KONGU ENGINEERING COLLEGE
PERUNDURAI ERODE – 638 052
(Autonomous)

VISION

To be a centre of excellence for development and dissemination of knowledge in Applied Sciences, Technology, Engineering and Management for the Nation and beyond.

MISSION

We are committed to value based Education, Research and Consultancy in Engineering and Management and to bring out technically competent, ethically strong and quality professionals to keep our Nation ahead in the competitive knowledge intensive world.

QUALITY POLICY

We are committed to

- Providing value based quality education for the development of students as competent and responsible citizens.
- Contributing to the nation and beyond through research and development
- Continuously improving our services

DEPARTMENT OF MECHATRONICS ENGINEERING

VISION

To be a centre of excellence for development and dissemination of knowledge in Mechatronics Engineering for the Nation and beyond.

MISSION

Department of Mechatronics Engineering is committed to:

MS1: Disseminate knowledge through effective teaching-learning process to develop quality Mechatronics professionals to meet the global challenges

MS2: Foster continuous learning and research by nurturing innovation and providing state-of-the art facilities

MS3: Develop expertise in consultancy and training activities focused on industrial needs

2011 REGULATIONS

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduates of Mechatronics Engineering will

PEO1: Utilize the fundamental knowledge of basic sciences and engineering to succeed in their professional career.

PEO2: Analyse, design and develop Mechatronics Engineering based products and processes for real world applications.

PEO3: Exhibit professional and managerial capabilities with ethical conduct and an aptitude for continuous learning.

MAPPING OF MISSION STATEMENTS (MS) WITH PEOs

MS\PEO	PEO1	PEO2	PEO3
MS1	3	3	2
MS2	3	3	3
MS3	2	2	2

1 – Slight, 2 – Moderate, 3 – Substantial

PROGRAM OUTCOMES (POs)

Graduates of Mechatronics Engineering will be able to

a. apply basic knowledge of mathematics, science and engineering concepts to solve domain specific engineering problems
b. identify, analyse and formulate Mechatronics Engineering problems based on the knowledge of basic sciences and engineering
c. design and develop Mechatronics systems by synergistic combination of precision mechanical engineering, electronic controls and systems
d. analyse complex engineering problems through research based knowledge / experimentation to arrive at appropriate conclusions
e. solve Mechatronics Engineering problems by applying appropriate techniques, resources and modern engineering and IT tools within realistic constraints
f. assess safety, social and global consequences of Mechatronics engineering solutions and relate them to the responsibilities of a professional engineer
g. demonstrate the knowledge of and need for sustainable development by understanding the impact of Mechatronics engineering solutions in social and environmental context
h. commit to professional and ethical behaviour including a respect for diversity
i. effectively demonstrate leadership and professionalism as an individual and in a multi-disciplinary team
j. communicate effectively in oral, written and graphical forms
k. exhibit knowledge of project and financial management useful to become an entrepreneur
l. recognize the need for lifelong learning in the context of continuous technological and other changes

MAPPING OF PEOs WITH POs

PEO\PO	a	b	c	d	e	f	g	h	i	j	k	l
PEO1	3	2	2	2	2	1	1	1	1	2	1	2
PEO2	3	3	3	3	2	1	1	1	2	2	2	2
PEO3	1	1	1	1	1	2	2	3	2	2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial

CURRICULUM BREAKDOWN STRUCTURE UNDER REGULATION 2011

Curriculum Breakdown Structure(CBS)	**Curriculum Content (% of total number of credits of the program)**	**Total number of contact hours**	**Total number of credits**
Basic Sciences(BS)	16.25	510	30
Engineering Sciences(ES)	14.59	465	27
Humanities and Social Sciences(HS)	8.64	270	16
Program Core(PC)	48.10	1725	89
Program Electives(PE)	4.86	135	9
Open Electives(OE)	1.62	45	3
Project(s)/Internships(PR)	5.94	360	11
		Total	**185**

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B.E. DEGREE IN MECHATRONICS ENGINEERING

CURRICULUM

(For the candidates admitted from academic year 2011 – 12 onwards)

SEMESTER – I

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
11EL101	Technical English	3	0	0	3	50	50	100	HS
11MA101	Engineering Mathematics-I	3	1	0	4	50	50	100	BS
11PH101	Applied Physics	3	0	0	3	50	50	100	BS
11CY101	Applied Chemistry	3	0	0	3	50	50	100	BS
11CS101	Problem Solving and Programming	3	0	0	3	50	50	100	ES
11EE201	Circuit Theory	3	1	0	4	50	50	100	ES
	PRACTICAL								
11PH102	Physical Sciences Laboratory-I	0	0	3	1	50	50	100	BS
11CS102	Programming Laboratory	0	0	3	1	50	50	100	ES
				Total	**22**				

CA- Continuous Assessment, ESE- End Semester Examination
CBS – Curriculum Breakdown Structure

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SEMESTER – II

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
11EL201	Communication Skills	3	0	0	3	50	50	100	HS
11MA201	Engineering Mathematics-II	3	1	0	4	50	50	100	BS
11PH201	Materials Science	3	0	0	3	50	50	100	BS
11CY201	Environmental Science	3	0	0	3	50	50	100	BS
11ME101	Basics of Civil and Mechanical Engineering	3	0	0	3	50	50	100	ES
11ME102	Engineering Drawing	2	0	3	3	50	50	100	ES
	PRACTICAL								
11PH202	Physical Sciences Laboratory-II	0	0	3	1	50	50	100	BS
11ME103	Engineering Practices Laboratory	0	0	3	1	50	50	100	ES
11EL202	Communication Skills Laboratory	0	0	3	1	50	50	100	HS
				Total	**22**				

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SEMESTER - III

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
11MA301	Engineering Mathematics - III	3	1	0	4	50	50	100	BS
11EE301	Electrical Machines	3	1	0	4	50	50	100	PC
11ME301	Engineering Mechanics	3	1	0	4	50	50	100	ES
11ME403	Kinematics of Machinery	3	1	0	4	50	50	100	ES
11MT301	Electron Devices and Digital Circuits	3	1	0	4	50	50	100	PC
11MT302	Manufacturing Processes	3	0	0	3	50	50	100	PC
	PRACTICAL								
11EE304	Electrical Machines Laboratory	0	0	3	1	50	50	100	PC
11MT303	Electron Devices and Digital Circuits Laboratory	0	0	3	1	50	50	100	PC
11MT304	Manufacturing Processes Laboratory	0	0	3	1	50	50	100	PC
				Total	**26**				

CA - Continuous Assessment, ESE - End Semester Examination
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SEMESTER - IV

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
11MA401	Numerical Methods	3	1	0	4	50	50	100	BS
11EE503	Control Systems	3	1	0	4	50	50	100	PC
11ME401	Strength of Materials	3	1	0	4	50	50	100	ES
11ME303	Fluid Mechanics and Machinery	3	1	0	4	50	50	100	PC
11ME502	Dynamics of Machinery	3	1	0	4	50	50	100	PC
11MT401	Sensors and Signal Processing	3	0	0	3	50	50	100	PC
	PRACTICAL								
11ME305	Fluid Mechanics and Machinery Laboratory	0	0	3	1	50	50	100	PC
11MT402	Sensors and Signal Processing Laboratory	0	0	3	1	50	50	100	PC
11MT403	Computer Aided Machine Drawing Laboratory	0	0	3	1	50	50	100	PC
				Total	**26**				

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CURRICULUM

(For the candidates admitted from academic year 2011 – 12 onwards)

SEMESTER - V

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
11EE504	Microprocessors and Microcontrollers	3	0	0	3	50	50	100	PC
11MT501	Design of Mechanical Systems	3	1	0	4	50	50	100	PC
11MT502	Thermodynamics and Heat Transfer	3	1	0	4	50	50	100	PC
11MT503	CNC Technology	3	0	0	3	50	50	100	PC
11MT504	Engineering Metrology	3	0	0	3	50	50	100	PC
11MT505	Virtual Instrumentation: Theory and Applications	3	0	0	3	50	50	100	PC
	PRACTICAL								
11EE506	Microprocessor and Microcontroller Laboratory	0	0	3	1	50	50	100	PC
11MT506	CNC Programming Laboratory	0	0	3	1	50	50	100	PC
11MT507	Virtual Instrumentation and Data Acquisition Laboratory	0	0	3	1	50	50	100	PC
				Total	**23**				

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CURRICULUM

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SEMESTER - VI

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
11GE601	Economics and Management for Engineers	3	0	0	3	50	50	100	HS
11EI601	Process Control	3	1	0	4	50	50	100	PC
11ME604	Fluid Power System	3	0	0	3	50	50	100	PC
11MT601	Programmable Automation Controllers	3	0	0	3	50	50	100	PC
11MT602	Power Electronics and Drives	3	0	0	3	50	50	100	PC
	Elective - I	3	0	0	3	50	50	100	PE
	PRACTICAL								
11MT603	Fluid Power and Process Control Laboratory	0	0	3	1	50	50	100	PC
11MT604	Programmable Automation Controllers Laboratory	0	0	3	1	50	50	100	PC
11MT605	Power Electronics and Drives Laboratory	0	0	3	1	50	50	100	PC
				Total	**22**				

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SEMESTER - VII

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
11GE701	Total Quality Management	3	0	0	3	50	50	100	HS
11ME505	Operations Research	3	1	0	4	50	50	100	PC
11MT701	Design of Mechatronics Systems	3	1	0	4	50	50	100	PC
11MT702	Robotics and Machine Vision System	3	0	0	3	50	50	100	PC
11MT703	Automotive Engineering	3	0	0	3	50	50	100	PC
	Elective - III	3	0	0	3	50	50	100	PE
	PRACTICAL								
11MT704	Computer Aided Engineering and Robotics Laboratory	0	0	3	1	50	50	100	PC
11MT705	Design and Fabrication Project	0	0	6	2	50	50	100	PR
				Total	**23**				

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CURRICULUM

(For the candidates admitted from academic year 2011 – 12 onwards)

SEMESTER - VIII

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
11GE801	Professional Ethics and Human Values	3	0	0	3	50	50	100	HS
11MT801	Automotive Electronics	3	0	0	3	50	50	100	PC
	Elective - IV	3	0	0	3	50	50	100	PE
	Elective – V	3	0	0	3	50	50	100	OE
	PRACTICAL								
11MT802	Project Work	0	0	18	9	100	100	200	PR
				Total	**21**				

CA - Continuous Assessment, ESE - End Semester Examination
CBS – Curriculum Breakdown Structure

LIST OF ELECTIVES						
Course Code	**Course Title**	**L**	**T**	**P**	**C**	**CBS**
11CS401	Database Management Systems	3	0	0	3	PE
11IT502	Computer Communication Networks	3	0	0	3	PE
11EC017	Digital Image Processing	3	0	0	3	PE
11EI605	Embedded Control	3	0	0	3	PE
11EC012	Soft Computing	3	0	0	3	PE
11EI603	Biomedical Instrumentation	3	0	0	3	PE
11EI015	Optimal Control	3	1	0	4	PE
11GE011	Entrepreneurship Development	3	0	0	3	PE
11ME025	Maintenance Engineering	3	0	0	3	PE
11ME014	Introduction to Aircraft Systems	3	0	0	3	PE
11ME023	Renewable Energy Resources	3	0	0	3	PE
11ME011	Design of Jigs, Fixtures and Press Tools	3	0	0	3	PE
11ME016	Design for Manufacture and Assembly	3	0	0	3	PE
11MT011	Applied Finite Element Analysis	3	0	0	3	PE
11MT012	Micro Electro Mechanical Systems	3	0	0	3	OE
11MT013	Rapid Manufacturing Technologies	3	0	0	3	PE
11MT014	Principles of Digital Signal Processing	3	0	0	3	PE
11MT015	Computer Integrated Manufacturing	3	0	0	3	PE
11MT016	Advanced Manufacturing Technology	3	0	0	3	OE
11MT017	Modelling and Simulation	3	0	0	3	OE
11MT018	Advanced Robotics	3	0	0	3	PE

11EL101 TECHNICAL ENGLISH

(Common to all Engineering and Technology branches)

3 0 0 3

MODULE – I **17**

Grammar and Vocabulary: Word formation with prefixes and suffixes – Synonyms and Antonyms – Verb Patterns – Tenses (simple and compound tenses) - Simple, Compound and Complex Sentences - Voice – Use of Conditionals - Comparative Adjectives (affirmative and negative) – Expanding Nominal compounds - Articles - Use of Prepositions – Identifying Odd Words – Acronyms.

MODULE – II **13**

Listening: Listening for General Content – Intensive Listening – Listening for Specific Information : Retrieval of Factual Information – Listening to Identify Topic, Context, Function, Speaker's Opinion, Attitude, etc. – Global Understanding Skills and Ability to infer, extract gist and understand main ideas – Note-taking: Guided and unguided- Listening to fill up gapped texts.

Writing: Introduction to the Characteristics of Technical Style - Writing Definitions and Descriptions - Paragraph Writing (topic sentence and its role, unity, coherence and use of cohesive expressions) - Process Description(use of sequencing connectives)– Comparison and Contrast - Classifying the data - analysing / interpreting the data – Personal letter - Formal letter writing (Inviting Guest Speakers, letter to the editor, letter for seeking practical training, and letter for undertaking project works in industries) – editing (punctuation, spelling and grammar) – Recommendations & Suggestions.

MODULE- III **15**

Reading: Exposure to different Reading Techniques - Reading for Gist and global meaning - Predicting the content - Skimming the text – Identifying the Topic Sentence and its role in each paragraph - Scanning - Inferring / identifying lexical and contextual meanings - Reading for structure and detail - Transfer of information / guided note-making - Understanding discourse coherence - Sequencing of sentences.

Speaking: Verbal and Non Verbal Communication - Pronunciation drills/ Tongue Twisters – Formal and Informal English - Oral practice – Developing Confidence - Introducing Oneself - Asking for or Eliciting Information - Describing Objects – Offering Suggestions and Recommendations – expressing opinions (agreement / disagreement.

TOTAL : 45

TEXT BOOK

1. "English for Engineers and Technologists", Combined Edition, Volume. I & II, Orient Longman, Oxford University Press, New Delhi, 2006.

REFERENCE BOOKS

1. Aysha Viswamohan, "English for Technical Communication", Tata McGraw-Hill, New Delhi, 2008.
2. Rizvi M Ashraf, "Effective Technical Communication", Fifth Edition, Tata McGraw- Hill, New Delhi, 2007.
3. Mark Ibbotson, "Cambridge English for Engineering", Cambridge University Press, New Delhi, 2009.
4. Rama Krishna Rao, A, "Learning English: A Communicative Approach" Orient Black Swan, Hyderabad, 2008.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: improve their vocabulary and appropriate usage of words in different academic and professional contexts.

CO2: familiarize with different rhetorical functions of technical English.

CO3: develop strategies that could be adopted while reading texts.

CO4: speak effectively in English and career related situations.

CO5: acquire knowledge in academic and professional writing.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1									2	3		1
CO2									2	3		
CO3				2					2	3		1
CO4									2	3		
CO5				1					1	3		1

3 – Substantial, 2 – Moderate, 1 – Slight

11MA101 ENGINEERING MATHEMATICS – I

(Common to all Engineering and Technology branches)

3 1 0 4

MODULE – I **15**

Matrices: Linear independent and dependent of vectors – Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of eigen values and eigen vectors (without proof) – Cayley – Hamilton theorem (without proof).

Diagonalisation: Similarity transformation (concept only) – Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Nature of quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation.

MODULE – II **15**

Differential Calculus: Curvature – Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature. Involutes and evolutes – Envelopes – Properties of envelopes and evolutes.

Functions of several variables: Functions of two variables – Partial derivatives – Total differential – Maxima and minima – Constrained maxima and minima – Lagrange's multiplier method – Jacobians.

MODULE - III **15**

Differential Equations: Linear differential equations of Second and higher order with constant coefficients when the R.H.S is e^{ax}, x^n, $n > 0$, Sinax, Cosax, $e^{ax}x^n$, $e^{\alpha x}$ Sinβx, $e^{\alpha x}$ Cosβx, x^n Sinαx and x^n Cosαx– Differential Equations with variable coefficients (Cauchy's form). Method of variation of parameters - Simultaneous first order linear equations with constant coefficients.

Applications of Differential Equations: Solution of specified differential equations connected with electric circuits, simple harmonic motion (Differential equations and associated conditions need to be given).

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS

1. Kandasamy. P, Thilagavathy. K and Gunavathy. K., "Engineering Mathematics For First Year B.E/B.Tech", Reprint Edition 2011, S.Chand and Co., New Delhi.
2. Veerarajan. T., "Engineering Mathematics, (for first year)", Reprint Edition 2011, Tata McGraw-Hill, New Delhi.

REFERENCE BOOKS

1. Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, New Delhi, 2007.
2. Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House, New Delhi, 2007.
3. Bali N.P and Manish Goyal, "Text Book of Engineering Mathematics", 3rd Edition, Laxmi Publications, New Delhi, 2008.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: identify and solve algebraic Eigen value problems from practical area

CO2: understand the geometric aspects of curvature, maxima and minima concepts as elegant applications of differential equations.

CO3: solve differential equations of certain types and to handle application in engineering fields

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3		1	2							1
CO2	3	3										1
CO3	3	3		1	2							1

3 – Substantial, 2 – Moderate, 1 – Slight

11PH101 APPLIED PHYSICS

(Common to all Engineering and Technology branches)

3 0 0 3

MODULE – I **15**

Acoustics : Classification of sound – Characteristics of musical sound – Weber-Fechner law – Absorption Coefficient – Reverberation – Reverberation time – Sabine's formula (growth & decay) – Factors affecting acoustics of buildings (reverberation time, loudness, focusing, echo, echelon effect, resonance and noise) and their remedies.

Ultrasonics : Introduction – Production – Magnetostriction effect – Magnetostrictive generator - Inverse piezoelectric effect - Piezoelectric generator - Detection of ultrasonics - Properties – Cavitation - Industrial applications – drilling, welding, soldering and cleaning – SONAR - Non destructive testing – Ultrasonic pulse echo system - Medical applications – A, B and C Scan displays – Ultrasonic imaging technique.

MODULE – II **15**

Lasers: Introduction – Principle of spontaneous emission and stimulated emission - Population inversion, Pumping, Einstein's Coefficients (A&B) - Types of lasers – Nd:YAG, CO_2, Semiconductor lasers: Homojunction and Heterojunction – Laser Applications – Industrial applications – Laser welding, Laser cutting, Laser drilling – Holography – Construction and reconstruction of images.

Fiber Optics & Applications: Principle – Classification based on materials, Modes of propagation, Refractive index profile - Crucible-crucible technique of fiber fabrication - Light sources for fiber optics – Detectors - Fiber optical communication links - Losses in optical fibers – Fiber optic sensors – Temperature, displacement, voltage and magnetic field measurement.

MODULE - III **15**

Quantum Physics and Applications: Black body radiation – Planck's theory (derivation)– Deduction of Wien's displacement law and Rayliegh – Jean's Law from Planck's theory – Compton effect – Theory and experimental verification - Matter waves – Uncertainty principle - Experimental verification – Schroedinger's wave equations – Time independent and time dependent equation – Physical Significance of wave function – Particle in a box (One dimensional) - Optical microscope – Limitations of optical microscopy - Scanning electron microscope - Transmission electron microscope.

TOTAL : 45

TEXT BOOKS

1. Avadhanalu M N and Kshirsagar P G, "A Text Book of Engineering Physics", S.Chand & company Ltd, New Delhi, 2007.
2. Palanisamy P K, "Engineering Physics", Scitech Publications, Chennai, 2008.

REFERENCE BOOKS

1. Gaur R K and Gupta S L , "Engineering Physics", Dhanpat Rai and Sons, New Delhi, 2006.
2. Rajendran V, "Engineering Physics", Prentice Hall of India, New Delhi, 2008.
3. Rajagopal K, "Textbook of Engineering Physics", Part I, PHI Learning Pvt. Ltd., New Delhi, 2008.
4. Personick S D, "Fibre Optics, Technology and Applications", Khanna Publishers New Delhi, 1987.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: infer and apply the basic concepts of design of acoustically good buildings and ultrasonics in engineering and technology.

CO2: demonstrate the basics of fiber optic communication system and laser phenomena, and make use of them in engineering and technology.

CO3: relate and inference the concepts of quantum physics to optical, electrical and other physical phenomena.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3		2						1		1
CO2	3	3		2						1		1
CO3	3	3		2						1		1

3 – Substantial, 2 – Moderate, 1 – Slight

11CY101 APPLIED CHEMISTRY

(Common to all Engineering and Technology branches)

3 0 0 3

MODULE – I **15**

Water: Introduction - Sources of water - impurities in water - Types of water - Water quality standards - Water quality parameters (Discussion not required) - Hardness of water- Expression of hardness - Units of hardness –Estimation of Hardness of water by EDTA method – Determination of alkalinity - Disadvantages of using hard water - Boiler troubles due to hard water - scale and sludge formation – Boiler corrosion – caustic embrittlement- priming and foaming-Softening of water- External treatment methods - Lime soda, zeolite and demineralization process (principle, process, advantages and disadvantages only) Internal treatment process - colloidal, carbonate, calgon and phosphate conditioning (brief discussion only) - desalination by reverse osmosis method.

Electrochemistry: Introduction - Cells – Representation of a galvanic cell - EMF measurements and its applications – Electrode potential - Nernst Equation – Reference electrodes (hydrogen and calomel electrodes) – Electrochemical series and its applications – Conductometric titrations (strong acid Vs strong base only) - Batteries – Lead acid and Ni-Cd batteries.

MODULE – II **15**

Corrosion and Its Control: Introduction – Mechanism of dry and wet corrosion – galvanic corrosion - concentration cell corrosion – Galvanic series - Factors influencing rate of corrosion – corrosion control methods - Sacrificial anode and impressed current cathodic method – Corrosion inhibitors - Protective coatings - classifications - Pretreatment of metal surface - Metallic coating -electroplating and electrolessplating (General discussion) - Hot dipping (Tinning and galvanising) - Nonmetallic coating - surface conversion coating (phosphate coating and anodized coating) - Organic coating - paints – constituents and their function – Special paints (Fire retardant, temperature indicating, water repellant and luminescent paints)

Combustion: Introduction – Calorific Values – Gross and net – Theoretical calculation of minimum air for combustion (Theoretical aspects only) – flue gas analysis – Orsat's method - Explosive range and Spontaneous Ignition Temperature.

MODULE - III **15**

Fuels: coal – proximate and ultimate analysis – their importance – metallurgical coke - Otto-Hoffman byproduct method - Liquid fuel - refining of petroleum - Straight run, cracked and polymer petrol – Manufacture of synthetic petrol - polymerization (thermal and catalytic methods) - Hydrogenation of coal (Fisher Tropsch and Bergius methods) - knocking - octane number – improving octane number by additives – Diesel – cetane number – Gaseous fuels (Water gas, producer gas and biogas)

Polymers: Introduction – Nomenclature of polymers – functionality – polymerization - types – addition, condensation and co-polymerization with examples – Effect of polymer structure on properties (strength, plastic deformation, crystallinity and chemical resistance) - plastics – types (thermo and thermosetting plastics) - individual polymers - Polyethylene, polypropylene, PVC, Teflon, Bakelite and epoxy resin (preparation, properties and uses only) - Compounding of plastics-Fabrication of plastics (compression, injection and extrusion moulding methods) – conducting polymers

TOTAL : 45

TEXT BOOK

1. Jain PC and Monica Jain, "Engineering Chemistry", 15th Edition, Dhanpat Rai publication Co., New Delhi, 2008.

REFERENCE BOOKS

1. Dara S.S., "A Text Book of Engineering Chemistry", S.Chand & Co. Ltd., New Delhi, 2006.
2. Sharma B.K., "Engineering Chemistry", Krishna Prakasan Media (P) Ltd., Meerut, 2001.
3. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill, New Delhi, 2008.
4. Krishnamurthy N., "Engineering Chemistry", 2nd Edition, PHI Learning private Limited, New Delhi, 2008.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: represent the water quality parameters, water treatment methods for potable and industrial purpose and apply the principles of electrochemistry for EMF measurement and energy storing devices

CO2: comprehend the effect of corrosion and corrosion control methods.

CO3: represent the calculation for calorific values, theoretical amount of minimum air required for complete combustion and flue gas analysis.

CO4: represents the types of fuel, engines, some individual polymers ,fabrications of plastics.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3		2	2	1				3		2
CO2	3	3		2	2	1				3		2
CO3	3	3		2	2	1				3		2
CO4	3	3		2	2	1				3		2

3 – Substantial, 2 – Moderate, 1 – Slight

11CS101 PROBLEM SOLVING AND PROGRAMMING

(Common to all Engineering and Technology branches)

3 0 0 3

MODULE – I **15**

Basics: Evolution of computers- Generations of computers- Classification of computers- Applications of computers- Hardware - Software-Information Technology-Internet Problem-Solving Techniques- Program Control Structures- Programming Paradigms and Languages-Generations of Programming Languages.

Problem Solving: Introduction – Problem Solving Aspects- Top-Down Design-Implementation of Algorithms-Program Verification- Efficiency of Algorithms- Analysis of Algorithms- Fundamental algorithm- Factorial Computation - Generation of Fibonacci Sequence.

