Rajshahi University of Engineering & Technology
Rajshahi-6204, Bangladesh

RUET

MTE

Information Catalogue

Undergraduate Studies

Department of Mechatronics Engineering

Heaven's Light is Our Guide

Rajshahi University of Engineering & Technology

DEPARTMENT OF MECHATRONICS ENGINEERING

Rajshahi-6204, Bangladesh

Information Catalogue
Undergraduate Studies

Issued To _____

Roll No _____

DISCLAIMER

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Head
Department of Mechatronics Engineering
Rajshahi University of Engineering & Technology
Rajshahi-6204

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Message from the Editorial Board

On behalf of the editorial board members, it is with great pleasure and honor to announce the publication of the first edition of the Undergraduate course curriculum bulletin for MTE, RUET. This bulletin has a strong emphasis on interdisciplinary issues related to modern mechatronics education. It elucidates the academic regulation, course curriculum and research programs offered by the Department of Mechatronics Engineering, RUET. Students who are seeking to attain the required degree of B.Sc. in Mechatronics Engineering can find it as a significant reference for their respective academic programs. This publication may also be useful for the teachers to create learning environments for the students who are active participants as individuals and as members of collaborative groups and design lessons that will allow students to take part in educational activities. This bulletin covers a brief introduction about RUET, its location, administration, facilities offered by the University, course offering method and instruction, departments and other necessary information. It also presents information about the Department of Mechatronics Engineering such as its laboratory facilities, research programs, extra-curricular activities and so on. It can be noted that, the undergraduate studies will be furnished with the following academic rules and regulations in this bulletin: admission procedure, course registration, credit structure, grading system, performance evaluation, degree completion requirements etc. The provided information in this curriculum can be updated and revised at any time without any kind of prior notification. Finally, this bulletin contains the detailed outlines of the courses for B.Sc. Engg. (Mechatronics) Degree Program, RUET.

Information Catalogue

Message from the Head

It is my pleasure to welcome all to the Department of Mechatronics Engineering in the Faculty of Mechanical Engineering, Rajshahi University of Engineering & Technology (RUET). In Bangladesh, RUET is the first public university to introduce Mechatronics Engineering in the year of 2013. This department offers a world-class education to its students. At present, there are nine faculty members who teach over more than 150 undergraduate students each year.

Our program aims to provide the students with a solid background and elementary principles in mechanics, electronics, control system, electro-mechanics, software engineering and so on. We provide an appropriate learning environment and techniques to our students, so that they will have an enriched intellectual, creative thinking and practical knowledge for solving challenging engineering problems. This department possesses a number of laboratories including Artificial Intelligence and Control System Lab updated with latest technologies. This laboratory has been formed under a project of Bangladesh High Tech Park Authority, ICT Division, Bangladesh. Being a part of the department, students will have a chance to practice their acquired knowledge in these outstanding laboratories. This will enable them not only to establish their carrier in automated or semi-automated industries or in research but also to play a vital role in the planning and implementation of the development scheme for our nation and for the universe.

I invite everybody to come and visit our department and have a chance to meet with our energetic students and staff to discover this stirring department.

Dr. Sajal Kumar Das
Head, Department of Mechatronics Engineering

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Information Catalogue

Information Catalogue

*** **This is the compressed low-resolution version of the original Information Catalogue printed by the Dept. of Mechatronics Engineering, RUET.**

*** **Page No. 06 to Page No. 48 has been removed intentionally to reduce the size of the online version of the Information Catalogue.**

*** **Printed Information Catalogue can be obtained from the Office of the Dept. of MTE, RUET.**

Chapter-IV
Course Structure of the Undergraduate Studies

Summary of Course Credits

Year	Semester	Total Credit
1st	Odd	18.75
1st	Even	19.50
2nd	Odd	19.50
2nd	Even	19.50
3rd	Odd	20.50
3rd	Even	18.25
4th	Odd	22.00
4th	Even	22.00
Total Credit		**160.00**

Contribution of Various Sciences and Engineering in MTE Courses

Degree	Credit Hours			Core Engg. (%)	Related Engg. (%)	Basic Sciences (%)	Hum (%)
	Theory	Sessional	Total				
B.Sc. Engg. (Mechatronics)	120	40.00	160.00	42.35	37.50	14.06	6.09

Course structure at a glance

First Year: Odd Semester			
Course No.	**Course Title**	**Contact Hrs/week**	**Credits**
	Theory Courses		
MTE 1101	Mechatronic Systems	3.00	3.00
Math 1127	Calculus and Solid Geometry	3.00	3.00
Phy 1127	Physics	3.00	3.00
Chem 1127	Chemistry	3.00	3.00
Hum 1127	Sociology and Engineering Ethics	3.00	3.00
	Sessional Courses		
ME 1130	Engineering Graphics	3.00	1.50
MTE 1102	Mechatronic Systems Sessional	1.50	0.75
Phy 1128	Physics Sessional	1.50	0.75
Chem 1128	Chemistry Sessional	1.50	0.75
	Total=	**22.50**	**18.75**

First Year: Even Semester			
Course No.	**Course Title**	**Contact Hrs/week**	**Credits**
	Theory Courses		
ME 1255	Thermodynamics and Heat Transfer	3.00	3.00
EEE 1287	Electrical Circuits	3.00	3.00
CSE 1287	Computer Fundamentals & Programming	3.00	3.00
Math 1227	Vector, Matrix and Ordinary Differential Equation	3.00	3.00
Hum 1227	Technical English & Communication Skills	3.00	3.00
	Sessional Courses		
ME 1256	Thermodynamics and Heat Transfer Sessional	1.50	0.75
EEE1288	Electrical Circuits Sessional	3.00	1.50
CSE 1288	Computer Fundamentals & Programming Sessional	3.00	1.50
Hum 1228	Technical English & Communication Skills Sessional	1.50	0.75
	Total=	**24.00**	**19.50**

Second Year: Odd Semester			
Course No.	**Course Title**	**Contact Hrs/week**	**Credits**
	Theory Courses		
ME 2155	Engineering Mechanics	3.00	3.00
EEE 2187	Electronics	3.00	3.00
CSE 2187	Software Engineering	3.00	3.00
Math 2127	Fourier Series, Laplace Transform and Partial Differential Equation	3.00	3.00
Hum 2127	Engineering Economics & Accounting	3.00	3.00
	Sessional Courses		
ME 2130	CAD Practice	3.00	1.50
ME 2156	Engineering Mechanics Sessional	1.50	0.75
EEE 2188	Electronics Sessional	3.00	1.50
CSE 2188	Software Engineering Sessional	1.50	0.75
	Total=	**24.00**	**19.50**

Third Year: Odd Semester			
Course No.	**Course Title**	**Contact Hrs/week**	**Credits**
	Theory Courses		
MTE 3101	Control Systems	3.00	3.00
MTE 3103	Microcontroller and Interfacing	3.00	3.00
MTE 3105	Linear Integrated Circuits and Digital Systems	3.00	3.00
ME 3155	Mechanics of Solids	3.00	3.00
Math 3127	Numerical Analysis & Statistics	3.00	3.00
	Sessional Courses		
MTE 3100	Industrial Training	4 weeks	1.00
MTE 3102	Control Systems Sessional	3.00	1.50
MTE 3104	Microcontroller and Interfacing Sessional	3.00	1.50
MTE 3106	Linear Integrated Circuits and Digital Systems Sessional	1.50	0.75
ME 3156	Mechanics of Solids Sessional	1.50	0.75
	Total=	**24.00**	**20.50**

Second Year: Even Semester			
Course No.	**Course Title**	**Contact Hrs/week**	**Credits**
	Theory Courses		
MTE 2205	Sensors and Instrumentations	3.00	3.00
ME 2255	Manufacturing Processes	3.00	3.00
EEE 2297	Signals and Linear Systems	3.00	3.00
EEE 2287	Electro-Mechanical Systems and Drives	3.00	3.00
Math 2227	Complex Variables and Harmonic Analysis	3.00	3.00
	Sessional Courses		
MTE 2206	Sensors and Instrumentation Sessional	1.50	0.75
MTE 2210	Modeling and Simulation Sessional	1.50	0.75
ME 2156	Manufacturing Processes Sessional	3.00	1.50
EEE 2288	Electro-Mechanical Systems and Drives Sessional	3.00	1.50
	Total=	**24.00**	**19.50**

Third Year: Even Semester			
Course No.	**Course Title**	**Contact Hrs/week**	**Credits**
	Theory Courses		
MTE 3201	Power Electronics and Drives	3.00	3.00
MTE 3205	Hydraulic and Pneumatic Control	3.00	3.00
ME 3255	Machine Dynamics and Vibrations	3.00	3.00
ME 3265	Fluid Mechanics and Machinery	3.00	3.00
EEE 3287	Network and Communication Systems	3.00	3.00
	Sessional Courses		
MTE 3200	Mechatronics Case Study	2.00	1.00
MTE 3202	Power Electronics and Drives Sessional	1.50	0.75
MTE 3206	Hydraulic and Pneumatic Control Sessional	1.50	0.75
ME 3256	Machine Dynamics and Vibrations Sessional	1.50	0.75
	Total=	**21.50**	**18.25**

Fourth Year: Odd Semester			
Course No.	**Course Title**	**Contact Hrs/week**	**Credits**
	Theory Courses		
MTE 4101	Automation	3.00	3.00
MTE 4103	Digital Signal Processing & Machine Vision	3.00	3.00
MTE 4107	Design of Mechatronic Systems	3.00	3.00
IPE 4155	Industrial Management	3.00	3.00
MTE 4105(*)	Optional-I	3.00	3.00
	Sessional Courses		
MTE 4100	Project and Thesis	3.00	1.50
MTE 4110	Seminar	2.00	1.00
MTE 4102	Automation Sessional	3.00	1.50
MTE 4104	Digital Signal Processing & Machine Vision Sessional	3.00	1.50
MTE 4108	Design of Mechatronic Systems Sessional	3.00	1.50
	Total=	**29.00**	**22.00**

