Department of Robotics and Mechatronics Engineering
University of Dhaka

Syllabus for B.Sc. in Robotics and Mechatronics Engineering
Session : 2015-16 and 2016-17

Semester-I (First Year First Semester)

Sl No.	Course Code	Course title	Contact Hr	Credit Hr
1.	ME 101	Fundamentals of Mechanical Engineering	3	3
2.	ME 102	Engineering Drawing Lab	3	1.5
3.	ME 103	Machine Shop and Workshop Practices Lab	3	1.5
4.	CSE 101	Fundamentals of Computing	3	3
5.	ENG 101	Functional English	2	2
6.	PHY 101	Physics	3	3
7.	PHY 102	Physics lab	3	1.5
8.	CHEM 101	Chemistry	3	3
9.	CHEM 102	Chemistry Lab	3	1.5
Total Credit:				20

Semester-II (First Year Second Semester)

Sl No.	Course Code	Course title	Contact Hr	Credit Hr
1.	MTE 101	Fundamentals of Mechatronics Engineering	3	3
2.	MTE 102	Fundamentals of Mechatronics Engineering Lab	3	1.5
3.	EEE 101	Fundamentals of Electrical and Electronics Engineering	3	3
4.	EEE 102	Fundamentals of Electrical and Electronics Engineering Lab	3	1.5
5.	CSE 102	Fundamentals of Programming	3	3
6.	CSE 103	Fundamentals of Programming Lab	3	1.5
7.	MATH 101	Differential and Integral Calculus	3	3
8.	STAT 101	Statistics for Engineers	3	3
9.	ACC 101	Accounting	3	3
Total Credit:				22.5

Semester-III (Second Year First Semester)

Sl. No.	Course Code	Course title	Contact Hr	Credit Hr
1.	EEE 201	Digital Logic Circuit and Microprocessor	3	3
2.	EEE 202	Digital Logic Circuit and Microprocessor Lab	3	1.5
3.	EEE 203	Power Electronics and Drives	3	3
4.	EEE 204	Power Electronics and Drives Lab	3	1.5
5.	ME 201	Thermo-Fluid Engineering	3	3
6.	ME 202	Thermo-Fluid Engineering Lab	3	1.5
7.	MATH 201	Linear Algebra	3	3
8.	HUM 201	Managerial and Engineering Economics	3	3
9.	SOC 201	Society and Technology	3	3
Total Credit:				22.5

Semester-IV (Second Year Second Semester)

Sl. No.	Course Code	Course title	Contact Hr	Credit Hr
1.	ROB 201	Introduction to Robotics	3	3
2.	ROB 202	Introduction to Robotics Lab	3	1.5
3.	RME 201	Microcontroller and Programmable Logic Controller	3	3
4.	RME 202	Microcontroller and Programmable Logic Controller Lab	3	1.5
5.	EEE 205	Electrical Machines	3	3
6.	CSE 201	Object Oriented Programming	3	3
7.	CSE 202	Object Oriented Programming Lab	3	1.5
8.	MATH 202	Differential Equations and Coordinate Geometry	3	3
9.	HUM 202	Industrial Management	3	3
Total Credit:				22.5

Semester-V (Third Year First Semester)

Sl No.	Course Code	Course title	Contact Hr	Credit Hr
1.	ROB 301	Artificial Intelligence	3	3
2.	ROB 302	Artificial Intelligence Lab	3	1.5
3.	MTE 301	Advanced Mechatronics Engineering	3	3
4.	MTE 302	Advanced Mechatronics Engineering Lab	3	1.5
5.	RME 301	Simulation and Modeling	3	3
6.	RME 302	Control Systems Design	3	3
7.	MATH 301	Multivariate and Vector Calculus	3	3
Total Credit:				18

Semester-VI (Third Year Second Semester)

Sl No.	Course Code	Course title	Contact Hr	Credit Hr
1.	ROB 303	Intelligent Systems and Robotics	3	3
2.	ROB 304	Intelligent Systems and Robotics Lab	3	1.5
3.	MTE 303	Instrumentation and Measurements	3	3
4.	MTE 304	Instrumentation and measurements Lab	3	1.5
5.	ME 301	Manufacturing Process with CNC Programming	3	3
6.	ME 302	Manufacturing Process with CNC Programming Lab	3	1.5
7.	MATH 302	Numerical Methods	3	3
8.	HUM 301	Bangladesh Studies	2	2
Total Credit:				18.5

Semester-VII (Fourth Year First Semester)

Sl No.	Course Code	Course title	Contact Hr	Credit Hr
1.	ROB 401	Robotics Systems Design	3	3
2.	ROB 402	Robotics Systems Design Lab	3	1.5
3.	RME 401	Digital Signal Processing	3	3
4.	RME 402	Digital Signal Processing Lab	3	1.5
5.	MTE 401	Electromechanical Engineering	3	3
6.	CSE 401	Digital Image Processing	3	3
7.	CSE 402	Digital Image Processing Lab	3	1.5
8.	RME 403	Research Methodology, Technical and Scientific Writing	3	1.5
9.	RME 409	Project / Dissertation	2	2
Total Credit:				20