MODULE – II **15**

C Fundamentals and Arrays: Introduction to C – C programming structure – C character set – Identifiers – keywords. Data types – Constants – variables- Operators – Expressions – Library functions Managing Input and Output – formatted input and output. Control statements – Decision making and branching – Looping structures- Arrays – One dimensional array – Two dimensional arrays – Multidimensional arrays. Character arrays and strings.

MODULE - III **15**

Functions, Structures and Files: Functions - User defined functions: declaration, definition function call and parameter passing mechanisms – Recursion –Array and Functions - User defined data types –typedef - Structures – Unions –File operations in C- Introduction to pointer –Pointer Declaration and Initialization-Accessing a Variable through a pointer-Difference between array and Pointers.

TOTAL : 45

TEXT BOOKS

1. Kamthane, Ashok N. “Computer Programming”, Pearson Education, New Delhi, 2007.
2. Dromey, R.G., “How to solve it by Computers”, Pearson Publishers, New Delhi, 2007.

REFERENCE BOOKS

1. Gottfried Byron S, “Programming with C”, Second Edition, Tata McGraw-Hill, New Delhi, 2006.
2. Kanetkar Yashavant P., “Let us C”, Fifth Edition, BPB publications, New Delhi, 2005.
3. Schildt Herbert, “The Complete Reference C”, Fourth Edition, Tata McGraw-Hill, New Delhi, 2000.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: outline the changes in hardware and software technologies with respect to evolution of computers and programming languages

CO2: apply fundamental principles of problem solving techniques

CO3: develop programs using basic programming principles of C language

CO4: design simple applications using structured programming techniques and file concepts

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	2											3
CO2	3	3	3		2							2
CO3	3	3	2	1								2
CO4	3	3	3	1								2

3 – Substantial, 2 – Moderate, 1 – Slight

11EE201 CIRCUIT THEORY

(Common to ECE, EEE, EIE and Mechatronics Engineering)

3 1 0 4

MODULE – I **15**

DC Circuit Analysis: Ohms law, Temperature coefficient of resistors, resistors in series and parallel circuits, Kirchhoff's laws, Voltage and current division, Dependent and independent sources, source transformation, star delta transformation, mesh and nodal analysis for DC circuits. Steady state analysis of DC circuits.

Simple AC Circuits: Sinusoidal voltage and current, definitions, analysis of simple AC series and parallel circuits, RL,RC,RLC-concept of power and power factor

MODULE – II **15**

Three phase AC circuits: Three phase system- Relation between phase and line values in star and delta. Three phase balanced and unbalanced system- Three phase power measurement.

Network Theorems: Thevenin's and Norton's theorem, Superposition theorem, maximum Power Transfer theorem, Reciprocity theorem and Substitution theorem for DC and AC circuits.

MODULE- III **15**

Resonance Circuits: Series and Parallel Resonance, Frequency response, Quality factor and Bandwidth.

Transients in DC circuit: Transient of RL, RC, RLC circuit analysis with source free and forced (step) response.

Coupled Circuits: Mutual Inductance, Co efficient of coupling, dot convention, analysis of simple coupled circuits.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS

1. Sudhakar A and Shyam Mohan S.P, "Circuits and Network Analysis and Synthesis", Tata McGraw-Hill, New Delhi, 2007.

REFERENCE BOOKS

1. Edminister Joseph A. and Nahri, Mahmood., "Electric Circuits", Schaum's Series, Tata McGraw-Hill, New Delhi, 2007.
2. Arumugam, M and Premkumar, N., "Electric Circuit Theory", Khanna Publishers, New Delhi, 1989.
3. Hayt William H., Kemmerly, Jack E. and Durbin ,Steven M., "Engineering Circuit Analysis", Sixth edition, Tata McGraw –Hill, New Delhi, 2007.
4. Chakrabati, A., "Circuit Theory: Analysis and Synthesis", Dhanpath Rai & sons, New Delhi, 1999.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: solve simple DC and AC circuits.

CO2: apply network theorems to simplify the circuits.

CO3: analyse poly phase, resonant and coupled circuits.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		3	2		1						1
CO2	3	2	3	2								
CO3	3	2	2	3								

3 – Substantial, 2 – Moderate, 1 – Slight

11PH102 PHYSICAL SCIENCES LABORATORY – I

(Common to all Engineering and Technology branches)

0 0 3 1

PART-A: APPLIED PHYSICS LABORATORY

(Any five experiments)

LIST OF EXPERIMENTS /EXERCISES

1. (a) Particle size determination using Diode Laser.
   (b) Determination of Laser parameters – Wavelength and angle of divergence.
   (c) Determination of acceptance angle in 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. Determination of specific resistance of a given coil of wire – Carey Foster Bridge.
5. Determination of dispersive power of a prism using spectrometer.
6. Determination of Young's modulus of the material – non uniform bending.

PART-B: APPLIED CHEMISTRY LABORATORY

(Any five experiments)

LIST OF EXPERIMENTS /EXERCISES

1. Estimation of Total, Temporary and Permanent hardness of water by EDTA method.
2. Estimation of Ca^{2+} and Mg^{2+} hardness separately by EDTA method.
3. Estimation of Alkalinity of a water Sample.
4. Conductometric titration - Mixture of acids.
5. Estimation of Hydrochloric acid using PH meter.
6. Estimation of Ferrous ion by Potentiometric titration.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: perform experiments on fiber, laser, optics, ultrasonic wave and Carey Foster's bridge.

CO2: understand the concepts of numerical aperture, acceptance angle, wavelength, dispersive power, interference, velocity, compressibility and specific resistance.

CO3: get a basic idea about the analysis of hardness, amount of Ca^{2+} and Mg^{2+} ions and presence of alkalinity in water

CO4: get a basic idea about the handling of instruments like pH meter, conductivity meter and potentiometer for the estimation of unknown concentration of acids and ferrous ion.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3		2						2		1
CO2	3	3		2						2		1
CO3	3	2		2						3		3
CO4	3	2		2						3		3

3 – Substantial, 2 – Moderate, 1 – Slight

11CS102 PROGRAMMING LABORATORY

(Common to all Engineering and Technology branches)

0 0 3 1

LIST OF EXPERIMENTS /EXERCISES

A) APPLICATION PACKAGES

1. To create an advertisement using word
2. To illustrate the concept of mail merging using word
3. To create a spread sheet to analyse the marks of the students of a class and also to create appropriate charts using excel
4. To create the presentation for the department using power point
5. To create the presentation for digital computers using power point

B) C PROGAMMING (ANY TWO PROGRAMS IN EACH SECTION)

6. Simple programs using decision making and branching:
   a. Program to find biggest of three numbers
   b. Design of simple menu driven calculator
   c. Program to find the roots of the quadratic equation
   d. Program to convert the given decimal number to binary
   e. Program to print the prime numbers between 100 to 500
   f. Program to print the electricity bill in a specified format applying specified rules
7. Programs using arrays:
   a. Program to find the biggest number in the array
   b. Menu driven program to insert and delete a specified element from the array
   c. Program to arranged the elements of the array in ascending order
   d. Program to merge given two one dimensional arrays and to remove the duplicates
   e. Program for multiplication of two matrices
8. String manipulations:
   a. Program to find the length of the string, copy one string to another and compare two strings, concatenate two strings without using library functions.
   b. Program to check whether the given string is a palindrome or not without reversing
   c. Program to find the occurrence of a substring in a main string and replace the substring by another string.
   d. Arranging the list of names in alphabetical order
   e. Program to count the number of occurrences of vowels, consonants, words, white spaces and special characters in the given statement.
9. Functions:
   a. Program to swap the contents of two variables using functions (Pass by address and pass by reference)
   b. Program to print the Fibonacci series using recursive function
   c. Program to print the average and standard deviation of the elements of the one- dimensional array using function.
   d. Program to print the transpose of a matrix using functions
   e. Menu driven program to perform string operations using functions
10. Structures and file operations:
    a. Define a structure to store the student details viz., Roll no, name, marks in three subjects, total, avg and class obtained. Read the first three fields and write
    your logic to calculate the total, average and class obtained for ten students. Print the results in the order of ran obtained.
    b. Structure based program to print the pay slip of an employee.
    c. Program using files to copy the contents of one file to another

REFERENCES / MANUALS/SOFTWARE:

Software requirements

Operating System : Windows / Linux

Compiler : C compiler

Packages: MS office or Equivalent

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: utilize the features of MS office package to create documents, presentation and reports

CO2: write and execute programs to illustrate decision making and branching

CO3: develop programs using 1D and 2D arrays

CO4: create programs for manipulating strings

CO5: demonstrate the use of functions and structures to develop applications

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1					3							1
CO2		2	2	2								1
CO3		2	2	2								1
CO4		2	2	2								1
CO5		3	3	3								2

3 – Substantial, 2 – Moderate, 1 – Slight

11EL201 COMMUNICATION SKILLS

(Common to all Engineering and Technology branches)

3 0 0 3

MODULE – I **15**

Focus on language: Cause and effect expressions - indicators of purpose and function - connectives -imperatives - modal verbs - infinitives and gerunds - reporting verbs - homonyms - commonly confused (mispronounced and misspelt) words - phrasal verbs - British and American Vocabulary.- rules for writing SI [system international] units - concord.

MODULE – II **15**

Listening: Listening practice - Radio / TV news - documentaries - listening to short and long conversations in different domains of activity/ live speech - new inventions, products, announcements, casual conversation, and academic lectures.

Writing: Formal letter writing (letter of application - job application) , Business (calling for quotation, placing orders , letter of complaint) - structure of memorandum and technical reports (reports on visits made to industries, report on an accident in the factory, meeting report) – notices - agenda - instructions - e-mails - Preparing Checklist- note taking and note making.

MODULE- III **15**

Speaking: Communication – accuracy, fluency, appropriateness – levels of formality – oral practice activities related to professional skills – role play using different functions (persuasion, negotiation, giving directions and guidance) – conversational etiquette (greetings, making requests, permission, accepting, denying, declining, politeness strategies, turn-taking, body language) – making speeches – describing people, place, things and events.

Reading: Reading comprehension – guided note- making – providing a suitable title - identifying main points, supporting ideas – evaluating the style (argumentative / descriptive etc) – drawing inferences separating facts from opinions – interpreting text in different genres.

TOTAL : 45

TEXT BOOK

1. Department of Science and Humanities, Anna University, Chennai. “English for Engineers and Technologists”, Combined Edition Volumes (I & II), Orient Longman, Oxford University Press, New Delhi, 2006.

REFERENCE BOOKS

1. Kiranmai. Dutt P, Geetha Rajeevan and Prakash, C. L. N., “A Course in Communication Skills”, Cambridge University Press, New Delhi, 2007.
2. Meenakshi Raman and Sangeetha Sharma, “Technical Communication”, Oxford University Press, New Delhi, 2006.
3. Sangeetha Sharma and Binod Mishra, “Communication Skills for Engineers and Scientists”, PHI Learning, New Delhi, 2009.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: improve their vocabulary and appropriate usage of words.

CO2: familiarize with different rhetorical functions of technical english.

CO3: speak effectively in english in real-life and career-related situations.

CO4: acquire knowledge in academic and professional writing.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1									2	3		1
CO2									2	3		
CO3									1	3		
CO4				1					1	3		1

3 – Substantial, 2 – Moderate, 1 – Slight

11MA201 ENGINEERING MATHEMATICS – II

(Common to all Engineering and Technology branches)

3 1 0 4

MODULE – I **15**

Multiple Integrals: Double integration in Cartesian coordinates – Change of order of integration – Area between two curves – Area as double integrals – Triple integration in Cartesian coordinates –Volume as Triple integrals (Simple problems only).

Vector Calculus: Gradient, divergence and curl – Line, surface integral (Concept Only) and volume integrals (Concept Only) – Green's, Gauss divergence and Stoke's theorems (without proof) – Verification of the above theorems and evaluation of integrals using them (Simple problems only).

MODULE – II **15**

Analytic Functions: Functions of a complex variable – Analytic functions – Necessary conditions and Sufficient conditions (excluding proof) – Cauchy– Riemann equations — Properties of analytic function (Statement only) – Harmonic functions – Construction of Analytic functions – Conformal mapping: $w = z + a$, az, $\frac{1}{z}$ - Bilinear transformation.

Complex Integration: Cauchy's theorem (without proof) – Cauchy's integral formula – Taylor and Laurent's series (without proof) – Singularities – Classification – Cauchy's residue theorem (Statement only) – Contour integration – circular and semi-circular contours (excluding poles on real axis).

MODULE – III **15**

Laplace Transforms: Conditions for existence – Transform of elementary functions –Basic properties – Derivatives and integrals of transforms – Transforms of derivatives and integrals – Initial and final value theorems – Transform of unit step function – Transform of periodic functions.

Inverse Laplace transforms: Inverse Transform of elementary functions – Partial fraction method – Convolution theorem (without proof) – Solution of linear ODE of second order with constant coefficients.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS

1. Kandasamy. P, Thilagavathy. K and Gunavathy. K, "Engineering Mathematics For First Year B.E/B.Tech", Reprint Edition 2011, S.Chand and Co., New Delhi.
2. Veerarajan. T., "Engineering Mathematics, (for first year), Reprint Edition 2011, Tata McGraw-Hill New Delhi.

REFERENCE BOOKS

1. Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, New Delhi, 2007.
2. Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", Third Edition, Narosa Publishing House, New Delhi, 2007.
3. Bali. N.P and Manish Goyal, "Text Book of Engineering Mathematics", Third Edition, Laxmi Publications, New Delhi, 2008.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: identify problems involving vectors, double and triple integrals

CO2: measure the knowledge of analytic functions.

CO3: evaluate complex integrals which are extensively applied in engineering.

CO4: adapt laplace transforms to solve practical problems.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3		1	2							1
CO2	3											1
CO3	3	3		1	2							1
CO4	3	3		1	2							1

3 – Substantial, 2 – Moderate, 1 – Slight

11PH201 MATERIALS SCIENCE

(Common to all Engineering and Technology branches)

3 0 0 3

MODULE – I **15**

Crystal Physics: Introduction – Lattice – Unit cell – Crystal systems – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Crystal imperfections : Point, line and surface imperfections.

Conducting Materials: 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.

MODULE – II **15**

Semiconducting Materials: Intrinsic semiconductor – Carrier concentration derivation – Extrinsic semiconductors – Carrier concentration derivation in n-type and p-type semiconductors – Hall effect – Determination of Hall coefficient – Applications - Semiconductor devices – Solar cells - LDR.

Magnetic and Dielectric Materials: Types of magnetic materials – Domain theory – Hysteresis – Soft and hard magnetic materials - Magnetic devices – Transformer core - Magneto optical recording - Dielectric constant - Qualitative study of polarization – Frequency and temperature dependence of polarization – Dielectric loss – Dielectric breakdown – Uses of dielectric materials (capacitor and transformer) – Ferro electric materials.

MODULE- III **15**

Smart Materials : Metallic glasses: Preparation, properties and applications - Shape memory alloys (SMA): Characteristics, properties, applications, advantages and disadvantages of SMA – Superconductors: Properties – Types of superconductors – BCS theory of superconductivity(Qualitative) - High T_c superconductors – Applications of superconductors – SQUID – cryotron - magnetic levitation.

Nano Materials: Synthesis: Lithographics – Vapour phase physical and chemical deposition methods - Colloidal and solgel methods - Properties of nanoparticles and applications - Carbon nanotubes: Structure – Properties – Fabrication by Laser ablation – Applications.

TOTAL : 45

TEXT BOOKS

1. Kittel. Charles, “Introduction to Solid State Physics”, Seventh Edition, John Wiley & sons, Singapore, 2007.
2. Poole. Charles P and Ownen. Frank J., “Introduction to Nanotechnology”, Wiley India, 2007. (For Module III).

REFERENCE BOOKS

1. Pillai. S O, “Solid State Physics”, Fifth Edition, New Age International, New Delhi, 2003.
2. Rajendran. V, “Engineering Physics”, Prentice Hall of India, New Delhi, 2008.
3. Palanisamy. P K, “Engineering Physics - II”, SciTech publications (India), Chennai 2008.
4. Raghavan. V, “Materials Science and Engineering: A first course”, Fifth Edition, Prentice Hall of India, New Delhi, 2009.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: gain basic knowledge in concepts like crystal physics, conducting and superconducting materials.

CO2: understand the concepts of semiconducting materials, devices, magnetic and dielectric materials.

CO3: acquire basic knowledge of smart materials, nano materials and its applications.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3		2						1		1
CO2	3	3		2						1		1
CO3	3	3		2						1		1

3 – Substantial, 2 – Moderate, 1 – Slight

11CY201 ENVIRONMENTAL SCIENCE

(Common to all Engineering and Technology branches)

3 0 0 3

MODULE – I **15**

Introduction to Environmental Studies and Natural Resources: Introduction to Environmental Science – Forest resources: Use and over-exploitation, deforestation, case studies. – Water resources: Use and over-utilization of surface and ground 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 - effects of modern agriculture, fertilizer and 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 – Conservation Practices - Role of an individual in conservation of natural resources. **Ecosystems:** Concept of an ecosystem – Structural features – Functional attributes (Food chain and Food web only) – Introduction, types, characteristic features, structure and functions of the (a) Forest ecosystem (b) Aquatic ecosystems (ponds, rivers and oceans). **Biodiversity:** Introduction to Biodiversity – Definition - genetic, species and ecosystem diversity – Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic, option values and ecosystem service value– Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife – Endangered and endemic species of India – In-situ and Ex-situ conservation of biodiversity.

MODULE – II **15**

Pollution: Definition – Causes, effects and control measures of: (a) Air pollution - Climate change, global warming, acid rain, ozone layer depletion (b) Water pollution (c) Soil pollution (d) Radioactive Pollution - Solid waste Management - Disaster management: floods, earthquake, cyclones and landslides - Role of an individual in prevention of pollution - Case studies. **Water Treatment methods**: Treatment of Water for Domestic Supply (Screening, Aeration, Sedimentation with Coagulation, Filtration and Disinfection methods) - Break point chlorination –Estimation of dissolved oxygen, BOD and COD - Bacteriological examination of water - Sewage treatment (Primary, Secondary & Tertiary methods) - Miscellaneous methods of Sewage treatments (Oxidation Ponds, Aerated Lagoons, Oxidation ditch, Anaerobic Lagoons, Septic tanks) – Methods of Sewage treatment by activated sludge process – Introduction to industrial waste water treatment using Reverse Osmosis Technology- Self purification of Natural Waters - Membrane Technology for wastewater treatment - Activated carbon in pollution abatement of wastewater.

MODULE- III **15**

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people - case studies – Environmental ethics - Issues and possible solutions - 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 – Issues involved in enforcement of environmental legislation – Public awareness. **Human Population and the Environment:** Introduction - Population growth - Variation of population based on age structure - 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

TEXT BOOK

1 Anubha Kaushik, and Kaushik C P, "Environmental Science and Engineering", Third Edition: 2008, (Reprint 2010), New Age International (P) Ltd, New Delhi.

REFERENCE BOOKS

1 B.K.Sharma, **"** Industrial Chemistry",Tenth Edition, Krishna Prakashan Media(P) Ltd,Meerut-250001(UP), India.
2 B Uppal M M revised by S C Bhatia, "Environmental Chemistry", Sixth Edition Khanna Publishers, New Delhi, 2002.
3 Trivedi R.K. and Goel P. K., "Introduction to Air Pollution", Techno-Science Publications, Jaipur, 2003.
4 Masters. Gilbert M, "Introduction to Environmental Engineering and Science", Second Edition, Pearson Education, New Delhi, 2004.
5 Miller, T.G., "Environmental Science", Wadsworth Publishing Co.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Represent the importance of conservation of natural resources and gain the basic knowledge of maintaining ecological balance and conservation of biodiversity
CO2: Comprehend the different types of pollution and waste water treatment methods
CO3: Represent the awareness about making a clean environment and useful environment for the future generations, Consequences of population explosion and Social Issues**.**

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3		2		2	3	2		3		2
CO2	3	3		2		2	3	2		3		2
CO3	3	3		2		2	3	2		3		2

3 – Substantial, 2 – Moderate, 1 – Slight

11ME101 BASICS OF CIVIL AND MECHANICAL ENGINEERING

(Common to all Engineering and Technology branches)

3 0 0 3

PART-A: CIVIL ENGINEERING

MODULE – I **7**

Construction Materials: Introduction – Civil Engineering – Materials – bricks – stones – sand – cement – concrete – steel sections – Site selection for foundations – Bearing capacity – loads – Types of foundations – requirements.

MODULE – II **7**

Elements of Structures: Superstructure – brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – Types of Bridges and Dams.

MODULE - III **8**

Elements of Surveying: Surveying – Objects – types – classification – principles – measurements of distances – Determination of areas –Building area calculation – illustrative examples – Basics of Interior and Landscaping.

PART–B: BASIC MECHANICAL ENGINEERING

MODULE – I Metal Forming and Joining Processes **7**

Foundry: Introduction- patterns – molding –casting - cupola furnace.

Forming: Introduction-Classification- Rolling, extrusion, and drawing.

Welding: Introduction-Classification - TIG, MIG welding, Gas welding, soldering and brazing.

Machining process: Introduction-Classification – lathe and drilling machines.

MODULE – II **8**

Boilers and Power Plants

Steam Boilers: Introduction-Classification- Working Principle of Cochran boiler, Babcock and Wilcox boiler- Benson boiler - Boiler Mountings and accessories. Power Plants: Classification of power plants – working principle of steam, Diesel, Hydro-electric and Nuclear Power plants-Merits and Demerits.

MODULE – III **8**

IC Engines, Refrigeration and Air-conditioning: IC Engines: Classification-components - Working principle of Petrol and Diesel Engines- Four stroke and two stroke cycles- Comparison of four stroke and two stroke engines. Working principle of carburetor, fuel pump and multi point fuel injector. **Refrigeration and Air Conditioning System:** Terminology of Refrigeration and Air conditioning, Properties of refrigerant -Principle of vapour compression and absorption system - Layout of typical domestic refrigerator - Window and Split type room Air conditioner.

TOTAL : 45

TEXT BOOKS

1. Palanichamy, M S., "Basic Civil Engineering", Tata McGraw-Hill, New Delhi, 2006.
2. Shanmugam, G, "Basic Mechanical Engineering", 4th Edition, Tata McGraw-Hill, New Delhi, 2011.

REFERENCE BOOKS

1. Rao, M.S., "Basics of Civil Engineering", Dhanpat Rai and Co, New Delhi, 2006.
2. Venugopal, K and Prabhu Raja, V, "Basic Mechanical Engineering", Sixth Edition, Anuradha Publishers, Kumbakonam, 2005.
3. Rao, P N, "Manufacturing Technology: Foundry, Forming and Welding", Tata McGraw-Hill, New Delhi, 2008.
4. Rajan, T.S, "Basic Mechanical Engineering", 3rd Edition, New Age International Publishers, New Delhi, 2009.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: select the suitable construction materials and foundation required for a building
CO2: recall the various elements of the super structure
CO3: point out the various elements of surveying and landscaping
CO4: demonstrate the ability to describe the basics of metal forming and joining processes.
CO5: demonstrate the knowledge on patterns, molding, casting, rolling, extrusion, drawing, TIG, MIG welding, gas welding, soldering and brazing.
CO6: describe basics of boilers and power plants.
CO7: explain the working principle of steam, Diesel, Hydro-electric and Nuclear power plants.
CO8: demonstrate the working of IC engines, Refrigeration and Air-conditioning systems.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	2	2	2	2	1						
CO2	3	2	2	2	2	1						
CO3	3	2	2	2	2	1						
CO4	3				2			1				3
CO5	3				2			3				2
CO6	3				2			1				3
CO7	3				3			2				3
CO8	3				2			1				3

3 – Substantial, 2 – Moderate, 1 – Slight

11ME102 ENGINEERING DRAWING

(Common to all Engineering and Technology branches)

2 0 3 3

Concepts (Not for Exam)

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

MODULE – I **15**

Projections of Points, Lines, Planes and Solids:

General principles of orthographic projection – First angle projection – Layout of views – Projection of points, located in all quadrant and straight lines located in the first quadrant – Determination of true lengths and true inclinations and location of traces – Projection of polygonal surface and circular lamina inclined to both reference planes.

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

MODULE – II **15**

Sectioning and development of solids:

Sectioning of solids- prisms, pyramids, cylinder and cone 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 cone with cutout, perpendicular and inclined to the horizontal axis.

15

MODULE- III

Isometric projection, and Perspective projection :

Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones

Conversion of isometric projection into orthographic projection.

Perspective projection of prisms, pyramids and cylinders by visual ray method.

TOTAL: 45

TEXT BOOKS

1. Venugopal K. and Prabhu Raja V. "Engineering Graphics", New Age International (P) Limited, New Delhi, 2008.
2. Dhananjay A. Jolhe, "Engineering Drawing with an introduction to AutoCAD", Tata McGraw Hill, New Delhi, 2008.

REFERENCE BOOKS

1. Bhatt N.D, "Engineering Drawing", 46th Edition, Charotar Publishing House, Anand, 2003.
2. Gopalakrishnana K.R., "Engineering Drawing", Volume. I & II, Subhas Publications, Bangaluru, 2006.
3. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw-Hill, New Delhi, 2008.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: prepare elementary sketches of 2D and 3D objects with correct interpretation and mark dimensions properly.