Fourth Year: Even Semester			
Course No.	**Course Title**	**Contact Hrs/week**	**Credits**
	Theory Courses		
MTE 4203	Embedded Systems	3.00	3.00
MTE 4205	Robotics	3.00	3.00
MTE 4207	Computer Integrated Manufacturing	3.00	3.00
CSE 4287	Artificial Intelligence	3.00	3.00
MTE 4209(*)	Optional-II	3.00	3.00
	Sessional Courses		
MTE 4200	Project and Thesis	6.00	3.00
MTE 4204	Embedded Systems Sessional	1.50	0.75
MTE 4206	Robotics Sessional	3.00	1.50
CSE 4288	Artificial Intelligence sessional	1.50	0.75
MTE 4210	Seminar	2.00	1.00
	Total=	**29.00**	**22.00**

Optional-I Courses

Course No	Course Title	Contact hours/Week	Credits
MTE 4105(a)	Machine Learning Algorithms	3.00	3.00
MTE 4105(b)	Micro-Nano Technology	3.00	3.00
MTE 4105(c)	Aerodynamics and Avionics	3.00	3.00
MTE 4105(d)	Finite Element Analysis	3.00	3.00
MTE 4105(e)	Advanced Vehicle Technology	3.00	3.00
MTE 4105(f)	Applied Materials Engineering	3.00	3.00

Optional-II Courses

Course No	Course Title	Contact hours/Week	Credits
MTE 4209(a)	Human-Robot Interaction	3.00	3.00
MTE 4209(b)	Digital Speech Processing	3.00	3.00
MTE 4209(c)	Biomedical Engineering	3.00	3.00
MTE 4209(d)	Parallel and Distributed Processing	3.00	3.00
MTE 4209(e)	Multimedia Systems and Applications	3.00	3.00
MTE 4209(f)	Rapid Prototyping	3.00	3.00
MTE 4209(g)	Advanced Control Theory and Applications	3.00	3.00

Chapter-V
Details Structure of the Undergraduate Studies

First Year: Odd Semester			
Course No.	**Course Title**	**Contact Hrs/week**	**Credits**
	Theory Courses		
MTE 1101	Mechatronic Systems	3.00	3.00
Math 1127	Calculus and Solid Geometry	3.00	3.00
Phy 1127	Physics	3.00	3.00
Chem 1127	Chemistry	3.00	3.00
Hum 1127	Sociology and Engineering Ethics	3.00	3.00
	Sessional Courses		
ME 1130	Engineering Graphics	3.00	1.50
MTE 1102	Mechatronic Systems Sessional	1.50	0.75
Phy 1128	Physics Sessional	1.50	0.75
Chem 1128	Chemistry Sessional	1.50	0.75
	Total=	**22.50**	**18.75**

MTE 1101 (Mechatronic Systems)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Introduction: Definitions of Mechatronics, Overview of different Mechatronic systems, Scope and applications of Mechatronics.
Sensors and transducers: Basic principles of potentiometer, op-amps, Wheatstone bridge, introduction to sensors and transducers, sensor terminologies, sensor characteristics, classification of sensors, proximity sensors.
System Modeling and Control: Introduction to signals and systems, Modeling of Mechanical, Electrical, Fluid and Thermal systems, Linearization of nonlinear systems, Rotational-translational systems, Electro-Mechanical systems and Hydraulic-Mechanical System. Basic components of Control system, Types of control system, System representation, System responses, Time constant, Measurement of system performance, Transfer function, Block diagram and Illustrative examples.
Actuation systems: Linear and rotary actuators. AC and DC motors, Solenoids, Stepper motor, Fluid power actuators and Smart actuators.
Recent trends in Mechatronic systems.

Math 1127 (Calculus and Solid Geometry)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Calculus: Differential Calculus: Limit, continuity and differentiability of functions of single and several variables, Rolle's theorem, Mean value theorem, Taylor's theorem in finite and infinite forms, McLaren's series in finite and infinite forms, Cauchy's and Lagrange's forms of remainder, Differentiation of composite and implicit functions, Derivatives of higher order and their commutatively, Partial differentiation. Euler's theorem on homogeneous functions, harmonic functions, Taylor's expansion of function of several variables Maxima and Minima (Single and Several variables), Points of inflection, Tangent, Normal and Asymptotes, Curvature, Concavity and Convexity of curve
Integral Calculus: Fundamental theorem of integral calculus, mean value theorems, evaluation of definite integrals - reduction formulae.
Solid Geometry: System of co-ordinates, distance between two points; section formula; Projection, direction cosines; Equations of planes and lines.

Phy 1127 (Physics)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Electricity and Magnetism: Electric charge, Coulomb's law, Electric flux and Gauss's law, Application of Gauss's law, electric potential, electric potential energy, Capacitance, dielectrics; Ohm's law, Ampere's law, Faraday's law. Lenz's law, self-inductance and mutual inductance, Wheatstone bridge Magnetic properties of matter; magneto-motive force, magnetic field intensity, permeability, susceptibility, classifications of magnetic materials, magnetization curves
Waves and Oscillation: Simple harmonic motion, Differential equation of simple harmonic oscillator, vibrations of membranes and columns, progressive wave, power and intensity of wave, stationary wave, energy calculation of progressive and stationary wave, sound waves-Doppler Effect, Sabine's formula, architected acoustics.
Physical optics: Lens Equation, Image Resolution, Depth of Field View, Optical instruments: Compound microscope, polarizing microscope, resolving power of a microscope, camera and photographic techniques, Fiber Optics, Physics of LASER, Photonics.

Semiconductor Physics: Semiconductor characteristics, classification of semiconductor, p-type and n-type Semiconductor Diodes, characteristic curve of p-n Junction, Rectifiers, LED, Transistors, FET, IC, Photoelectric effect and Photovoltaics.

Chem 1127 (Chemistry)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Atomic structure, periodic table, different types of chemical bonds and their properties, molecular structures of compounds, hybridization, selective organic reactions. Different types of solutions and their compositions. Phase rule, phase diagram of monocomponent system. Properties of dilute solutions. Thermochemistry, chemical kinetics, chemical equilibrium. Ionization of water and pH concept. Electrical properties of solution, Electro-chemistry, chemistry regarding etching and metal removal, Coating materials and Lubricants
Chemistry of Lasers, Chemistry of silicon technology, Nuclear-chemistry, analytical chemistry

Hum 1127 (Sociology and Engineering Ethics)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Sociology: Sociology of architecture, Society, groups and sub-groups, group formation and dynamics, culture, elements of culture, cultural systems and sub-systems, lag, Ageing and Society, Civilization, relationship between culture and civilization. Urban culture, ecology, socialization, rural sociology, rural power structure, Institutions: social, political and economic; formal Organization & bureaucracy, Stratification, Status and Role, Social Policy and Planning.
Ethics & Technology: Historical Perspectives of Technology, Social Perspectives of Technology, Ethical Perspectives of Technology, Economics, Globalization and Human Rights, Information Systems Technology, Biomedical Technology, Population and The Environment.

ME 1130 (Engineering Graphics)

Lecture: 3 hrs. /week **No. of credit: 1.50**

Introduction, drawing equipment and use of instruments, Graphical mathematics, Geometrical construction, Lettering, Theory of projection, orthographic projection, Oblique projection, size description, scale, dimensioning rules, Isometric drawing, auxiliary views, Perspective views, sectional views.

MTE 1102 (Mechatronic Systems Sessional)

Lecture: 3/2 hrs. /week **No. of credit: 0.75**

Sessional Based on MTE 1101.

Phy 1128 (Physics Sessional)

Lecture: 3/2 hrs. /week **No. of credit: 0.75**

Sessional Based on Phy 1127.

Chem 1128 (Chemistry Sessional)

Lecture: 3/2 hrs. /week **No. of credit: 0.75**

Sessional Based on Chem 1127.

First Year: Even Semester			
Course No.	**Course Title**	**Contact Hrs/week**	**Credits**
	Theory Courses		
ME 1255	Thermodynamics and Heat Transfer	3.00	3.00
EEE 1287	Electrical Circuits	3.00	3.00
CSE 1287	Computer Fundamentals & Programming	3.00	3.00
Math 1227	Vector, Matrix and Ordinary Differential Equation	3.00	3.00
Hum 1227	Technical English & Communication Skills	3.00	3.00
	Sessional Courses		
ME 1256	Thermodynamics and Heat Transfer Sessional	1.50	0.75
EEE1288	Electrical Circuits Sessional	3.00	1.50
CSE 1288	Computer Fundamentals & Programming Sessional	3.00	1.50
Hum 1228	Technical English & Communication Skills Sessional	1.50	0.75
	Total=	**24.00**	**19.50**

ME 1255 (Thermodynamics and Heat Transfer)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Thermodynamics: Systems, Properties, Process and Cycles, Laws of Thermodynamics, Heat and work transfer in flow and non-flow processes, Steady flow energy Equation, Entropy and Enthalpy.
Basic Vapor power and Gas Power Cycles: Rankine cycle, Reheat cycle, Thermal efficiency, Otto, Diesel, Dual and Brayton cycles, Air standard efficiency, Boiler, IC Engines.
Energy: Concept & Fundamental, Forms & Sources of Energy, Energy Conservation and Conversion techniques, Renewable Energy.
Refrigeration and Air Conditioning: Principles of refrigeration and Air conditioning, Vapor compression and Vapor absorption types, HVAC systems.
Heat Transfer: Modes of Heat Transfer, steady and unsteady state Heat Conduction, Radiation Heat Transfer, Natural and Forced Convection, Heat exchangers.
Phase Changed Convection: Boiling and Condensation.
Recent Trends: Recent advancements in Thermodynamics and Heat transfer related applications.