Semester-VIII (Fourth Year Second Semester)

Sl No.	Course Code	Course title	Contact Hr	Credit Hr
1.	ROB 403	Human Robot Interaction	3	3
2.	XXXX	Optional course I	3	3
3.	XXXX	Optional I Lab	3	1.5
4.	XXXX	Optional course II	3	3
5.	XXXX	Optional course II Lab	3	1.5
6.	RME 410	Project / Dissertation	4	4
Total Credit:				16

Total Credit: 160 (4 Years Program)

Summary of Eight Semester

Semester I (First Year First Semester)	20
Semester II (First Year Second Semester)	22.5
Semester III (Second Year First Semester)	22.5
Semester IV (Second Year Second Semester)	22.5
Semester V (Third Year First Semester)	18
Semester VI (Third Year Second Semester)	18.5
Semester VII (Fourth Year First Semester)	20
Semester VIII (Fourth Year Second Semester)	16
Total Credit in Eight Semester	**160**

Semester-I (First Year First Semester)

ME 101: Fundamentals of Mechanical Engineering - 3 Credit

Heat, Energy, Power, Power Generation Systems and Related Environmental Issues. Study of Fuels, Combustions, Steam Generation Units with Accessories and Mountings; Study of Steam Generators, Steam Turbines and Gas Turbines with their Accessories. Introduction to Internal Combustion Engines and their Cycles, Power Cycles (Carnot, Otto, Petrol, Diesel). Types of Fluid Machinery, Study of Impulse and Reaction Turbine, Pelton Wheel and Kaplan Turbine. Study of Centrifugal and axial flow machines; pumps, fans, Blowers and Compressors, Study of Reciprocating Pumps.

Books Recommended:

1. Engineering Thermodynamics – Moran, Shapiro
2. Introduction to Thermodynamics and Heat Transfer - Yunus A. Cengel, McGraw Hill
3. Heat Engineering - V.P. Vasandani, D.S.Kumar

ME 102: Engineering Drawing Lab – 1.5 Credit

Introduction to Lettering, Numbering and Heading, Instrument and their Use, Sectional and Isometric Views of Solid Geometrical Figures. Isometric Projection, Orthoraphic Projection, Surface Development, Use of Software such as Auto CAD to Draw Engineering Objects.

Books Recommended:

1. Engineering Drawing - Shah & Rana, Pearson Education
2. Engineering Drawing - Junnarkar, Pearson Education
3. Machine Drawing with Auto CAD - Pohit, Ghosh, Pearson Education

ME103: Machine Shop and Workshop Practices Lab – 1.5 Credit

Mechanical Tools, Hand Tools, Power Tools, Grinding Machine, Lathe Machine, Shaper Machine, Welding; Arc Welding, Gas Welding.

CSE 101: Fundamentals of Computing – 3 Credit

Number System: Binary, Decimal, Hexadecimal, Octal number systems, Arithmetic in Different Number Systems. Combinatorial Logic: Logic Gates and Boolean Algebra, Combinational Circuits Design using Logic Gates. Introduction to Computers: Components of a Computer System, Importance and Limitations of Computers, Classification of Computers, History of Computers, Computer Generations. Microcomputer System: Microcomputer Basics, Bus Architecture, Motherboard and its Components. Input and Output Devices: I/O Operations and Interfaces, Input Devices, Output Devices. Microprocessors: Functions of Microprocessors, Organization of a

Microprocessor, Arithmetic Logic Unit, Control Unit. Memory Organization: Classification of Memory, Memory hierarchies, Read Only Memory, Random Access Memory, Cache Memory, Secondary Memory: Floppy Disk, Hard Disk, Optical Disk, Comparisons of Primary Memory and Secondary Memory. Computer Software: Software, Classification of Software, Programming Languages. System Software and Operating System: System software, The role of BIOS, Language Translators, The Tasks of an OS, Types of OS. Database Concepts: Basic Concepts, Database Software, Database Structures, Database Management System, Benefits and Limitations of Database Management. Computer Networks and the Internet: Introduction to Computer Network, Network Terminologies, LAN Topology, Transmission Media, Communication Over Telephone Lines, Evolution of the Internet, Internet Services, Internet Address, Electronic Mail, The World Wide Web, Internet Protocols. IT Applications: Concepts and Applications of IT, Electronic Commerce, Access, Control, Security.

Books Recommended:

1. Computer Fundamentals - Pradeep K. Sinha and Priti Sinha, BPB Publications.
2. Introduction to Computers - Peter Norton, McGraw-Hill Education.

ENG 101: Functional English – 2 Credits

Grammar: Articles, Verb Patterns, Sentence Combining Subordination and Coordination, Conditional Sentences, The Infinitive, Gerund, and Participle, Subject-Verb Agreement. Writing: Paragraph and Analytical Writings, Writing on Current Affairs, Scientific Writing. Commercial Correspondences: Defining Context, Feedback and Semantic Gap. Different types of Commercial and Business Letter Writing, Writing of Different Types of Reports on Specific Topics. Reading: Basic Reading Skills (Skimming, Scanning, Making Inferences, Recognizing Patterns) and Apply these Skills in an Extensive Reading Environment. Speaking: Developing Speaking Skill which will include Strategies for Communication and an Acquaintance with Phonetics. Effective Oral Presentation. Tasks will include Making Statements, Requests, Inquiries, Disagreeing, Complaining and Apologizing, Discussing, and other Oral Presentations. Listening: Practice Listening to Spoken English and Taking Useful Notes.

