Semester 7

B. Tech 4th year (7th Semester) Mechatronics

Course No	Course Title	Teaching Schedule				Allotment Marks				Duration of Exam
		L	T	P	Total	Sessional	Theory	Practical	Total	
MT-401	Digital Signal Processing	3	1	-	4	50	100	-	150	3
MT-403	Systems Engineering	3	1	-	4	50	100	-	150	3
	Elective 1*	3	1	-	4	50	100	-	150	3
	Elective II*	3	1	-	4	50	100	-	150	3
MT-405	Sensors and Actuators	3	1	-	4	25	100	-	125	3
MT-407	Digital Signal Processing Lab	-	-	3	3	25	-	25	50	3
MT-409	The Professional Engineer (Project 1)	2	-	3	5	100	-	100	200	3
MT-411	Sensors and Actuators lab	-	-	3	3	25	-	25	50	3
MT-413	Seminar	2	-	-	2	25	-	-	25	
MT-415	In Plant Training report	-	-	-	-	125	-	-	125	
	Total	19	5	9	33	525	500	150	1175	

Students are allowed to use single memory, non-programmable scientific calculator during examination.

ELECTIVE – I

1. MT 417 Advanced Manufacturing Technology
2. MT 419 Finite Element Method
3. MT 421 Applied Numerical Techniques and Computer Programming
4. MT 423 Advanced Microprocessor

ELECTIVE – II

1. MT 425 Renewable Energy Resources
2. MT 427 Computational Fluid Dynamics
3. MT 429 Mechatronics Engineering
4. MT 431 Antenna & Wave Propagation

MT-401
Digital Signal Processing

L	T	P
3	1	-

Sessional: 50 Marks
Theory: 100 Marks
Total: 150 Marks
Exam Duration: 3 Hours

UNIT – I:

DISCRETE TRANSFORMS: Z- transform and its properties, Inversion of Z-transform, One sided Ztransform and solution of differential equations. Analysis of LTI systems in Z-domain, causality, stability, schur-cohn stability test; relationship between Z-transform and Fourier transform. Frequency selective filters; all pass filters, minimum-phase, maximum-phase and mixed-phase systems. Frequency domain sampling and DFT; properties of DFT, Linear filtering using DFT, Frequency analysis of signals using DFT, radix 2, radix-4, goertzel algorithm, Chirp Z-transform, applications of FFT algorithm, computation of DFT of real sequences. Quantization effects in computation of DFT.

UNIT – II:

IMPLEMENTATION OF DISCRETE TIME SYSTEMS: Direct form, cascade form, frequency sampling and lattice structures for FIR systems. Direct forms, transposed form, cascade form parallel form. Lattice and lattice ladder structures for IIR systems. State space structures Quantization of filter co-efficient structures for all pass filters.

UNIT – III:

DESIGN OF FIR FILTERS: Characteristics of practical frequency selective filters. Filters design specifications peak pass band ripple, minimum stop band attenuation. Four types of FIR filters Design of FIR filters using windows. Kaiser window method comparison of design methods for FIR filters Gibbs phenomenon, design of FIR filters by frequency sampling method, design of optimum equiripple FIR filters, alternation theorem.

UNIT – IV:

DESIGN OF IIR FILTERS: Design of IIR filters from analog filters, Design by approximation of derivatives, Impulse invariance method bilinear transformation method characteristics of Butterworth, Chebyshev, and Elliptical analog filters and design of IIR filters, Frequency transformation, least square methods, design of IIR filters in frequency domain.

Suggested Books:

1. John G. Proakis, Digital Signal Processing, PHI

2. S. K. Mitra, Digital Signal Processing , TMH
3. Rabiner and Gold, Digital Signal Processing, PHI
4. Salivahan, Digital Signal Processing , TMH
5. Digital Signal Processing: Alon V. Oppenhelm;PHI

Note:-

Examination :- The Examiners will set eight questions, taking two from each UNIT. The students are required to attempt five questions in all selecting at least one from each UNIT. All questions will carry equal marks.

Assignment :- Assignment based upon learning outcomes, as mention below, will be set by lecturer where the student will be required to achieve the LO's as mentioned below. The assessment of assignment will be done based upon the learning made by the student.