CO2: draw multi-view orthographic and other projections including isometric, sectional, true and perspective.

CO3: read, understand, interpret drawings and communicate effectively.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3				2				3			
CO2	3				2				2			
CO3	3				2				2			

3 – Substantial, 2 – Moderate, 1 – Slight

11PH202 PHYSICAL SCIENCES LABORATORY – II

(Common to all Engineering and Technology branches)

0 0 3 1

PART - A: APPLIED PHYSICS LABORATORY

(Any five experiments)

LIST OF EXPERIMENTS /EXERCISES

1. Determination of band gap of a semiconductor material.
2. Determination of wavelength of mercury spectrum – spectrometer grating.
3. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
4. Determination of hysteresis loss in a ferromagnetic material.
5. Determination of Young's modulus of the material – uniform bending.
6. Determination of viscosity of liquid – Poiseuille's method.

PART - B: APPLIED CHEMISTRY LABORATORY

(Any five experiments)

LIST OF EXPERIMENTS /EXERCISES

1. Estimation of Chloride in a given water sample.
2. Determination of Dissolved Oxygen in a sample of water / sewage.
3. Estimation of Chromium in Industrial waste water.
4. Estimation of Ferrous ion in rust solution.
5. Estimation of percentage of Copper present in brass.
6. Estimation of ferric ion by Spectrophotometeric method.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: perform experiments on semiconductors, thermal conductivity, optics, elasticity, viscosity of liquids.

CO2: understand the concepts of wavelength, band gap, thermal conductivity, Young's modulus and viscosity.

CO3: get a knowledge about the estimation of DO, chloride, chromium, ferrous ion and copper in wastewater.

CO4: get an idea about the estimation of iron in unknown solution using spectrophotometer.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3		2						2		1
CO2	3	3		2						2		1
CO3	3	3		2						2		1
CO4	3	3		2						2		1

3 – Substantial, 2 – Moderate, 1 – Slight

11ME103 ENGINEERING PRACTICES LABORATORY

(Common to all Engineering and Technology branches)

0 0 3 1

PART-A: CIVIL & MECHANICAL

LIST OF EXPERIMENTS

1.FITTING

Tools & Equipments – Practice in Filing and Drilling.

Making Vee Joints, Square, dovetail joints, Key Making.

2. PLUMBING

Tools & Equipments - Pipe connection for a bath room, Pipe connection for multi-storey building,

Pipe connection with different components like valves, tap, coupling, union, reducers, elbows etc.

Plumbing work with metal, PVC and flexible hoses (Threading, joining of pipes)

3.CARPENTRY

Tools and Equipments- Planning practice. Making Half Lap, dovetail, Mortise & Tenon joints, a mini model of a single door window frame.

Making of Pen stand, Box, etc. from plywood. (Use of modern power tools for cutting)

4.SHEET METAL

Tools and equipments - Fabrication of a small cabinet, Rectangular Hopper, etc.

5.WELDING

Tools and equipments - Arc and Gas welding of butt joint, Lap Joint and Tee Fillet.

REFERENCES / MANUALS / SOFTWARE:

1. Suyambazhahan, S, "Engineering Practices Laboratory Manual", PHI Learning, NewDelhi, 2010.
2. John, K. C., "Mechanical Workshop Practice", Second Edition, PHI Learning, NewDelhi, 2009.

PART-B: ELECTRICAL & ELECTRONICS

1. Safety aspects of Electrical wiring.
2. Wiring circuit for a lamp using single and two way switches (stair case).
3. Wiring circuit for fluorescent lamp.
4. Study of Electronic components and equipment – Resistor-colour coding, measurement of AC Signal parameter (Peak-Peak, RMS Value, Frequency and Power factor) using CRO
5. Assembling electronic components on a small PCB (Etching, Fabrication and Testing)
6. Measurement of earth resistance and insulation resistance of an electrical equipment
7. Study of Telephone, FM radio & Transducers.
8. Study of Mixie, Iron box, Ceiling & Table Fans.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: understand the functions of different tools used in fitting, carpentry, sheet metals and welding.

CO2: prepare different types of joints in metal pieces, sheet metals and wooden pieces.

CO3: plan and fabricate simple models.

CO4: utilize the basic laboratory equipment

CO5: build the layout of domestic wiring circuits and troubleshoot it.

CO6: estimate Earth Resistance, assemble electronic components in PCB and understand operation of various domestic appliances

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	2							2			1	
CO2	2							3			2	
CO3	3							2			2	
CO4	3		1		3						2	3
CO5	3	2			2	3						3
CO6	3					2						3

3 – Substantial, 2 – Moderate, 1 – Slight

11EL202 COMMUNICATION SKILLS LABORATORY

(Common to all Engineering and Technology branches)

0 0 3 1

LIST OF EXPERIMENTS

English Lab

1. Listening Comprehension
   Listening to instructional software packages in the communication laboratory, using them, understanding the mechanics of language like grammar, listening to native speakers' presentation, and developing oral communication by imitating the model dialogues. Listening for specific information – listening to improve pronunciation – Listening and typing – Filling the blanks – TV programmes and News.
2. Reading comprehension and vocabulary:
   Reading for getting information and understanding; scanning, skimming and identifying topic sentences – reading for gaining knowledge, looking for transitions, understanding the attitude of the writer – Filling the blanks – Cloze exercises – vocabulary building – Comprehension.
3. Speaking:
   Group discussion; verbal and non-verbal communication; speaking on situational topics – maintaining eye contact, speaking audibly, clearly and with confidence – Common errors in English
   Conversations – face-to-Face conversation – Telephone Conversation – Roll play.
4. Writing Skills:
   Writing job application: resume, applications for jobs, making complaint letters – Projects: report writing – editing and proof reading – research paper and translating numerical data from charts and diagrams into verbal communication.

Career Lab

1. Letter Writing / Resume / Report preparation:
   Structuring Letter Writing / Resume / Report preparation / E-Mail
2. Presentation skills
   Elements and structure effective presentation – presentation tools – voice Modulation – Body language – Video samples
3. Group Discussion
   Structure of Group Discussion – Strategies in GD – Team work – Video Samples
4. Interview skills
   Kinds of Interview- corporate culture – video samples
5. Soft Skills
   Time management – stress management – assertiveness – case study

Communication Software Package:

a. Presentation Skills
b. Interview Skills
c. Group Discussion
   - From Globarena Software

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: write, read and listen english effectively
CO2: communicate efficiently in english in real life and career related situations
CO3: demonstrate good presentation skill.
CO4: use the modern communication software package to enhance the soft skills

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1				2					2	3		1
CO2				2					2	3		1
CO3				2					2	3		1
CO4									2	3		

3 – Substantial, 2 – Moderate, 1 – Slight

11MA301 ENGINEERING MATHEMATICS – III

(Common to all Engineering and Technology branches)

3 1 0 4

MODULE – I **15**

Fourier Series: Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Change of interval - Parseval's Identity - Harmonic analysis.

MODULE - II **15**

Partial Differential Equations: Formation – By elimination of arbitrary constants and arbitrary functions – Standard types– Lagrange's linear equation- Linear partial differential equations of second order with constant coefficients.

Applications of Partial Differential Equations: Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two-dimensional heat equation (Insulated edges excluded).

MODULE - III **15**

Fourier transform: Fourier integral theorem (Statement only) – Fourier transform pair – Properties – Transforms of simple functions – Sine and Cosine transforms – Convolution theorem and Parseval's identity (Statement only).

Z-transform: Elementary properties – Transforms of simple functions - Inverse Z – transform(Partial Fraction Method and Residue method) – Convolution theorem (Statement Only) – Solution of Difference Equations.

Lecture : 45, Tutorial : 15, TOTAL : 60

TEXT BOOKS

1. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics", Volume - III, S. Chand & Co, New Delhi, 2008.
2. Veerarajan, T., "Engineering Mathematics", Tata McGraw-Hill, New Delhi, Reprint 2010.

REFERENCE BOOKS

1. Grewal, B.S., "Higher Engineering Mathematics", Thirty Sixth Edition, Khanna Publishers, New Delhi, 2007.
2. Wylie, C. Ray and Barrett, Louis, C., "Advanced Engineering Mathematics", Sixth Edition, McGraw-Hill, New York, 2004.
3. Andrews, L. A. and Shivamoggi, B. K., "Integral Transforms for Engineers and Applied Mathematicians", Macmillan, New York, 2004.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: utilize Fourier series to solve engineering problems.

CO2: formulate and solve higher order partial differential equations.

CO3: interpret the basic knowledge of Fourier transforms and Z-transforms in engineering field.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3		1	2							1
CO2	3	3		2	2							1
CO3	3	3		1	2							1

3 – Substantial, 2 – Moderate, 1 – Slight

11EE301 ELECTRICAL MACHINES

(Common to Mechatronics, ECE, EIE and Chemical)

3 1 0 4

MODULE - I **15**

DC Machines: DC Generator: Constructional details – EMF equation – Methods of excitation – Self and separately excited generators – Characteristics of series, shunt and compound generators – Principle of operation of DC motor – Back emf and torque equation – Characteristics of series, shunt and compound motors - Starting of DC motors – Types of starters – Speed control of DC shunt motors- Applications.

MODULE –II **15**

Transformers: Construction – Principle of operation – EMF equation — Equivalent circuit – Transformer on load – Regulation Transformer Testing: Load test, open circuit and short circuit tests- Auto transformers.

Alternator: Construction of Synchronous Generators – Principles-EMF equation- Voltage regulation- EMF and MMF methods.

MODULE -III **15**

Induction Motors: Construction – Types – Principle of operation of three-phase induction motors –Starting and speed control – Single-phase induction motors - Applications.

Synchronous Motor: Construction-Principle- Methods of starting of synchronous motors

Electric Drives: Basic Elements of electric drive – Types of Electric Drives – factors influencing the choice of electrical drives –Classes of duty – Selection of motors for various industrial applications: Textile mills, Steel rolling mills, Cement mills, Machine tools.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOK

1. Theraja, B.L and Theraja, A.K., "A Text Book of Electrical Technology", Volume-II, S. Chand & Co, New Delhi, 2008.
2. Vedam Subramaniyam, "Electric Drives: Concepts and Applications", Tata McGraw-Hill, New Delhi, 2004.

REFERENCE BOOKS

1. Rajput, R. K., "Electrical Machines", Third Edition, Laxmi Publications (P) Ltd, New Delhi, 2002.
2. Kothari, D. P and Nagrath, I. J, "Basic Electrical Engineering", Second Edition, Tata McGraw-Hill, New Delhi, 2002.
3. Bhattacharya, S.K., "Electrical Machines", Second Edition, Tata McGraw-Hill, New Delhi, 1998.
4. Mittle, V.N. and Mittle, Aravinth., "Basic Electrical Engineering", Second Edition, Tata McGraw-Hill, New Delhi, 2007.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: interpret the construction, working principle, and applications of Electrical Machines

CO2: analyze the performance of the Electrical machines

CO3: choose the various electrical drives for industrial applications

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		3									1
CO2	3		3									1
CO3		3	3									1

3 – Substantial, 2 – Moderate, 1 – Slight

11ME301 ENGINEERING MECHANICS

(Common to Civil, Mechanical and Mechatronics Engineering)

3 1 0 4

MODULE – I **15**

Statics of Particles and Rigid Bodies: Introduction - Laws of Mechanics – Parallelogram and triangular Law of forces – Principle of transmissibility- Coplanar Forces – Resolution and Composition of forces -Free body diagram- Equilibrium of a particle- Forces in space -Vectorial representation of forces- Equilibrium of a particle in space. Moments – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar component of moments – Varignon's theorem– Equivalent systems of forces – Single equivalent force. Types of supports and their reactions – requirements of stable equilibrium – Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions – Simple Trusses, Types-Method of joints-Zero – force members, Method of sections- virtual work.

MODULE - II **15**

Friction: Surface Friction – Laws of dry friction – Sliding friction – Static and Kinetic friction–ladder friction – Wedge friction – Rolling resistance – Belt friction.

Properties of Surfaces and Solids: Determination of Areas and Volumes – First moment of area and the Centroid of sections – Rectangle, circle, triangle areas from integration – T section, I section, Angle section, Hollow section from primary simpler sections – second moments of plane area – Parallel axis theorem and Perpendicular axis theorem- Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow sections – Polar moment of inertia – Principle Moment of inertia of plane area-Principle axis of inertia- Mass moment of inertia – Derivation of mass moment of inertia for prism, cylinder and sphere from first principle – Relation to area moments of inertia.

MODULE - III **15**

Dynamics of Particles and Rigid Body: Rectilinear motion of particles - Relative motion – Curvilinear motion – Newton's law – Energy and momentum Equation of particles – Impulse – Impact of elastic bodies – Motion of connected particles. Kinematics of Rigid body, Kinetic equation of motion, Translation, Rotation about a fixed axis- General plane motion.

Lecture : 45, Tutorial : 15, TOTAL : 60

TEXT BOOKS

1. Rajasekaran, S, and Sankarasubramanian, G., "Fundamentals of Engineering Mechanics", Vikas Publishing House, New Delhi, 2008.
2. Beer, F. P and Johnson, E. R., "Vector Mechanics for Engineers- Statics and Dynamics", Eighth Edition, Tata McGraw-Hill, New Delhi, 2007.

REFERENCE BOOKS

1. Shames, Irving H., "Engineering Mechanics: Statics and Dynamics", Fourth Edition, Pearson Education Asia, Singapore, 2003.
2. Hibbeller, R. C., "Engineering Mechanics", Volume - I: Statics, Volume - II: Dynamics, Pearson Education Asia, Singapore, 2006.
3. Timoshenko, Stephen and Young, D. H., "Engineering Mechanics", Tata McGraw-Hill, New Delhi, 2006.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: analyze forces and their moments in terms of vector components and formulate static equilibrium equations for mechanical systems

CO2: predict the effect of dry friction for various applications

CO3: determine the centroid, centre of gravity and moment of inertia of geometrical shapes and solids respectively

CO4: apply different principles to study the motion of a body and develop their constitutive equations

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	3	2	2							2
CO2	3	3	3	2	2							2
CO3	3	3	3	2	2							2
CO4	3	3	3	2	2							2

3 – Substantial, 2 – Moderate, 1 – Slight

11ME403 KINEMATICS OF MACHINERY

(Common to Mechanical and Mechatronics Engineering)

3 1 0 4

MODULE – I **15**

Basics of Mechanisms and Synthesis: Terminology and Definitions –Kinematics of Links, Pairs and Chains -Degree of Freedom Mobility-Kutzbach criterion-Grashoff's law-Kinematic Inversions of 4-bar chain and slider crank chains-Mechanical Advantage-Transmission angle-Description of common Mechanisms-Single, double and offset slider mechanisms - Quick return mechanisms. Straight line generators-Design of Crank-rocker Mechanisms. Displacement, velocity and acceleration - analysis in simple mechanisms - Graphical Method velocity and acceleration polygons kinematic analysis of simple mechanisms- Displacement, velocity and acceleration –instantaneous centre method Coincident points – Introduction - Coriolis component.

MODULE - II **15**

Kinematics of CAM: Classifications - Terminology-Displacement , Velocity and acceleration diagrams-Uniform Velocity, Simple harmonic, Uniform acceleration retardation and Cycloidal motions - Layout of plate cam profiles - Derivatives of Follower motion - High speed cams - circular arc and tangent cams - Standard cam motion - Pressure angle and undercutting.

MODULE - III **15**

Kinematics of Gears and Gear Trains: Spur gear Terminology and definitions-Gear materials-Fundamental Law of toothed gearing and involute gearing-Length of arc of contact and approach-Length of path of contact-Inter changeable gears-gear tooth action – Terminology - Interference and undercutting-Non standard gear teeth- Basics of Helical, Bevel, Worm, Rack and Pinion gears. Gear trains-Parallel axis gear trains -Epicyclic gear trains-velocity ratio-Differentials-Applications

Lecture : 45, Tutorial : 15, TOTAL : 60

TEXT BOOKS

1. Rattan, S. S., “Theory of Machines” Third Edition, Tata McGraw-Hill, New Delhi, 2009.
2. Shigley, J. E and Uicker, J. J., “Theory of Machines and Mechanisms”, Third Edition, McGraw-Hill, New York, 2006.

REFERENCE BOOKS

1. R.S.Khurmi, J.K.Gupta, “Theory of Machimes”, S.Chand & Co., New Delhi, 14th Edition.
2. Rao, J. S and Dukkipati, R. V., “Mechanism and Machine Theory”, Wiley Eastern Limited, New Delhi, 1992.
3. Bevan, Thomas, “Theory of Machines”, C B S Publishers & Distributors, New Delhi, 2003
4. Ballaney P L, “Theory of Machines”, Khanna Publishers, New delhi, 2003.
5. Ghosh A, Mallik AK, “Theory of Mechanisms & Machines”, Third Edition, Affiliated Est -West Press Pvt Limited, 2000.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: classify the different types of mechanisms and analyze its velocity and acceleration

CO2: assess the displacement, velocity and acceleration of CAM mechanisms with various motions and develop the CAM profile

CO3: perceive the nomenclature of various gears and estimate the speed and torque in various gear trains

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	3	3								2
CO2	3	3	3	3								2
CO3	3	3	3	3								2

3 – Substantial, 2 – Moderate, 1 – Slight

11MT301 ELECTRON DEVICES AND DIGITAL CIRCUITS

3 1 0 4

MODULE-I **15**

Semiconductor Devices : Conductors, Semiconductors and Insulators – Properties of Semiconductors – PN Junction Diode - Rectifiers and Filters - Zener Diodes – Zener Diode Voltage Regulator– LEDs. Junction Transistors: Principle of Operation – CE,CB and CC Configurations – Static Characteristics – CE Transistor as an Amplifier - Construction and characteristics of FET.

MODULE – II **15**

Boolean Algebra and Combinational Circuits: Number systems – Complements – Boolean postulates and laws – De-Morgan's Theorem - Minimization of Boolean expressions – Canonical forms – Minimization: Karnaugh map, Tabulation Method - Don't care conditions. Logic Gates - Implementations of Logic Functions using gates, NAND – NOR implementations – Adder – Subtractor – Multiplexer – Demultiplexer - Encoder / Decoder – Parity generator and checker - Shift register.

MODULE - III **15**

Sequential Circuits

Synchronous Sequential Circuits: RS, JK, JKMS, D and T Flip flops - Excitation tables –Realization of one flip flop using other flip flops – Analysis and design of sequential circuits with state diagram, State table, State minimization and State assignment - Design of Synchronous and asynchronous counters.

Asynchronous sequential Circuits: Design of fundamental mode and pulse mode circuits – primitive state / flow table – Minimization of primitive state table – State assignment – Excitation table - Cycles – Races – Hazards.

Lecture : 45, Tutorial : 15, TOTAL : 60

TEXT BOOKS

1. Millman, Jacob and Halkias, Christos C., "Electronic Devices and Circuits", Tata McGraw-Hill, New Delhi, 2003.
2. Morris Mano, M, "Digital Design", Third Edition, Prentice Hall of India, New Delhi, 2003.
3. Roth. Charles H., "Fundamentals of Logic Design", Thomson Publication, New Delhi, 2003.

REFERENCE BOOKS

1. Floyd, "Electronic Devices", Sixth Edition, Pearson Education, New Delhi, 2003.
2. Bell, David A., "Electronic Devices and Circuits", Fourth Edition, Prentice Hall of India, New Delhi, 2003.
3. Givone, Donald D., "Digital Principles and Design", Tata McGraw-Hill, New Delhi, 2003.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: interpret the basic characteristics of semiconductor devices and its application

CO2: analyze the boolean functions and implementation using logics gates

CO3: design combinational and sequential circuits

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		3	2	2							2
CO2	3		3	2	2							2
CO3	3		3	2	2							2

3 – Substantial, 2 – Moderate, 1 – Slight

11MT302 MANUFACTURING PROCESSES

3 0 0 3

MODULE – I **12**

Foundry and Forming Technology: Pattern and Core making: Pattern types, allowances, types of cores, core print - Moulding sand: types, properties, green sand moulding - Melting furnaces: Induction furnaces , CO_2 process, Centrifugal Castings, Shell Casing, Investment Casting, Die casting, V Process, Defects in casting. Hot working and cold working - Rolling: Introduction, Rolling Mills, Rolling Operations, Production of Seamless Tubing and Pipes. Forging: Introduction, Forging Operations, Drop forging - Extrusion and Drawing: Introduction, Hot and Cold, Hydrostatic Extrusion, Wire Drawing Process, Sheet metal working – Operations – Blanking and punching dies - Deep drawing.

MODULE - II **18**

Principles of Metal Joining Processes: Classification of Welding Process. Fusion Welding: Gas welding, Arc Welding, Gas Tungsten Arc welding, Gas Metal Arc Welding, Electron Beam Welding, Laser Beam Welding, Solid State Welding: Cold Welding, Ultrasonic Welding, Friction Welding, Resistance Welding and Explosive Welding, Friction Stir Welding, Brazing and Soldering - Principles and applications.

MODULE – III **15**

Material – Removal Processes: Lathe: types, main parts and Lathe Operations, Drilling Machines - Types, operations - Reaming and Reamers - Tapping and Tap Cutting Tools: Tool materials, single point tool nomenclature, twist drill nomenclature, cutting fluids – Properties, types – Disposal of swarf. Milling Machines and Operations, Planning and Shaping, Broaching, Grinding Process – Types, abrasives, grinding wheel specifications Finishing Operations – Lapping, Honing and super finishing.

TOTAL: 45

TEXT BOOKS

1. Kalpakjian, S., “Manufacturing Engineering and Technology”, Fourth edition, Pearson education India, New Delhi, 2009.
2. Hajra Choudhury, S. K. and Hajra Choudhury, A. K., “Elements of Workshop Technology”, Fourteenth edition, Volume I and II, Media Promoters and Publishers, Mumbai, 2009.

REFERENCE BOOKS

1. Sharma, P. C., “A Textbook of Production Technology”, S. Chand and Co. Ltd., 2006.
2. Paul Degarma, E., Black, J. T. and Ronald A. Kosher, “Materials and Processes in Manufacturing”, Eighth edition, Prentice Hall of India, New Delhi, 1997.
3. Boothroyd, G. and Knight, W. A., “Fundamentals of Machining and Machine Tools”, Marcel Dekker, New York, 2005.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: perceive various foundry techniques like pattern making, molding, casting, melting furnaces and inspection

CO2: apply different forming processes involving bulk forming and sheet metal operations

CO3: choose the metal joining processes like welding, brazing and soldering for a particular product

CO4: recommend different material removal and finishing processes for product development

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3					2	2					2
CO2	3					2	2					2
CO3	3					2	2					2
CO4	3					2	2					2

3 – Substantial, 2 – Moderate, 1 – Slight

11EE304 ELECTRICAL MACHINES LABORATORY

(Common to Mechatronics, Chemical and EIE branches)

0 0 3 1

LIST OF EXPERIMENTS

1. Open circuit and load characteristics of separately excited and self excited DC generator.
2. Load test on DC shunt motor.
3. Load test on DC series motor.
4. Swinburne's test.
5. Speed control of DC shunt motor.
6. Load test on single phase transformer.
7. Open circuit and short circuit test on single phase transformer.
8. Regulation of three phase alternator by EMF and MMF methods.
9. Load test on three phase induction motor.
10. Load test on single phase induction motor.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: experiment with different electrical machines and transformers

CO2: analyze the performance of the Electrical machines

CO3: apply the different speed control methods for DC motor

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3			3					2	1		
CO2	3			3					2	1		
CO3	3			3					2	1		

3 – Substantial, 2 – Moderate, 1 – Slight

11MT303 ELECTRON DEVICES AND DIGITAL CIRCUITS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

1. Characteristics of semiconductor diode and zener diode.
2. Input and output characteristics of transistor under CE configuration.
3. Drain characteristics of FET.
4. Characteristics of LED.
5. Halfwave and Fullwave circuits.
6. Bridge rectifier circuits.
7. Verification of Boolean theorems using digital logic gates.
8. Design and implementation of binary adder and subtractor.
9. Design and implementation of multiplexer and de-multiplexer.
10. Design and implementation of encoder and decoder.
11. Design and implementation of shift register.
12. Design and implementation of counters.