Books Recommended:

1. A Practical English Grammar - A.J. Thomson and A.V. Martinet
2. From Paragaph to Essay - Maurice Imhoof and Herman Hudson,
3. Advancing Language Skills - Clive Taylor,
4. Advanced Writing Skills - John Arnold and Jeremy Harmer,
5. Effective Reading - Simon Greenall and Michael Swan,
6. Writing Voyage: An Integrated Process Approach to Basic Writing - Thomas E. Tyner,
7. View Points: Interviews for Listening - Robert O'Neill and Reger Scott,
8. Commercial Correspondences and Report Writing – R. C. Sharma and Krishna Mohon.

PHY 101: Physics - 3 Credit

Mechanics: Basic Concepts of Mechanics; Statistics of Particles and Rigid Bodies; Newton's Second Law of Motion; Principles of Work; Energy; System of Particles; Kinetics of Plane Motion

of Rigid Bodies; Forces and Acceleration; Principles of Work and Energy. Law of Gravitation. Waves & Oscillations: Differential Equation of a Simple Harmonic Oscillator, Total Energy and Average Energy, Combination of Simple Harmonic Oscillations, Damped Oscillation, Determination of Damping Co-Efficient, Forced Oscillation, Resonance, Two-Body Oscillations, Reduced Mass, Laplace's Correction, Doppler Effect. Newton's Law of Velocity. Modern Physics: Relativity: Michelson Morley's Experiment, Galilean Transformation, Special Theory of Relativity, Lorentz- Transformation, Length Contraction, Time Dilation, Mass-Energy Relation. Radioactivity: Radioactive Decay, Half Life, Mean Life, Nuclear Binding Energy, Alpha, Beta, Gamma Decay. Photoelectric Effect.

Books Recommended:

1. Physics (Volume I and II) - Halliday, Resnick
2. Fundamentals of Physics - Halliday, Resnick
3. Modern Physics - Aurthur Beiser

PHY 102: Physics Lab – 1.5 Credit

Practical Classes based on the topics covered in **PHY 101**

CHEM 101: Chemistry - 3 Credit

Modem Concepts Of Atomic Structure, Modem Periodic Table with Reference to Group Cherpistry, Dual Nature of Electron and Modem Concepts of Chemical Bonds. Properties and Molecular Structure. Oxidation Reduction Reaction. Modem Concepts of Acids and Bases. Classification of Organic Chemistry and Different Types of Organic Reactions. Different Types of Solutions and their Compositions, Properties of Solutions, Phase Rule, Phase Diagram of Monocomponent Systems, Thermochemistry, Chemical Kinetics, Chemical Equilibrium, Electrical Properties of Solution and Electrochemical Cells. Spectrohotometry, Colorimeter, Light Intensity.

Books Recommended:

1. Introductory Chemistry – Sevenair & Burkett
2. General Chemistry – Ebing
3. Physical Chemistry – Atkins
4. Modern Organic Chemistry – S.Z. Haider

CHEM 102: Chemistry Lab – 1.5 Credit

Practical Classes based on the topics covered in **CHEM 101**

Semester-II (First Year Second Semester)

MTE 101: Fundamentals of Mechatronics Engineering - 3 Credit

Introduction: Definition and Applications of Mechatronics, Relationship amongst Different Disciplines. Basics of Electronics: Fundamental concepts of Circuits and Electrics. Basics of Mechanical Engineering: Fundamental Concepts of Mechanics, Measurement Systems, Control Systems, Mechanical Design, Discrete Linear Systems. Sensors and Transducers: Sensors for Displacement, Proximity, Motion, Sound, Light, Temperature, Fluid Level and Flow, Force, etc. Actuation Systems: Basics of Pneumatic and Hydraulic Systems, Mechanical Actuation Systems, Electrical Actuation Systems, Servos. System Models and Controllers: Fundamentals of Electrical, Mechanical, Fluid and Thermal Systems, Electromechanical Systems, Process Controllers, Control Modes, PID and Digital Controllers, Velocity, Adaptive, Digital Logic, Microprocessor Control. Programmable Logic Controllers: Fundamentals of PLCs, Mnemonics and Timers, Relays and Counters, Master and Jump Control, Data Control, Analog I/O Control. Design of Mechatronics Systems: Steps of Mechatronics System Design, Possible Design Solutions, Case Study.

Books Recommended:

1. Introduction to Mechatronics and Measurement Systems - Michael B., Histand and David G. Alciatore, McGraw-Hill.
2. Mechatronics Electronic Control Systems in Mechanical and Electrical Enginneering - W. Bolton, Pearson Education.
3. Mechatronics Engineering - Sastry, Tata McGraw Hill.

MTE 102: Fundamentals of Mechatronics Engineering Lab – 1.5 Credit

Practical classes based on the topics covered in **MTE 101**.