Learning outcomes(LO's)

1) Demonstrate systematic knowledge and understanding of key aspects and Concepts o f digital signal processing techniques, devices and architectures.	Knowledge & Understanding
2) Apply and extend appropriate analytical techniques to signal processing Processes and critically evaluate the outcomes.	Analysis
3) Use of simulation software and the key analytical skills and understanding to Evaluate arguments and assumptions in relating results to theory.	Application
4) Communicate ideas effectively.	Communication

MT - 403

Systems Engineering

L	T	P	
3	1	-	**Sessional: 50 Marks**
			Theory: 100 Marks
			Total: 150 Marks
			Exam Duration: 3 Hours

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UNIT-I

System, its objectives, quality, optimization and reliability, different types of problems: Importance, value, timing, accountability, and Organizational structure in the systems with its definition and environment, multi-objective analysis: Multi-Objective Decision Analysis (MODA) and trade-offs,

UNIT-II

Multidisciplinary Design Optimization (MDO), Trade space Exploration, Design structure matrices, System Dynamics, parameters for optimization of system and planning and analysis with mathematical optimization techniques, simulation techniques to understand system modeling using Monte Carlo Simulation Method

UNIT-III

Shortest path problem including Project Evaluation and Review Technique / Critical Path Method, Allocation of scarce resources: Assignment using Hungarian Method, Decision analysis with the help of decision trees, Dynamic programming and numerical on Dynamic programming

UNIT-IV

Advanced problems of Project Evaluation and Review Technique/Critical Path Method, IDEF and IDEF0-14 techniques, different dimensions of quality of the system and its assurance with control charts: R and $\bar{X}$ -charts and standards, TQM with its stages: inspection, quality control, quality assurance and TQM and Taguchi methods, reliabilities of the system in context with design and analysis. Explanation of Reliability with three tests: failure-terminated, time-terminated and sequential.

Text Books/ Reference Books

- Systems Engineering - An Introduction, J Boardman, 1990, Prentice Hall, ISBN: 0-13-504424-3
- Systems Engineering and Analysis, BS Blackford and WJ Fabrycky, 1990, Prentice Hall, ISBN: 0-13-880840-6

Note:-

Examination :- The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

Assignment :- Assignment based upon learning outcomes, as mention below, will be set by lecturer where the student will be required to achieve the LO's as mentioned below. The assessment of assignment will be done based upon the learning made by the student.

Learning outcomes(LO's)

1) Specify problems and design generic frameworks requiring systems solutions.	Application Knowledge & Understanding
2) Use systems optimisation techniques in industrial and societal environments.	Application
3) Use decision making and problem solving tools including statistical techniques in Contextual situations.	Problem solving
4) Critically appraise systems engineering in context.	Knowledge & Understanding Reflection

MT-405
Sensors and Actuators

L	T	P	
3	1	-	**Sessional: 25 Marks**
			Theory: 100 Marks
			Total: 125 Marks
			Exam Duration: 3 Hours

UNIT I - INTRODUCTION AND DISPLACEMENT MEASUREMENT

Sensors - Basic requirements of a sensors- Classification of sensors- Static and Dynamic characteristics of sensors- Displacement Sensors- Linear and Rotary displacement sensors- Potentiometer, Capacitive and Inductive type displacement sensor- position sensors- Optical encoder, Photoelectric sensor, Hall Effect Sensor.

UNIT II - MEASUREMENT OF PROXIMITY, FORCE AND PRESSURE

Eddy current proximity sensor- Inductive Proximity sensor- Capacitive Proximity sensor - Pneumatic Proximity sensors- Proximity Switches- Contact and Noncontact type – Strain Gauge – Diaphragm Pressure Sensor- Capsule Pressure sensors- Bellows Pressure Sensor- Bourdon tube pressure sensor- Piezoelectric Sensor- Tactile sensor.

UNIT III - MEASUREMENT OF VELOCITY, FLOW AND LEVEL

Tachogenerator - Pyroelectric sensors - Ultrasonic sensor – Resistive sensor- Pitot tube – Orificeplate - flow nozzle- Venturi tubes – Rotameter- Electromagnetic flow meter. Float level sensor- Pressure level sensor- Variable capacitance sensor.

UNIT IV - MEASUREMENT OF TEMPERATURE, MOTION AND LIGHT SENSORS

Thermocouples- Thermistors -Thermodiodes - Thermotransistors- Bimetallic Strip- Resistance Temperature Detector- Infrared Thermography. Vibrometer and accelerometer- seismic accelerometer. Photoresistors -Photodiodes - Phototranistors- Photocondutors.