TOTAL: 45

REFERENCES:

- Laboratory manual

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: analyze the characteristics of semiconductor devices and its application

CO2: build the boolean function using logic gates

CO3: design and implementation of combinational and sequential circuits

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		2	3	2				3	1		
CO2	3		2	3	2				3	1		
CO3	3		2	3	2				3	1		

3 – Substantial, 2 – Moderate, 1 – Slight

11MT304 MANUFACTURING PROCESSES LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

1. Exercises using Lathe - Taper turning, Thread Cutting, Eccentric Turning, Knurling
2. Exercises using Drilling machine- Drilling, Reaming and Tapping
3. Exercises using Milling machine –Spur gear cutting
4. Exercises using Shaper/planner Machine – Cutting Key ways
5. Exercises using grinding machine – Cylindrical grinding and Surface grinding
6. Exercises on Mould with solid, Split patterns
7. Exercises on TIG Welding

TOTAL: 45

REFERENCES

1.Laboratory manual
2. Hajra Choudhury, S. K. and Hajra Choudhury, A. K., "Elements of Workshop Technology", Fourteenth edition, Volume I and II, Media Promoters and Publishers, Mumbai, 2009.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: experiment with various machine tools for metal removal process

CO2: develop sand molds using standard patterns

CO3: create weldments using TIG/MIG welding

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1			2	3		3	2		3	2		2
CO2			2	3		3	2		3	2		2
CO3			2	3		3	2		3	2		2

3 – Substantial, 2 – Moderate, 1 – Slight

11MA401 NUMERICAL METHODS

(Common to all Engineering and Technology branches except ECE & CSE)

3 1 0 4

MODULE - I **15**

Linear Algebraic Equations: Method of false position - Newton's method - Solution of linear system of equations by Gaussian elimination and Gauss - Jordan methods – Iterative methods: Gauss Jacobi and Gauss – Seidel methods.

Interpolation: Newton's forward and backward difference formulae – Bessel's formula - Lagrange's interpolation formula - Newton's divided difference formula.

MODULE - II **15**

Numerical Differentiation: Differentiation Using Newton's forward , backward and divided difference interpolation formula - Single step Methods - Taylor Series, Euler and Modified Euler methods - Fourth order Runge-Kutta method for solving first order equations - Multistep methods – Milne's and Adam's predictor and corrector methods.

Numerical Integration: Trapezoidal rule – Simpson's 1/3 – Double integrals using Trapezoidal and Simpson's rules.

MODULE - III **15**

Boundary Value Problems in PDE: Finite difference approximations to partial derivatives - Two dimensional Laplace equations - Poisson equations – One dimensional heat equation by implicit and explicit methods – One dimensional wave equation.

Lecturer: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS

1. Kandasamy, P., Thilakavathy, K. and Gunavathy, K., "Numerical Methods", S.Chand & Co, New Delhi, reprint 2010.
2. Venkatraman, M. K, "Numerical Methods", National Publishing Company, Chennai, 2000.

REFERENCE BOOKS

1. Balagurusamy, E., "Numerical Methods", Tata McGraw-Hill, New Delhi, 1999.
2. Jain, M. K., Iyengar, S. R. K. and Jain, R. K., "Numerical Methods for Scientific and Engineering Computation", Fourth Edition, New Age International (P) Ltd., New Delhi, 2006.
3. Sankara Rao, K., "Numerical Methods for Scientists and Engineers", Second Edition, Prentice Hall India, New Delhi, 2004.
4. Thangaraj, P, "Computer – Oriented Numerical Methods", Prentice Hall of India, New Delhi, 2008.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: discuss the various methods of solving linear algebraic and transcendental equations.

CO2: estimate the intermediate values using interpolation concepts.

CO3: interpret the knowledge of numerical differentiations and integration

CO4: apply various numerical techniques in solving complex partial differential equations.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3		1	2							1
CO2	3	3										1
CO3	3	3		1	2							1
CO4	3	3		1	2							1

3 – Substantial, 2 – Moderate, 1 – Slight

11EE503 CONTROL SYSTEMS

(Common to Mechatronics, ECE, EEE and EIE)

3 1 0 4

MODULE-I **15**

System Representation: Basic elements in control systems – Open and closed loop systems – Modeling of Electrical and mechanical systems – Electrical analogy of mechanical systems – Transfer function – Synchros – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs – Masons gain formula.

Introduction to state space analysis – canonical form and companion forms.

MODULE – II **15**

Time Response and Stability Analysis: Time response – Time domain specifications – Types of test input – First and Second order system response – Error coefficients – Steady state error- Generalized error series –effect of P, PI, PID controllers on time response.

Characteristics equation – Location of roots in S plane for stability – Routh Hurwitz criterion – Root locus construction – Effect of poles and zeros on system stability.

MODULE – III **15**

Frequency Response and Compensator Design: Frequency response – Bode plot – Polar plot – Constant M an N circles – Nichols chart – Determination of closed loop response from open loop response – Correlation between frequency domain and time domain specifications– stability via gain margin and phase margin - Nyquist stability criterion- Need for compensators - Compensators design - Lag, lead and lag-lead compensator design using bode plot.

Lecture : 45, Tutorial : 15, TOTAL : 60

TEXT BOOKS

1. Gopal, M., "Control Systems: Principles and Design", Third Edition, Tata McGraw- Hill, New Delhi, 2008.
2. Ogata K., "Modern Control Engineering", Fourth Edition, Pearson Education/ PHI, New Delhi, 2007.

REFERENCE BOOKS

1. Nagrath I.J. and Gopal M., "Control Systems Engineering", Fifth Edition, New Age International Publishers, New Delhi, 2008.
2. Kuo, B.C., "Automatic Control Systems", Eighth Edition, John Wiley & Sons, New York, 2003.
3. Nise, Norman S., "Control Systems Engineering", Fifth Edition, Wiley Publishers, 2007.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: develop the mathematical model of an electrical and mechanical system

CO2: analyze the time response, frequency response and stability of the system

CO3: design the controller and compensator to meet the system requirements

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	3		2							1
CO2	3		3		2							1
CO3	3		3		2							1

3 – Substantial, 2 – Moderate, 1 – Slight

11ME401 STRENGTH OF MATERIALS

(Common to Mechanical and Mechatronics)

3 1 0 4

MODULE – I **15**

Stress, Strain, and Deformation of Solids Analysis of State of Stress: Rigid and deformable bodies- Stability, Strength and Stiffness- Tensile, compressive and shear stresses, strain. Poisson's ratio - lateral stress. Deformation of simple and compound bars- Relation between elastic constants- Thermal stresses- Strain Energy in uniaxial loads- gradually applied load, suddenly applied load and impact load.

Biaxial state of stress- thin cylinders and shells- Deformation in thin cylinders and spherical shells- Thick cylinders, Lame' s equation- compounding of thick cylinders-Biaxial stresses at a point- stresses on inclined planes- principal planes and stresses- Mohr's circle for biaxial stress. Maximum shear stress.

MODULE - II **15**

Transverse Loading on Beams, Stresses in Beams and Deflection of Beams: Beams – types and transverse loading on beams-shear force and bending moment in beams- cantilevers, simply supported and overhanging beams-Point of contraflextures. Theory of simple bending – analysis of stress-load carrying capacity .Stress distribution of simple beams – circular, rectangular, 'I' section, 'T' section and channel sections.

Elastic curve of neutral axis of the beam under normal loads – Evaluation of beam deflection and slope. Double integration method- Macaulay's method- Area moment theorems for computation of slopes and deflection in beams.

MODULE - III **15**

Columns and Torsion on Circular Shafts: Columns: End condition- Equivalent length of column – Eulers's equation – Slenderness ratio – Rankine formula for columns.

Torsion – circular shaft- Shear stress distribution- hollow and solid circular section. Torsional rigidity- stepped shaft – Twist and torsional stiffness-compound shafts-shafts fixed at both ends and simply supported. Torsion on springs – Whal's factor of springs stresses in helical springs under torsion loads-stiffness and deflection of springs under axial load.

Lecture : 45, Tutorial : 15, TOTAL : 60

TEXT BOOKS

1. Rajput, R.K., "Strength of Materials", S.Chand & Co, New Delhi, 2007.
2. Popov, E.P., "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, 2006.

REFERENCE BOOKS

1. Timoshenko, S.P., "Elements of Strength of Materials", Tata McGraw-Hill, New Delhi, 2006.
2. Sadhu Singh, "Strength of Materials", Khanna Publishers, New Delhi, 2006.
3. Beer F. P. and Johnson R, "Mechanics of Materials", Third Edition, McGraw-Hill Book Co, 2002.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: examine stress and strain relationship for simple and compound bars

CO2: evaluate biaxial stresses and deformations of thin, thick cylinders and spherical shells

CO3: construct shear force and bending moment diagrams to predict the bending stresses, shearing stresses and deflections of beams

CO4: estimate strengths of columns, springs and shafts

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	3	3	2							2
CO2	3	3	3	3								2
CO3	3	3	3	3	2							2
CO4	3	3	3	3								2

3 – Substantial, 2 – Moderate, 1 – Slight

11ME303 FLUID MECHANICS AND MACHINERY

(Common to Mechanical and Mechatronics)

3 1 0 4

MODULE – I **15**

Basic Concepts and Fluid Kinematics: Properties of fluids – Classification of fluids- Fluid statics: concept of fluid static pressure- pressure measurement by manometers- Buoyancy and equilibrium of floating bodies

Fluid Kinematics - Lines of flow - Types of flow - Velocity field and acceleration - continuity equation - control volume analysis of mass - Equation of streamline - stream function – velocity potential function – Introduction to flow visualization techniques

MODULE – II **15**

Fluid Dynamics and Viscous Flow: Fluid dynamics - Equations of motion - Euler's equation along a streamline - Bernoulli's equation – applications - Venturi meter, Orifice meter, Pitot tube - Dimensional analysis - Buckingham's π theorem- applications - similarity laws and models

Viscous flow - Shear stress, pressure gradient relationship - laminar flow between parallel plates and circular tubes – Hydraulic and energy gradient – flow through pipes - Darcy weisback's equation – pipe roughness friction factor- minor losses - flow through pipes in series and in parallel - power transmission- Boundary layer flows, boundary layer thickness, boundary layer separation - drag and lift coefficients.

MODULE – III **15**

Fluid Machines: Impact force – work done – Efficiency on stationary, moving flat and curved vanes due to moving water jet - Euler's equation for turbo machines - Construction of velocity vector diagrams - head and specific work components of energy transfer - degree of reaction- Pelton wheel – Francis turbine - Kaplan turbine - working principles - velocity triangles - work done.

Centrifugal pump: classifications, working principle, velocity triangles, Work done - Reciprocating pump: classification, working principle, Basic principles of indicator diagram – Work saved by air vessels and performance curves - cavitations in pumps -working principles of gear ,vane and Monobloc pumps

Lecture : 45, Tutorial : 15, TOTAL : 60

TEXT BOOKS

1. Cengel, Yunus A. and Cimbala, John M., "Fluid Mechanics", Tata McGraw- Hill, New Delhi, 2nd Edition, 2010.

REFERENCE BOOKS

1. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", Fifth Edition, Laxmi publications, New Delhi, 2010
2. Som, S.K. and Biswas, G., "Introduction to Fluid Mechanics and Fluid Machines", Second Edition, Tata McGraw-Hill, New Delhi, 2nd Edition, 2007.
3. Kumar, K.L., "Engineering Fluid Mechanics", Seventh Edition, Eurasia Publishing House, New Delhi, 2005.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: recognize the type of fluid flow and its properties occurring in a particular physical system and analyse the problems in static and kinematic state

CO2: apply fundamental knowledge of mathematics to model and analyze the fluid flow problems in dynamic state

CO3: infer the working of various pumps, turbines and analyze the performance of various fluid machines

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	2	3								2
CO2	3	3	3	3								2
CO3	3	2	3	3								2

3 – Substantial, 2 – Moderate, 1 – Slight

11ME502 DYNAMICS OF MACHINERY

(Common to Mechanical and Mechatronics)

3 1 0 4

MODULE - I **15**

Force Analysis and Balancing of Masses: Static Force Analysis - Free body diagrams - conditions of two, three and four force members. Inertia forces and D'Alembert's principle- - Crank shaft Torque Analysis - Fly wheels- turning moment diagrams and fluctuation of energy of reciprocating engine mechanisms, coefficient of fluctuation of energy and speed, weight of flywheel required. Static and dynamic balancing - Balancing of rotating masses - Balancing a single cylinder Engine - Balancing Multi-cylinder Engines - Partial balancing in locomotive Engines – Introduction to Balancing of radial engine – Direct and reverse crank method.

MODULE - II **15**

Free and Forced Vibration: Basic features of vibratory systems- types- Single degree of freedom system- Transverse vibration of beams- Natural frequency by energy method, Dunkerly's method-Critical speed-damped free vibration of single degree freedom system-Types of damping- free vibration with viscous damping, Critically damped system, under damped system. Torsional systems; Natural frequency of two and three rotor systems. Response to periodic forcing - Harmonic Forcing - Forcing caused by unbalance - Support motion-Logarithmic decrement-magnification factor – Force transmissibility and amplitude transmissibility - Vibration isolation.

MODULE - III **15**

Vibration Measurements, Governors and Gyroscopic: Vibration Measurement Scheme – Transducers - Different types of Pickups - Exciters, Frequency Measurement Instruments - FFT Spectrum Analyzer - Introduction to vibration monitoring techniques.

Governors - Types - Centrifugal governors - Gravity controlled and spring controlled centrifugal governors – Characteristics - Effect of friction - Controlling Force - other Governor mechanisms. Gyroscopes - Gyroscopic forces and Torques - Gyroscopic stabilization - Gyroscopic effects in Automobiles, ships and airplanes

Lecture: 45, Tutorial: 15 TOTAL: 60

TEXT BOOKS

1 Rattan, S.S.," Theory of Machines", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2008.
2 Abdul Sheffif," Theory of Machines", Dhanpat Rai Sons., New Delhi, 1987.

REFERENCE BOOKS

1 Bevan, Thomas, "Theory of Machines", CBS Publishers and Distributors, New Delhi, 2002.
2 Shigley J.E. and Uicker J.J., "Theory of Machines and Mechanisms", McGraw-Hill, New York, 2006.
3 Meirovitch, "Elements of Mechanical Vibrations", Tata McGraw Hill
4 Rao S. S. "Mechanical Vibrations ", 4th Edition, Pearson Education Pte. Ltd..

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: estimate inertia force, torque for reciprocating mechanisms and parameters of flywheel

CO2: analyze the static and dynamic unbalance of revolving and reciprocating masses

CO3: determine the natural frequencies of free and forced vibration and infer various vibration measurement techniques

CO4: evaluate the characteristics of different types of governors

CO5: construct the effect of reactive gyroscopic couple and evaluate the couple

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	3	2	2							2
CO2	3	3	3	2	2							2
CO3	3	3	3	2	2							2
CO4	3	3	3	2	2							2
CO5	3	3	3	2	2							2

3 – Substantial, 2 – Moderate, 1 – Slight

11MT401 SENSORS AND SIGNAL PROCESSING

3 0 0 3

MODULE - I **15**

Basic Measurement Systems: Functional elements of a Measurement System - Methods of Measurement - Classification of Instruments – Measurement system Errors - Static and dynamic characteristics of transducers – Generalized Performance of Zero Order and First Order Systems - Classification of transducers – Temperature Measurement: Filled system thermometer – Bimetallic thermometer – Pressure Transducers: Elastic transducers – Bourdon gauge – Bellows – Diaphragm. Vacuum: McLeod gauge, thermal conductivity gauge – Ionization gauge.

MODULE - II **15**

Electrical Measurements: Flow measurement: turbine flow meter, Electromagnetic flow meter - Hot wire anemometer – Ultrasonic Meter - Resistive transducers – Potentiometer - RTD – Thermistor – Thermocouple – Radiation Pyrometer - Strain gauges - Force measurement – Inductive transducer – LVDT – RVDT – Capacitive transducer – Piezo electric transducer – Vibration transducers - Digital displacement transducers.

MODULE - III **15**

Miscellaneous Measurements and Signal Processing: Measurement of Torque, Humidity, Sound and Level - Radiation sensor - Wireless sensors - Applications - Automobile, Aerospace, Home appliances, Manufacturing, Medical diagnostics, Environmental monitoring – Signal Conditioning – Amplification, Filtering, A/D & D/A converters and Sample and Hold circuit – Data Acquisition – Data logging.

TOTAL: 45

TEXT BOOKS

1. Doebelin, E. O., "Measurement Systems: Applications and Design", Tata McGraw Hill, 2004.
2. Sawhney, A. K., "A Course in Electrical and Electronic Measurement and Instrumentation", Dhanpat Rai & Co, New Delhi, 2004.

REFERENCE BOOKS

1. Beckwith, Marangoni and Lienhard, "Mechanical Measurements", Fifth Edition, Addison – Wesley, New York, 2006.
2. Roy Choudhury, D. and Jain, Sheil, "Linear Integrated Circuits", New Age International Pvt. Ltd., New Delhi, 2003.
3. Patranabis, D., "Sensors and Transducers", Second Edition, Prentice Hall of India, New Delhi, 2009.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: perceive the basic concepts of measurement system

CO2: maximize the knowledge of various electrical transducers for measurement

CO3: interpret the importance of sensors in various applications by realizing the signal processing concepts

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		3									2
CO2	3		3									2
CO3	3		3									2

3 – Substantial, 2 – Moderate, 1 – Slight

11ME305 FLUID MECHANICS AND MACHINERY LABORATORY

(Common to Civil, Mechanical and Mechatronics)

0 0 3 1

LIST OF EXPERIMENTS

1. Determination of co-efficient of discharge for venturimeter
2. Determination of co-efficient of discharge for orifice meter
3. Study on impact of jet on flat plate (normal / inclined)
4. Study on friction losses in pipes
5. Study on minor losses in pipes
6. Study on performance characteristics of Pelton turbine (constant head method)
7. Study on performance characteristics of Francis turbine (constant head method)
8. Study on performance characteristics of Kaplan turbine (constant head method)
9. Study on performance characteristics of Centrifugal pump
10. Study on performance characteristics of reciprocating pump.
11. Study on performance characteristics of submersible pump.
12. Study on performance characteristics of Jet pump.
13. Study on performance characteristics of Gear pump

REFERENCES / MANUALS / SOFTWARE:

1. Cengel, Yunus A. and Cimbala, John M., "Fluid Mechanics", Tata McGraw- Hill, New Delhi, 2nd Edition, 2010.
2. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", Fifth Edition, Laxmi publications, New Delhi, 2010.
3. Som, S.K. and Biswas, G., "Introduction to Fluid Mechanics and Fluid Machines", Second Edition, Tata McGraw-Hill, New Delhi, 2nd Edition, 2007.
4. Lab Manuals

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: compile empirical and experimental data of fluid flow through written and oral reports

CO2: determine the co-efficient of discharge and frictional losses in the pipe lines

CO3: analyze the performance and determine characteristics of different types of turbines and pumps

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3		3					2	2		2
CO2	3	3		3					2	2		2
CO3	3	3		3					2	2		2

3 – Substantial, 2 – Moderate, 1 – Slight

11MT402 SENSORS AND SIGNAL PROCESSING LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

1. Measurement of temperature using thermistor / RTD.
2. Measurement of temperature using thermocouple.
3. Measurement of displacement using POT, LVDT & Capacitive transducer.
4. Torque measurement using torque measuring devices.
5. Strain Measurement.
6. Force Measurement.
7. Flow measurement.
8. Pressure Measurement.
9. Level Measurement.
10. Speed Measurement.
11. A/D and D/A Converter.
12. Frequency to Voltage Converter.

TOTAL: 45

REFERENCES

1. Doebelin, E. O., "Measurement Systems: Applications and Design", Tata McGraw Hill, 2004.
2. Sawhney, A. K., "A Course in Electrical and Electronic Measurement and Instrumentation", Dhanpat Rai & Co, New Delhi, 2004.
3. Sensors and Signal processing Lab Manual.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: perform the measurements of different physical parameters

CO2: analyse the characteristics of various measurement system

CO3: disseminate the design concepts for signal processing circuits

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		2	3	1				3	1		
CO2	3		2	3	1				3	1		
CO3	3		2	3	1				3	1		

3 – Substantial, 2 – Moderate, 1 – Slight

11MT403 COMPUTER AIDED MACHINE DRAWING LABORATORY

0 0 3 1

LIST OF EXERCISES

(Use 2D & 3D Software package)

1. Introduction to Machine Drawing - Dimensioning, Sectional views, abbreviations and conventions, Welding symbols, surface finish symbols.
2. Study of Limits, Fits and tolerances.
3. Free hand sketching of Machine Elements - Keys, Pin joints, Fasteners, Hexagonal and Square Head Bolts and Nuts, Conventional representation of Threads.
4. Part and Assemble drawing of Joints.
5. Part and Assemble drawing of Couplings.
6. Part and Assemble drawing of Bearings.
7. Part and Assemble drawing of Valves.
8. Part and Assemble drawing of Machine Elements – Tail Stock, Screw Jack and Connecting Rod Assembly.

TOTAL: 45

REFERENCES

- Laboratory manual

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: interpret detailed and assembly drawings of various machine parts conforming to IS conventions

CO2: determine the limits, fits and tolerances of machine components

CO3: construct the technical drawings with exact dimensions in different sectional views

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1			3		3							2
CO2	2	2	3		3							2
CO3			3		3							2

3 – Substantial, 2 – Moderate, 1 – Slight

11EE504 MICROPROCESSORS AND MICROCONTROLLERS

(Common to EEE, EIE, CSE and Mechatronics branches)

3 0 0 3

MODULE– I **15**

8085 Micro processor: 8085 Architecture – Functional block diagram - Instruction set – Addressing modes – Timing diagrams – Reset and Power on Reset-Assembly language programming – Interrupts- Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface

MODULE– II **15**

89C51 Microcontroller: Introduction to RISC and CISC Machines -89C51 Micro controller hardware- Memory Bank-Memory mapping-Register organization-I/O pins – Ports and circuits- Counters and Timers-modes of operation-Serial Data communication I/O- Interrupts-Interfacing to external memory-Instruction sets-Addressing modes

MODULE-III **15**

89C51 Programming and Applications :Assembly language programming and Programming with C – Simple programming -I/O port programming -Timer and counter programming – Serial data Communication using max232 converter – Interrupt programming –89C51 Interfacing with Peripherals : LED-Seven segment display – Switch interfacing- LCD, Parallel Analog to Digital Converter- Sensors – Stepper Motors - Speed control of DC motors- Matrix Keyboard and Digital to Analog Converter .

TOTAL : 45

TEXT BOOKS

1. Gaonkar R.S, "Microprocessor Architecture, Programming, and Applications with the 8085", Fifth Edition, Prentice Hall of India, New Delhi, 2002.
2. Mazidi, Mohammed Ali, Mazidi, Janice Gillispie, McKinlay, Rolin.D "The 8051 Microcontroller and Embedded Systems", Pearson Education Asia, second edition, New Delhi, 2007.

REFERENCE BOOKS

1. Hall Douglas V, "Microprocessors and Interfacing Programming and Hardware", Tata McGraw Hill, 1995.
2. Ayala Kenneth J, "The 8051 Microcontroller Architecture Programming and Application", Second Edition, Penram International Publishers (India), New Delhi, 1996.
3. Kleitz. William, "Microprocessor and Microcontroller Fundamental of 8085 and 8051 Hardware and Software", Pearson Education, New Delhi, 1998.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: explain the basics concepts, special features and the interfacing techniques of 8085and 89C51

CO2: apply the Programming knowledge for real time applications

CO3: design an application specific Microcontroller system

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	2	3		2							2
CO2	3	2	3		2							2
CO3	3	2	3		2							2

3 – Substantial, 2 – Moderate, 1 – Slight

11MT501 DESIGN OF MECHANICAL SYSTEMS

3 1 0 4

MODULE – I **15**

Design Fundamentals and Design of Shafts Keys and Couplings: Design Process - Computer aided design - Optimum design – Material Standards - Industrial design form and shape design, embodiment design and design for manufacture (Qualitative treatment only) - Types of loads - Stresses - Static, varying, thermal, impact and residual - Factors of safety - Theories of failure – Stress concentration factors - S-N curves and its applications - Design of Solid and Hollow shafts – Based on strength, rigidity and deflection – Torsional rigidity – Lateral rigidity – Material constants - Design of Keys – Types – Keyways - Design of rigid and flexible couplings.

MODULE – II **15**

Gear and Gear Train Design: Principles of gear tooth action - Gear correction - Gear tooth failure modes - Stresses and loads – Design of spur, helical, bevel and worm gears – Design of speed reducers and multi speed gear trains – Gear backlash and its effect on machine performance – Gear materials – Heat treatment.

MODULE – III **15**

Design of Brakes, Clutches, Bearings and Springs: Brakes – Types – Dynamic and thermal aspects of Braking – Braking system in automobiles - Design of clutches – Single plate – Multi plate – Conical clutch – Over running clutch - Study of Bearings - Design of Bearings – Sliding contact – Rolling contact – Cubic mean load – Design of Journal Bearings – Calculation of Bearing dimensions – Design of Helical, Leaf springs – Types of springs – Wahl factor – Problems – Condition health monitoring of bearings.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS

1. Shigley, Joseph Edward and Mischke, Charles R., "Mechanical Engineering Design", Sixth Edition, McGraw-Hill International Edition, New York, 2008.
2. Bhandari.V.B., "Design of Machine Elements", Tata McGraw Hill, New Delhi, 2009.