EEE 101: Fundamentals of Electrical & Electronics Engineering - 3 Credit

Electrical:

Direct Current circuits: Laws and Theorems. DC Network Analysis: Delta/Star Transformation, Source Conversion. Alternating Current: AC Quantities and Sinusoidal Waveforms, Phasors, AC Circuit Analysis: Series and Parallel Branches- RL, RC, and RLC. Balanced Three Phase Circuits. Circuit Variables and Elements: Voltage, Current, Power, Energy, Independent and Dependent Sources, and Resistance. Basic Laws: Ohm's Law, Kirchoff's Current and Voltage Laws. Simple Resistive Circuits: Series and parallel Circuits, Voltage and Current Division. Techniques of Circuit Analysis: Nodal and Mesh Analysis including Supernode and Supermesh with Applications in Circuits having Independent and Dependent Sources. Network Theorems: Source Transformation, Thevenin's, Norton's and Superposition Theorems with Applications in Circuits having Independent and Dependent Sources, Maximum Power Transfer Condition and Reciprocity Theorem. Energy Storage, Elements: Inductors and Capacitors, Series Parallel Combination of Inductors and Capacitors.

Electronics:

Semiconductor Diode: Operation, Characteristics and Applications. Introduction to Bipolar Junction Transistors (BJTs), Characteristic. Common–Emitter (CE), Common-Base (CB) and Common-Collector (CC) Amplifier Configurations. Voltage and Current Gain, Input and Output Impedance of a Common Base, Common Emitter and Common Collector Amplifier Circuits. Metal Oxide Semiconductor Field Effect Transistor (MOSFET) as Circuit Element: Structure and Physical Operation of an Enhancement MOSFET, Biasing Discrete and Integrated MOS Amplifier Circuits, Single-stage MOS Amplifiers, MOSFET as a Switch, CMOS Inverter. Junction Field Effect Transistor (JFET): Structure and Physical Operation of JFET, Transistor Characteristics. Operational Amplifiers (Op-Amp): Properties of Ideal Op-Amps, Non-inverting and Inverting Amplifiers, Inverting Integrators, Differentiator.

Books Recommended:

1. Introduction to Circuit Analysis- Boylestad
2. A text book of Electrical Technology- B. L. Theraja
3. Fundamentals of Electric Circuits – Alexander, Sadiku
4. Principle of Electronics -V. K. Mehta
5. Basic Electronics -Grob
6. Fundamentals of Electrical Engineering- R.P.Ward
7. Electrical Circuits, Sehilling, 3rd edition, 1989, Mc Graw-Hill

EEE 102: Fundamentals of Electrical & Electronics Engineering Lab - 1.5 Credit

Practical classes based on the topics covered in **EEE 101**

CSE 102: Fundamentals of Programming – 3 Credit

Introduction to Computer Programming, Problem Solving Techniques, Algorithm Specification and Development. Programming Style, Debugging And Testing, Documentation. C Programming Language: Basic I/O, Data Type, Conditional Logic, Switch Case, Character, Integer to Character Conversion. Operators: Arithmetic, Relational, Logical and Bitwise Operators, Operator Precedence and Associativity, Arithmetic Expression Evaluation. Loops: Looping Basic, Necessity of Loops, While Loop, For Loop, Do While Loop, Nested Loop. Formatted I/O: Specifying Width using Format Specifier in printf and scanf in Details. Arrays: Basics of Array, Accessing through Indices, Accessing using Loops, Two Dimensional Arrays. Functions: Basic Functions, Different Types of Functions, Local and Global Variables, Call by Value, Call by Reference, Passing Arrays in a Function as Parameter, Recursion, Scope Visibility and Lifetime of Variable. Strings: Basics, I/O Operations using String, Basic Operations without using Library Functions, Basic String Operations. Structures: Basics, Accessing, Initialization, Array of structures. Pointers: Basics, Pointer Operation, Call by Reference using Pointers, Pointer for Array, Array of Pointers. Dynamic Memory Allocation: Basics, Malloc, Free, Calloc. File Operation: Basics, File Opening, Closing, File I/O.

Books Recommended:

1. The C Programming Language - Brian W. Kernighan, Dennis M. Ritchie, Prentice Hall.
2. Programming in ANSI C - E. Balagurusamy, MHE.
3. C the Complete Reference - Herbert Schieldt, McGraw-Hill Education.

CSE 103: Fundamentals of Programming Lab - 1.5 Credit

Practical classes based on the topics covered in **CSE 102**

MATH 101: Differential and Integral Calculus - 3 Credits

Differential Calculus:

Functions: Functions and their Graphs (Polynomial, Rational, Logarithmic, Exponential, Trigonometric, Hyperbolic Functions and Combination of such Functions). Limits, Continuity and Differentiability: Concepts and definitions; One Sided Limits; Limit at Infinity and Infinite Limits; Limit Laws; Sandwich Theorem; Continuous and Discontinuous Functions with Properties; Intermediate Value Theorem; One Sided Derivatives; Differentiability of Functions. Differentiation: Tangent Lines and Rates of Change; Techniques of Differentiation; Chain Rule; Derivatives of Various Functions; Successive Differentiation; Leibnitz Theorem; Related Rates; Indeterminate Forms; L'Hospital's Rule. Applications of Differentiations: Analysis of Functions; Absolute Extrema; Applied Maximum and Minimum Problems; Rolle's Theorem; Mean-Value Theorem.