UNIT V - MICRO SENSORS AND ACTUATORS

Micro Sensors: Principles and examples, Force and pressure micro sensors, position and speed micro sensors, acceleration micro sensors, chemical sensors, biosensors, temperature micro sensors and flow micro sensors. Micro Actuators: Actuation principle, shape memory effects-one way, two way and pseudo elasticity. Types of micro actuators- Electrostatic, Magnetic, Fluidic, Inverse piezoeffect, other principles.

TEXT BOOKS

1. Sawhney.A.K, *"Course in Mechanical Measurements and Instrumentation"*, Dhanpat Rai and Sons, 1997.
2. Patranabis.D, "*Sensors and Transducers"*, Wheeler publisher, 1994.
3. Sergej Fatikow and Ulrich Rembold, *Microsystem "Technology and Microbotics"* First edition, Springer -Verlag NEwyork, Inc, 1997.
4. Gupta.I.C, "*A Text book of Engineering Metrology"*, Dhanpat Rai and Sons, 1996.
5. *"ASTE Hand Book of Industries Metrology"*, Prentice Hall of India, 1992.

Note:-

Examination :- The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

Assignment :- Assignment based upon learning outcomes, as mention below, will be set by lecturer where the student will be required to achieve the LO's as mentioned below. The assessment of assignment will be done based upon the learning made by the student.

Learning outcomes(LO's)

1) To Understand the basic concepts of sensors.
2) To study about the various sensors types based on their applications.
3) To study about the micro level sensors and actuators.

MT - 407
Digital Signal Processing Lab

L	T	P
-	-	2

Sessional: 25 Marks
Practical: 25 Marks
Total: 50 Marks
Duration of Exam: 3 Hrs

NOTE:

1. At least ten experiments/ jobs are to be performed/ prepared by students in the semester.

2. At least 8 experiments/ jobs should be performed/ prepared from the below list, remaining 2 may either be performed/ prepared from the above list or designed & set by the concerned institution as per the scope of the syllabus of Digital Signal Processing and facilities available in the institute.

3. For Learning outcomes refer to Digital Signal Processing (MT-401).

LIST OF EXPERIMENTS

1. Define a function to compute DTFT of a finite length signal. Plot the magnitude and phase plots using subplots. Use this function to obtain DTFT of a 21 point triangular pulse over the domain 10<n<10: Plot the results over -1t<w<1t.
2. Write a program to plot the following functions: a)impulse function b)unit step c)unit ramp d) exponential e) sinusoidal
3. Verify the Symmetry, time shifting and modulating properties of DTFT with a rectangular pulse of length 21.
4 Study the aliasing effect by using a Sinusoidal Signal. Show the plots of' continuous time Signal. Sampled Signal and reconstructed signals by using subplot.
5. Study different window functions available in signal processing toolbox and their Controlling parameters.
6. Write a program to plot real, imaginary phase and magnitude of exponential function.
7 Verify the properties of Discrete Fourier Transform (DFT).
8 Write a program to find the convolution of two sequences using in built convolution function
9 Study of Digital Signal Processing Kit (TMSI ADSP)
10. Implementation of FlR/digital filter using DSP Kit.

TEXT BOOKS

1. Digital Signal Processing A Practical Approach, Emmanuel Ifeachor & Barrie Jervis, 2001, Prentice Hall, ISBN: 0201569199
2. Linear System s and Signal, B. P. Lathi, Berkeley Cam bridge Press, 1992, ISBN: 0941413349.
3. Signal Analysis and Signal Processing, Philip Denbeigh, 1998, Addison Wesley, ISBN:0201178605.
4. Principles of Signals and System s, Fred Taylor, 1994, McGraw Hill, ISBN: 0079111718.

MT - 409

The Professional Engineer (Project 1)

L	T	P
2	-	3

Sessional: 100 Marks
Practical: 100 Marks
Total :- 200 Marks
Duration of exam: 03 hrs

Unit-1

Ethics-scope and issues in the engineering sector: What are research ethics, Importance of research ethics, Plagiarism Avoidance, Referencing and citation

Unit 2

Project Management and Scheduling Techniques: Planning Activities, Estimating the time requirements of a project, Project Milestones, Project Quality, Project Management, Gantt Chart, Pert Chart, COCOMO model, Function Point Analysis,

Unit 3

Research Methodologies: Designing a Research Programme, Research Approaches, Quantitative Methods, Qualitative Methods.

Data Gathering Methods: Questionnaire, Interview, Focus Groups, Observation, Studying Documentation

Unit 4

Abstract and Literature Review: Writing an abstract, Structure of a Literature Review, Guidelines for writing a literature review, Identifying a good literature review and a bad literature review, Literature searching techniques and sources.