REFERENCE BOOKS

1. Prabhu, T.J., "Design of Transmission Elements", T.J. Prabhu Publications, 2005.
2. Kulkarni, S.G., "Machine Design: Solved Problems", Tata McGraw-Hill, New Delhi, 2003.
3. Maitra, G. M. and Prasad, L N., "Hand Book of Mechanical Design", Second Edition, Tata McGraw-Hill, New Delhi, 2005.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: interpret, analyze and select mechanical components using design principles

CO2: design and analyze the shafts, keys and couplings

CO3: design the spur, helical, bevel, worm gear drives and multi speed gear box with proper assumptions

CO4: design and analyze the bearings, springs, clutches and braking systems with realistic constraints

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	3		2	3						2
CO2	3	3	3		2	3						2
CO3	3	3	3		2	3						2
CO4	3	3	3		2	3						2

3 – Substantial, 2 – Moderate, 1 – Slight

11MT502 THERMODYNAMICS AND HEAT TRANSFER

3 1 0 4

MODULE - I **15**

Basics of Thermodynamics

First Law of Thermodynamics: Thermodynamics – Microscopic and macroscopic point of view – Systems, properties, process, path, cycle – Units – Pressure, Temperature – Zeroth law. First law –Steady Flow Energy Equation- Application to closed and open systems, internal energy, specific heat capacities C_V and C_P – Enthalpy.

Second Law of Thermodynamics: Second Law of thermodynamics – Statements – Equivalents of Kelvin Planck and Clausius' statements. Reversibility – Irreversibility, reversible cycle – Carnot cycle and theorem. Clausius' theorem, the property of entropy, the inequality at Clausius – Entropy principle – Simple problems in entropy.

MODULE - II **16**

Internal Combustion Engines: Classification of IC engines - IC engine components and functions. Valve timing diagram and port timing diagram - Comparison of two stroke and four stroke engines. Fuel supply systems - Ignition Systems - Performance calculations. Comparison of petrol & diesel engine – Lubrication system - Cooling system. Exhaust gas analysis - Pollution control norms.

Refrigeration & Air conditioning: Principle of refrigeration - Refrigerants properties and selection - Components of refrigeration cycle. Heat pump and heat engine. Vapour compression refrigeration cycle - Vapour absorption refrigeration cycle. Comfort air-conditioning – Psychrometry - Psychrometric chart.

MODULE - III **14**

Heat Transfer: Basic Concepts – Mechanism of Heat Transfer – Conduction, Convection and Radiation. Differential equation of Heat Conduction – Fourier's Law of heat Conduction, Heat Transfer Coefficients – Boundary Layer Concept – Types of Convection – Free and Forced Convection, Types of Heat Exchangers. Laws of Radiation – Stefan Boltzman Law, Kirchoff's Law – Black Body Radiation – Grey body radiation.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS

1. Nag, P.K, "Engineering Thermodynamics", Third Edition, Tata McGraw-Hill, New Delhi, 2005.
2. Cengel, Yunus A. and Boles, Michael A., "Thermodynamics: An Engines Approach", Second Edition, McGraw-Hill, New York, 1994.

REFERENCE BOOKS

1. Kothandaraman, C.P., Domkundwar, S. and Domkundwar, A.V., "A Course in Thermal Engineering", Fifth Edition, Dhanpatrai & Co (P) Ltd, New Delhi, 2000.
2. Kothandaraman, C. P., "Heat and Mass Transfer", New Age International Publishers, New Delhi, 2002.
3. Holman, J. P., "Thermodynamics", Third Edition, Tata McGraw-Hill, New Delhi, 1995.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: utilize the basic concepts, first law, second law of thermodynamics and entropy

CO2: apply the thermodynamic relations in physical problems and infer psychrometric chart and solve the problems related to I.C.Engines, Refrigeration & Air conditioning

CO3: solve the problems which involves conduction, convection and radiation heat transfers

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	3									2
CO2	3	3	3									2
CO3	3	3	3									2

3 – Substantial, 2 – Moderate, 1 – Slight

11MT503 CNC TECHNOLOGY

(Common to Mechanical and Mechatronics Engineering branches)

3 0 0 3

MODULE – I **15**

Basic Concepts of CNC Machines: Introduction – classification – Construction details of CNC machines: Structure, Drives and Controls: Drive Mechanism, gearbox, Spindle Drives, Axes drives - Magnetic Levitation and Linear motors. Timing belts and pulleys, Spindle bearing – Arrangement and installation. Slide ways. Re-circulating ball screws – Backlash measurement and compensation, linear motion guide ways. Configuration of CNC system – Interfacing – Monitoring – Diagnostics – Machine data – Compensations for Machine accuracy – DNC – Adaptive control CNC systems.

MODULE – II **15**

Programming and Economics of CNC Machines: Part Program Terminology - G and M Codes – Types of interpolation Methods of CNC part programming – Manual part programming (Turning and Milling). Various programming techniques – APT programming for various machines in ISO and FANUC - CAM packages for CNC machines – Master CAM, Pro-Engineer, etc. Factors influencing selection of CNC Machines – Cost of operation of CNC Machines – Practical aspects of introducing CNC machines in industries – Maintenance features of CNC Machines – Preventive Maintenance, Other maintenance requirements.

MODULE – III **15**

Tooling For CNC Machines and Retrofitting: Interchangeable tooling system – Preset and qualified tools – coolant fed tooling system – Modular fixturing – Quick change tooling system – Automatic head changers – Tooling requirements for Turning and Machining centres – Tool holders – Tool assemblies – Tool Magazines – ATC Mechanisms – Tool management. Qualified and Preset tooling, Principles of location, clamping and work holding devices – Retrofitting-necessary for Retrofitting-Advantages.

TOTAL: 45

TEXT BOOKS

1. Radhakrishnan, P., "Computer Numerical Control Machines", New Central Book Agency, 2001.
2. Sehrawat, M.S. and Narang, J.S., "CNC Machines: Computer Numerical Control with Robotics", Dhanpat Rai and Sons, New Delhi, 2002.

REFERENCE BOOKS

1. HMT Limited, "Mechatronics", Tata McGraw-Hill, New Delhi, 2001.
2. Thyer, G.E., "Computer Numeric Control of Machine Tools", Second Edition, Butterworth-Heinemann, Burlington, 1996.
3. Adithan, M., and Pabla, B.S., "CNC Machines", Second Edition, New Age International (P) Limited, New Delhi,. 2008.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: dissect and elaborate the basic components involved in a CNC system

CO2: develop Part Programming for various machining process

CO3: estimate operation and maintenance cost of CNC machines

CO4: identify various CNC tooling systems and fixtures

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	2	3	3		3							2
CO2	2	3										2
CO3	2	3	3		3	3						2
CO4	2	3	2		3							2

3 – Substantial, 2 – Moderate, 1 – Slight

11MT504 ENGINEERING METROLOGY

3 0 0 3

MODULE - I **15**

Linear and Angular Measurements: Basic concept – Legal metrology- Precision- Accuracy- Types of errors – Standards of measurement- traceability – Interchange ability and selective assembly, Introduction to fits and tolerances, gauge blocks, limit gauges - Gauge design. Comparators: mechanical, electronic, optical and pneumatic - Angular measurement: bevel protractor - Angle gauges - Sine bar – Autocollimator - Profile projectors.

MODULE - II **15**

Surface Finish and Form Measurement: Measurement of surface finish: terminology – Roughness – Waviness – Evaluation of surface finish - Stylus probe instrument – Talysurf – Screw thread metrology: errors in thread – Pitch error – Measurement of various elements - Two and three wire method - Best wire size - Thread gauges - Floating carriage micrometer. Measurement of gears - Terminology- Measurement of various elements of gear - Tooth thickness - Constant chord and base tangent method - Parkinson Gear Tester.

MODULE - III **15**

Laser and Advances in Metrology: Principle of light wave interference – Optical flats – Flatness checking – Michelson and NPL flatness interferometer, Laser Metrology: LASER interferometer – Constructional features, sources of error, measurement of positional error, straightness and flatness of machine tools - LASER Alignment Telescope - LASER Micrometer – In process and On line measurement – Automatic gauging - Coordinate measuring machine (CMM): Types - Constructional features – Probes, applications, applications of machine vision in measurement.

TOTAL: 45

TEXT BOOKS

1. Jain, R.K., "Engineering Metrology", Khanna Publishers, New Delhi, 2008.
2. Doeblin, E.O., "Measurement System Applications and Design", Tata McGraw-Hill, New Delhi, 2008.

REFERENCE BOOKS

1. Connie Dotson et al., "Fundamentals of Dimensional metrology", Thomas Asia, Singapore, 2003.
2. Gupta, I.C., "A Text Book of Engineering Metrology", Dhanpat Rai & Sons, New Delhi, 2003.
3. Groover, M.P., "Automation, Production System and Computer Integrated Manufacturing", Prentice-Hall of India, New Delhi, 2003.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: apply various instruments for linear and angular measurements

CO2: determine surface roughness and form features

CO3: Summarize the applications of laser interferometry and infer recent advancements in metrology

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		3		2					2		2
CO2	3		3		2					2		2
CO3	3		3		2					2		2

3 – Substantial, 2 – Moderate, 1 – Slight

11MT505 VIRTUAL INSTRUMENTATION: THEORY AND APPLICATIONS

3 0 0 3

MODULE – I **14**

Virtual Instrumentation & Software: Historical perspective and traditional bench-top instruments - General functional description of a digital instrument - Block diagram of a Virtual Instrument – Physical quantities and analog interfaces - Hardware and Software – User Interfaces – Advantages of Virtual Instruments over conventional instruments – Architecture of a Virtual Instrument and its relation to the operating system. LabVIEW – Graphical user interfaces - Controls and Indicators – 'G' programming: Data types – Data flow programming.

MODULE – II **15**

VI Software Tools & Programming Techniques: Editing Debugging and Running a Virtual Instrument – Graphical programming palettes and tools – Front panel objects – Function and Libraries – VI and sub-VI, FOR Loops, WHILE loops, Shift Registers, CASE structure, Formula nodes –Sequence structures – Arrays and Clusters – Array operations – Bundle, Unbundle – Bundle/Unbundle by name, graphs and charts – String and file I/O – High level and Low level file I/Os – Attribute nodes- local and global variables.

MODULE – III **16**

Data Acquisition & Applications: Basics of DAQ Hardware and Software – Concepts of Data Acquisition and terminology – Installing Hardware, Installing drivers – Configuring the Hardware – addressing the hardware in LabVIEW – Digital and Analog I/O function – Buffered I/O – Real time Data Acquisition – USB based DAQ –Advantages and Applications – Advanced concepts in LabVIEW – TCP/IP VI's – PXI – Instrument Control, Development of process database management system – Computer based instruments – Image acquisition – Motion Control.

TOTAL: 45

TEXT BOOKS

1. Jeffery Travis and Jim kring, "LabVIEW for Everyone: Graphical programming made easy and Fun", Third Edition, Pearson Education, India, 2009.
2. Gupta, Joseph, John, "Virtual Instrumentation using LabVIEW", Second Edition, Tata McGraw Hill, 2010.

REFERENCE BOOKS

1. "LabVIEW Basics I and II Manual", National Instruments, 2005.
2. Paton, Barry, "Sensor, Transducers and LabVIEW", Prentice Hall, New Jersey, 2000.
3. Minura, Bruce, "LabVIEW for Data Acquisition", Prentice Hall, New Jersey, 2005.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: elaborate the fundamentals of Virtual Instrumentation

CO2: develop LabVIEW programming

CO3: perceive the knowledge of data acquisition system in real-time applications

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		2									2
CO2	2		3	2								2
CO3	3		3	2								2

3 – Substantial, 2 – Moderate, 1 – Slight

11EE506 MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

(common to Mechatronics, EEE, EIE and CSE branches)

0 0 3 1

LIST OF EXPERIMENTS

MICROPROCESSOR PROGRAMMING:

1. Study of 8085 Microprocessor Kits.
2. Arithmetic operations using 8085
3. Sorting of number series.
4. Code conversion
5. Arithmetic and geometrical series.
6. A/D and D/A conversions.

MICROCONTROLLER PROGRAMMING:

7. Study of 8051/8031 Microcontroller Kits.
8. Arithmetic functions using microcontroller 8051.
9. Logical operations.
10. Stepper motor control.
11. Interfacing of high power devices.
12. Hex code conversion using Keil compiler and burning into the microcontroller

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: evaluate programming skills in 8085 and 89C51

CO2: develop interfacing circuits with peripheral devices using 8085 and 89C51

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		3		3				3	1		
CO2	3		3		3				3	1		

3 – Substantial, 2 – Moderate, 1 – Slight

11MT506 CNC PROGRAMMING LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

1. Study of G codes and M codes for machining centre and turning centre.
2. Programming and machining of given component using HMT VMC 200T
3. Programming and machining of given component using HMT VMC T70
4. Programming and machining of given component using CNC Turning Centre.
5. Programming and machining of given component using CNC Turning Centre.
6. Programming and simulation of given component using MASTER CAM (Lathe)
7. CNC code generation of given component using MASTER CAM (Lathe) and interfacing it to CNC turning centre.
8. CNC code generation of given component using MASTER CAM (Lathe) and interfacing it to CNC turning centre.
9. Programming and machining of given component using CNC Machining Centre.
10. Programming and machining of given component using CNC Machining Centre.
11. Programming and simulation of given component using MASTER CAM (Milling)
12. CNC code generation of given component using MASTER CAM (Mill) and interfacing it to CNC Machining Centre.
13. CNC code generation of given component using MASTER CAM (Mill) and interfacing it to CNC Machining Centre.
14. CNC code generation of given component using Pro Manufacturing.

TOTAL: 45

REFERENCES

- Lab Manuals

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: develop, simulate and execute part program using CNC production and trainer machines

CO2: create simulation using CAM package and interface the developed program with the machine

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	2			2	3	2						2
CO2	2			2	3	2						2

3 – Substantial, 2 – Moderate, 1 – Slight

11MT507 VIRTUAL INSTRUMENTATION AND DATA ACQUISITION LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

1. Study on LabVIEW graphical programming environment.
2. Develop a graphical programming using Array, Cluster and structures.
3. Develop a graphical programming using Max and Min function operates with different data types and data representation.
4. Develop graphical program File Input / File Output function
   (a) Read from XML file (b) Write to the XML file
5. Develop a graphical program in SubVI's and property node operations.
6. Develop a graphical program for simulation of tank level process control.
7. Develop graphical program to transfer data between client and server using TCP/IP.
8. Develop a graphical program for real time interface with PID based Control of temperature system.
9. Develop a graphical program for real time interface with strain gauge and measure the applied strain.
10. Develop a graphical program for real time interface with flow measurement system.
11. Develop a graphical program for real time interface with vibration measurement system.
12. Develop a fuzzy controller using fuzzy logic toolbox.

TOTAL: 45

REFERENCES

1. Virtual Instrumentation and Data Acquisition Lab Manuals.
2. Jeffery Travis and Jim kring, "LabVIEW for Everyone: Graphical programming made easy and Fun", Third Edition, Pearson Education, India, 2009.
3. LabVIEW Basics I & II Manual, National instruments, India, 2005.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: examine the Virtual Instrumentation concepts and Data acquisition system

CO2: experiment LabVIEW programming techniques for real-time applications with data acquisition system

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		3		3					3		
CO2	3		3		3					3		

3 – Substantial, 2 – Moderate, 1 – Slight

11GE601 ECONOMICS AND MANAGEMENT FOR ENGINEERS

(Common to all Engineering and Technology branches)

3 0 0 3

MODULE – I **15**

Economics – Basics Concepts and Principles – Demand and Supply – Law of demand – Determinants of demand, Law of supply – market Equilibrium – National Income – Circular Flow of Economic activities and Income –National Income and its measurement techniques – Inflation – Causes of Inflation – Controlling Inflation –Business Cycle .

MODULE – II **15**

Forms of business – Management Functions: Planning, Organizing, Staffing, Leading and Controlling- Managerial Skills - Levels of Management - Roles of manager.

Marketing – Core Concepts of Marketing, Four P's of Marketing, New product development, Product Life Cycle, Pricing Strategies and Decisions. Operations Management – Resources – Site selection, Plant Layout, Steps in Production Planning and Control – EOQ Determination

MODULE – III **15**

Accounting Principles – Financial Statements and its uses – Time value of Money – Depreciation methods — Break Even Analysis – Capital budgeting techniques – Introduction to FDI, FII, Mergers & Acquisition.

TOTAL : 45

TEXT BOOK

1. Geetika, Plyali Ghosh, Purba Roy Choudhury, "Managerial Economics", 1st Edition, Tata McGraw-Hill, New Delhi, 2008.
2. Jeff Madura, "Fundamentals of Business", Cengage Learning Inc, India, 2007.

REFERENCE BOOKS

1. Stanley L. Brue and Campbell R Mcconnell, "Essentials of Economics", Tata McGraw-Hill, New Delhi, 2007.
2. S.P.Jain, K.L.Narang, Simi Agrawal, "Accounting for Management", First Edition, Tata McGraw-Hill, New Delhi, 2009

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: estimate market equilibrium and interpret national income calculation and inflation issues

CO2: categorize the forms of business and analyse the functions of management

CO3: appraise marketing and operations management decisions

CO4: interpret financial and accounting statements

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	1	1	2			3		2	2	2	3	2
CO2		1	2			2	2	2	2	2	3	2
CO3	1	2	1			2		2	2	2	3	2
CO4	2	2				2		2	2	2	3	2

3 – Substantial, 2 – Moderate, 1 – Slight

11EI601 PROCESS CONTROL

(Common to Mechatronics and EIE branches)

MODULE - I **15**

Process Control Modeling: Definition of industrial process and control- Automatic process control- Need for process control in industry –Process control systems: level, pressure, flow and thermal. Mathematical model of systems –Dynamic behavior of higher order processes – Interacting and non-interacting systems – Continuous and batch processes – Self-regulation – Servo and regulator operations.

MODULE - II **15**

Controller Characteristics ,Tuning and Multiple Loops: Basic control actions – Characteristics of on-off, proportional, single-speed floating, Integral and Derivative control modes – P+I, P+D and P+I+D control modes – Electronic controllers. Evaluation criteria: IAE, ISE, ITAE and ¼ decay ratio. Tuning of controllers: Process reaction curve method – Ziegler Nichols method – Damped oscillation method. Feed forward control – Ratio control – Cascade control – Inferential control – Split range control – Selective control systems - Adaptive control – Introduction to multivariable control.

MODULE - III **15**

Final Control Elements and Unit Operations: I/P converter – Pneumatic and electric actuators – Valve positioner – Control valves – Characteristics of control valves: Inherent and Installed characteristics. Valve body – Commercial valve bodies – Control valve sizing – Cavitation and flashing – Selection criteria. Mixing – Evaporation and control – Drying process – Heat Exchanger - Distillation processes - Case study of binary distillation column – Control schemes..

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS

1. Krishnaswamy K., "Process Control", New Age International Publishers, New Delhi, 2006.
2. Stephanopoulos, G, "Chemical Process Control", Prentice Hall of India, New Delhi, 1990.

REFERENCE BOOKS

1. Eckman, Donald. P., "Automatic Process Control", Wiley Eastern Ltd., New Delhi, 1967
2. Seborg, Dale E., Edgar, Thomas F., and Mellichamp, Duncan A., "Process Dynamics and Control", Wiley Series Edition, New Delhi, 2004.
3. Harriott, P., "Process Control", Tata McGraw-Hill Publishing Co., New Delhi, 1991.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: develop the system dynamics for different processes

CO2: dissect the detailed concept behind the controller action, tuning and advanced control technique

CO3: perceive knowledge of control valves and advanced control techniques for different applications

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3			2							2
CO2	3	3	3		2							2
CO3	3		3									2

3 – Substantial, 2 – Moderate, 1 – Slight

11ME604 FLUID POWER SYSTEM

(Common to Mechanical and Mechatronics Engineering)

3 0 0 3

MODULE – I **16**

Fundamentals of Hydraulic System: Basics of fluid power system – Advantages of Fluid power systems – Fluid properties – Pascal's Law and applications – Fluid power symbols – Hydraulic pumps – Gear, Vane and Piston pumps, Sizing of Pumps, Pump Performance, Characteristics and Selection. Control valves – Direction control valves – Three way valve, Four way valve, Check valve and shuttle valve – Actuation mechanism – Pressure control valves – Pressure relief, Pressure Reducing, Counter balance, Sequencing and Unloading Valves – Flow control valves – Types – Proportional Valves – Servo valves.

MODULE – II **14**

Fundamentals of Pneumatic System: The perfect Gas laws – Compressors – Piston, screw and vane compressor – Fluid conditioning Elements – Filter, Regulator and Lubricator unit, Pneumatic silencers, Aftercoolers, Air dryers – Air control valves – Fluid power actuators – Cylinders and Motors – Types – Cushioning mechanism – Sizing of Actuators – Basic pneumatic circuits – Electrical controls for Fluid power circuits – Introduction to Fluid logic devices and applications – PLC applications in Fluid power circuit.

MODULE – III **15**

Industrial Circuits and Maintenance of Fluid Power System: Circuit design methodology – Cascade method – Industrial circuits – Speed control circuits – Regenerative cylinder circuits – Pump unloading circuit – Double pump circuit – Counter balance valve circuit – Hydraulic cylinder sequencing circuit (using pressure sequence valve) – Automatic cylinder reciprocating circuit – Cylinder synchronizing circuits – Fail safe circuits – Accumulator – Types and application circuits – Pressure intensifier circuits – Sealing devices – Types and materials – Installation, Maintenance and trouble shooting of Fluid Power systems – Safety considerations and Environmental issues in Fluid power system.

TOTAL: 45

TEXT BOOKS

1. Esposito Anthony, "Fluid Power with Applications", Seventh Edition, Pearson Higher Education, New York, 2009.
2. Majumdar, S.R., "Oil Hydraulic Systems – Principles and Maintenance", Second Edition, Tata McGraw-Hill, New Delhi, 2006.

REFERENCE BOOKS

1. Majumdar, S.R., "Pneumatic Systems – Principles and Maintenance", Second Edition, Tata McGraw-Hill, New Delhi, 2006.
2. Sullivan James A., "Fluid Power - Theory and Applications", Fourth Edition, Prentice Hall International, New Jersey, 1998.
3. Pippenger, John and Hicks, Tyler, "Industrial Hydraulics", Third Edition, Tata McGraw-Hill, New Delhi, 1987.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: identify fluid power components and their symbols as used in the industry

CO2: interpret the functions and operations of hydraulic components

CO3: build basic circuits using pneumatic components

CO4: design, construct, test, install, maintain and trouble shoot the fluid power circuits for engineering applications in a safe manner

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	3		3							2
CO2	3	3	3		3							2
CO3	3	3	3		3							2
CO4	3	3	3	3	3	2						2

3 – Substantial, 2 – Moderate, 1 – Slight

11MT601 PROGRAMMABLE AUTOMATION CONTROLLERS

3 0 0 3

MODULE – I **15**

Programmable Logic Controllers: Device Layer Components – Input Devices-Pushbuttons – Proximity Sensors. Read Switches -Encoders – MCB - Output Devices – Relays – Contactors – OLR – DOL – Starter - Solenoid valves – Types - Architecture of PLC – Principles of operation – Advantages – Types of PLC – I/O modules - Distributed I/O modules - I/O devices – CPU processor memory module.

MODULE – II **15**

Programming of PLC: Programming devices - Sourcing and sinking concept – Ladder diagram – Conversion of relay ladder to PLC ladder diagram – Arithmetic instruction - Data manipulating instructions – Latching relays – Timer instructions – Counter instructions - Closed loop control functions – Simple programmes – Selection of PLC - Maintenance and troubleshooting of PLC.

MODULE – III **15**

SCADA: Definition - Elements of SCADA - SCADA control - Remote terminal units – Master station – Communications protocol in SCADA - Applications of SCADA - Web based Automation.

TOTAL: 45

TEXT BOOKS

1. Petruzella, Frank D., "Programmable Logic Controllers", Third Edition, McGraw-Hill, New York, 2010.
2. Stuart Boyer A., "SCADA Supervisory Control and Data Acquisition ", Fourth Edition ISA,USA,2009

REFERENCE BOOKS

1. Webb, John, W and Reis, Ronald A., "Programmable Logic Controllers: Principles and Applications", Fifth Edition, Prentice Hall of India, New Delhi, 2004.
2. McMillan. K., "Process/Industrial Instruments and Controls Handbook", Tata McGraw-Hill, New York, 1999.
3. Hughes, T., "Programmable Logic Controllers", ISA Press, 2000.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: interpret PLC architecture and field I/O devices

CO2: construct PLC programming for simple case studies

CO3: perceive knowledge about SCADA and its applications

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	3									2
CO2	3	3	3	3	3							2
CO3	3	2	3	2	3							2

3 – Substantial, 2 – Moderate, 1 – Slight

11MT602 POWER ELECTRONICS AND DRIVES

3 0 0 3

MODULE - I **15**

Power Electronic Devices and Phase Controlled Converters: Principle of operation – Characteristics of power diodes, SCR, TRIAC, GTO, Power BJT, Power MOSFET and IGBT – Uncontrolled and controlled converters – Single phase full converters – Voltage source inverters PWM inverters – Types – Current source inverters - Types.

MODULE - II **15**

DC - DC and AC - AC Converters: DC Chopper – Control strategies – Principle of operation – Step up and step down chopper – Voltage, current and load commutated choppers. Single phase AC voltage controller – On - off control and phase control – Multistage sequence control – Step up and step down cycloconverters – Three phase to single phase and three phase to three phase cycloconverters.