Integral Calculus:

Integration: Indefinite Integral (Integration by Substitution, Integration by Parts, Standard Integrations, Integration by Successive Reduction); Definite Integrals; Fundamental Theorem of Calculus; Properties of Definite Integrals. Applications of Integration: Area between Two Curves; Volume of Solid by Slicing; Disk and Washers; Volume by Cylindrical Shells; Arc Length; Area of a Surface of Revolution. Improper Integrals: Different Types of Improper Integrals.

Books Recommended:

1. Calculus: Early Transcendentals - H. Anton, I. Bivens and S. Davis, Wiley.
2. Calculus and Analytic Geometry - G. B. Thomas and R. L. Finney, Addison Wesley.
3. Calculus: Early Transcendentals - J. Stewart, , Thomson Brooks/Cole.
4. Calculus - R.T. Smith & R. B. Minton.

STAT 101: Statistics for Engineers – 3 Credit

Basic Statistics: Basic Concept of Statistics, Classification & Tabulation, Frequency Distribution and Construction of Frequency Distribution, Statistical Graphs for Frequency Distributions, Measures of Central Tendency: Mean, Median, Mode, Quartile, Percentile, Measures of Variation:

Range, Mean Deviation, Standard Deviation, Co-Efficient of Variation. Simple Correlation and Liner Regression Models: Measures of Correlation, Scatter Diagram, Karl Pearson's Correlation Coefficient – Properties, of Karl Pearson's Correlation Coefficient, Spearman's Rank Correlation Coefficient, Multiple Correlations, Regression – The Method of Least Squares, Inferences Based on Least Square Estimators. Probability Distributions: Sample Spaces and Events, Theorems of Probability, Conditional Probability, Mathematical Expectation, Joint Probabilities and Independence. Bayes' Theorem, Law of Large Numbers, Central Limit Theorem, Chebyshev's Inequality. Probability Distributions: Random Variables, Joint Probability Distribution, Bernoulli Distribution, Binomial Distribution- Assumptions for Applying A Binomial Distribution – Approximation of The Binomial Distribution, Poisson Distribution - Assumptions for Applying The Poisson Distribution, The Uniform Distribution, Normal Distribution - Standard Normal Distribution, Exponential Distribution. Inferences / Testing of Hypothesis: Point Estimation, Bayesian Estimations, Null Hypothesis, Test Statistics, Type I And II Errors, Level of Significance, One-Tailed And Two-Tailed Tests, P-Value, Power of a Test, Confidence Intervals, Hypothesis Test Concerning One and Two Population Mean, Hypothesis Test Concerning One and Two Population Proportions, Tests about a Population Variances.

Books Recommended:

1. An Introduction to Statistics and Probability - Islam M. N., Book World
2. Statistics for Engineers - Walepole & Myer.

ACC 101: Accounting – 3 Credit

Financial Accounting: Objectives and Importance of Accounting; Accounting as an Information System; Computerized System and Applications in Accounting; Accounting Concepts/Principles; Double Entry Mechanism; Accounts and their Classifications; Accounting Equation; Accounting Cycle; Recording System: Journal, Ledger, Trial Balance; Preparation of Financial Statements Considering Adjusting and Closing Entries; Financial Statement Analysis and Interpretation. Management Accounting: Cost Concepts and Classification; Overhead Cost: Meaning and Classification; Distribution of Overhead Cost; Overhead Recovery Method/Rate; Job Order Costing: Preparation of Job Cost Sheet and Quotation Price; Inventory Valuation: Absorption Costing and Variable Costing Technique; Cost Behavior and Cost-Volume-Profit Analysis: Meaning, Breakeven Analysis, Operating Leverage, Sensitivity Analysis. Performance Evaluation: Budgetary Control; Standard Costing; Balanced Score Card; Short-Term Investment Decisions: Relevant and Differential Cost Analysis; Long-Term Investment Decisions: Capital Budgeting, Various Techniques of Evaluation of Capital Investments.

Books Recommended:

1. Accounting Principles - Weygandt, J., Kimmel, P., and Kieso, D., Wiley: NJ.
2. Advanced Accounting - M.M. Khan

Semester-III (Second Year First Semester)

EEE 201: Digital Logic Circuit and Microprocessor - 3 Credit

Digital Logic Circuit:

Combinatorial Logic: Minimization of Functions, Algebraic Simplification, the Karnaugh Map. Arithmetic Circuits: Adder, Subtractor. Sequential Logic: NAND and NOR Latches. Different Types of Flip-Flops, FF Timing Consideration, Frequency Division and Counting, Different Types of Counters, Propagation Delay, Decoding a Counter, Shift Registers. Decoder and Encoder. Multiplexer and Demultiplexer. Analog-to-Digital Converter, Digital-to-Analog Converter, Memory Devices: Semiconductor Memory Technologies, ROM Architecture, RAM Architecture.