Text Books

1. Research Methodology: Methods and Techniques- C R Kothari
2. Project Management: Planning and Control Techniques- Rory Burke

Reference Books

1. Research Methodology- R. Panneerselvam

Note: Students will have to submit a preparatory report for a proposed project, including literature survey, data gathering methods, ethical assessment, project plan and resources and a logbook detailing background work, sources and reflective comment on the work undertaken.

MT-411

Sensors and Actuators lab

L	T	P	
-	-	3	**Sessional: 25 Marks**
			Practical: 25 Marks
			Total: 50 Marks
			Duration of Exam: 3 Hrs

NOTE:

1. At least ten experiments/ jobs are to be performed/ prepared by students in the semester.
2. At least 5 experiments/ jobs should be performed/ prepared from the below list, remaining 5 may either be performed/ prepared from the above list or designed & set by the concerned institution as per the scope of the syllabus of Sensors and Actuators and facilities available in the institute.
3. For Learning outcomes refer to Sensors and Actuators (MT-405).

LIST OF EXPERIMENTS

Characteristics of

1. Displacement sensors
a. LVDT
b. RVDT
2. Position sensors
a. Potentiometer
b. Synchro and resolver
c. Rotary encoders – absolute and incremental
3. Speed sensors
a. Tachogenerator
b. Hall effect sensor
4. Force and pressure sensors
a. Strain gauge
b. Load cell
5. Torque sensors
a. Load cell
b. Hall effect sensors
c. Stroboscope
6. Proximity and range sensors
a. Infra red sensors
b. SONAR
c. Inductive, Capacitive, Magnetic and Optical Proximity Sensors
7. Temperature Sensors
a. Thermocouple
b. Resistance Temperature detectors
c. Thermistors
d. IC Temperature sensors
8. Flow measurement
a. Venturimeter
b. Hot wire anemometer

9. Vibration measurement using Accelerometer
10. Miscellaneous measurements

LIST OF EXPERIMENTS

1. Stepper motors (Unipolar and Bipolar)– Modes of operation
2. DC motor characteristics (Armature controlled and BLDC)
3. DC Servo motor characteristics
4. Characteristics of Solenoids and relays
5. Electro pneumatic actuators – Linear and rotary (full and limited rotation)
6. Exercises involving mechanical drives (gear trains, lead screw and ball screw, belt drives etc.,)

TEXT BOOKS

1. Sawhney.A.K, *"Course in Mechanical Measurements and Instrumentation"*, Dhanpat Rai and Sons, 1997.

2. Patranabis.D, "*Sensors and Transducers"*, Wheeler publisher, 1994.

3. Sergej Fatikow and Ulrich Rembold, *Microsystem "Technology and Microbotics"* First edition, Springer -Verlag NEwyork, Inc, 1997.

4. Gupta.I.C, "*A Text book of Engineering Metrology"*, Dhanpat Rai and Sons, 1996.

5. *"ASTE Hand Book of Industries Metrology"*, Prentice Hall of India, 1992.

Seminar
MT – 413

P/D	Total	Sessional: 25
2	2	

Student will give a talk on some technical topics.

Note: The seminar will continue in eighth semester and will be evaluated in eighth semester.

In Plant Training Report
MT – 415

L	T	P/D	Total
	-	-	

Sessional: 125 marks

Student will submit a summer training report (about 8 weeks industrial training) for his/her assessment.

Advanced Manufacturing Technology
MT 417

L	T	P
3	1	-

Sessional: 50 Marks
Theory: 100 Marks
Total: 150 Marks
Exam Duration: 3 Hours

UNIT I

Hot machining, Machining of Plastics, Unit heads, Plastics cooling, electro forming, Surface Cleaning and Surface Treatments, Surface Coatings, Paint Coating and Slushing, Adhesive Bonds, Adhesive Bond Joints, Adhesives, Surface Coating for Tooling, Graphite Mould Coating, Vacuum Mould Process.

Introduction, Types of Composites materials, Agglomerated Materials, Reinforced materials, Laminates, Surface Coated Materials, Production of Composite Structures, Fabrication of particulate composite Structures, Fabrication of reinforced Composite, Fabrication of Laminates, Machining, Cutting and Joining of Composites.