MODULE - III **15**

Solid state AC and DC drives: Analysis of series and separately excited DC motor with single-phase and three-phase converters – Waveforms, performance parameters, performance characteristics - Chopper based implementation of braking schemes - AC drives - VSI and CSI fed induction motor control - Rotor controlled induction motor drives

TOTAL: 45

TEXT BOOKS

1. Rashid, M. H., "Power Electronics: Circuits Devices and Application", Third Edition, Prentice Hall India, New Delhi, 2004.
2. Bimbhra, B. S., "Power Electronics", Fourth Edition, Kanna Publishers, New Delhi, 2006.
3. Gobal K.Dubey, "Fundamentals of Electrical Drives", Narosal Publishing House, New Delhi, 2001.

REFERENCE BOOKS

1. Lander, W., "Power Electronics", Third Edition, McGraw-Hill, New York, 1993.
2. Dubey, G. K., Doradia, S. R., Joshi, A. and Singh, R. M., "Thyristorised Power Controllers", Wiley Eastern Limited, New Delhi, 2001.
3. Singh, M. D. and Khanchandani, K. B, "Power Electronics", Second edition, Tata McGraw-Hill, New Delhi, 2007.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: interpret the static and switching characteristics of power solid state devices

CO2: analyze the various types of convectors for power electronics application

CO3: assess the performances of converter fed AC and DC drives

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		3	3	2							2
CO2	3		3	3	2							2
CO3	3		3	3	2							2

3 – Substantial, 2 – Moderate, 1 – Slight

11MT603 FLUID POWER AND PROCESS CONTROL LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

FLUID POWER LABORATORY:

1. Design and testing of Electro-hydraulic circuit with pressure sequence valve
2. Design of hydraulic circuit for speed control of hydraulic motor and cylinder
3. Circuits with logic controls – AND valve and OR valve
4. Sequential Circuit with pneumatic control (with and without pneumatic timers)
5. Circuits with multiple cylinder sequences - Electrical control
6. Proportional control of Pressure and Flow in hydraulic Circuits
7. Simulation of basic hydraulic and pneumatic circuits using fluid power simulation software

PROCESS CONTROL LABORATORY:

1. Response of ON/OFF Control
2. Closed loop response of Flow Control System
3. Closed loop response of Level Control System
4. Closed loop response of Temperature Control System
5. Closed loop response of Pressure Control System
6. Tuning of PID Controller
7. Response feedforward and feedback control system

TOTAL: 45

REFERENCES

1. "Hydraulic power pack – Instruction Manual", Mansco Fluidtek Private Ltd., Coimbatore.
2. "Automation studio exercise circuits", Janatics Ltd., Coimbatore.
3. "Pneumatics", Basic level TP101 text book, Fifth Edition, Festo Ltd., 1999.
4. "Electro Pneumatics", Basic level TP201 Text Book, Festo Ltd., Tenth Edition, 1990.
5. Lab manuals

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: identify the fluid power components and their symbols as used in industry

CO2: design, simulate, construct and test fluid power circuits with pilot, Electrical, PLC and Logic control for different applications

CO3: develop the adequate knowledge of controller modes and its response of different process control system

CO4: analyze the process and its different types of control algorithms

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	3	3	3				3	3		2
CO2	3	3	3	3	3				3	3		2
CO3	3	3	3	3	3				3	3		2
CO4	3	3	3	3	3				3	3		2

3 – Substantial, 2 – Moderate, 1 – Slight

11MT604 PROGRAMMABLE AUTOMATION CONTROLLERS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

1. Construction of Ladder programming for Boolean operations.
2. Logical testing of field devices such as Relay, Pushbutton, Contactor, selector switch , proximity sensor etc., by using PLC
3. Level control using PLC.
4. Linear actuation of Pneumatic cylinder with Timer and counter functions.
5. Sequential operation of Pneumatic cylinders using PLC.
6. Interfacing of AC drive with PLC.
7. Servo control using PLC
8. Human Machine Interface (HMI) with PLC.
9. Temperature control using PLC and SCADA.
10. Flow and Pressure Measurement and Control using PLC and SCADA.

TOTAL: 45

REFERENCES

- Lab manuals

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: apply the knowledge of PLC programming for interfacing analog and discrete I/Os

CO2: develop, simulate and implement PLC and SCADA programming

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	3	2	3				3	2		
CO2	3	3	3	2	3				3	2		

3 – Substantial, 2 – Moderate, 1 – Slight

11MT605 POWER ELECTRONICS AND DRIVES LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

1. Study of SCR characteristics.
2. Study of MOSFET and IGBT characteristics
3. UJT, R, RC firing circuits for SCR.
4. Single phase half controlled & fully controlled converters.
5. Voltage commutated chopper.
6. Parallel inverter
7. Single-phase Cycloconverter
8. Simulation of closed loop control of converter fed DC motor
9. Simulation of VSI fed 3ϕ induction motor
10. Speed control of 3ϕ induction motor using PWM inverter.
11. Simulation of closed loop control of chopper fed DC motor.

TOTAL: 45

REFERENCES

- Lab manuals

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: analyse the characteristics of power devices and infer the roll of triggering circuits

CO2: evaluate the performance of various types of controlled convertors

CO3: design and analysis of convertor fed drives for AC and DC machines

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		3		3				3	1		
CO2	3		3		3				3	1		
CO3	3		3		3				3	1		

3 – Substantial, 2 – Moderate, 1 – Slight

11GE701 TOTAL QUALITY MANAGEMENT

(Common to all Engineering and Technology branches)

3 0 0 3

MODULE – I **15**

Quality Systems: Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs, Basic concepts of Total Quality Management, Historical Review. Need for ISO 9000 and Other Quality Systems, ISO 9000:2008 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, Introduction to TS 16949, QS 9000, ISO 14000, ISO 18000, ISO 20000, ISO 22000.

MODULE – II **15**

TQM Principles: Principles of TQM, Leadership – Concepts, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation. Customer satisfaction – Customer Perception of Quality, Customer Complaints, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits. Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts.

MODULE – III **15**

TQM Tools: The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools, Poka Yoke. Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

TOTAL :45

TEXT BOOKS

1. Besterfield, Dale H. et al., "Total Quality Management", Third Edition, Pearson Education, 2008
2. Subburaj Ramasamy, "Total Quality Management", Tata McGraw Hill, New Delhi, 2007.

REFERENCE BOOKS

1. Feigenbaum. A.V, "Total Quality Management", Tata McGraw Hill, New Delhi, 1999.
2. Suganthi, L and Samuel A Anand., "Total Quality Management", PHI Learning, New Delhi.
3. Evans James R. and Lindsay William M., "The Management and Control of Quality", Seventh Edition, South-Western (Thomson Learning), 2007.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: illustrate the evolution and basic concepts of TQM

CO2: interpret various ISO standards and their implementation procedures

CO3: apply the principles of TQM and its elements in real time scenario

CO4: adapt quality tools and techniques to implement TQM at the work place

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1						2	2	3	2	2	2	2
CO2						3	3	3	3	2	2	2
CO3					2	3	2	3	3	3	2	2
CO4	3	2	2	2	2	1		2	2	2	3	3

3 – Substantial, 2 – Moderate, 1 – Slight

11ME505 OPERATIONS RESEARCH

(Common to Mechanical and Mechatronics branches)

3 1 0 4

MODULE – I **15**

Linear and Network Models: The phases of OR study – formation of an L.P model- graphical solution – simplex algorithm – artificial variables technique– Big M method, two phase method. Transportation problems- VAM – MODI technique- Assignment problems – sequencing problems.

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

MODULE – II **15**

Inventory and Queuing Models: Types of Inventory- EOQ – Deterministic inventory problems – Price breaks - Stochastic inventory problems- selective inventory control techniques.

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

MODULE – III **15**

Replacement Models and Metaheuristics: Replacement of items that deteriorate with time-value of money changing with time-not changing with time-optimum replacement policy-individual and group replacement.

Introduction to design of experiments-ANOVA

The nature of metaheuristics-Genetic Algorithms- Simulated Annealing- Tabu Search-Ant colony optimization-Particle swarm optimization-Memetic Algorithms- Case studies.

Lecture : 45, Tutorial : 15, TOTAL : 60

TEXT BOOKS

1. Taha, Hamdy A., "Operation Research: An introduction", Pearson Education, Ninth Edition, 2010.
2. Hiller, Frederick. S. and Lieberman, Gerald. J., "An introduction to Operations research- concepts and cases", Tata McGraw Hill (SIE) Eighth Edition, 2005.

REFERENCE BOOKS

1. Winston Wayne.L., "Operations Research Applications and Algorithms", Fourth Edition, Thomson learning, 2007.
2. Hira and Gupta "Problems in Operations Research: Principles and Solutions", S.Chand and Co, Reprint 2007.
3. Panneerselvam.R, "Operations Research", Prentice Hall of India, 2007
4. Eiben, A.E. and Smith, J.E., "Introduction to Evolutionary Computing", Springer, 2008.
5. Godfrey C.Onwubolu, "New Optimization Techniques in Engineering", Springer, 2004.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: formulate and solve Linear programming problems and sequencing problems

CO2: construct networks and analyze optimality for various applications

CO3: categorize inventory models and solve for optimality

CO4: perceive queuing characteristics and solve problems

CO5: recommend the optimum replacement period for capital equipment's and items that fails

CO6: utilize metaheuristics techniques and design of experiments for solving industrial problems

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	2	3	2						3	2
CO2	3	3	2	3	2						3	2
CO3	3	3	2	3	2						3	2
CO4	3	3	2	3	2						3	2
CO5	3	3	2	3	2						3	2
CO6	3	3	2	3	2						3	2

3 – Substantial, 2 – Moderate, 1 – Slight

11MT701 DESIGN OF MECHATRONICS SYSTEMS

3 1 0 4

MODULE – I **15**

Fundamentals of Mechatronics System: Introduction to Mechatronics system - Key elements - Mechatronics Design process - Types of Design - Traditional and Mechatronics designs - Industrial design and ergonomics, safety - Man machine interface – Integrated product design - Advanced approaches in Mechatronics – Applications.

MODULE – II **15**

System Integration: Introduction - Model categories - Fields of application - Model development - Model verification - Model validation - Model simulation - Model transformation - Electro mechanical system design - Simulator coupling.
Model development, validation and simulation of real time system such as speed control of DC motor, temperature control system etc, using MATLAB

MODULE – III **15**

Case Studies on Mechatronics System: Introduction - Cantilever beam Force measurement system - Strain gauge weighing system - pH control system – Transducer calibration system - Auto focus Camera, exposure control - Engine torque management systems during manufacturing - Controlling temperature of a hot/cold reservoir using PID – Independent axle control of vehicle using wireless technologies - Control of pick and place robot – Factory Safety system - Mechatronics control in Manufacturing - Fuzzy logic control in Washing Machine – Printer - Dot matrix application.

Lecture:45, Tutorial: 15, TOTAL: 60

TEXT BOOKS

1. Pelz, Georg., "Mechatronic Systems: Modeling and Simulation with HDL's", John Wiley & Sons Ltd, New York, 2003.
2. Shetty, Devdas and Kolk, Richard A., "Mechatronics System Design", Thomson Learning/ Vikas publishing house, New Delhi, 2001.

REFERENCE BOOKS

1. Bolton, W., "Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering", Second Edition, Addison Wesley Longman Ltd., New York, 2003.
2. Bishop, Robert H, "Mechatronics Hand book", CRC Press, London, 2002.
3. Bradley, D.A., Dawson, D., Burd, N.C. and Loader, A.J., "Mechatronics: Electronics in Products and Processes", Chapman and Hall, London, 1991.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: choose the suitable key elements to design Mechatronics system

CO2: identify the different methods of model development, verification, validation and simulation of systems

CO3: develop electro-mechanical system for real time applications

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3				2						2
CO2	3		3		3							2
CO3	3		3	2	3							2

3 – Substantial, 2 – Moderate, 1 – Slight

11MT702 ROBOTICS AND MACHINE VISION SYSTEM

(Common to Mechatronics, EEE and EIE branches)

3 0 0 3

MODULE - I **15**

Introduction and End Effectors: History - Basic components of robot - Laws of robotics – Technical specification of robot- Robot degree of freedom- Types of joints - Work space – Dexterity - Accuracy - Resolution – Repeatability of robot - Robot End Effectors – Singularity – Redundant and parallel manipulator – Economics consideration - Sociological consequence of robot – Robotics application current and future.

MODULE - II **15**

Robot Kinematics: Introduction – Position analysis and finite translations, rotations and transformations – Homogeneous transformations, skews symmetric matrices - Forward & inverse kinematics - Velocity and static force Analysis for serial manipulator.

Robot Dynamics: Acceleration of rigid body, Newton's equation, Euler equation, Newton-Euler dynamic formulation, Lagrangian formulations.

MODULE - III **15**

Trajectory planning and Robot programming: Point to point, continuous path control, Joint trajectory, Cartesian trajectory, trajectory planning – Introduction to robot programming.

Machine Vision: Image acquisition - Digital images - Sampling and quantization - Levels of computation - Feature extraction - Windowing technique – Segmentation – Thresholding - Edge detection - Binary morphology - Grey morphology – 3D vision. Case study: Ball sorting on a conveyor system depending on size.

TOTAL: 45

TEXT BOOKS

1. Groover, M.P., "Industrial Robotics: Technology, Programming and Applications", McGraw-Hill, New York, 2003.
2. Craig, John. J., "Introduction to Robotics: Mechanics and Control", Second Edition, Pearson Education, New Delhi, 2002.

REFERENCE BOOKS

1. Fu, K.S., Gonzalez, R.C. and Lee, C.S.G., "Robotics: Sensing, Vision and Intelligence", Tata McGraw-Hill, New Delhi, 1987.
2. Dair, Gorden M., "Industrial Robotics", Prentice Hall International, New Jersey, 1988.
3. Deb, Sathya Ranjan, "Robotics Technology and Flexible Automation", Sixth Edition, Tata McGraw-Hill, New Delhi, 2003.
4. Niku, Saeed.B "Introduction to Robotics: Analysis, Systems, Applications", New Delhi: Prentice Hall of India Pvt Ltd , 2005.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: interpret the basic components and total functionality of an industrial robot

CO2: formulate the kinematics, dynamics and velocity equations for different configurations of the manipulators

CO3: apply the different types of trajectory planning and robot programming for industrial applications

CO4: explain the role of machine vision system and image processing techniques

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	3	3	2							2
CO2	3	3	3	3	2							2
CO3	3	3	3	3	2							2
CO4	3	3	3	3	2							2

3 – Substantial, 2 – Moderate, 1 – Slight

11MT703 AUTOMOTIVE ENGINEERING

3 0 0 3

MODULE - I **17**

Basics and Transmission Systems: Engine components: Cylinder block – Cylinder head – Sump – Manifolds – Gaskets – Cylinder - Piston – Rings – Connecting rod – Piston pins – Crank shaft – Bearings – Valves – Mufflers. Transmission System: Clutch – Types and Construction – Clutch operation: Electromagnetic – Mechanical – Hydraulic – Vacuum. Gear Boxes: Manual and Automatic – Simple Floor Mounted Shift Mechanism – Over Drives – Transfer Box - Fluid flywheel - Torque converters – Propeller shaft – Slip Joint – Universal Joints – Differential and Rear Axle – Hotchkiss Drive and Torque Tube Drive.

MODULE - II **13**

Steering, Brakes and Suspension: Steering: Wheels and Tyres – Wheel Alignment Parameters - Steering Geometry - Types of steering gear box – Davis and Ackermann steering mechanism - Power Steering – Electronic Steering. Types of Front Axle. Braking Systems: Types and Construction – Hydraulic brakes - Diagonal Braking System – Antilock Braking System. Suspension systems: Types of suspension springs – Plastic, Air and Independent suspension system – Shock absorbers – Active vibration control.

MODULE - III **15**

Battery, Lighting and Alternate Energy Sources: Battery System: Types of batteries - Construction, Operation and Maintenance. Electrical systems: Lighting – Wiring circuit - Head lights – Switches – Indicating lights – Trouble shooting. Accessories: Direction indicators – Windscreen wiper – Horn – Speedometer – Heaters – Air conditioner. Alternate energy sources: Use of Natural Gas, LPG, Bio diesel, Alcohol and Hydrogen in Automobiles - Electric and Hybrid Vehicles, Fuel Cells.

TOTAL: 45

TEXT BOOKS

1. Kirpal Singh, "Automobile Engineering", Eighth Edition, Volume I & II, Standard Publishers, New Delhi, 2007.
2. Sethi, H.M., "Automobile Technology", Tata McGraw-Hill, New Delhi, 2003.

REFERENCE BOOKS

1. Crouse, William H and Anglin, Donald L., "Automotive Mechanics", Ninth Edition, Tata McGraw-Hill, New Delhi, 2003.
2. Heitner, Joseph, "Automotive Mechanics", Second Edition, East-West Press, New Delhi, 2004.
3. Narang, G.B.S, "Automobile Engineering", Khanna Publications, New Delhi, 1991.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: identify the functions of IC engine, transmission, suspension, brake and steering systems used in automobile

CO2: perceive the concept of automotive electrical system

CO3: analyze the use of alternate fuel sources recommended for automobiles

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		3			3						2
CO2	3		3			2						2
CO3	2	3	3	3		3	3					2

3 – Substantial, 2 – Moderate, 1 – Slight

11MT704 COMPUTER AIDED ENGINEERING AND ROBOTICS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

COMPUTER AIDED ENGINEERING LABORATORY:

1. Structural analysis of a model using ANSYS.
2. Thermal analysis of a model using ANSYS.
3. Modal analysis of a model using ANSYS.
4. Contact analysis of a model using ANSYS.
5. Shear Force and Bending moment diagram using ANSYS
6. Vibration analysis of a model using ANSYS.

ROBOTICS LABORATORY:

1. Point to Point and Continuous Programming exercise for 6 axis articulated arm robot.
2. Robot programming exercises – using Virtual reality Software.
3. Study and analysis of single stage linear inverted pendulum.
4. Mechanical modelling for ball and beam system using MATLAB.
5. Programming for sbRIO - Mobile robot using Lab VIEW.
6. Defect identification using Smart Camera Evaluation for Mission Vision application.

TOTAL: 45

REFERENCES

- Lab Manuals

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: build working knowledge on analysis tools

CO2: solve structural, contact, vibrational problems with different loadings using analysis tools

CO3: analyze robot work cell problems and program an industrial robot through ON-line and OFF-line mode

CO4: solve path planning problems of a mobile robot and design the vision based inspection system

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	2		3					2		2
CO2	3	3	2		3					2		2
CO3	3	3	2		3					2		2
CO4	3	3	2		3					2		2

3 – Substantial, 2 – Moderate, 1 – Slight

11MT705 DESIGN AND FABRICATION PROJECT

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: design the components and systems related to mechatronic ideologies

CO2: examine the knowledge and skills in design, development, fabrication and testing by way of carrying out the project model to solve an engineering problem

CO3: plan, organize and execute the project and to be finished within time

CO4: compile the technical and scientific findings professionally through written and oral method with the support of software tools

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	3	3	3	3	2	2	3	3	3	2
CO2	3	3	3	3	3	3	2	2	3	3	3	3
CO3	3	3	3	3	2	3	2	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial

11GE801 PROFESSIONAL ETHICS AND HUMAN VALUES

(Common to all Engineering and Technology branches)

3 0 0 3

MODULE – I **15**

Introduction to Human Values and Engineering Ethics: Understanding: Morals- Values-Ethics– Honesty – Integrity – Work Ethic – Service Learning – Civic Virtue –caring – Sharing– Courage – Valuing Time – Co-operation – Commitment – Empathy –Self-Confidence – Character – Spirituality- Senses of 'Engineering Ethics' - variety of moral issues - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest –customs and religion- uses of ethical theories.

MODULE - II **15**

Safety, Responsibilities and Rights: Meaning of Engineering experimentation - engineers as responsible experimenters - codes of ethics for engineers - a balanced outlook on law - the challenger case study. Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the Three Mile Island and Chernobyl case studies. Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights – discrimination- Intellectual Property Rights (IPR)

MODULE - III **15**

Global Ethical Issues and Codes : Multinational corporations - Environmental ethics - computer ethics – weapons development-engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of Electronics and Telecommunication Engineers(IETE),India. etc.

TOTAL: 45

TEXT BOOKS

1. Martin Mike and Schinzinger Roland., "Ethics in Engineering", Tata McGraw-Hill, New Delhi,2003.
2. Govindarajan M, Natarajan S, and Senthil Kumar V. S., "Engineering Ethics", Prentice HallofIndia, NewDelhi, 2004.

REFERENCE BOOKS

1. Fleddermann, Charles D., "Engineering Ethics", Pearson Education/Prentice Hall, New Jersey, 2004.
2. Harris, Charles E., Protchard, Michael S. and Rabins,Michael J., "Engineering Ethics: Concepts and Cases", Wadsworth Thompson Learning, United States, 2000.
3. Seebauer Edmund G and Barry Robert L., "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: examine the various aspects of human values

CO2: develop as responsible experimenters particularly with reference to safety

CO3: apply appropriate code of ethics to evaluate the probable consequences of actions

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1						3		3		2		3
CO2	1	2	2	2		2	2	3	3	2		3
CO3				1		2	1	3	3			3

3 – Substantial, 2 – Moderate, 1 – Slight

11MT801 AUTOMOTIVE ELECTRONICS

(Common to Mechatronics Engineering and ECE branches)

3 0 0 3

MODULE - I **15**

Basics of Automotive Electrical and Electronics: Need for electronics in automotive systems: Performance (speed, power, and torque), Control (emission, fuel economy, drivability, and safety) and Legislation (environmental legislation for pollution & safety norms). Overview of vehicle electronic systems - Basic electrical components and their operation in an automobile: power train subsystem (starting systems, charging systems - ignition systems – electronic fuel control), chassis subsystem (abs, tcs,& esp) – comfort and safety subsystems (night vision, airbags, seatbelt tensioners, cruise control-lane-departure-warning, parking).

MODULE - II **15**

Embedded Systems for Automotive Electronics: Introduction to Embedded Systems: H/W Module: Program Memory (PM), Data Memory (DM), Parallel Port Structures, Timer, Input Capture & Output Compare Units, ADC, PWM, Introduction to an embedded board S/W Module: IDE; generating different Files; Programming, testing and debugging using different Emulators, debuggers. Introduction to Embedded RTOS: Tasks and Task states, Tasks and Data, Semaphores and shared data, Inter-task Communication. Use of MicroC/OS-II and other software Tools for development of Embedded Systems. Features of Micro/OS-II. In vehicle networks: CAN, LIN, FLEXRAY, MOST, KWP2000-Diagnostics systems in modern automobiles

MODULE - III **15**

Embedded System in Automotive Applications: Engine management systems – Gasoline / Diesel systems, various sensors used in system –Electronic transmission control - Vehicle safety system – Electronic control of braking and traction – Body electronics – Infotainment systems – Navigation systems – System level tests – Software calibration using engine and vehicle dynamometers – Environmental tests for Electronic Control Unit - Application of Control elements and control methodology in Automotive System.

TOTAL: 45

TEXT BOOKS

1. Tom Denton, "Automobile Electrical and Electronics Systems", Edward Arnold Publishers, London, 2000.
2. David E. Simon, "An Embedded Software Primer", Addison-Wesley Professional, 1999.
3. Raj Kamal, "Embedded Systems - Architecture, Programming and Design", Tata McGraw Hill, New Delhi, Second Edition, 2003

REFERENCE BOOKS

1. Hollembeak, Barry, "Automotive Electricity, Electronics & Computer Controls", Delmar Publishers, New York, 2001.
2. Jean J. Labrosse, "MicroC OS II: The Real Time Kernel", CMP Books, Second Edition, 2002
3. William B. Ribbens, "Understanding Automotive Electronics", Butterworth-Heinemann, Burlington, 2003.
4. Bosch Automotive Hand Book, 8th Edition, 2011.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: elaborate the basic concepts and working principle of various vehicle electronic and safety systems

CO2: analyze the importance of embedded systems and vehicle networking systems in automotive Applications

CO3: apply the concept of embedded system in automotive for developing engine management system and control elements

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	2		1					3				2
CO2		3	2									3
CO3	3	2	3				2					2

3 – Substantial, 2 – Moderate, 1 – Slight

11MT802 PROJECT WORK

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: design the components and systems using mechatronic principles
CO2: develop fabrication / experimental / analytical / simulation skills while carrying out the project
CO3: plan and execute the project as a team
CO4: compile the findings and conclude with oral / written reports

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	3	3	2	2	2	2	3	3	2	2
CO2	2	2	2	3	3	2	2	2	3	3	2	2
CO3	2	2	2	2	2	2	2	3	3	3	3	2
CO4	3	3	3	3	2	3	3	3	3	3	3	2

1 – Slight, 2 – Moderate, 3 – Substantial

11CS401 DATABASE MANAGEMENT SYSTEMS

(Common to Mechatronics, EIE,CSE and IT branches)

3 0 0 3

MODULE – I **15**

Data Models and Normalization: Introduction – Database System Applications – Purpose of database systems – View of data – Database Languages – Relational Databases – Database Design – Data Storage and Querying – Transaction Management – Database Architecture – Database Users and Administrators- Relational Model – Structure of Relational Databases – Database Schema – Keys – Schema Diagrams – Relational Query Languages - Relational Operations - SQL introduction – Intermediate SQL – Database Design and E-R model – Relational Database Design.