EEE 1287 (Electrical Circuits)

Lecture: 3 hrs. /week **No. of credit: 3.00**

DC Networks: Kirchhoff's laws, node voltage and mesh current methods, Delta-star and star-delta conversion, Superposition principle, Thevenin's and Norton's theorems.
Single phase AC Circuits: Single phase EMF generation, average and effective values of sinusoids, solution of R,L,C series circuits, the j operator, complex representation of impedances, phasor diagram, power factor, power in complex notation, solution of parallel and series, parallel circuits, power factor correction.
Three Phase AC Circuits: Three phase EMF generation, delta and wye connections, line and phase quantities, solution of three phase circuits, balanced supply voltage and balanced load, phasor diagram, measurement of power in three phase circuits, Three phase four wire circuits.
Magnetic Circuits: Ampere's circuital law, B-H curve, solution of magnetic circuits, hysteresis and eddy current losses, relays, applications of magnetic force, resonance.

CSE 1287 (Computer Fundamentals & Programming)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Computer Fundamentals: Main parts like I/O devices, Memory unit and CPU. Primary and secondary storage devices, different memory types. Number System**,** Concept of Algorithms: Development of programming logic, algorithm, flow chart; Assembly level language and Machine level language, high level language, Compiler, interpreter, Source and Object programs. Overview of DOS, Windows, Linux, MAC, UNIX operating systems, Essential general purpose packages for word processing, spreadsheet analysis etc.
Programming with C/C++ Language: Preliminaries, program construction and data types, I/O statements, Expressions, Decision making, Loops, Function and its Calling procedure, Recursion, Arrays and pointer, structure abdominal, Application of computer programming for solving Mechatronics Engineering problems.

Math 1227 (Vector, Matrix and Ordinary Differential Equation)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Vector Analysis: Linear dependent and independent vectors, product of vectors; Differentiation and integration of vectors together with elementary application; Line, surface and volume integrals; gradient of a scalar function, divergence and curl of a vector function and their physical significance, Integral forms of gradient, divergence and curl; Divergence theorem, Stokes theorem, Green theorem and Gauss theorem.
Matrices: Algebra of matrices; transpose, adjoint and inverse of a matrix; rank and elementary transformations of matrices; Normal and canonical forms, matrix polynomial, quadratic forms.
Ordinary Differential Equations: First order differential equations-exact, linear and Bernoulli's form, second order differential equations with constant coefficients, method of variation of parameters, general linear differential equations with constant coefficients, Euler's equations, system of differential equations. Second order equations with variable coefficient; Taylor and Frobenius methods.

Hum 1227 (Technical English & Communication Skills)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Reading: Review of Basic Grammar; Sentence, Parts of Speech, Tense, Voice; International Phonetics Alphabet, Looking up a Dictionary entry; Vocabulary: Phrases and Idioms, Prepositional Phrases, Analogy, Synonym, Antonym; Reading Comprehension: Techniques of Reading, Skimming, Scanning, SQ3R Technique;

Francis Bacon's Essays: Of Studies, Of Beauty, Of Travel, Of Love, Of Marriage and Single Life; Short stories by Renowned Writers.
Writing: Mechanics of Writing; Essay/Paragraph Writing: The Modes of Discourse-Exposition, Description, Narration, Argumentation (EDNA); Letter and Email Writing; Report Writing; Tender and Schedule, Quotation; APA Style Sheet, Product Description; Translation.

ME 1256 (Thermodynamics and Heat Transfer Sessional)
Lecture: 3/2 hrs. /week **No. of credit: 0.75**

Sessional Based on ME 1255.

EEE 1288 (Electrical Circuits Sessional)
Lecture: 3 hrs. /week **No. of credit: 1.50**

Sessional Based on EEE 1287.

CSE 1288 (Computer Fundamentals & Programming Sessional)
Lecture: 3 hrs. /week **No. of credit: 1.50**

Sessional Based on CSE 1287.

Hum 1228 (Technical English & Communication Skills Sessional)
Lecture: 3/2 hrs. /week **No. of credit: 0.75**
Listening: Monologue, Conversation (Formal and Informal), Telephoning and Direction, Note Taking Skills.
Speaking: Basic Conversation, Job Interview, Seminar and paper Presentation. Formal Speech, Telephoning, Difference between British and American English.

Second Year: Odd Semester			
Course No.	**Course Title**	**Contact Hrs/week**	**Credits**
	Theory Courses		
ME 2155	Engineering Mechanics	3.00	3.00
EEE 2187	Electronics	3.00	3.00
CSE 2187	Software Engineering	3.00	3.00
Math 2127	Fourier Series, Laplace Transform and Partial Differential Equation	3.00	3.00
Hum 2127	Engineering Economics & Accounting	3.00	3.00
	Sessional Courses		
ME 2130	CAD Practice	3.00	1.50
ME 2156	Engineering Mechanics Sessional	1.50	0.75
EEE 2188	Electronics Sessional	3.00	1.50
CSE 2188	Software Engineering Sessional	1.50	0.75
	Total=	**24.00**	**19.50**

ME 2155 (Engineering Mechanics)
Lecture: 3 hrs. /week **No. of credit: 3.00**
Statics: Introduction – Units and Dimensions– Basic concepts of Mechanics, Laws of Mechanics– Lami's theorem, Parallelogram and triangular Law of forces. Statics of particles and rigid bodies; Friction, Forces in truss and frames; Centroids of lines, areas and volumes; Moments of inertia of areas and masses.
Kinematics: Curvilinear motion of particles; Motion relative to frame in translation; Tangential, normal, radial and transverse components, General plane motion; Absolute& Relative velocity and acceleration; Mechanism-Velocity and acceleration analysis.
Kinetics: Newton's second law of motion; linear and angular momentum; Radial and transverse component of motion; Work and kinetic energy; conservative force systems; Work done by a conservative force; potential energy, Principle of conservation of momentum; direct and oblique impact; Plane motion of rigid bodies; Angular momentum and Alembert's principle; Inertial force and inertia torque; Impulse and momentum of rigid bodies.

EEE 2187 (Electronics)
Lecture: 3 hrs. /week **No. of credit: 3.00**

Introduction to Solid State Physics: Classification of Metals, Intrinsic and extrinsic semiconductors, doping, operational principle of p-n junction.
Diode: current-voltage characteristics of a diode, Half wave and full wave rectifiers, rectifiers with filter capacitor, characteristics of a Zener diode, Zener shunt regulator, clamping and clipping circuits, Clipper and Clampers.
Bipolar Junction Transistor (BJT): Current components, BJT characteristics and regions of operation, BJT as an amplifier, small signal equivalent circuit models, BJT as a switch and amplifier, BJT DC and AC analysis, Multistage Amplifier, loading effect in Amplifier.

FET Family: Structure and physical operation, current-voltage characteristics of JFET, MOSFET. CMOS as an inverter. small signal equivalent circuit models, FET DC and AC analysis, Multistage Amplifier, loading effect in Amplifier.
Electronic Circuit Design: Operational Amplifiers (Op-Amp), internal design, feedback amplifier and their gain, input and output impedances, offset null adjustment, frequency response and noise, applications of op-amp; Filters, Oscillators: RC phase shift oscillator, Crystal and Wien bridge oscillator

CSE 2187 (Software Engineering)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Object Oriented Programming in C++ and JAVA: Class and Object, Inheritance, Arrays of Objects, Pointer to Objects, C++ I/O Libraries, C++ Streams, Polymorphism, OPP with C++. Java: Introduction to Java, Java Development Environment, JVM, Advances of Java Over Computer Programming, Byte Codes, Variable, Operator and Data Types, Classes, Threads, Introduction to Applets, Concept of Threading, Execution of Java Programs in UNIX Operating System. Introduction to application software for Robot Programming.
Software Design: Software Life-cycle Models, Software Requirements, Object Oriented Analysis and Design (using UML), Software Integration and Testing, Support Processes and Software Quality.
Software Development: Software specification, Software process, Software modularization, Random Access files systems, data structures, linked lists, queues and stacks.

Math 2127 (Fourier Series, Laplace Transform and Partial Differential Equation)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Fourier Transform: Periodic functions, Fourier series, Fourier Integral formula, Fourier Transform, Fourier sine and cosine transforms. Linearity, Scaling, frequency shifting and time shifting properties. Self-reciprocity of Fourier Transform. Convolution theorem. Application to boundary value problems. Brief Introduction of Z-Transform and Wavelet Transform.
Laplace Transform: Definition of Laplace Transform, Linear properties, condition for existence of Laplace Transform; First & Second Shifting properties, Laplace Transform of derivatives and integrals; Unit step functions, Dirac delta-function, Periodic functions, Differentiation and Integration of transforms, Inversion. Evaluation of integrals by Laplace Transformation, Solution of boundary value problems.
Partial Differential Equations: First order Linear and non-linear equations; Standard forms; Linear equation of higher order. Partial differential equations governing transverse vibrations of elastic string its solution. Heat equation, steady-state configuration for heat flow.

Hum 2127 (Engineering Economics & Accounting)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Engineering Economics: Definition of Economics, Relation between Economics and Engineering, Engineering economic decisions, Concept of NI, Inflation, Market and effective interest rates; Money management.
Economics of Development and Planning: Basic concept, savings, investment, GNP, NNP, per capita income, growth rate, monetary policy, trade policy and their relative applicability in Bangladesh.
Business Evaluation from Engineering Perspective: Capital budgeting: Time value of money, Present value calculation, rate-of-return analysis, Benefit-cost analysis, Accounting for depreciation and income tax, Project cash flow analysis; risk analysis, replacement decisions.
Accounting: Basic concepts and principles of accounting; Accounts, Transaction, Journal and Ledger. Accounting procedure; financial statement and their analysis, Cost terms and classification; Costing methods; Cost-volume-profit analysis; Standard costing; Relevant cost and profitability analysis for decision making, Standard costing, Material cost variance, Break even analysis.