Microprocessor:

Introduction to Microprocessor: Evolution of Microprocessor, Overview of Microcomputer. 8086 Microprocessor: Introduction, Architecture, Instruction Sets, Constructing Machine Codes for 8086 Instructions, Interrupts and 8259A (Priority Interrupt Controller), Higher Versions of 8086. Pentium Microprocessor: Introduction to Pentium Microprocessor, Pentium Processor Architecture, Register Sets, Cache, Floating Point Operations, Addressing Modes, Paging, Instruction Set, Interrupt, Protected Mode Operations.

Books Recommended:

1. Digital Systems: Principles and Applications - Ronald Tocci, Neal Widmer, Greg Moss; Prentice Hall.
2. Logic and Computer Design Fundamentals - M. M. Mano and C. R. Kime; Prentice-Hall.
3. Microprocessor and interfacing - D.V. Hall.
4. Microprocessor – Rafiquzzaman.
5. The Pentium Microprocessor - James L. Antonakos.

EEE 202: Digital Logic Circuit and Microprocessor Lab – 1.5 Credit

Practical classes based on the topics covered in **EEE 201.**

EEE 203: Power Electronics and Drives - 3 credit

Power Electronics:

Devices: Power electronics; Diodes; Thyristors; Bipolar Transistors; Power Amplifiers: Classification of Output Stages. Rectifiers: Single Phase Half Wave, Single-Phase Full Wave, and Bridge Rectifiers. Converters: Derivation of Operating Equations; Variable Speed Drives; Motoring and Regeneration. Inverters: 3-phase Inverters; DC Link Inverter, Comparison with Thyristor; Variable Speed Induction Motor Drive. Power Supplies: Linear And Switched Mode Power Supplies; Practical Characteristics and Analysis of Step-up and Step-down Switched Mode Power Supplies.

Drives:

Induction Motor Drives: Control Methods, Voltage Drive and Current Drive, Quasi-Square Wave, PWM, Sine Wave, Harmonics, Flux Vector Philosophy. Synchronous Motor Drives: DC Link, Starting, Power Converter. Sensors and Communication: Types of Sensors used for Velocity and Position Feedback on Modern Drive Systems. Brushless DC Drive Systems: Types of Motor Construction of the Two Commonly used Motor Drives in Industry. Characteristics of the Operation of Motor and Amplifier Combinations using Two Types of Sensor Feedback.

Books Recommended:

1. Power Electronics - Lander C W, McGraw Hill.
2. Power Electronics Bradley D A, Power Electronics, Van Nostrand Reinhold 1987
3. Principle of Electronics- V. K. Mehta
4. Electronic Devices and Circuits- Millman Halkias
5.. Operational Amplifier and Linear Integrated Circuits - Coughlin,Driscoll

EEE 204: Power Electronics and Drives Lab - 1.5 credit

Practical classes based on the topics covered in **EEE 203.**

ME 201: Thermo-fluid Engineering - 3 Credit

Introduction to Thermodynamic, Thermodynamic Properties, Open & Closed Systems, Control Volumes, Thermodynamic Cycles, Reversibility & Irreversibility, Equations of State, Thermodynamic Laws, Steady State and Unsteady State Heat Transfer (Conduction, Convection, Radiation).

Development and Scope of Fluid Mechanics. Fluid Properties, Flow Properties, Newtonian and Non-Newtonian Fluids. Static's & Kinematics of Fluid Flow. Fluid Flow Concepts and Basic Equations-Continuity Equation, Bernoulli's Equation, Energy Equation, Momentum Equation and Forces in Fluid Flow. Laminar and Turbulent Flows, General Equation for Fluid Friction. Empirical Equations for Pipe Flow. Minor Losses in Pipe Flow. Fluid Measurement: Pitot Tube, Orifice, Mouth-Piece, Nozzle, Venturimeter, Weir.

Books Recommended:

1. Engineering Thermodynamics - Moran, Shapiro
2. Thermodynamics - Faires
3. Fluid Mechanics - Modi
4. Fluid Mechanics - Fanzani

ME 202: Thermo-fluid Engineering Lab – 1.5 Credit

Practical classes based on the topics covered in **ME 201**

MATH 201: Linear Algebra - 3 Credit

Matrices and Determinants: Notion of Matrix; Types of Matrices; Matrix operations; Laws of Matrix Algebra; Determinants and Properties of Determinants; Minors, Cofactors, Expansion and Evaluation of Determinants; Elementary Row and Column Operations and Row-reduced Echelon Matrices. System of Linear Equations: Linear Equations; System of Linear Equations (Homogeneous and Non-homogeneous); Solutions of System of Linear Equations using Different Methods; Applications to Network Flow and Electrical Networks. Vector Space: Vectors in $\mathbb{R}^n$ and $\mathbb{C}^n$; Vector Space; Subspace; Linear Dependence of Vectors; Basis and Dimension of Vector Spaces; Change of Bases; Row Space and Column Space of Matrix; Rank of Matrices; Solution Space of System of Linear Equations. Linear Transformation: Linear Transformations; Example and Illustrations with Applications; Kernel and Image of a Linear Transformation and their Properties. Eigenvalues and Eigenvectors of Matrices: Eigenvalues and Eigenvectors; Diagonalization; Cayley-Hamilton Theorem; Applications.