MODULE - II **15**

Indexing and Transaction Processing: RAID – File Organization – Organization of Records in Files – Ordered indices – B^+ Tree index files – Static and Dynamic Hashing – Bitmap indices – Index in SQL - Query Processing - Overview – Measures of Query Cost - Sorting – Selection, Join and Other Operations - Transactions - Concurrency control- Lock-based Protocols - Deadlock Handling – Multiple Granularity – Timestamp and Validation Based Protocols -Recovery System- Failure classification – Storage – Recovery and atomicity – Algorithm – Buffer management – Failure with loss of nonvolatile storage – Early lock release and Logical undo operations-ARIES

MODULE - III **15**

Distributed and Parallel Database: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems – Distributed Systems -Parallel Databases – I/O Parallelism – Interquery and Intraquery Parallelism – Interoperation and Intraoperation Parallelism- Distributed Databases- Homogeneous and Heterogeneous Databases – Distributed Data Storage and Transactions – Commit Protocols – Concurrency Control – Availability – Query Processing

TOTAL : 45

TEXT BOOKS

1. Silberschatz. Abraham, Korth, Henry F. and Sudarshan S., "Database System Concepts", Sixth Edition, McGraw-Hill, New York, 2011.

REFERENCE BOOKS

1. Elmasri, Ramez and Navathe, Shamkant B., "Fundamental Database Systems", Fifth Edition, Pearson Education, New Delhi, 2007
2. Kifer Michael, Philip Lewis, Arthur Bernstein and Prabin Panigrahi "Database Systems: An Application-Oriented Approach, Introductory Version", Second Edition, Pearson Education, New Delhi, 2007.
3. Date C J, Kannan A and Swamynathan S, "An Introduction to Database Systems", Eighth Edition, Pearson Education, New Delhi, 2006.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: design a relational database using ER model and normalization

CO2: apply SQL to create and manipulate a relational database

CO3: demonstrate the use of indexing techniques, query processing and recovery system

CO4: explain the concepts of distributed databases, concurrency control and parallel databases

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	2	1	2	2	3							2
CO2	2	1	2	2	3							2
CO3	2	1	2	2	3							2
CO4	2	1	2	2	3							2

3 – Substantial, 2 – Moderate, 1 – Slight

11IT502 COMPUTER COMMUNICATION NETWORKS

(Common to Mechatronics, ECE and IT branches)

3 0 0 3

MODULE – I **15**

Introduction to Data Communications and Physical Layer: Components and representations– Data flow – Networks – Criteria, physical structures and categories – Topologies –Protocols and standards – ISO / OSI model- Line coding – Line coding schemes – Transmission Modes - Transmission Media –Guided media -Twisted-pair- Coaxial Cable – Fiber Optics .

Data Link Layer -Flow Control and Error Control: CRC – Check sum - Stop and wait – Go back-N - ARQ – Selective repeat ARQ- Sliding window – HDLC – Point-to-Point protocol

MODULE – II **15**

Data Link Layer -Local Area Network(LAN): Wired LAN – Ethernet- IEEE Standards- IEEE 802.3 - IEEE 802.4 - IEEE 802.5 - Fast Ethernet- Gigabit Ethernet- IEEE 802.11

Network Layer: Inter-networks – IPV4 and IPV6 addressing methods – IPV4 –IPV6 – ARP - RARP – ICMP – Forwarding and routing - Unicast routing protocols – Intra and inter-domain routing - Distance vector routing – Link state routing – Path vector routing- VLAN

MODULE – III **15**

Transport Layer: Process-to-process delivery - UDP - TCP – Congestion Control – Quality of services (QoS) – Techniques to improve QoS - Integrated Services- Differentiated service.

Application Layer: Domain Name Space (DNS) – Distribution of name space- DNS in the Internet- Resolution- Remote logging –Electronic Mail- File transfer- HTTP - WWW - SNMP

TOTAL : 45

TEXT BOOKS

1. Forouzan, Behrouz A., “Data communication and Networking”, Fourth Edition, Tata McGraw-Hill, New Delhi, 2006.
2. Peterson, Larry L. and Davie, Peter S., “Computer Networks”, Second Edition, Harcourt Asia, Singapore, 2000.

REFERENCE BOOKS

1. Kurose, James F. and Ross, Keith W., “Computer Networking: A Top-Down Approach Featuring the Internet”, Pearson Education, New Delhi, 2003.
2. Tanenbaum, Andrew S., “Computer Networks”, Fourth Edition, Prentice Hall of India, New Delhi, 2003.
3. Stallings, William, “Data and Computer Communication”, Sixth Edition, Pearson Education, New Delhi, 2000.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: understand the basic concepts of Networking

CO2: acquire knowledge in layered architecture and its need in networking

CO3: identify the need for IEEE standards and its types

CO4: know the various network components and topologies

CO5: understand QoS and different QoS parameters

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	2	1	3	2	3		1					1
CO2	2	1	3	2	3		1					1
CO3	2	1	3	2	3		1					1
CO4	2	1	3	2	3		1					1
CO5	2	1	3	2	3		1					1

3 – Substantial, 2 – Moderate, 1 – Slight

11EC017 DIGITAL IMAGE PROCESSING

(Common to Mechatronics, ECE, EIE, and Information Technology branches)

3 0 0 3

MODULE – I **15**

Digital Image Fundamentals and Transforms: Elements of digital image processing systems- Elements of visual perception- psycho visual model- brightness- contrast- hue- saturation- mach band effect -Image sampling- Quantization - Basic relationship between pixels - Color image fundamentals - RGB- HSI models. Image Trasforms: 1D DFT- 2D transforms – DFT- DCT- Discrete Sine, Walsh- Hadamard, Slant- Haar, Hough Transform, KL transforms - properties of all transforms.

MODULE – II **15**

Image Enhancement and Restoration: Spatial domain enhancement: gray level transformations - histogram equalization - Image averaging- Spatial filtering: Smoothing, Sharpening filters– Frequency domain filters: Smoothing – Sharpening filters - Homomorphic filtering- Color image enhancement. Image Restoration: degradation model- Unconstrained and Constrained restoration- Inverse filtering - Wiener filtering.

MODULE – II **15**

Image Segmentation, Compression and Representation: Point- line and edge detection- Thresholding - Region based segmentation: Region splitting and merging. Need for data compression-Lossless compression-Lossy compression-compression standards. Image representation: chain codes – polygonal approximations – signatures – boundary segments – skeletons - Regional descriptors –Simple descriptors- Texture.

TOTAL: 45

TEXT BOOK

1. Gonzalez Rafael C and Woods Richard E, “Digital Image Processing”, Second Edition, Pearson Education, New Delhi, 2004.

REFERENCE BOOKS

1. Jain Anil K., “Fundamentals of Digital Image Processing”, Prentice Hall of India, New Delhi, 2002.
2. Salomon David., “Data Compression: The Complete Reference”, Second Edition, Springer, Verlag, New York, 2001.
3. Pratt William K, “Digital Image Processing”, John Wiley, New York, 2002.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: apply knowledge in the science of images and image processing, including mathematical transforms (Fourier transform, DFT and 2-D DFT, FFT, IFFT, Walsh, Hadamard, Discrete cosine, Slant transform)

CO2: analyze various techniques of Digital Image Processing, including Image Enhancement in the Spatial and Frequency Domain

CO3: understands various Compression standards, and image representation methods for recognition and retrieval

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	2	3	3	2	2	1		1				2
CO2	2	3	3	2	2	1		1				2
CO3	2	3	3	2	2	1		1				2

3 – Substantial, 2 – Moderate, 1 – Slight

11EI605 EMBEDDED CONTROL

(Common to EIE, EEE, CSE and Mechatronics branches)

3 0 0 3

MODULE– I **15**

Introduction to 8 - Bit Microcontrollers: Architecture of PIC 18- Pin Description – Memory organization: Program memory – Data Memory: Register Organization – Oscillator and Reset circuits – Addressing Modes – Instruction set – Simple Programs.

MODULE– II **15**

PIC Programming and Applications: Timers – Counters – Capture/ Compare mode – PWM – External Hardware Interrupts – I/O Ports – USART – I^2C – ADC – Interfacing to External memory – Assembly language programming: I/O ports – Timers – Counters – PWM – External Hardware Interrupts.

MODULE-III **15**

Real-Time Operating System Concepts and Case Studies: Architecture of the Kernel - task and task scheduler - Interrupt Service Routines – Semaphores –Mutex – Mailboxes - Message Queues - Event Registers – Pipes – Signals – Timers - Memory Management – Priority Inversion Problem - Scheduling approaches - Optimality of the Earliest deadline first (EDF) algorithm - challenges in validating timing constraints in priority driven systems - Use of µC/OS-II - Case study of coding for an Automatic Chocolate Vending Machine using MUCOS RTOS

TOTAL : 45

TEXT BOOKS

1. Mazidi, Muhammad Ali, Mckinlay, Rolin D., and Causey Danny, "PIC Microcontroller and Embedded Systems using Assembly and C for PIC 18", Pearson Education Asia, 2008.
2. Rajkamal, "Embedded Systems Architecture, Programming and Design", Tata McGraw Hill, New Delhi, 2003.

REFERENCE BOOKS

1. Peatman, John B., "Design with PIC Microcontrollers", Pearson Education, New Delhi, 2002.
2. Microchip/PIC Microcontroller Data manuals.
3. Valvano Jonathan W., "Embedded Microcomputer Systems- Real Time Interfacing", Second Edition, Thomson Asia, Singapore, 2001.
4. Labrosse, Jean J., "Micro C/ OS –II : The real –time curnal", Second Edition, CMP Books group west publications, 2002.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: elaborate the architecture and interfacing concepts of PIC18 microcontroller

CO2: apply the programming skills for peripheral interfacing and real time applications using PIC18 microcontroller

CO3: interpret the concepts of RTOS

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	1	2		1							2
CO2	3	1	3		3							2
CO3	3	1			3							2

3 – Substantial, 2 – Moderate, 1 – Slight

11EC012 SOFT COMPUTING

(Common to Mechatronics, ECE, CSE and IT branches**)**

3 0 0 3

MODULE – I **15**

Artificial Neural Networks: Basic concepts - Biological neuron, Artificial neuron ,single layer perceptron-Multi layer perceptron-Supervised Learning Neural Networks - Adaline - Backpropagation Mutilayer Perceptrons - Radial Basis Function Networks - Unsupervised Learning Neural Networks - Competitive Learning Networks - Kohonen Self-Organizing Networks - Learning Vector Quantization - Hebbian Learning.

MODULE - II **15**

Fuzzy Systems, Neuro-Fuzzy Modelling: Fuzzy sets and Fuzzy reasoning-Fuzzy Matrices-Fuzzy functions-decomposition- Membership Function Formulation and Parameterization - Defuzzification methods Fuzzy Rules and Fuzzy Reasoning: Extension Principle and Fuzzy Relations - Fuzzy If-Then Rules - Fuzzy Reasoning - Fuzzy Inference Systems - Mamdani Fuzzy Models - Sugeno Fuzzy Models - Tsukamoto Fuzzy Models - Input Space Partitioning , Applications. Adaptive Neuro-Fuzzy Inference Systems - Architecture - Hybrid Learning Algorithm - Learning Methods that Cross-fertilize ANFIS and RBFN , Classification and Regression trees-Data clustering algorithm.

MODULE - III **15**

Genetic Algorithm and Neuro-Fuzzy Applications: Survival of the fittest-schema theorem -cross over, mutation-, reproduction methods-Application. ANFIS Applications - Introduction- Printed Character Recognition- Nonlinear System Identification- Channel Equalization- Adaptive Noise Cancellation – Soft Computing for color receipe prediction.

TOTAL : 45

TEXT BOOKS

1. Jang J.S.R., Sun C.T and Mizutani E, "Neuro Fuzzy and Soft Computing", Pearson/Prentice Hall India, New Delhi, 2006.
2. Goldberg David E., "The Design of Innovation; Genetic Algorithm and Evolutionary Computation", Kluwer Academic publisher, Dordrecht, 2002.

REFERENCE BOOKS

1. Ross Timothy J., "Fuzzy Logic Engineering Applications", Tata McGraw-Hill, New Delhi, 1997.
2. Rajasekaran S and Vijayalakshmi Pai G A, "Neural Networks: Fuzzy Logic and Genetic Algorithms Synthesis and Applications", Prentice Hall India, New Delhi, 2007.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: elaborate the basics of neural networks and its application in engineering field

CO2: apply the fuzzy systems in real world problems

CO3: build solutions for engineering problems using genetic algorithm, neural and hybrid systems

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		2	2	3							2
CO2	3		2	2	3							2
CO3	3		2	2	3							2

3 – Substantial, 2 – Moderate, 1 – Slight

11EI603 BIOMEDICAL INSTRUMENTATION

(Common to Mechatronics, EEE and EIE branches)

3 0 0 3

MODULE - I **15**

Human Physiology and Measurement: Brief review of Human physiology and anatomy – Cell and its structure – Action and Resting Potential- propagation of action potential – Sodium pump – Nervous system: CNS – PNS – Nerve cell – Synapse. Transducers for body temperature measurements: Piezo–electric, Photoelectric, pressure transducers for physiological measurements, Bio sensors. Basic components of a biomedical system – Electrode-Electrolyte Interface. Electrodes: Micro, needle and surface electrodes.

MODULE - II **15**

Electro-Physiological Measurements: ECG, EEG, EMG, ERG and EOG: Lead systems and recording methods – Typical waveforms. Electrocardiograph measurements, Vectorcardiograph, Phonocardiograph- Blood pressure measurement- Ultrasonic method, Sphygmomanometer – Blood flow measurement by electromagnetic flow meter – Cardiac output measurement by dilution method and Fick's method –Blood pH measurement- Blood Sugar measurement.

MODULE - III **15**

Medical Imaging Systems and Therapeutic Equipments: X-ray machine – Computer tomography – MRI – Ultrasonography – Endoscopy – Different types of biotelemetry systems. Heart lung machine –Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Audio meters – Dializers.

TOTAL : 45

TEXT BOOKS

1. Cromwell, Leslie, Weibell. Fred J. and Pfeiffer. Erich A., "Bio-Medical Instrumentation and Measurements", Second Edition, Pearson Education, New Delhi, 2002.
2. Khandpur R.S., "Handbook of Bio-Medical instrumentation", Tata McGraw-Hill Publishing Co Ltd., New Delhi, 2003.

REFERENCE BOOKS

1. Arumugam M., "Bio-Medical Instrumentation", Anuradha Agencies, Kumbakonam, 2003.
2. Webster J., "Medical Instrumentation", John Wiley & Sons, New York, 1995.
3. Rajarao C. and Guha S.K., "Principles of Medical Electronics and Bio-medical Instrumentation", Universities press (India) Ltd, New Delhi, 2000.
4. Anandanatarajan.R., "Biomedical Instrumentation and Measurements", PHI Learning Private Limited, New Delhi ,2011

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: perceive the knowledge of human physiology and basics of medical measurements

CO2: assess the importance of sensing and measurement devices in medical assistance

CO3: explain the working and constructional features of medical imaging and therapeutic equipment's

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	3	2		2	1					2
CO2	3	3	3	2		2	1					2
CO3	3	3	3	2		2	1					2

3 – Substantial, 2 – Moderate, 1 – Slight

11EI015 OPTIMAL CONTROL

(Common to Mechatronics and EIE branches)

3 1 0 4

MODULE – I **15**

Introduction: State space representation – Linearization - Review of matrix theory - Eigen values and Eigen vectors - Vector norms - Matrix transformations - Vector/matrix calculus - Optimization techniques - Static optimization - Constrained and unconstrained - Kuhn-Tucker conditions.

MODULE – II **15**

Optimal Control Formulation: Objective - Selection of performance index - Calculus of variation - Boundary condition- Optimum of a functional - Necessary condition of optimality - Hamiltonian approach-optimal control systems

MODULE - III **15**

LQR Design: LQR Problem formulation - Infinite time regulator problem - Riccati equation Constrained optimal control- Pontryagin minimum principle - Dynamic programming applied to discrete time systems.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOK

1. Kirk, Donald E., ”ptimal Control Theory: An Introduction”, Dover publications, 2004.
2. Desineni Subburam Naidu, “Optimal Control Systems”, CRC Press,2003

REFERENCE BOOKS

1. M.Gopal , “Modern Control System Theory”,Wiley Eastern ltd,1993
2. Anderson B.D.O. and Moore J.B., “Optimal Control: Linear Quadratic Methods”, Prentice Hall, New Jersey, 1979.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: elaborate the matrix theory and optimization techniques

CO2: formulate optimal control problems

CO3: design Linear Quadratic Regulator controller

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	2	3	3	2								1
CO2	2	3	3	2								1
CO3	2	3	3	2								1

3 – Substantial, 2 – Moderate, 1 – Slight

11GE011 ENTREPRENEURSHIP DEVELOPMENT

(Common to all Engineering and Technology branches except Civil Engg.)

3 0 0 3

MODULE – I **15**

Entrepreneurship Concepts: Meaning and Concepts of Entrepreneurship – Definition and Characteristics of an Entrepreneur – Entrepreneurial Process – The scope of Entrepreneurship in India. Entrepreneurial Motivation – Factors creating Entrepreneurship – Classification of Entrepreneurs – Intrapreneurship - Barriers to Entrepreneurship – Creativity, Innovation & Entrepreneurship - Role of Entrepreneurship in Economic Development.

MODULE – II **15**

Business Plan: Business Planning Process – Idea generation, Environmental Scanning, Feasibility Analysis, Drawing Functional Plan - Marketing Plan – Production/Operations Plan –Organizational Plan – Financial Plan – Human Resource Plan – Project Report Preparation , Evaluation, Control and Review.

MODULE – III **15**

Managing a Small Business: Sources of Finance - Institutions Supporting Entrepreneurs - EDPs. Small Scale Industry – The Strengths and Weaknesses of Small Business - Growth strategies – Sickness - Evaluation, Symptoms, Causes and Assessment – Rehabilitation of Sick Industries.

TOTAL :45

TEXT BOOKS

1. Madhurima Lall and Shikha Sahai, " Entrepreneurship", Excel Books, New Delhi, 2006
2. S.S.Khanka, " Entrepreneurial Development", S.Chand & Company Ltd, 2005

REFERENCE BOOKS

1. Robert D Hisrich, Michael P Peters and Dean A Shepherd, "Entrepreneurship", Sixth Edition, Tata McGraw Hill, New Delhi, 2009.
2. Mary Coulter, "Entrepreneurship in Action", Second Edition, Prentice Hall of India, New Delhi, 2005.
3. Jain P.C., "Handbook for New Entrepreneurs", Oxford University Press, Oxford, 2003.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: demonstrate knowledge of entrepreneurship concepts

CO2: plan various aspects of business activities

CO3: manage to start and run small business.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	1			1		3	3	3		3		
CO2	1			1		3	3	3		3		
CO3	1			1		3	3	3		3		

3 – Substantial, 2 – Moderate, 1 – Slight

11ME025 MAINTENANCE ENGINEERING

(Common to Mechanical and Mechatronics branches)

3 0 0 3

MODULE – I **15**

Principles and Practices of Maintenance Planning, Condition Monitoring: 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-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-Case studies.

MODULE – II **15**

Maintenance Policies – Préventive Maintenance-Failures Analysis: Maintenance categories – Comparative merits of each category – Preventive maintenance, maintenance schedules, repair cycle - Principles and methods of lubrication – TPM- Failure analysis – Failures and their development – Logical fault location methods – Sequential fault location-Case studies.

MODULE – III **15**

Repair Methods for Basic Machine Elements, Material Handling Equipment: Repair methods for beds, slide ways, spindles, gears, lead screws and bearings –Material handling equipment - Equipment records –Job order systems -Use of computers in maintenance.

TOTAL: 45

TEXT BOOKS

1. Srivastava, S.K., "Industrial Maintenance Management", S. Chand & Co., New Delhi, 2011.
2. Bhattacharya, S.N., "Installation, Servicing and Maintenance", S. Chand & Co., New Delhi, 2010.

REFERENCE BOOKS

1. White, E.N., "Maintenance Planning", I Documentation, Gower Press, 2002.
2. Garg, M.R., "Industrial Maintenance", S. Chand & Co., New Delhi, 2004.
3. Higgins, L.R., "Maintenance Engineering Handbook", Seventh Edition, McGraw Hill, New York, 2008.
4. Armstrong, "Condition Monitoring", BSIRSA, 1988.
5. Davies, "Handbook of Condition Monitoring", Chapman &Hall, London, 1998.
6. "Advances in Plant Engineering and Management", Seminar Proceedings - IIPE, 1996.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: organize maintenance planning and judge condition monitoring of machine elements

CO2: assess preventive maintenance policies and failure analysis through TPM

CO3: propose repair methods for basic machine elements and material handling equipment

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	2	2			3						2
CO2	3		2			3						2
CO3	3	2	2			3						2

3 – Substantial, 2 – Moderate, 1 – Slight

11ME014 INTRODUCTION TO AIRCRAFT SYSTEMS

(Common to Mechanical and Mechatronics Engineering branches)

3 0 0 3

MODULE - I **15**

Introduction to Aircrafts and Aircraft Systems: Basic components of an Aircraft, Structural members, Aircraft Axis System, Aircraft Motions, Control surfaces and High lift Devices.

Types of Aircrafts - Lighter than Air/Heavier than Air Aircrafts Conventional Design Configurations based on Power Plant Location, Wing vertical location, intake location, Tail Unit Arrangements, Landing Gear Arrangements. Unconventional Configurations-Biplane, Variable Sweep, Canard Layout, Twin Boom Layouts, Span loaders. Advantages and disadvantages of these Configurations.

Types of Aircraft Systems - Mechanical Systems

MODULE - II : **15**

Basic Principles of Flight: Aerofoil Nomenclature, Types of Aerofoil, Wing Section- Aerodynamic Center, Aspect Ratio. Significance of speed of Sound, Air speed and Ground Speed, Properties of Atmosphere, lifting surfaces-lift and drag, angle of attack, Pressure Distribution over a wing section, centre of pressure and its effects.

Generation of Lift, Drag, Pitching moments, Types of Drag, Lift curve, Drag Curve, Lift/Drag Ratio Curve, Factors affecting Lift and Drag.

MODULE - III **15**

Stability and Control: Degree of Stability- Lateral, Longitudinal and Directional Stability, Controls of Aircraft. Taxying, Landing, Gliding and Turning.

Aircraft Performance and Maneuvers: Taking off, climbing, Power Curves, Maximum and minimum speeds of horizontal flight, Effects of Changes of Engine Power, Effects of weight on performance, Effects of Altitude on Power Curves, Forces acting on a Aeroplane during a Turn, Correct and incorrect Angles of Bank, Aerobatics, Inverted Maneuvers, Maneuverability.

TOTAL: 45

TEXT BOOKS

1. Kermode A.C, “Mechanics of Flight”, Fifth Edition, Pearson Education, New Delhi.
2. Shevell, “Fundamentals of Flight”, Second Edition, Pearson Education, New Delhi.

REFERENCE BOOKS

1. Anderson, Dave “Introduction to Flight”,
2. Ian Moir, “Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration”, Allan Seabridge
3. Delp Frank, and Kroes, Michael J. and Watkins, William A., “Aircraft Maintenance & Repair”, Sixth Edition, Glencoe & McGraw-Hill, 1993.
4. Hurst, Dale, “Aircraft Structural Maintenance”, Second Edition, Avotek publishers, 2006.
5. Schaufele, Roger D., “The Elements of Aircraft Preliminary Design”, Aries Publications, 2000.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: assess engineering technologies to design vehicles and aircrafts

CO2: perceive the concept of stability related to aircraft

CO3: analyze the use of aerofoil in aircraft and its effect related to different maneuvers

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	2	2	3	3	3	2						1
CO2	2	2	3	3	3	2						1
CO3	2	2	3	3	3	2						1

3 – Substantial, 2 – Moderate, 1 – Slight

11ME023 RENEWABLE SOURCES OF ENERGY

(Common to Mechanical and Mechatronics branches)

3 0 0 3

MODULE- I **15**

Solar Energy and Wind Energy: 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.Wind Energy- Sources and potentials, horizontal and vertical axis windmills, performance characteristics- Wind Energy Storage – Applications – Hybrid systems

MODULE- II **15**

OTEC, Tidal, Geothermal Energy and New Energy Sources: Tidal energy – Wave energy – Data, Technology options – Open and closed OTEC Cycles – Small hydro, turbines – Geothermal energy sources, power plant and environmental issues Hydrogen - generation, storage, transport and utilization – Applications - power generation, and transport – Fuel cells – technologies, types – economics in power generation

MODULE- III **15**

Bio – Energy and Direct Energy Conversion: Biomass, Source, Composition, Technology for utilization– Biomass direct combustion – Biomass gasifier – Biogas plant – Digesters – Ethanol production – Bio diesel production and economics - combustion characteristics of bio-gas and utilization for cooking.

Need for DEC, principles of DEC. Thermo-electric generators, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, electron gas dynamic conversion, economic aspects.Faraday's laws, thermodynamic aspects, selection of fuels and operating conditions.