ME 2130 (CAD Practice)

Lecture: 3 hrs. /week **No. of credit: 1.50**

Introduction to Engineering Drawing: Types of lines and usage, Basic geometrical Constructions; CAD tool, Understanding and drawing simple 2D objects.
Introduction to AutoCAD software: Graphic coordinate system, Practice of various commands in AutoCAD, Drawing and dimensioning of a Machine Part using AutoCAD, Electrical Circuit drawing,

Solid Works: Introduction, Practice of various commands in Solid works, drawing simple 2D and 3D objects. Various applications in mechatronics Engineering.
Brief introduction to some design Software's: CATIA, Pro/Engineer, Unigraphics NX etc.

ME 2156 (Engineering Mechanics Sessional)

Lecture: 3/2 hrs. /week **No. of credit: 0.75**

Sessional Based on ME 2155.

EEE 2188 (Electronics Sessional)

Lecture: 3 hrs. /week **No. of credit: 1.50**

Sessional Based on EEE 2187.

CSE 2188 (Software Engineering Sessional)

Lecture: 3/2 hrs. /week **No. of credit: 0.75**

Sessional Based on CSE 2187

Second Year: Even Semester			
Course No.	**Course Title**	**Contact Hrs/week**	**Credits**
	Theory Courses		
MTE 2205	Sensors and Instrumentations	3.00	3.00
ME 2255	Manufacturing Processes	3.00	3.00
EEE 2297	Signals and Linear Systems	3.00	3.00
EEE 2287	Electro-Mechanical Systems and Drives	3.00	3.00
Math 2227	Complex Variables and Harmonic Analysis	3.00	3.00
	Sessional Courses		
MTE 2206	Sensors and Instrumentation Sessional	1.50	0.75
MTE 2210	Modeling and Simulation Sessional	1.50	0.75
ME 2156	Manufacturing Processes Sessional	3.00	1.50
EEE 2288	Electro-Mechanical Systems and Drives Sessional	3.00	1.50
	Total=	**24.00**	**19.50**

MTE 2205 (Sensors and Instrumentations)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Introduction: Functional elements of a measurement system, Errors in measurement and its eliminations.
Sensors: Selection criteria of sensors for mechatronic systems, Sensor Evolution, Displacement sensors, LVDT, Strain gauge and load cell sensor, Piezo Sensor, RTD, thermistors, radiation pyrometry, Ultrasonic sensors, speed sensor, Optical sensors, Accelerometer and Gyro, Magnetometer, Rotameter, humidity sensor, gas/chemical sensor, UV, Thermal imaging, Finger print sensor, smart sensors and MEMS.
Sensor Applications: Automotive sensors, Environmental sensors, sensors for medical diagnosis and patient monitoring, Aerospace sensors.
Instrumentations: Definition and Classification of Instruments. Components, Circuits for signal conditioning, Timers: Functional block diagram, working, design and applications of 555 timers Instrumentation amplifier, Active Filters: First order filters, second order active finite and infinite gain low pass, high pass, band pass and band reject filters; Analog signal filters, Analog signal Preprocessing, Analog to digital signal conversion, sampling, digital signal processing, A/D and D/A converters, sample and hold circuits. Modular instrumentation: VXI, PXI, Virtual instrumentation notions.
Data Transmission and Telemetry: Methods of data transmission, DC/AC telemetry system and digital data transmission, Recording and display devices, Data acquisition system and microprocessor applications in instrumentation

ME 2255 (Manufacturing Processes)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Introduction: Definition, Classification of manufacturing processes.
Casting: Patterns and Allowance, Molding tools and operation, casting processes for ferrous and non-ferrous metals; sand, die, centrifugal, slush, plaster mold, loam mold, precision investment casting. Casting defects and remedies.
Joining methods: Soldering, brazing, welding, conventional welding processes: Gas, arc, TIG, MIG, Submerged, Resistance, Thermit, LASER, Electron beam etc.
Press working processes: Dies, Drawing, Forming and Blanking operations.
Metal removal processes: Chip formation and tool design, tool geometry, chip breakers. Cutting forces, metal cutting dynamometers, economics of metal cutting, tool life.

Different machining processes: Cutting tools and their analyses in turning, milling, drilling, shaping, grinding, broaching etc. Machine Tools: Types, main parts, power transmission, drives and control systems. Automation and CNC Machine tools. Unconventional Machining Processes, Fabrication process for PCB making.
Processes for plastic products: Injection molding, compression molding, blow molding, transfer molding, compounding, extrusion, vacuum forming, thermo-forming etc.

EEE 2297 (Signals and Linear Systems)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Introduction to Signals and Systems: Signals- classification, basic operation on signals, elementary signals, representation of signal using impulse function; systems- classification.
Properties of Linear Time Invariant (LTI) Systems: Linearity, causality, time invariance, memory, stability, invertibility.
Time Domain Analysis of LTI Systems: Differential equations- system representation, order of the system, solution techniques, zero state and zero input response, System properties: impulse response – convolution integral, determination of system properties; state variable- basic concept, static equation and time domain solution.
Frequency Domain Analysis of LTI Systems: Fourier series- properties, harmonic representation, system response, frequency response of LTI systems; Fourier transformation- properties, inverse transform, system transfer function, system response and distortion less systems. Laplace Transformation: Properties, inverse transform, solution of system equations, system transfer function, system stability and frequency response and application.
Applications of Time and Frequency Domain Analysis: Solution of analog electrical and mechanical systems, amplitude modulation and demodulation, time-division and frequency-division multiplexing.
Analogous Systems: Electrical, Mechanical and Electro-Mechanical systems.

EEE 2287 (Electro-Mechanical Systems and Drives)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Electro-Mechanical Systems: Definition, analyzing drive systems, selection of drives, sizing of motor drives. Electro-magnetic principle and Transformers.
Brushed DC motor: Equivalent circuit, speed-torque characteristics, Coreless Motor, Drives for DC brushed motors.
Brushless motors and controllers: Uni- and bi-directional Brushless DC motors, torque-speed characteristics, BLDC motor controller.
Induction Motors: Equivalent circuit, starting, braking and speed control of single and 3 phase induction motor, linear induction motor

Synchronous Motors: operation of alternator, synchronous motor types and operation, equivalent circuit and method of synchronization
Stepper Motors and Drives: method of operation, driver circuits for stepper motors
Servo Drives: Operation of servo motors, motion control system, axis of motion, system power up, over travel, distance and position, homing, actuators
Special Motors: Switched reluctance motors, universal motor, reluctance motor and electrostatic motor.

Math 2227 (Complex Variables and Harmonic Analysis)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Complex Variable: Complex number system; General functions of a complex variable; Limits and continuity of a function of complex variables and related theorems, Complex differentiation and Cauchy-Riemann equation; Line integral of a complex function; Cauchy's integral formula, Liouville's theorem; Tailor's and Laurent's theorem; Singular points, Residue; Cauchy's residue theorem; Contour integration; Conformal mapping.
Harmonic Analysis: Periodic functions; Fourier series (both real and complex forms); Finite transformation, Harmonic functions, Laplace equations, spherical harmonic, surface zonal harmonic; gravitational potential due to spherical shell and sphere.
Power Series Method: Solution of differential equations in series; Bessel's function, Legendre's polynomials and their properties. Application of Bessel functions especially in mechanics.

MTE 2206 (Sensors and Instrumentations Sessional)

Lecture: 3/2 hrs. /week **No. of credit: 0.75**
Sessional Based on MTE 2205.

MTE 2210 (Modeling and Simulation Sessional)

Lecture: 3/2 hrs. /week **No. of credit: 0.75**

Mathematical Models, Mechanical, electrical, Fluid and Thermal system building blocks, Engineering systems, rotational-translational, electromechanical and hydraulic-mechanical systems, Modeling of dynamic systems.
Modeling a system with MATLAB and simulate it by SIMULINK.

EEE 2288 (Electro-Mechanical Systems and Drives Sessional)

Lecture: 3 hrs. /week **No. of credit: 1.50**

Sessional Based on EEE 2287.

ME 2256 (Manufacturing Processes Sessional)

Lecture: 3 hrs. /week **No. of credit: 1.50**

Sessional Based on ME 2255.

Third Year: Odd Semester			
Course No.	**Course Title**	**Contact Hrs/week**	**Credits**
	Theory Courses		
MTE 3101	Control Systems	3.00	3.00
MTE 3103	Microcontroller and Interfacing	3.00	3.00
MTE 3105	Linear Integrated Circuits and Digital Systems	3.00	3.00
ME 3155	Mechanics of Solids	3.00	3.00
Math 3127	Numerical Analysis & Statistics	3.00	3.00
	Sessional Courses		
MTE 3100	Industrial Training	4 weeks	1.00
MTE 3102	Control Systems Sessional	3.00	1.50
MTE 3104	Microcontroller and Interfacing Sessional	3.00	1.50
MTE 3106	Linear Integrated Circuits and Digital Systems Sessional	1.50	0.75
ME 3156	Mechanics of Solids Sessional	1.50	0.75
	Total=	**24.00**	**20.50**

MTE 3101 (Control Systems)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Introduction: Review of different response and stability criterion, State space modeling, linearization of nonlinear systems, Root locus analysis and frequency response analysis, Response of linear systems, Controllability and Observability-concept and test.
System Design: Design with gain adjustment, compensator and P, PI & PID controllers.
Intelligent Control Systems: Sampling & holding, z-transform, representation of digital system, solution properties, eigenvectors, structural decomposition, controllability/observability, stabilizability /detectability, Optimal control Method (LQR), LQG/Kalman Filtering
Robust control and adaptive control approaches, internal stability, small gain theorem, H-infinity control, parameter estimation. Introduction to fuzzy logic with its control structure.