UNIT II

Introduction, Polymers, Polymerization, Addition of Polymers, Plastics, Types of plastics, Properties of Plastics, Processing of Thermoplastic Plastics, Injection Moulding, Extrusion Process, Sheet forming processes, Processing of Thermosetting Plastics, Compression Moulding, Transfer Moulding, Casting of Plastics, Machining of plastics, other processing methods of plastics

Introduction, casting, thread chasing, Thread Rolling, Die Threading and Tapping, Thread Milling, Thread Measurement and Inspection

UNIT III

Theoretical basis of metal forming, classification of metal forming processes, cold forming, hot working, Warm working, Effect of variables on metal forming processes, Methods of analysis of manufacturing processes, Open Die forging, Rolling Power Rolling, Drawing, Extrusion.

UNIT IV

Introduction, Product Application, Limitation of Die Casting, Die Casting Machines, Molten metal Injection systems, I lot chamber machines, Cold chamber machines, Die casting Design, Design of Die casting Dies, Types of Die casting Dies, Die design, Die material, Die Manufacture, Die Lubrication and Coating, Preheating of Dies, Vacuum Die Casting, Recent trends In Die Casting Process.

Quality Control, CMM, Application of AI in CAD/CAM/CIM., Reverse Engineering, Rapid Prototyping and Tooling.

Reference and Text Books:

1. Principles of Manufacturing
   - By J.S.Campbell, Tata McGraw-Hill
2. Production Engineering Sciences
   - By Pandey and Sinh Standard Pub.
3. A text book of Production Technology
   - By P.C. Sharma S.Chand & Company.
4. Manufacturing Materials and Processes
   - By Lindberg Prentice Hall
5. A text book of Production Engineering
   - By P.C. Sharma S.Chand & Company.
6. Manufacturing Technology
   - Radhakrishnan,Scitech
7. Manufacturing Science
   - A.Ghosh, East-West Publications.

Note:-

Examination :- The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

Finite Element Method
MT 419

L	T	P
3	1	-

Sessional: 50 Marks
Theory: 100 Marks
Total: 150 Marks
Exam Duration: 3 Hours

UNIT I

Basic Concept, Historical background, Engineering applications, general description, Comparison with other methods.

Need for weighted-integral forms, relevant" mathematical concepts and formulae, weak formulation of boundary value problems, variational methods, Rayleigh-Ritz method, and weighted residual approach.

UNIT II

Model boundary value problem, finite element discretization, element shapes, sizes and node locations, interpolation functions, derivation of element equations, connectivity, boundary conditions, FEM solution, post-processing, compatibility and completeness requirements, convergence criteria, higher order and isoparametric elements, natural coordinates, Langrange and Hermite polynomials.

UNIT III

External and internal equilibrium equations, one-dimensional stress-strain relations, plane stress and strain problems, axis-symmetric and three dimensional stress-strain problems, strain displacement relations, boundary conditions, compatibility equations, computer programs.

UNIT IV

Weighted residual methods: Galerkin FE formulation – axially loaded bar – heat flow in a bar. Isoparametric formulation: Natural coordinates – linear and quadratic bar element – linear triangle and plane bilinear elements for scalar fields – jacobian matrix – element matrices - Gauss quadrature – requirements for isoparametric elements – accuracy and mesh distortion. Advanced topics: Introduction to non-linear and dynamic finite element procedures, error estimation, coupled problems (only brief details are needed).

Reference and Text Books:

1. The Finite Element Method
   - By Zienkiewicz, Tata McGraw
2. The Finite Element Method for Engineers
   -By Huebner, John Wiley
3. An Introduction to the Finite Element Method
   -By J.N.Reddy, McGraw Hill

Note:-

Examination :- The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

Applied Numerical Techniques and Computer Programming
MT 421

L	T	P
3	1	-

Sessional: 50 Marks
Theory: 100 Marks
Total: 150 Marks
Exam Duration: 3 Hours

Unit I

Interpolation and Curve Fitting : Lagrangian Polynomials, Divided differences, Interpolating with a cubic spline, Bezier Curves and B-Spline Curves, Polynomial approximation of surfaces, Least Square approximations, Flow Chart for Computer Programmes.

Unit II

Solving Non-Linear Equations: Bisection Method, Linear Interpolation Methods, Newton's Methods, Muller's Methods, Fixed-point Iteration Method, Flow Chart for Computer Programmes.

Solving Sets of Equations: The Elimination Method, Gauss and Gauss Jordan Methods, Other Direct Methods, Iterative Methods, The Relaxation Methods, Flow Chart for Computer Programmes.