TOTAL:45

TEXT BOOKS

1. G.D. Rai, "Non Conventional Energy Sources", Khanna Publishers, New Delhi, 1999.
2. Kothari D.P. et. al., "Renewable Energy Sources and Emerging Technologies", Prentice Hall of India Pvt. Ltd. 2008

REFERENCES BOOKS

1. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, U.K., 1996.
2. Twidell, J.W. & Weir, A., "Renewable Energy Sources", EFN Spon Ltd., UK, 1986
3. G.N. Tiwari, "Solar Energy – Fundamentals Design, Modelling & applications", Narosa Publishing House, New Delhi, 2002.
4. L.L. Freris, "Wind Energy Conversion systems", Prentice Hall, UK, 1990.
5. S.P. Sukhatme, "Solar Energy", Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: examine the working and applications of solar and wind energy systems

CO2: perceive the concept of OTEC, tidal, geothermal energy and fuel cell technologies

CO3: build knowledge on bio-energy production and direct energy conversion techniques

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		3									3
CO2	3		3									3
CO3	3		3									3

3 – Substantial, 2 – Moderate, 1 – Slight

11ME011 DESIGN OF JIGS, FIXTURES AND PRESS TOOLS

(Common to Mechanical and Mechatronics branches)

3 0 0 3

MODULE - I **15**

Purpose Types and Functions of Jigs and Fixtures: Tool design objectives - Production devices - Materials used in Jigs and Fixtures – Types of Jigs - Types of Fixtures-Mechanical, pneumatic and hydraulic actuation-Analysis of clamping force-Tolerance and error analysis. Drill bushes –different types of jigs-plate latch, channel, box, post, angle plate, angular post, turnover, pot jigs-Automatic drill jigs-Rack and pinion operated. Air operated Jig components. Design and development of Jigs for given components. lathe, milling and broaching fixtures- Grinding, planning and shaping fixtures assembly, Inspection and welding fixtures- Modular fixtures. Design and development of fixtures for given component.

MODULE - II **15**

Press Working Terminologies and Elements of Dies and Strip Lay Out: Press working terminology-Presses and press accessories-Computation of capacities and tonnage requirements. Elements of progressive combination and compound dies: Die block-die shoe. Bolster plate-punch plate-punch holder-guide pins and bushes – strippers – knockouts-stops – pilots-Selection of standard die sets strip lay out-strip lay out calculations

MODULE - III **15**

Design and Development of Dies: Design and development of progressive and compound dies for Blanking and piercing operations. Bending dies – development of bending dies-forming and drawing dies-Development of drawing dies. Design considerations in forging, extrusion, casting and plastic dies.

(Use of approved design data book is permitted)

TOTAL : 45

TEXT BOOKS

1. Hoffman, Edward G., "Jigs & Fixture Design", Thomson – Delmar Learning, Singapore 2004.
2. Donaldson. C., "Tool Design", Tata McGraw-Hill, 1986

REFERENCE BOOKS

1. Kempster., "Jigs & Fixtures Design", The English Language Book Society", 1978
2. Joshi, P.H., "Jigs & Fixtures", Second Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2004.
3. Hiram E Grant, " Jigs and Fixture" Tata McGraw-Hill, New Delhi, 2003.
4. "Fundamentals of Tool Design", CEEE Edition, ASTME, 1983.
5. "Design Data Handbook", PSG College of Technology, Coimbatore.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: illustrate the principles of jigs and fixtures design, locating principles, locating elements and clamping devices

CO2: interpret the principles, functions and terminologies in press work, elements of dies and strip layout

CO3: design the dies for forging, extrusion, casting and plating with realistic constraints

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	3	3	3	2						2
CO2	3	3	3	3	3	2						2
CO3	3	3	3	3	3	2						2

3 – Substantial, 2 – Moderate, 1 – Slight

11ME016 DESIGN FOR MANUFACTURE AND ASSEMBLY

(Common to Mechanical and Mechatronics branches)

3 0 0 3

MODULE - I **15**

DFM Guidelines and Geometric Tolerance: General design principles for manufacturability - strength and mechanical factors - Geometric tolerances – Tolerance analysis - Worst case method - Assembly limits –Design and Manufacturing Datum – Conversion of design datum into manufacturing datum -Tolerance stacks- Process capability – Principal materials - Selection of materials and processes - Design - Possible solutions - Evaluation method.

MODULE - II **15**

DFA Guidelines and Machining Considerations: General design guidelines for manual assembly – Assembly efficiency – Effects of part symmetry, part thickness and weight on handling time – Types of manual assembly methods – Application of DFA methodology- Design for high speed automatic assembly and robot assembly – Design for machining – Single point and multipoint cutting tools – Choice and Shape of work material – Accuracy and surface finish - Reduction of machined area- Design for clampability - Design for accessibility.

MODULE - III **15**

Design for Injection molding and Casting: Injection molding Materials - The molding cycle – Molding systems and molds – Cycle time and mold cost estimation – Estimation of optimum number of cavities – Design guidelines for injection molding - Die casting alloys –The die casting cycle, Determination of number of cavities and appropriate machine size in die casting – Design principles for die casting – Sand casting alloys – Sand cores - Design rules for sand castings - Identification of uneconomical design - Modifying the design.

TOTAL : 45

TEXT BOOKS

1. Boothroyd, G, “Product Design for Manufacture and Assembly”, New York, CRC Press, London, 2002.
2. Peck, Harry., “Design for Manufacture”, Pitman Publications, London 1983.

REFERENCE BOOKS

1. Otto, Kevien and Wood, Kristin, “Product Design”. Pearson Publication, New Delhi, 2004.
2. Matousek, “Engineering Design: A Systematic Approach”, Blackie & Son Ltd., Glasgow, 1974.
3. Bralla, “Design for Manufacture Handbook”, McGraw Hill, New York, 1999.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: perceive the basics of manufacturability and materials selection

CO2: appraise various concepts in design and assembly

CO3: develop a solution, related to die casting, molding and all other foundry related problems

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	3	3	3	2	1					2
CO2	3	3	3	3	3	2	1					2
CO3	3	3	3	3	3	2	1					2

3 – Substantial, 2 – Moderate, 1 – Slight

11MT011 APPLIED FINITE ELEMENT ANALYSIS

3 0 0 3

MODULE – I **15**

Introduction: Historical background – Matrix approach – Application to the continuum – Discretisation – Matrix algebra – Gaussian elimination – Governing equations for continuum – Classical Techniques in FEM – Weighted residual method – Ritz method - Potential energy approach – Galerkin approach for one and two dimensional.

MODULE – II **15**

One Dimensional Problems and Two Dimensional Problems: 1-D Finite element modeling – Coordinates and shape functions – Assembly of stiffness matrix and load vector – Finite element equations – Quadratic shape functions – Applications to plane trusses.

Introduction to 2-D Finite element modeling – Scalar valued problem – Poisson equation – Laplace equation – Triangular elements – Element stiffness matrix – Force vector - Stress calculation – Temperature effects.

MODULE – III **15**

Axisymmetric Continuum, Isoparametric Elements for Two Dimensional Continuum: Axisymmetric formulation – Element stiffness matrix and force vector – Galerkin approach – Body forces and temperature effects – Stress calculations – Boundary conditions – Applications to cylinders under internal or external pressures – Rotating discs.

The four node quadrilateral – Shape functions – Element stiffness matrix and force vector – Numerical integration - Stiffness integration – Stress calculations – Four node quadrilateral for axisymmetric problems.

TOTAL : 45

TEXT BOOKS

1. Rao, S.S., "The Finite Element Method in Engineering", Pergamon Press, New York, 2005.
2. Zienkiewicz, O.C. and Taylor R.L., "The Finite Element Methods", Volume. I: The Basic Formulation And Linear Problems, Fifth Edition, Butterworth Heineman, London, 2005.

REFERENCE BOOKS

1. Chandrupatla, T.R., and Belegundu A.D., "Introduction to Finite Elements in Engineering", Third Edition, Pearson Education, New Delhi, 2002.
2. Logan, D.L., "A First course in the Finite Element Method", Third Edition, Thomson Learning, New York, 2007.
3. Cook, Robert D., Malkucs, David. S, and Plesha Michael E, "Concepts and Applications of Finite Element Analysis", Fourth Edition, John Wiley & Sons, New York, 2003.
4. Reddy, J.N., "An Introduction to Finite Element Method", McGraw-Hill International, New York, 2006.
5. Hutton, David V., "Fundamentals of Finite Element Analysis". McGraw-Hill, New York, 2005

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: utilize finite element concepts for designing engineering components

CO2: formulate elemental matrix equation for solving 1D and 2D, structural and thermal problems

CO3: solve and analyze engineering problems using axisymmetric and isoparametric elements

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	3	3	3							2
CO2	3	3	3	3	3							2
CO3	3	3	3	3	3							2

3 – Substantial, 2 – Moderate, 1 – Slight

11MT012 MICRO ELECTRO MECHANICAL SYSTEMS

(Common to Mechatronics, ECE, EEE, and EIE branches)

3 0 0 3

MODULE - I **15**

Microsystems, Microsensors and Actuators: Overview-Microsystems - Working principle of Microsystems - Scaling laws - Scaling in geometry - Scaling in rigid body dynamics - Scaling in electrostatic forces - Scaling in electromagnetic forces - Scaling in electricity - Scaling in fluid mechanics - Scaling in heat transfer - Micro actuation techniques - Micro sensors - Micropump – Micromotors – Microvalves – Microgrippers - Micro accelerometers.

MODULE - II **15**

Micro System Fabrication Process and Manufacturing: Substrates - Single crystal silicon wafer formation – Photolithography - MEMS materials - Ion implantation - Diffusion - Oxidation - CVD - Physical Vapor Deposition - Deposition by epitaxy - Etching process - Bulk Micromanufacturing Surface Micromachining – LIGA - SLIGA

MODULE - III **15**

Micro System Design and Application: Micro system packaging – Materials - Die level - Device level - System level - Packaging techniques - Surface bonding - Wire bonding – Sealing - Design considerations - Process design - Mask layout design - Applications of micro system in – Automotive - Bio medical – Aero space – Telecommunications field. Basic exposure to software for MEMS design - Intellisuite

TOTAL: 45

TEXT BOOKS

1. Gad-el-Hak, Mohamed, "The MEMS Hand book", CRC press, Florida, 2009.
2. Tai-Ran Hsu, "MEMS and Microsystems: Design and Manufacture", Tata McGraw-Hill, New Delhi, 2006.

REFERENCE BOOKS

1. Fatikow, S. and Rembold, U., "Microsystem Technology and Microrobotics", Springer-Verlag, Berlin Heidelberg, 1997.
2. Gardner, Julian W., Varadan, Vijay K. and AwadelKarim Osama, O., "Microsensors MEMS and Smart Devices", John Wiley & sons, New York, 2001.
3. Marc Madou, Fundamentals of Microfabrication, CRC press, New York, 2002
4. W.Trimmer, Editor, Micromechanics and MEMS: Classic and Seminar papers to 1990, IEEE press, 1996.
5. Tay, Francis E.H. and Choong, W.O, "Microfludics and BioMEMS Applications", Springer, Berlin, 2002.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: interpret the fundamentals of micro systems, micro sensors and micro actuators

CO2: analyze the importance of micro fabrication and micro manufacturing techniques

CO3: elaborate the packaging techniques and micro systems design for various applications

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	3							2		1
CO2	3	3	3	2	1					2		1
CO3	3	3	3				1			2		1

3 – Substantial, 2 – Moderate, 1 – Slight

11MT013 RAPID MANUFACTURING TECHNOLOGIES

3 0 0 3

MODULE – I **15**

Overview of Rapid Prototyping and Liquid Based RP Processes: Definitions – Evolution - CAD for RPT - Product design and rapid product development - Conceptual design - Detail design – Prototyping - Fundamentals of RP systems - 3D solid modeling software and their role in RPT - Creation of STL file - Liquid based RP systems: Stereo lithography (SLA) – Principle - Process parameters - Process details -Machine details – Applications. Solid Ground Curing – Principle - Process parameters - Process details -Machine details – Applications.

MODULE – II **15**

Solid Based RP Processes: Fusion Deposition Modeling – Principle - Process parameters - Process details - Machine details - Applications. Laminated Object Manufacturing – Principle - Process parameters - Process details -Machine details – Applications

Powder based RP systems: Selective Laser Sintering (SLS) – Principle - Process parameters - Process details - Machine details - Applications.

MODULE – III **15**

Advances in RP and Rapid Tooling: 3-Dimensional Printers – Principle - Process parameters -Process details - Machine details - Applications – Laser Engineered Net Shaping (LENS) –Principle, Applications. Rapid Tooling – Soft Tooling, Hard Tooling – Applications of RP in Automotive Industry, Aerospace Industry and Biomedical Industry. Reverse Engineering – 3D scanning - 3D digitizing and Data fitting.

TOTAL: 45

TEXT BOOKS

1. Chua, C K., Leong, K F and Lim, C S., "Rapid Prototyping: Principles and Applications", John Wiley, New York, 2003.
2. Pham, D.T. and Dimov, S.S., "Rapid Manufacturing", Springer-Verlag, London, 2001.

REFERENCE BOOKS

1. Jacobs, Paul, F., "Stereolithography and other Rapid Prototyping and Manufacturing Technologies", Tata McGraw-Hill, New york,1996.
2. Hilton, P.D., "Rapid Tooling", Marcel Dekkar, London, 2000.
3. Zeid, I., "CAD/CAM: Theory and Practice", McGraw-Hill, Singapore, 1991.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: apply the concepts of rapid prototyping in product development

CO2: compare the principles, process, machines and process parameters of different RP processes

CO3: develop manufacturing processes and systems through direct and indirect tooling systems

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	1		1		3		2					2
CO2	1		1		3		2					2
CO3	1		1		3		2					2

3 – Substantial, 2 – Moderate, 1 – Slight

11MT014 PRINCIPLES OF DIGITAL SIGNAL PROCESSING

3 0 0 3

MODULE - I **15**

Introduction to Digital Signal Processing: Need and advantages of Digital Signal Processing- Classification of systems - Classification of signals - Signal representation by singularities - Typical signal processing operations: convolution, correlation ant transformation - Typical DSP system: ADC/DAC – Sampling, quantization, quantization error, Nyquist rate, aliasing effect.

MODULE - II **15**

Discrete Time System and Discrete Transforms: Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform, application to discrete systems – Stability analysis, frequency response – Fourier transform of discrete sequence – Discrete Fourier series – Convolution using Z-transform and Fourier transform. DFT – Definition – Properties, Computation of DFT using FFT algorithm – DIT & DIF – FFT using radix 2 – Butterfly structure; Computation of IDFT using DFT. Wavelet transform

MODULE - III **15**

Design of Digital Filters: IIR design: Approximation of analog filter design – Butterworth and Chebyshev; digital design using impulse invariant and bilinear transformation – Warping, prewarping – Frequency transformation. FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. FIR and IIR filter realization

TOTAL: 45

TEXT BOOKS

1. Proakis J.G. and Manolakis D.G., "Digital Signal Processing: Principles, Algorithms and Applications", Pearson Education/ PHI, New Delhi, 2003.
2. Mitra S.K., "Digital Signal Processing: A Computer Based Approach", Tata McGraw-Hill, New Delhi, 2001.

REFERENCE BOOKS

1. Oppenheim Alan V., Schafer Ronald W. and Buck, John R., "Discrete–Time Signal Processing", Pearson Education, New Delhi, 2003.
2. Salivahanan S., Vallavaraj A. and Gnanapriya C., "Digital Signal Processing", Tata McGraw Hill, New Delhi, 2003.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: interpret discrete time signals and signal processing operations

CO2: formulate the transformation techniques and their computation

CO3: analyze the design and implementation of filters

CO4: evaluate the finite impulse response and quantization effects

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	2	1	2	1								1
CO2	2	1	2	1								1
CO3	2	1	2	1								1
CO4	2	1	2	1								1

3 – Substantial, 2 – Moderate, 1 – Slight

11MT015 COMPUTER INTEGRATED MANUFACTURING

3 0 0 3

MODULE - I **13**

Introduction: Introduction to CIM – External communication – Automation strategies – Fundamental concepts in manufacturing and automation – Manufacturing Automation Protocol (MAP) - Marketing engineering - Production planning. AS/RS – Types, components of AS/RS, AS/RS controls, AGV -Types.

MODULE - II **16**

Group Technology and FMS: Introduction - Part families - Parts classification and coding – DCLASS and MI CLASS and OPTIZ coding systems - Group technology machine cells - Benefits of group technology. Process planning function CAPP - Computer generated time standards. Types of production monitoring systems - Structure model of manufacturing process - Computer in QC – Integration of CAQC with CAD/CAM.

Flexible Manufacturing Systems (FMS) - FMS concept – Components of FMS - FMS workstation -material handling and storage systems - FMS layout - Benefits of FMS.

MODULE - III **16**

CAPP and Computer Monitoring: Production planning and control - Cost planning and control - Inventory management - Material requirements planning (MRP) – Manufacturing Resource Planning (MRP II) - Shop floor control - Factory data collection system - Automatic identification system - Barcode technology - Automated data collection system - Use of RFID and Barcode – Online Quality and Control – MES and ERP Integration

TOTAL: 45

TEXT BOOKS

1. Groover, M.P., "Automation, Production System and CIM", Prentice-Hall of India, New Delhi, 2009.
2. Radhakrishnan P., Subramanyan S and Raju V., "CAD/CAM/CIM", Third Edition, New Age International Publishers, New Delhi, 2007.

REFERENCE BOOKS

1. Bedworth, David D, Henderson, Mark R and Wolfe, Philip M., "Computer Integrated Design and Manufacturing", Tata McGraw Hill, New Delhi, 2002.
2. Koren, Yorem, "Computer Integrated Manufacturing Systems", Tata McGraw Hill, New Delhi, 2005.
3. Ranky, Paul.G., "Computer Integrated Manufacturing", Prentice Hall International, New Jersey, 2000.
4. Yeomamas, R.W., Choudry, A. and Ten Hagen, P.J.W., "Design Rules for a CIM System", North Holland, Amsterdam, 2001.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: infer the importance of automation in the manufacturing industry and choose proper methods for effective material handling and storage

CO2: identify coding systems for different manufacturing parts and design flexible manufacturing systems for a manufacturing industry

CO3: estimate the cost, production capacity, component planning and make use of Bar codes and RFID tags

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	1	1			2						2
CO2	3	3	3			2						2
CO3	3	1	1			2						2

3 – Substantial, 2 – Moderate, 1 – Slight

11MT016 ADVANCED MANUFACTURING TECHNOLOGY

3 0 0 3

MODULE – I **15**

Unconventional Manufacturing Process: Abrasive Jet Machining - Water Jet Machining - Abrasive Water Jet Machining - Ultrasonic Machining - Electrical Discharge Machining - Wire Cut EDM -Electro Chemical Machining - Laser Beam Machining - Plasma Arc Machining - Electron Beam Machining.

MODULE - II **15**

Agile and Lean manufacturing: History of Agile Manufacturing - Agile Manufacturing Vs Mass Manufacturing, Agile Manufacturing Vs Mass Customization - Agile Practices - Agile practice for product development - Manufacturing agile practices - Understanding the value of investing in people.

Objectives of lean manufacturing - Key principles and implications of lean manufacturing - Traditional Vs Lean manufacturing - Lean implementation - Reconciling lean with other systems - Lean six sigma - e-Manufacturing.

MODULE – III **15**

New Trends in Manufacturing: Digital Manufacturing: Concepts and tools - Precision Engineering – Concepts and significance – Micro fabrication – Types - Top down – Bottom up approaches – LIGA process – Lithography steps – X ray Lithography – Masks – Mask materials. Micromachining – Theory of micromachining – Types – Concepts – Tools used in micromachining - Near Net Shape Manufacturing – High speed machining - manufacturing of integrated circuits - Hybrid Manufacturing process. Nano-engineering – Its concepts – Significance and applications – Nano surface generation – Diamond turning – ELID grinding – Electron beam nano fabrication.

TOTAL: 45

TEXT BOOKS

1. Serope Kalpakjian and Steven R. Schmid, "Manufacturing Process for Engineering Materials" Prentice Hall, 5th edition, 2007.
2. Jain, Vijay K. “Advanced Machining Processes”, Allied Publishers Pvt. Ltd., New Delhi, 2007.

REFERENCE BOOKS

1. Pandey, P.C. and Shan, H.S., “Modern Machining Processes” Tata McGraw-Hill, New Delhi, 2007.
2. Askin R G and Goldberg J B, “Design and Analysis of Lean Production Systems”, John Wiley and Sons Inc., 2003.
3. Gunasekaran A, “Agile Manufacturing, 21st Strategy Competitiveness Strategy”, Elsevier Publications, 2001.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: select appropriate unconventional manufacturing process for component machining

CO2: adapt the principles of agile manufacturing and lean manufacturing concepts

CO3: apply the concept of MEMS, NEMS, Near net shape manufacturing and High speed machining

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		2		3							3
CO2	3		2		2							3
CO3	3		2		3							3

3 – Substantial, 2 – Moderate, 1 – Slight

11MT017 MODELING AND SIMULATION

3 0 0 3

MODULE - I **15**

Simulation Systems and Random Number Generation: Steps in Simulation study - Monte Carlo simulation of queuing and inventory using EXCEL-Nature of computer modeling and simulation. Limitation of simulation, areas of application. Components of a system - Discrete and continuous systems. Models of a system - Pseudo random numbers generation techniques and testing of random numbers.

MODULE - II **15**

Random Variate Generation and Simulation Experiments: Methods of generating random variates, discrete and continuous distributions - Inverse transform technique for Exponential, Uniform, Triangular, Weibull, Empirical, Uniform and discrete distribution. Acceptance rejection method for Poisson and Gamma distribution; Direct Transformation for normal distribution.

Similation experiments: Problem formulation, data collection and reduction, time flow mechanism, key variables logic flow chart, starting condition, run size, experimental design consideration, output analysis and interpretation validation.

MODULE - III **15**

Simulation Languages and Software: Comparison and selection of simulation languages, study of any one simulation language- Development of simulation models using the simulation language studied for systems like, queuing systems, production systems, inventory systems, maintenance and replacement systems, investment analysis and network. ARENA Simulation software: Development of simulation models using ARENA simulation package for queuing system, Production system, inventory system, maintenance system.

TOTAL: 45

TEXT BOOKS

1. Banks, J., Carson, J. S.,Nelson, B. L., Nicol, D.M. and Shahabudeen.P. “Discrete – Event System Simulation”, Fourth Edition, Pearson Education, New Delhi, 2007.
2. Geoffrey Gorden, “System Simulation”, Prentice Hall of India, New Delhi, 2003.

REFERENCE BOOKS

1. Thomas J. Schriber, “Simulation using GPSS”, John Wiley, New York, 1991.
2. Narsing Deo, “System Simulation with Digital Computer”, Prentice Hall of India, New Delhi, 2004.
3. David Kelton, W., “Simulation with ARENA”, Fourth Edition, McGraw-Hill Education (India), New Delhi, 2007.
4. Averill Law, “Simulation Modeling and Analysis”, Fourth Edition, McGraw-Hill Education (India), New Delhi, 2007.
5. Elizandro,D. and Hamdy A.Taha, “ Simulation of Industrial systems: Discrete Event Simulation using EXCEL/VBA”, Auerbach Publications, 2007.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: infer the modelling and simulation of queuing, inventory and generation of random numbers

CO2: identify the different methods of random variant generation and simulation experiments

CO3: develop a model using simulation languages and software

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	2	3	3	3	2		1					2
CO2	2	3	3	3	2		1					2
CO3	2	3	3	3	2		1					2

3 – Substantial, 2 – Moderate, 1 – Slight

11MT018 ADVANCED ROBOTICS

3 0 0 3

MODULE- I **12**

Introduction: Co-operative industrial robots – Underwater robots – Medical robots – Humanoid – Space robots – Nuclear robots.

MODULE - II **20**

Mobile robots: Introduction – Kinematics models of mobile robots – Hilare mobile robots – Car-like mobile robots – Locomotion – Perception: sensors for mobile robots – Mobile robot localization, challenge – Planning and navigation.

MODULE - III **13**

Redundant Manipulator: Introduction – Kinematics of redundant – Manipulator – Redundancy resolution at the velocity level and position level. Joint limit avoidance and obstacles avoidance. Hyper redundant – Manipulator: constraint – Least square fitting method – Recursive fitting method.

TOTAL: 45

TEXT BOOKS

1. Farbed Fahimi, "Autonomous robots – modeling, path planning and control", Springer, 2009.
2. Roland siegwart, Illah, R., and Nourbakhsh, "Introduction to autonomous mobile robots", MIT press, Cambridge, 2004.

REFERENCE BOOKS

1. Journal of Industrial Robot
2. Journal of field Robot

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: elaborate a broad view of advance robotics systems in various domains of application

CO2: explain the concepts of mobile robot kinematic models, locomotion and various sensory devices used in mobile robots

CO3: estimate the redundant manipulator kinematics and velocity computations to perform obstacle avoidance in its work volume

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	2	3	3	3	2		1					2
CO2	2	3	3	3	2		1					2
CO3	2	3	3	3	2		1					2

3 – Substantial, 2 – Moderate, 1 – Slight