MTE 3103 (Microcontroller and Interfacing)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Introduction: Definition of Embedded System, PCB Design Technique, Design of DC POWER Supply Unit,
microcontroller as a prime member of embedded system; it's comparison with microprocessor and microcomputer.
Microcontroller: ATMEL Microcontroller basics, classification, pin configuration, basic Architecture, memory,
registers, I/O ports, Assembly and C programming of microcontroller in Integrated Development Environment (IDE), General Purpose Input/Output, user defined function, binary Counter, Interrupts, Analog to digital Converter, Counter, Timer, reading sensor data, PWM techniques with Timer/Counter
Interfacing: Interface of ATMEL microcontroller with external devices such as Seven Segment Display, LCD, DOT Matrix, Touch Screen, Matrix keypad, RTC (Real Time Clock) Module, Bluetooth Module, USB-serial Module, Sonar sensor, Temperature Sensor, IR sensor, Motor Speed Control, Communication protocols such as USART, I2C, and SPI.
Introduction to Arduino: Basics and programming with C, interfacing with sensors and Design of Line Follower Robot.

MTE 3105 (Linear Integrated Circuits and Digital Systems)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Introduction to Digital Logic Families: Diode logic gates, Transistor gates, MOS gates, Properties of Logic Families; TTL, ECL, IIL and CMOS. Design and Implementation of basic logic gates in RTL, DTL, TLT and CMOS Families.
Digital Logic Gates and Minimization Techniques: Number system and codes. Boolean algebra, De Morgan's law, logic gates and truth tables, Minimization of

Boolean expressions: Minterm, Maxterm, Sum of Products (SOP), Product of Sums (POS), Karnaugh map Minimization, Don't care conditions, Quine – Mc Cluskey method of minimization.

Combinational Circuits: Design procedure, Half adder, Full Adder, Half subtractor. Full subtractor, Multiplexer, Demultiplexer – Decoder, Encoder.

Sequential Circuits: Latches, Flip-flops, SR, JK, D, T, and Master-Slave, Characteristic table and equation, Applications. Asynchronous Ripple or serial counter, Asynchronous Up/Down counter, Synchronous counters, Synchronous Up/Down counters, and Design of Synchronous counters: state diagram, State table, State minimization, State assignment, Excitation table and maps, Circuit implementation. Modulo–n counter, Registers, shift registers, Shift register counters, Ring counter, Johnson Counter.

Memory Devices: Classification of memories, ROM, ROM organization, PROM, EPROM, EEPROM, EAPROM, Programmable Logic Devices: Programmable Logic Array (PLA), Programmable Array Logic (PAL), Field Programmable Gate Arrays (FPGA), Implementation of combinational logic circuits using ROM, PLA, PAL.

ME 3155 (Mechanics of Solids)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Stress analysis: statically indeterminate axially loaded member, axially loaded member, thermal and centrifugal stresses; Stresses in thin and thick walled cylinders and spheres.

Torsion: Torsion formula; Angle of twist; Modulus of rupture; Helical springs.

Beams: Shear force and bending moment diagrams; various types of stresses in beams; Flexure formula.

Deflection of beams: integration and area moment methods; Introduction to reinforced concrete beams and slabs.

Combined stresses: principal stress, Mohr's Circle; Columns: Euler's formula, intermediate column formulas, the Secant formula; Flexure formula of curved beams.

Failure theories: Introduction to experimental stress analysis techniques; Strain energy; Failure theories.

Math 3127 (Numerical Analysis & Statistics)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Numerical Analysis: Solutions of transcendental and polynomial equations, Solutions of linear algebraic equations, Curve fitting, interpolation and Fourier approximation; Numerical differentiation and integration; Solutions of Ordinary differential equations: Initial value problems, single step and multistep method, boundary value and eigen value problems; Partial differential equations; finite difference and finite element method for elliptic and parabolic equations.

Statistics: Basic laws of probability, conditional probability, Bayes Theorem, Random variables; Measures of central tendency and dispersion. Mathematical expectation; Probability distributions, transformation of variables; Moments and moment generation functions; Sampling; Central limit theorem; Chi-Square distribution, t- distribution, Estimation and confidence interval; Correlation and regression analysis, variance, Introduction to stochastic problems in engineering.

MTE 3100 (Industrial Training)

Contact Period: 4 weeks **No. of credit: 1.00**

Practical hands on case study related to MTE to be done in suitable organization. To be arranged in suitable time in 3rd year.

MTE 3102 (Control Systems Sessional)

Lecture: 3 hrs. /week **No. of credit: 1.50**

Sessional Based on MTE 3101.

MTE 3104 (Microcontroller and Interfacing Sessional)

Lecture: 3 hrs. /week **No. of credit: 1.50**

Sessional Based on MTE 3103.

MTE 3106 (Linear Integrated Circuits and Digital Systems Sessional)

Lecture: 3/2 hrs. /week **No. of credit: 0.75**

Sessional Based on MTE 3105.

ME 3156 (Mechanics of Solids Sessional)

Lecture: 3/2 hrs. /week **No. of credit: 0.75**

Sessional Based on ME 3155.

Third Year: Even Semester			
Course No.	**Course Title**	**Contact Hrs/week**	**Credits**
	Theory Courses		
MTE 3201	Power Electronics and Drives	3.00	3.00
MTE 3205	Hydraulic and Pneumatic Control	3.00	3.00
ME 3255	Machine Dynamics and Vibrations	3.00	3.00
ME 3265	Fluid Mechanics and Machinery	3.00	3.00
EEE 3287	Network and Communication Systems	3.00	3.00
	Sessional Courses		
MTE 3200	Mechatronics Case Study	2.00	1.00
MTE 3202	Power Electronics and Drives Sessional	1.50	0.75
MTE 3206	Hydraulic and Pneumatic Control Sessional	1.50	0.75
ME 3256	Machine Dynamics and Vibrations Sessional	1.50	0.75
	Total=	**21.50**	**18.25**

MTE 3201 (Power Electronics and Drives)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Power Semiconductor Switches: SCR, TRIAC, power BJT, power MOSFET, IGBT**:** Principle of operation, static and dynamic characteristics, gate characteristics, and turn-on and turn-off methods, protection, commutation Process.
Converters: AC-DC Converters: Working and waveforms of: Single phase semi, full converters with R, R-L load. DC-DC converters: Basic principle of step up and step down choppers. Buck, Boost, Buck-Boost, Cuk regulators. Inverters (DC-AC): Single phase half / full bridge voltage source inverters with R load, Voltage control of single phase inverters using PWM techniques. AC-AC Converters: Single phase AC voltage controller with on– off control and phase control technique. single phase Cycloconverter, VFD.
Motor Drives:
DC Drives: Introduction to Four quadrant operation – Motoring, Plugging, Dynamic and Regenerative Braking.
Control of DC Drive by Chopper regulators: Single quadrant, Two –quadrant and four quadrant chopper fed dc separately excited motors, Continuous current operation, Output voltage and current wave forms, Speed torque expressions, speed torque characteristics. AC Drives: Induction Motor Drives: Characteristics, Current Source Inverter fed Induction motor drive, Speed control methods: Stator voltage, Variable frequency, Rotor resistance, V/F control, PWM Control, Closed-loop control. Synchronous Motor Drives: Characteristics, Classification, Open Loop Control and Self-control mode, Special machine drives.

MTE 3205 (Hydraulic and Pneumatic Control)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Hydraulic Control: Hydraulic Fluids; Hydraulic pumps: Types, Characteristics, Selection; Hydraulic Actuators: Types, Characteristics, Selection; Hydraulic Valves: Pressure, Flow and Direction Controls, Applications; Hydraulic Accumulators; Hydraulic Circuit Symbols, Design of Hydraulic circuits: Selection of components, Hydraulic circuits: Reciprocating, Quick return, Sequencing and synchronizing; Safety of Hydraulic circuits.
Pneumatic Control: Pneumatic Compressors: Types, Characteristics, Selection; Fluidics: Control Elements: Sensors, Logic Circuits, Switching; Pneumatic Circuit Symbols; Design of Pneumatic circuits: Selection of components; Pneumatic circuits: Classic, Cascade, Step counter, PLC and Microprocessor control, Safety of Pneumatic Circuits; Electro-Pneumatic, Electro-Hydraulic and Robotic Circuits, Maintenance of Hydraulic and Pneumatic Circuits.

ME 3255 (Machine Dynamics and Vibrations)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Machine Dynamics: Kinematic link, pair, chain, joints, Mechanisms, Degrees of Freedom and Mobility, Four bar mechanism, Grashof's law, Inversions of mechanisms, Velocity and Acceleration analysis of mechanisms, Belt, rope and chain drives, Gear systems, Gyroscopic motion, Flywheel, Governors, Cams, Static and Dynamic Balancing, Brakes, dynamometers and clutches.
Vibrations: Undammed free vibrations with one and two degrees of freedom; longitudinal, transverse and torsional vibrations; Damped free and forced vibrations with single degrees of freedom; Whirling of shafts and rotors; Torsional Vibrations, Vibration measurement and Applications, Vibration Control Techniques.
Application: Active vibration absorber, Conditioning Monitoring.

ME 3265 (Fluid Mechanics and Machinery)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Fluid Mechanics: Introduction, Continuum, Fluid Classification and Properties, Fluid statics, Fluid Flow Concepts and Basic Equations, Fluid Measurement, Viscous flows, Boundary layers.

