERIAL HANDLING 9

Manual handling – wheel barrows-trucks-bullock carts-cycles-automobiles-fuse handling – paper caps handling-nitric acid handling in snake eggs manufacture-handling the mix in this factory-material movement-co-down-waste pit – transport restrictions - overhead power lines - fire extinguishers - loose chemicals handling and transport

UNITV WASTE CONTROL AND USER SAFETY 9

Concepts of wastes – wastes in fireworks- disposal – spillages - storage of residues - Consumer anxiety hazards in display - methods in other countries - fires, burns and scalds - sales outlets – restrictions - role of fire service.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Ronald Lancaster, Roy E.A. Butler, J. Mark Lancaster and Takeo Shimizu, "**Fireworks Principles and Practice**", 4th Edition, Chemical Publishing Company, New York, 2006.
2. John Barton, **"Dust Explosion Prevention and Protection**", Institution of Chemical Engineers, UK, 2002

REFERENCES

1. Michael S. Russell, "**The Chemistry of Fireworks**", Royal Society of Chemistry, UK, 2009.
2. Geoffrey Lunn, "**Guide to Dust Explosion Prevention and Protection**", Institution of Chemical Engineers, UK, 1992
3. Proceedings of National conference on "**Pyro Tech 2013**", by Petroleum and Explosives Safety Organization (PESO), Ministry of Explosives, Government of India, 2013.
4. Bill Ofca, "**Fireworks Safety Manual: A Collection of Essays**",Hyde Park, New York, 1990