Unit III

Numerical Differentiation and Integration: Derivatives from difference tables. High Order Derivative, Extra-polation Techniques. The Trapezoidal Rule, Simpson's Rules. Flow Chart for Computer Programmes.

Numerical Solution of Ordinary Differential Equations:The Taylor-Series Method, Euler and modified Euler methods,Range-Kutta methods,Miline's Method.The adams-Moulton method, Convergence Criteria, Errors and error Propagation. Flow Chart for Computer Programmes.

Unit IV

Numerical Solution of Ordinary and Partial Differential Equations Taylor series method, Euler and modified Euler method, Runge Kutta methods, Milne's method, Finite differences approximations of partial derivatives,Solution of Laplace equation(Elliptic)by standard5–point formula, solution of one dimensional heat equation(Parabolic)by Bender-Schmidt method, crank–Nicolson method, Solution of one dimensional wave equation(Hyperbolic) by iterative method.

Text Books :

1. Applied Numerical Analysis by Curtis f. Gerald and Patrick O. Wheatley – Published by Addison Wesley.
2. Introductory Methods of Numerical Methods – S.S. Sastry, PHI, New Delhi.
3. Numerical Method : E. Balagurusamy ,Tata McGraw Hill Publication.

Reference Books :

1. MATHEMATICA – A system for doing mathematics by Computer by Wolfram, Stephen – Published by Addition – Wesley.
2. Applied Numerical Methods by Camahan, Brice,Et.al, Published by Wiley, York.

3. Numerical Solution of partial differential equations by Smith, G.D. Published by Oxford University Press London.
4. Iterative Methods for the solution of Equations by J.F. Traub – Published by Prentice Hall.
5. Numerical Methods in Engineering and Science by B.S. Grewal- Published by Khanna Publishers.
6. Numerical Methods in Engineering by M.G. Salvadori and M.L. Baron- Published by Prentice Hall India.

Note:-

Examination :- The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

MT - 423

Advanced Microprocessor

L	T	P
3	1	-

Sessional: 50 Marks
Theory: 100 Marks
Total: 150 Marks
Exam Duration: 3 Hours

UNIT-I

INTEL'S X86 FAMILY :Introduction, Register set, data formats, addressing modes, interrupts, memory hierarchy, pipelining, segmentation, paging, real and virtual mode execution, protection mechanism, task management.

UNIT-II

ARCHITECTURE OF INTEL X86 F AMIL Y :CPU block diagrams, Pin diagrams and internal descriptions of -80286.386,486 and Pentium. Instruction formats. Intel X86 Instruction set. Assembler directives.

UNIT-III

ARITHMETIC CO-PROCESSORS: Data formats; 80287 architecture - Pin diagram, internal architecture, status register, control register; tag register. Instruction set - data transfer, arithmetic, comparison, transcendental operations, constant operations and control instructions. Interfacing 80287 with 80286 Programming examples.

UNIT-IV

HIGHER- CO-PROCESSORS : Introduction to 80387,80487, pentium processors

NOTE: The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all , selecting at least one question tram each unit.

Suggested Books:

Daniel Tabak, Advanced Microprocessors (2nd cd) Mc Graw Hill Pub. Barry B.Brey,

The Intel Microprocessors (4'" ed) PHI Pub. , DV-Hall, Microprocessors & Interfacing (2nd ed) Mc Graw Hill Pub.

Renewable Energy Resources
MT - 425

L	T	P
3	1	-

Sessional: 50 Marks
Theory: 100 Marks
Total: 150 Marks
Exam Duration: 3 Hours

UNIT-I

Direct energy conversion, description, working principle, magneto hydrodynamic systems (MHD), thermoelectric generators, thermionic generator, fuel cells, solar cells, EMF generated, power output, losses and efficiency, applications, hydrogen conversion and storage systems.

UNIT-II

Extraterrestrial solar radiation, components of radiation, geometry of earth and sun, geometry of collector arid the solar beam, effects of earth's atmosphere, measurements of solar radiation, calculation of heat balance for a solar collector, type of water heaters, selective surfaces, crop heaters, space heating, space cooling, water desalination, solar ponds, solar concentrators, electric power system, problems.

Introduction, the silicon p-n junction, photon absorption solar radiation input, photovoltaic circuit properties and loads, limits to cell efficiency, solar cell construction type and adaptations of photovoltaic, other types of photoelectric and thermo electric generation, problems.