Machinery: Rotodynamic and positive displacement machines; Operations and Performance Study of Pumps, Turbines and Compressors, Hydraulic Transmissions.

EEE 3287 (Network and Communication System)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Network: Protocol Hierarchies, Data link Control; HLDC, DLL in Internet; DLL of ATM; LAN Protocols; Standards IEEE 802, Switches and Hubs, Bridges, FDDI, Fast Ethernet; Routing algorithm; Congestion Control, Internetworking, Wireless Networking, GSM, Wireless Access Protocol (WAP), WAN, CAN (Controller Area Network), Wireless Sensor Networks, Network Security and Encryption.
Communication System: Digital communication, Topologies, Protocols and Standards, Open Systems Interconnection communication model, Communication Ports: Serial, Parallel, Serial interface: RS family, Parallel interface: GPIB bus, Dedicated interfaces: USB, Ethernet, Industrial Communication Buses, Fiber Optic communication, Satellite communication and Remote Sensing, Wi-Fi and Bluetooth-compatible cellular telephone system, communication system for smart phone and iPhone.
Communication systems for distributed Robots: Peer to Peer, Tele-operation with Zigbee Networks, communication protocols for distributed sensors and Ambient Intelligence.

MTE 3200 (Mechatronics Case Study)

Sessional: 2 hrs/week **No. of credit: 1.00**

Case study on Mechatronics related problems.

MTE 3202 (Power Electronics and Drives Sessional)

Lecture: 3/2 hrs. /week **No. of credit: 0.75**

Sessional Based on MTE 3201.

MTE 3206 (Hydraulic and Pneumatic Control Sessional)

Lecture: 3/2 hrs. /week **No. of credit: 0.75**

Sessional Based on MTE 3205.

ME 3256 (Machine Dynamics and Vibrations Sessional)

Lecture: 3/2 hrs. /week **No. of credit: 0.75**

Sessional Based on ME 3255.

Fourth Year: Odd Semester			
Course No.	**Course Title**	**Contact Hrs/week**	**Credits**
	Theory Courses		
MTE 4101	Automation	3.00	3.00
MTE 4103	Digital Signal Processing & Machine Vision	3.00	3.00
MTE 4107	Design of Mechatronic Systems	3.00	3.00
IPE 4155	Industrial Management	3.00	3.00
MTE 4105(*)	Optional-I	3.00	3.00
	Sessional Courses		
MTE 4100	Project and Thesis	3.00	1.50
MTE 4110	Seminar	2.00	1.00
MTE 4102	Automation Sessional	3.00	1.50
MTE 4104	Digital Signal Processing & Machine Vision Sessional	3.00	1.50
MTE 4108	Design of Mechatronic Systems Sessional	3.00	1.50
	Total=	**29.00**	**22.00**

MTE 4101 (Automation)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Programmable Logic Controllers: Hardware, Internal Architecture, Input/Output Devices, I/O Processing, PLC Programming; Ladder and Functional Block Programming, IL, SFC and ST Programming Methods, Internal Relays, Jump and Call, Timer, Counters, Shift Registers, Data Handling.
Automation: Automation system components, Application of PLC in Automation, Industrial communications, Continuous control, PID control, overview of SCADA and DCS systems.

MTE 4103 (Digital Signal Processing and Machine Vision)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Introduction to Digital Signal Processing (DSP): Discrete-time signals and systems, analog to digital conversion, impulse response, finite impulse response (FIR) and infinite impulse response (IIR) of discrete time systems, difference equation, convolution, transient and steady state response.
Discrete Transformations (DTs): Discrete Fourier series, discrete-time Fourier series, discrete Fourier transform (DFT) and properties, fast Fourier transform (FFT), inverse fast Fourier transform, Z-transformation- properties and inverse Z-

transform.

Design of Digital filters and Implementation: Design of Infinite Impulse Response (IIR) filters using impulse invariant method and bilinear transformation method, Butterworth and Chebyshev filter approximation. Concepts of Finite Impulse Response (FIR) filter, symmetric and anti-symmetric FIR filter, FIR filter design using window method and frequency sampling method.

Machine Vision: Introduction, Low level & High level vision, Sensing & Digitizing, Template Matching, Image processing & analysis, Segmentation, Edge detection, Object description& recognition, Interpretation, Noises in Image, Applications.

Digital Image Processing: Digital image representation and acquisition; modern techniques for image analysis and enhancement; two dimensional system and transform theory; feature extraction, compression and coding, imaging systems, object recognition and machine learning.

MTE 4107 (Design of Mechatronic Systems)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Introduction to Design: Recognition of the need, Design approaches, conceptual design and functional specification, integrated design issues in Mechatronics.

Mechanical Systems Design: Elements of Mechanical systems, load conditions, design and flexibility of structures, Man Machine Interface, industrial design and ergonomics, Machine design principles, Design of some machine elements (gear, belt & pulley and bearing).

Electrical and Electronic System Design: Sensor modeling: sensor selection and signal conditioning. Actuator design: choice and selection of actuation system, design of drive systems. Control system design: choice of control system, selection and design of controller, embedded design with microcontroller.

Real time interfacing: Elements of data acquisition and control, Overview of I/O process, Installation of I/O card and software, networking and communication.

Integration and Optimization: Hardware-in-the loop simulation (prototyping), integration of different systems (Mechanical, Electrical and Software), Optimization of the system.

Case studies: Strain Gauge weighing system, controlling temperature of a hot/cold reservoir, Pick and place robot, Car park barriers, Autofocus Camera, exposure control, Motion control using D.C. Motor, A.C. Motor and Solenoids, Car engine management, Barcode reader.

IPE 4155 (Industrial Management)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Management and Organizational Behavior: Management functions, Group behavior and Organizational Behavior, Organization System, Foundation of Organizational Structure, Foundation of Group Behavior, Communication and Dynamics of Organization.

Operations Management: Fundamental concepts, Aggregate Planning, MPS, MRP, capacity planning, scheduling, JIT, MRPII, PERT and CPM, Supply Chain Management: Logistics planning, distribution strategies, Global issues in decisions–planning under uncertainty, real time monitoring and control, integrated scheduling.

Human-Resource Management: Human Resource Planning, Recruitment, Training and Development, Performance appraisal and wage systems.

Management of Creativity and Technology: Traits of creative individuals, Group creativity, Techniques of creative problem solving, Innovation and technology life cycle, Aspects of Technology Policies, Technology Transfer, Technology as strategic components, technological development and planning, Managerial Ethics and Social responsibility.

Management Information System: IT in business and management, Database Management System, E-commerce, Internet marketing, Data warehouse and Business Intelligence, Decision Support Systems.

Marketing Management: New product strategy, marketing mix, Market behavior and trend, Competitive marketing, consumer market, Sales and Advertising.

MTE 4105(*) (Optional-I)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Any one course should be taken from the list of **Optional-I** offered in the semester.

Optional-I Courses

Course No	Course Title	Contact hours/Week	Credits
MTE 4105(a)	Machine Learning Algorithms	3.00	3.00
MTE 4105(b)	Micro-Nano Technology	3.00	3.00
MTE 4105(c)	Aerodynamics and Avionics	3.00	3.00
MTE 4105(d)	Finite Element Analysis	3.00	3.00
MTE 4105(e)	Advanced Vehicle Technology	3.00	3.00
MTE 4105(f)	Applied Materials Engineering	3.00	3.00

MTE 4105(a) (Machine Learning Algorithms)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Neural Networks (NN) associative memories, Vector quantization, Self-organizing feature Maps, Support Vector Machines, Genetic Algorithms, fuzzy NN, Swarm intelligence, Particle Swarm Optimization, Decision trees, nearest neighbor method, Gaussian Mixture Model, Principal Component Analysis, Independent Component Analysis, hill climbing, reinforcement leaning, Markov decision processes, simulated Annealing, Hidden Markov Model, Bayesian Networks.

MTE 4105(b) (Micro-Nano Technology)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Micro MEMS: Basic of micro-fabrication technology; thin film growth and deposition, photolithography, X-ray lithography, wet and dry chemical etching, electrochemical machining, ultrasonic machining, plasma machining and laser machining, Introduction to MEMS and its applications.
Nanotechnology: Scope, Nano-fabrication technology, Carbon Nano Tubes (CNTs), applications of Micro-Nano technology for sensor and actuator design.

MTE 4105(c) (Aerodynamics & Avionics)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Aerodynamics: subsonic potential flows, source/vortex panel methods; viscous flows, Laminar and turbulent boundary layers; aerodynamics of airfoils and wings, thin airfoil theory, lifting line theory, aircraft propulsion and propeller; static performance problem, introduction to stability and control, Lateral and directional stability and control.
Avionics: Avionic Systems, Aircraft Instruments, Aircraft Navigation Systems, Principles of flight, Flight control technology, Autopilot and Control Systems, Introduction to Unmanned Aerial Vehicle (UAV).

MTE 4105(d) (Finite Element Analysis)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Concepts and Fundamentals: Review of Matrices, Numerical Analysis, Ordinary and Partial Differential Equations, Concept of Discretization, Nodal analysis, Elemental Interpolations.
Mathematical Formulation: Methods of discretization; Direct, Variational and weighted residual methods, Finite element analysis for one-dimensional problems, Truss / beam elements and coordinate transformation, Finite element analysis for multi-dimensional problems, Isoparametric formulation, element types: Axisymmetric element, Hexahedral and Tetrahedral elements and their shape functions, numerical integration.
Computer Implementation and Applications: Use of ANSYS for mesh/node analysis, modeling and simulation of Multiphysics (solving coupled systems of partial differential equations) problems.