Books Recommended:

1. Linear Algebra with Applications - H. Anton, and C. Rorres.
2. Linear Algebra - S. Lipshutz, Schaum's Outline Series.
3. Linear Algebra and Its Applications - David C. Lay.

HUM 201: Managerial and Engineering Economics – 3 Credit

Introduction: What is Economics, Macro and Micro Economics, Methods used in Microeconomics, Microeconomic Models, Basic Concepts used in Economics (Scarcity, Opportunity Cost, Goods and Bads, Factors of Production, Market, Equilibrium etc.). Theory of the Consumer. Uncertainty: Choices under Risk and Uncertainty, Expected Utility, Risk Aversion, Maximin Strategy. Theory of the Firm: Behavior of Firms, Production Function, Returns to scale, External Economies and Diseconomies, Technological Progress, Different Types of Costs, Cost Function, Profit Maximization, Supply Curve, Law of Supply, Own Price, Cross Price and Elasticity of Supply. Markets: Perfect Competition and the Market, Behavior of a Competitive Firm in Short- run, Consumer Surplus, Producer Surplus. Market Failure and Solutions: Public Goods, Externalities, Information Asymmetry, Problem of Unobservability, Moral Hazard, Adverse Selection, Principal-Agent Problem etc.

Books Recommended:

1. Engineering Economics – Tarquin.
2. Engineering Economics – Paul Degammo
3. General Economics – Samaulso
4. Mathematical Economics – A. Chang

SOC 201: Society and Technology – 3 Credit

Introduction and Overview. Evolution of Scientific Thoughts: History and Philosophy of Science. Social Complexity and Technology Change: Elman's Servic Stage of Social Evolution and Social Complexity, Relationship between Social Complexity and Tecnological Innovation, Economy, Craft Specialiazation, Population Size and How They Affect Diffusion of Technologies. Diffusion Theory: The Nature of technological diffusion into the Society. The Attributes of Innovation and their Rate of Adoption. Use and Impact of technologies in Various Social Aspects: Robotics in Warfare or Replacement of Workforce, Social Media Effect, Artificial Intelligence. Medical and Biological Technolgoies. Genetic Technolgoies. Technologies for the Poor. Privacy and Technology. Technology and Uncertainty. Professional Ethics. Ethics of Technology Design and Use. Regulatory Issues in Governing Technologies.

Books Recommended:

1. Society and Technological Change - Volti, Rudi - Worth Publishers Inc
2. Professional Ethics - R. Subramanian - OUP India

Semester-IV (Second Year Second Semester)

ROB 201: Introduction to Robotics – 3 Credit

Introduction, Basic Components of Robot Systems, Plane, Rotation and Spatial Motion with Application to Manipulators, Geometric Configuration: Structural Elements, Linkages, Arms and Grippers, Communication and Collaboration, Coordinate Frames, Homogeneous Transformations, Kinematics for Manipulator, Inverse Kinematics; Manipulator Dynamics (Mechanism and Grasp Analysis), Mapping, Simultaneous Localization and Mapping. Jacobians: Velocities and Static Forces, Trajectory Planning, Motor Control, Robot Control Architectures and Sensing, Motion Planning: Configuration Space , Grasping and Object Transport, Localization, Low Level Robot Vision, Fuzzy Logic Control of Manipulator and Robotic Programming.

Books recommended:

1. Modeling and Control of Robot Manipulators - Sciavicco and Siciliano, McGraw-Hill
2. Introduction to Robotics - Craig, Pearson Prentice Hall.

ROB 202: Introduction to Robotics lab – 1.5 Credit

Practical Classes based on the topics covered in **ROB 201**

RME 201: Microcontroller and Programmable Logic Controller – 3 Credit

Microcontroller:

Introduction, Architecture of Microcontroller, Evolution of Microprocessor, Microcontroller Family. The 8051 Microcontroller: Features, Architecture of 8051, Block Diagram of 8051, Functions of Each Pin of 8051, Registers and their Functions of 8051, I/O Ports, Timer, Counter, Interfacing with External Memory, Programming and Applications of Microcontroller, 8051 Instruction Set – Data Transfer Instructions, Arithmetic Instructions, Logical Instructions, Branching and Control Transfer Instructions, Arithmetic and Logical operations, Subroutines, Addressing Modes.

Programmable Logic Controller:

Fundamentals of PLC, Applications, Importance, Classification, Comparison of PLC with Relay Panel, Block Diagram and Operation of PLC, Ladder Programming, Types of Instructions – Timer/Counter Instructions, Logical Instructions, Compare Instructions, Move Instructions, Program Control Instructions, PLC Programming, Motor Control using PLC.

Books Recommended:

1. 8051 Microcontroller: Hardware, Software and Applications - V Udayashankara & M S Mallikarjunaswamy, Tata McGraw Hill.
2. The 8051 Microcontroller - Kenneth J. Ayala, Thomson Delmer Learning.
3. The 8051 Microcontroller and Embedded Systems: Using Assembly and C - Mazidi Muhammad Ali, Pearson Education.
4. Microprocessors and Microcontrollers - N. Senthil Kumar, OUP India.
5. Programmable logic controller - Frank D. Petro Zella, McGraw Hill Publications.