UNIT III

Principles of hydro power, assessing the resource for small installations, an impulse turbine, reaction turbines, hydro electric systems, the hydraulic rain pump, wind turbine types and terms, linear momentum and basic theory, dynamic matching, steam tube theory, characteristics of the wind, power extraction by a turbine, electricity generation, mechanical power, problems.

Introduction, tropic level photosynthesis, photosynthesis at the plant level, thermodynamic considerations, photosynthesis, molecularlevel photosynthesis, synthetic photosynthesis, bio fuel classification, bio-mass production for energy farming, direct combustion for heat, pyrolysis (destructive distillation), alcoholic fermentation, anaerobic digestion for bio-gas, agrochemical fuel extractions, problems.

UNIT IV

Introduction, wave motion, wave energy and power,wave patterns, devices, the causes of tides, enhancement of tides flow power, tidal range power, world range power sites, problems.

Principles of Ocean Thermal Energy Conversion (OTEC), heal exchangers, pumping requirements, other practical considerations, introduction to geothermal energy, geophysics, dry rock and hot aquifer analysis, harnessing geothermal resources, problems.

Text Books:

1. Renewable Energy Rsources by John W. Twidell and Anthony D. Weir, published by E.& F. N. Spon Ltd. London.
2. Non-Conventional energy sources by Rai G D, Khanna Publishers, New Delhi

Note:-

Examination :- The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

Computational Fluid Dynamics
MT - 427

L	T	P
3	1	-

Sessional: 50 Marks
Theory: 100 Marks
Total: 150 Marks
Exam Duration: 3 Hours

UNIT I

Methods of prediction: comparison of experimental investigation Vs theoretical calculation; Mathematical description of physical phenomena; significance of governing differential equations; the general form of governing differential equation.
Classification of problems: Physical classification: Equilibrium problems and Marching problems; Mathematical classification: Elliptic, parabolic and hyperbolic partial differential equations; Nature of co-ordinates; one way and two-way co-ordinates; Proper choice of co-ordinates.

UNIT II

The concept of discretisation; Finite differences; Taylor series formulation; Finite difference discretisation of ordinary and partial derivatives; Truncation error, round-off error, discretisation error; Consistency and stability of numerical schemes; Variation formulation; Method of weighted Residuals, control volume formulation.

UNIT III

Steady one- dimensional Conduction, The inter-face conductivity, Non linearity, Source-Term Linearization, Types of Boundary Conditions. Unsteady one-dimensional Conduction: Explicit, Crank-Nicolson and Fully Implicit scheme's Discretisation of two and three-dimensional problems, Stability analysis.

UNIT IV

Introduction to finite volume method – regular finite volume – approximations in the discretization technique – discretization procedure – semi-explicit method – implementation of boundary conditions (only elementary theory and no direct problems).

Reference and Text Books:

1. Computational Fluid Dynamics
   - By Anderson, McGraw-Hill
2. Numerical Heat Transfer and fluid flow
   - By Patankar, McGraw-Hill

Note:-

Examination :- The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

Mechatronics Engineering
MT- 429

L	T	P
3	1	-

Sessional: 50 Marks
Theory: 100 Marks
Total: 150 Marks
Exam Duration: 3 Hours

UNIT I

What is Mechatronics? A measurement system with its constituent elements, open and closed loop systems, sequential controllers, micro processor based controllers, the Mechatronics approach.

A review of displacement, position velocity, motion, force fluid pressure, liquid flow, liquid level, temperature, light sensors/along with performance terminology, selection of sensors, input data by switches, Signal Conditioning Processes, Inverting Amplifiers, Non Inverting Amplifiers, Summing, Integrating, Differential, Logarithmic Amplifiers, Comparators, Amplifiers Error, Filtering, Wheatstone Bridge, Temperature Compensation, Thermocouple Compensation, Modeling of Mechanical systems and Simulations

UNIT II

Pneumatic and hydraulic systems, directional control valves, valve symbols, pressure control valves, cylinder sequencing, process control valves, rotary actuators, mechanical systems - types of motion, kinematic chains, cams, gear trains, Ratchet & Pawl, belt and chain drives, bearings, mechanical aspects of motor selection, electrical systems, mechanical and solid state switches, solenoids, D.C. & A.C moto4rs, stepper motors, problems.

UNITIII

Electrical Actuation Systems: Switching Devices, Mechanical Switches – SPST, SPDT, DPDT, Debouncing keypads; Relays, Solid State Switches, Diodes, Thyristors, Transistors, Solenoid Type Devices: Solenoid Operated Hydraulic and Pneumatic Valves, Control of DC Motors, Permanent Magnet DC Motors, Bush less Permanent Magnet DC Motors, AC Motors and speed controls, Stepper Motors and Controls, Servo Motors.