MTE 4105(e) (Advanced Vehicle Technology)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Engine Systems: Brief introduction to Automotive Engine systems: ignition system, alternative fuels, lubrication, cooling, exhausts systems and their circuits.
Control Systems and Equipment: Automatic driving system, auto-gear, auto-skid brake system, safety devices and accessories, navigation system, modern development of economy speed and fuel economy and their electronic controls, Automatic Parking assistance and Balance control technology for cars. Introduction to Autotronics.
Emission Control techniques: Causes and Remedies of emission in engines. Fuel modification: Alternative fuels and additives, Exhaust after treatment: Particulate trap, Application of catalysts and modern techniques.
Modern engine technology: Hybrid vehicles, electric vehicles (maglev train etc.), fuel cell vehicles, solar energy for vehicle propulsion, Jet propelled Engines.

MTE 4105(f) (Applied Materials Engineering)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Properties of materials with applications: Structure of materials, chemical composition, phase transformations, corrosion and mechanical properties of metals, ceramics, polymers and related materials, Electrical, thermal, magnetic and optical properties of materials, Materials selection in engineering applications.
Bio and Nano materials: Materials for Bio-sensor and their applications, Carbon Nano Tubes and their applications.
Smart materials: Fundamental understanding of ferroic materials, ferromagnets, ferroelectric materials, shape memory alloys and multiferroic materials. Magnetostrictive materials and smart structures, Potential applications of smart materials.

MTE 4100 (Project and Thesis)

Lecture: 3 hrs. /week **No. of credit: 3.00**

In this course, students are required to undertake a major project in engineering analysis, design development of research. The objective is to provide an opportunity to develop initiative, self-reliance, creative ability and engineering judgment. The results must be submitted in a comprehensive report with appropriate drawings, charts, bibliography, etc. along with products if any. Use of locally available materials in manufacturing and feasibility study of local industrial units will be emphasized. In this course, the thesis or project topic will be selected. The literature related to the selected topic will be surveyed. Then design or modeling of the topic will be finished. If the project or thesis contains construction of the setup, then it should be started at least. The course will continue as MTE 4200 in eighth semester.

MTE 4110 (Seminar)

Sessional: 2 hrs/week **No. of credit: 1.00**

This course is intended to develop presentation skills of the students. Students need to present their research work which is based on the courses MTE 4100 for evaluation purpose.

MTE 4102 (Automation Sessional)

Contact hour: 3 hrs/week **No. of credit: 1.50**

Sessional Based on MTE 4101.

MTE 4104 (Digital Signal Processing and Machine Vision Sessional)

Contact hour: 3 hrs/week **No. of credit: 1.50**

Sessional Based on MTE 4103.

MTE 4108 (Design of Mechatronic Systems Sessional)

Contact hour: 3 hrs/week **No. of credit: 1.50**

Sessional Based on MTE 4107.

Fourth Year: Even Semester			
Course No.	**Course Title**	**Contact Hrs/week**	**Credits**
	Theory Courses		
MTE 4203	Embedded Systems	3.00	3.00
MTE 4205	Robotics	3.00	3.00
MTE 4207	Computer Integrated Manufacturing	3.00	3.00
CSE 4287	Artificial Intelligence	3.00	3.00
MTE 4209(*)	Optional-II	3.00	3.00
	Sessional Courses		
MTE 4200	Project and Thesis	6.00	3.00
MTE 4204	Embedded Systems Sessional	1.50	0.75
MTE 4206	Robotics Sessional	3.00	1.50
CSE 4288	Artificial Intelligence sessional	1.50	0.75
MTE 4210	Seminar	2.00	1.00
	Total=	**29.00**	**22.00**

MTE 4203 (Embedded Systems)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Embedded systems, electronic system-level (ESL) design; system-level design languages (SLDLs), SpecC, SystemC; Discrete event simulation semantics; Models of Computation, FSMs, dataflow, process networks; System specification and analysis; System-level design methodologies and tools, partitioning, scheduling, network design, communication synthesis; System platform modeling, processor and RTOS modeling, transaction-level modeling (TLM) for communication; Embedded hardware and software implementation, co-simulation; System design examples and case studies.

MTE 4205 (Robotics)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Definition, Scope and Trends of robotics, Classification of robots, Spatial descriptions and transformations, Kinematics of manipulators; Trajectory generation, Dynamics and Control of manipulators, Actuators and sensors for manipulators, Programming languages for robots, Mobile robots, Multi-robot systems Industrial robots, Service robots, Human-Robot Interaction, Social Robotics.

MTE 4207 (Computer Integrated Manufacturing)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Hardware components of CIM: Fundamental of automation in manufacturing, functions and components of CIMS. CNC Machines, PLC, automated material handling: Robots, Conveyors, AGV and ASRS.
Software components of CIM: APT/Part Programming, CAD, CAM and their integration.
Product data management: Direct translation between CAD systems; CAD/CAM data exchange, Expert systems.
Production process system: Flexible manufacturing cells; Planning and layout of flexible manufacturing system; Agile manufacturing; Lean production system; Reconfigurable manufacturing system.
Process planning: Process design and planning; Computer aided process planning; Group technology and cellular manufacturing; Automated quality inspection, quality assurance at TQC, control of accuracy at preasign, Shewart, Concurrent engineering, Shop floor communication and networking, Factory of the future.

CSE 4287 (Artificial Intelligence)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Survey of basic AI concepts and controversies; Knowledge representation and reasoning; propositional and first order predicate logic, inconsistencies and uncertainties, structured representation, Knowledge organization and manipulation; search and control strategies, game playing, planning, decision making; perception and communication; natural language processing, visual image understanding; knowledge acquisition (Machine learning: Neural Network, Genetic Algorithms); introduction to knowledge-based systems (Expert systems).

MTE 4209(*) (Optional-II)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Any one course should be taken from the list of **Optional-II** offered in the semester.

Optional-II Courses

Course No	Course Title	Contact hrs/Week	Credits
MTE 4209(a)	Human-Robot Interaction	3.00	3.00
MTE 4209(b)	Digital Speech Processing	3.00	3.00
MTE 4209(c)	Biomedical Engineering	3.00	3.00
MTE 4209(d)	Parallel and Distributed Processing	3.00	3.00
MTE 4209(e)	Multimedia Systems and Applications	3.00	3.00
MTE 4209(f)	Rapid Prototyping	3.00	3.00
MTE 4209(g)	Advanced Control Theory and Applications	3.00	3.00

MTE 4209(a) (Human-Robot Interaction)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Introduction to Robotics & HRI, Overview of Social Robots, Anthropomorphism and Design, Classifying HRI, Evaluating HRI, Autonomy and Perception, Mental Models, Shared Autonomy, Human-compatible Perception, Emotion and Empathy, HRI Interfaces, Enhancing HRI Interfaces, Robot Teams, Exoskeletons & Assistive Robotics, Museum Robots/Urban Search & Rescue, Educational Robotics.

MTE 4209(b) (Digital Speech Processing)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Application of digital signal processing to speech signals, Acoustic and aero acoustic theories of speech production leading to linear and nonlinear time-frequency models, Speech analysis-synthesis based on spectrogram, linear prediction, homomorphic, filter bank, and AM/FM sinusoidal representations, Extensions to wavelet, auditory-like and other multiresolution analysis, Waveform and model-based speech coding using scalar and vector quantization, Time-scale and pitch modification; speech restoration; speaker separation; pitch estimation; and speaker recognition. Application to music analysis-synthesis and voice controlled systems.

MTE 4209(c) (Bio-Medical Engineering)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Biomedical Instrumentation: Medical terminology, cell physiology, membrane potential, action potential and excitation, Rhythmic excitation of heart. Transducers used in medical diagnostics. Cardiovascular system and measurement, Electrocardiography, ECG simulator, Watch filter, ECG Amplifier, pulse beat monitor, measurement of blood flow, blood pressure and cardiac output, galvanic

skin resistance detector, respiratory and suction apparatus, Electronic stethoscope, Nervous system, Brain Scanning devices, MRI etc.

Patient Care and Monitoring: Diagnosis, calibration and reparability of patient-monitoring equipment, instrumentation for monitoring patients, organization of hospital for patient care monitoring, pace makers, Defibrillators, Electronic clinical thermometer, metabolic rate measurement. Instrumentation for the clinical laboratory.

Special topics: Bio-telemetry, Remote Surgery and Robotics in Bio-Medical Engineering, application of ultrasonic and laser in biology and medicine, Clinical X-ray equipment, Fluoroscopy, Infrared heating. Introduction to various sophisticated diagnostics machines, Devices for Rehabilitation and Physical Therapy.

MTE 4209(d) (Parallel and Distributed Processing)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Parallel Processing: Parallel processing and its Importance, Architectures for parallel processing-Classifications, comparative study of different architectures, PRAM models, parallel memory organizations, Multiprocessor Operating Systems, Hardware issues in parallel processing, Multiprocessing controls and Algorithms, Parallel programming models, Parallel languages and compilers.

Distributed Processing: Introduction: Communication Architecture and Protocols, Inter process communication, Remote Procedure Calls, Group Communication, Time and Coordination, Distributed Shared Memory, Distributed Operation Systems, Distributed File Services, Distributed Transactions, Design of Distributed Data, Distributed Database and Network Management, Distributed Objects.

Applications: Object recognition and image understanding by processing several data from various sensors.

MTE 4209(e) (Multimedia Systems and Applications)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Multimedia Systems: Media and data streams. Medium properties of multimedia system, Basic sound concepts, Music, MIDI devices and standards, Speech generation, Speech analysis and transmission. Image manipulation and storage: File formats for BMP, GIF, TIFF, IPEG, MPEG-II etc.