System Interfacing and data acquisition:

Data acquisition systems, Data loggers, SCADA, Interfacing requirements, Buffers, Darlington Pair, Handshaking, Serial and Parallel Port Interfacing, Peripheral Interface Adapters, Analog to Digital Conversion, Digital To Analog Conversion, Sample and Hold Amplifiers, Multiplexers, Time Division Multiplexing, Digital Signal Processing, Pulse Modulation, Component Interconnection and Impedance Matching, Interfacing Motor drives. Electrical power supply and protection.

UNIT IV

A review of number systems and logic gates, Boolean algebra, Karnaugh maps, sequential logic basic structure of programmable logic controllers, input/output processing, programming mnemonics; timest, internal relays and counters, master and jump controls, data handling, analog input/output, selection of a PLC, PROBLEMS.

Control, microcomputer structure, micro-controllers, applications, programming languages,

instruction sets, assembly language programs, subroutines, Why C Language? A review of program structure, branches, loops, arrays, pointers, examples of programs, interfacing, input/output, interface requirements. Peripheral interface adapters, serial communication interface, examples of interfacing, problems.

Text Book:

1. Mechatronics by W. Bolton, published by Addition Wesley.
2. Nitaigour Premchand Mahalik, Mechatronics principles, concepts and applications, Tata Mc Graw Hill.
3. Joji P, Pneumatic Controls, Wiley.
4. Dan Necsulescu, Mechatronics, Pearson
5. David g Alciatore, Michael B Histand, "Introduction to Mechatronics and measurement systems", Mc Graw Hill Education.
6. A Smaili, F Mrad, "Mechatronics – Integrated Technologies for Intelligent Machines, Oxford Higher Education.
7. Nitaigour Premchand Mahalik, "Mechatronics Principles, Concepts & Application", Tata McGraw Hill Publishing Co.Ltd., 2003.

Note:-

Examination :- The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

Antenna & Wave Propagation

MT- 431

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Sessional: 50 Marks
Theory: 100 Marks
Total: 150 Marks
Exam Duration: 3 Hours

UNIT I :

Basic Principle: Scalar & vector potential for electric & magnetic components, Retardation, retarded vector potential relation between scalar & vector potential current element.

Basic Antennas: Half wave dipole, quarter wave mono pole, short dipole, calculation of radiation resistance, effective length & pointing vector. Current distribution: Linear current & sinusoidal distribution.

UNIT II :

Antenna Parameter: Solid angle, radiation intensity, directive gain directivity, power gain, beam width: HPBW, FNBW, band width, Q factor resonance in antenna, antenna as a transmission line, antenna as active component, antenna temp. Radiation pattern, Eplane H plane, efficiency. Effective aperture, scattering aperture, loss aperture, directivity, polarization. Transmission between two Antenna, Reciprocity theorem application of Reciprocity theorem.

Low Freq Antennas: Monopole, folded, loop antenna, biconical antenna, yagiuda antenna: different antenna used for A.M & FM transmission. VHF & LHF antennas, Resonant Antennas & non-resonant antenna, design parameter of different Antenna.

UNIT III :

Microwave Antenna: Parabolic Antenna, Lens Antenna, horn Antenna, Antenna used for tracking & antenna used for satellite communication. E-plane horn, H-Plane horn circulars Horn, pyramidal Horn.

Radio Wave Propagation: Different technique for radio wave propagation: Ground wave propagation, space wave, sky wave, duct propagation, troposcatter.

UNIT IV :

Ionosphere propagation: Skip distance, LUF, MUF, Critical freq, Variation of refractive index with height, effect of earth magnetize field on ionospheres propagation, calculation of refractive index dielectric constant & Conductivity for ionospheres. Ionospheres abnormalities.

Antenna Array: Multiplication of Pattern, Significance of Antenna Array, Broadside, End fired, Uniform, Parasitic feed in Antenna Array, Calculation of Directivity & B.W for Antenna array. Increased directed directive end fired array. Tapering of Array: Binomial Array, Techepbyshe.

References:

1. Jordan Balmian:- Electromagnetic Field Theory (PHI)
2. Kraus Antenna & Wave propagation (Mc Graw Hill)
3. Antenna & Wave propagation by K.D.Prasad (Satya Prakashan)
4. Collin R.E :- Antenna & Wave Propagation (TMH)

Note:-

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