Computer Graphics and Animation: Principles of Computer Graphics using various mathematical concepts, Matrices algebra, Basics 3D operations in DirectX/Open GL, 3D Collision Detection and Special Effects.

Multimedia Applications: Tele conferencing, Virtual reality and Gaming.

MTE 4209(f) (Rapid Prototyping)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Introduction: Basic concepts, historical development, Comparison of conventional prototyping methods and rapid prototyping technologies, definition of rapid prototyping, fundamentals of RP, advantages of RP, overview of existing technologies of prototyping and tooling, classifications of RP systems.

Product Development: State of the technology, conceptual design, development, detail design, prototype, tooling, limitations. Application of CAD, Techniques, procedures, product slicing, software, applications.

Rapid Prototyping Systems: Working principles, advantages and limitations of Fused Deposition Modeling, Laminated Object Manufacturing, Solid Grand Curing, Stereo lithography, Selective Laser Sintering, Laser Engineered Net Shaping, Pro Metal System, Other functional RP processes like Precision Optical Manufacturing, Laser Additive Manufacturing Process, Topographic Shell Fabrication, Direct Shell Production, advantages and limitations. Rapid prototyping data formats, Cost justification of RP.

Applications of RP: Casting processes, finishing processes, applications in design, applications in aerospace, automotive, biomedical, jewelry, coin, tableware etc. industries, Rapid tooling, Reverse Engineering using RP, case studies.

MTE 4209(g) (Advanced Control Theory and Applications)

Lecture: 3 hrs. /week **No. of credit: 3.00**

Multivariable Control:

Introduction to multivariable control, Transfer functions for MIMO systems, Multivariable frequency response analysis, Control of multivariable plants, Introduction to multivariable RHP-zeros, Condition number and RGA, Introduction to MIMO robustness, General control problem formulation, Limitations on performance on MIMO systems, Limitations imposed by time delays, Limitations imposed by RHP-zeros, Limitations imposed by unstable (RHP) poles, Limitations imposed by uncertainty, Singular Value Decomposition, Norms, Linear fractional transformations.

Controller Design and Applications: Model predictive controller, Sliding Mode Controller, Hard Disk Drive, Piezoelectric Actuator, Flexible Structure, Unmanned Arial Vehicles.

Robust Stability and Performance Analysis: General control configuration with uncertainty, Representing uncertainty, Definitions of robust stability and robust performance, Robust stability of the M-structure, The structured singular value, Robust stability with structured uncertainty, Robust performance

Nonlinear System Analysis and Control: Introduction to nonlinear systems, Types of common nonlinearities, Stability of nonlinear systems, describing functions analysis, limit cycles, phase plane analysis, phase trajectories.

MTE 4200 (Project and Thesis)

Contact Hour: 6 hrs/week **No. of credit: 3.00**

Continuation of research work selected for MTE 4100. In this course, the construction of the setup should be finished. Experimentation and adjustments will be done with the setup. The thesis or project will be finished and thesis report will be submitted at the end of the course.

MTE 4210 (Seminar)

Sessional: 2 hrs/week **No. of credit: 1.00**

This course is intended to develop presentation skills of the students. Students need to present their research work which is based on the courses MTE 4200 for evaluation purpose.

MTE 4204 (Embedded Systems Sessional)

Sessional: 3/2 hrs/week **No. of credit: 0.75**

Sessional Based on MTE 4203.

MTE 4206 (Robotics Sessional)

Sessional: 3 hrs/week **No. of credit: 1.50**

Sessional Based on MTE 4205.

CSE 4288 (Artificial Intelligence Sessional)

Sessional: 3/2 hrs/week **No. of credit: 0.75**

Sessional Based on CSE 4287.

Some Important Text/Reference Books:

1. **Bolton**, Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, latest Edition
2. C. W. **Silva**, Mechatronics: An Integrated Approach, latest Edition
3. **Dietel**, C++ How to Program, latest Edition
4. **Rogers** B, "Engineering Thermodynamics", latest Edition, Longman Green & Co. Ltd. London(ELBS)
5. **Cengel** , "Thermodynamics and Heat Transfer", latest Edition, Tata McGraw Hills
6. **Gerson**, Technical Writing Process and Product, latest Edition
7. **Boylestad**, Electronic Devices and Circuit Theory, latest Edition
8. Murray R. **Spiegel**, "Vector Analysis", latest Edition, Schaum Publishing Co.
9. **Beer & Johnston**, Vector Mechanics for Engineers: Statics and Dynamics, SI latest Edition
10. **P. N. Rao**, Production Process, latest Edition
11. **Begman**, Manufacturing Process, latest Edition
12. **Malvino**, "Principles of Electronics" latest Edition, PHI
13. **Tocci**, Digital Systems: Principles and Applications, latest Edition
14. M. Morris **Mano**, "Digital Circuits and Logic Design", latest Edition, PHI
15. G. **Omura** , AutoCAD**,** latest Edition
16. **Gayakwad**, "OP-AMP and linear integrated circuits" , latest Edition, Wesley Eastern Publications
17. A.V. **Oppenheim** & A. S. Willsky "Signals and Systems", PHI, latest Edition
18. **Helfrick**, Modern Electronic Instrumentation and Measurement Techniques, latest Edition
19. **Rosenblatt,** Electrical Machines, latest Edition
20. R. M. **Crowder**, Electric Drives and their Control, latest Edition
21. **Hogg & Craig**, "Introduction of Mathematical Statistics", latest Edition, MacMillan
22. **Gerlad** C.F. and Patrick Wheatley, "Applied Numerical Analysis", latest Edition, Addison Wesley
23. **Ogata** (1997), Modern Control Engineering. New Delhi, latest Edition , PHI
24. N. **Nise**, Control Systems Engineering, latest Edition , Wiley-VCH
25. R.T. **Stefani**, Design of Feedback Control Systems, latest Edition, Oxford University Press
26. **Mackenzie**, The 8051 Microcontroller, latest Edition
27. **Gadre**, Programming and Customizing the AVR Microcontroller, latest Edition , McGraw-Hill

28. **Bansal** R.K, “Fluid Mechanics” and Hydraulic Machines”, latest Edition, Laxmi Publications, Bangalore
29. **Kumar** D.S, “Fluid Mechanics and Fluid Power Engineering”, latest Edition, S K Kataria Publishers, Delhi
30. **Shigley**, J.E. and Uicker (K), J.J. “Theory of Machines and Mechanisms”, latest Edition, McGraw-Hill.
31. **M. Bevan,** Mechanisms, latest Edition
32. R.S. **Khurmi**, Theory of Machines, latest Edition
33. **Thomson** W.T, “Theory of Vibrations with Applications”, latest Edition, Chapman and Hall
34. Devdas **Shetty** & Richard A. Kolk, “Mechatronics system Design”, latest Edition, FWS Publishing company
35. **Bradley**, D, “Mechatronics-Electronic in Product and Processes, latest Edition , Chapman and Hall, London
36. Brain **Morriess**, “Automated Manufacturing Systems-Actuators, Controls, Sensors and Robotics”, latest Edition, McGraw-Hill International Edition
37. Anthony **Esposito**, “Fluid Power with Applications”, latest Edition, Pearson Education, New Delhi
38. Peter **Rohner**, “Industrial Hydraulic Control”, latest Edition, John Wiley & Sons, Brisbane
39. **Hasebrink** J.P. “Fundamentals of Pneumatic Control Engineering” Festo Didactic GMBH & Co, Germany
40. Daniel W. **Hart** “Introduction to Power Electronics”, latest Edition , Prentice Hall International
41. **Rashid**, “Power Electronics: Circuits, Devices and Applications”, latest Edition, Pearson Education India
42. **Starlings**, “Data and Computer Communication”, latest Edition, Maxwell and Macmillan
43. Andrew **Tannenbaum**, S. “Computer Networks”, latest Edition, Prentice Hall of India
44. **Hibbeler**, Mechanics of Materials in SI Units, latest Edition
45. **Oppenhein** and Schafer, “Discrete Time Signal Processing”, latest Edition, Prentice Hall of India
46. J.G. **Prookis**, “Introduction to Digital Signal Processing”, latest Edition, Macmillan Publishing Company
47. **Bolton**, Programmable Logic Controllers, latest Edition, Elsevier
48. **Webb**, Programmable Logic Controllers: Principles and Applications, latest Edition
49. Rafael C. **Gonzalez** and Richard E. Woods Digital Image Processing, latest Edition
50. Geoffrey **Gordon**, System Simulation, Prentice Hall of India, latest Edition
51. Arnold S. **Berger** , “Embedded System Design” An Introduction to Processes, Tools , & Techniques
52. J. J. **Craig** , Introduction to Robotics, latest Edition
53. Ramez **Elmasri**, “Fundamentals of Database System”, latest Edition Addition Wesley, McGraw-Hill
54. **T. Lucy**, Management Information Systems, latest Edition
55. Mike **Martin** and Roland Schinzinger, “Ethics in Engineering”, latest Edition , McGraw-Hill, New York
56. Gail **Freeman**, “Management in Engineering-Principles and Practice”, latest Edition, PHI
57. Gene **Burton**, “Management Today Principles and Practice”, latest Edition , Tata McGraw Hill
58. Leslie **Cromwell**, “Biomedical instrumentation and measurement”, latest Edition, PHI
59. **Groover**, M.P, Automation, Production Systems and Computer Integrated Manufacturing, latest Ed, PHI
60. **Martin**, H. C. and Carey, “Introduction to Finite Element Analysis-Theory and Applications”, latest Edition, McGraw-Hill New York.
61. Elaine **Rich**, Kevin Knight, “Artificial Intelligence” latest Edition, Tata McGraw Hill
62. **Kosko**, B, “Neural Networks and Fuzzy Systems ", latest Edition , PHI

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