RME 202: Microcontroller and Programmable Logic Controller Lab – 1.5 Credit

Practical classes based on the topics covered in **RME 201**

EEE 205: Electrical Machines - 3 Credit

Electromechanical Energy Conversion Fundamentals: Faraday's Law of Electromagnetic Induction, Fleming’s Rule and Lenz's Law. Single Phase Transformer: Working Principle, Construction, Types, EMF Equation, Transformer on No Load and On Load, Vector Diagram. 3 Phase Induction Motor: Construction, Types, Rotating Magnetic Field, Principle of Operation, Slip, Frequency of Rotor Current, Rotor emf, Rotor Current, Expression for Torque, Conditions for Maximum Torque, Torque Slip Characteristics, Effect of Change in Supply Voltage on Torque, Relation between Full Load Torque and Maximum Torque. Synchronous Generator: Excitation Systems, Equivalent Circuit, Phasor Diagrams at Different Loads, Factors Affecting Voltage Regulation, Synchronous Impedance, Synchronous Impedance Method of Predicting Voltage Regulation and its Limitations. Synchronous Motor: Operation, Effect of Loading under Different Excitation Condition, Effect of Changing Excitation. DC Generator: Types. No-Load Voltage Characteristics, Build-Up of a Self Excited Shunt Generator, Critical Field Resistance,

Load-Voltage Characteristic, Effect of Speed on No-Load and Load Characteristics and Voltage Regulation.

Books Recommended:

1. Alternating Current Machines, Puchstein, A.F., Lioyd, T.C.& Conrad, A.G., John Wiley
2. A text book of Electrical Technology- B. L. Theraja
3. Machine Design – Khurmi

CSE 201: Object Oriented Programming – 3 Credit

Introduction: Object oriented programming overview. Object Oriented Concepts: Modeling problems using object oriented concepts. Introduction to UML. Encapsulation, Inheritance and Polymorphism. Object Oriented vs. Procedural programming, Basics of Object Oriented Programming language. Objects and Classes: Attributes and functions, constructors and destructors, functions or methods, overloading methods, access control, special considerations in different languages. I/O: Stream and files. Inheritance: Inheriting classes, subclass, super class, access control, inheritance hierarchy, overriding, dynamic binding, abstract class, inner classes, special considerations in different languages, multiple inheritance, interface. Exception and exception handling: Exception handling fundamentals, exception types, chained exception, creating own exception subclasses. Generics or Templates: Special considerations in different languages. Package/Namespace: Understanding and implementing package/namespace. Object-oriented Design Principles and examples: Introduction to object-oriented design principles and examples, introduction to object-oriented design. Case Study using Object Oriented Programming.

Books Recommended:

1. Herbert Schildt. Teach Yourself C++, Tata McGraw-Hill Education.
2. Flanagan, David. Java in a Nutshell, Cambridge, MA: O'Reilly.

CSE 202: Object Oriented Programming Lab – 1.5 Credit

Practical classes based on the topics covered in **CSE 201**

MATH 202: Differential Equations and Coordinate Geometry - 3 Credit

Differential Equations:

Ordinary Differential Equations: Order and Degree of an Ordinary Differential Equation; Classification of Differential Equations; Solutions of Differential Equations; Formation of Differential Equations; Basic Existence and Uniqueness Theorem (Statement and Illustration Only). First Order Differential Equations: Separable Equations; Homogeneous Equations; Exact Differential Equations; Linear and Bernoulli Equations; Special Integrating Factors; Substitutions and Transformations. Higher Order Differential Equations: Basic Theory of Linear Differential Equations; Reduction of Order; Homogeneous Linear Equations with Constant Coefficients; Non-

Homogeneous Equations (Method of Undetermined Coefficients, Variation of Parameters; Cauchy-Euler Differential Equations).

Coordinate Geometry:

Two-dimensional Geometry: Coordinates in Two Dimensions; Change of Axes; Transformation of Coordinates; General Equation of Second Degree (Pair of Straight Lines, Identification of Conics). Three-dimensional Geometry: Coordinates in Three Dimensions; Direction Cosines and Direction Ratios; Equations of Planes and Lines.

Books Recommended:

1. Differential Equations - S. L. Ross, 3rd Edition.
2. A First Course in Differential Equations With Applications - D. G. Zill.
3. Analytic Geometry and Vector Analysis - A.F.M. Abdur Rahman, P.K. Bhattacharjee,
4. Analytic Geometry and Vector Analysis - Khosh Mohammad.

HUM 202: Industrial Management – 3 Credit

Industrial Dynamics and the Interplay with Competitors and Stakeholders (Customers, Suppliers, Employees, the Society at Large and so on), the Distinctive Character of Industrial Operations, Organization and Human Resource Management, Innovation and Entrepreneurship, Leadership, Strategic Planning, Marketing, Cost-Volume-Profit Analysis, Finance (Supply and Use of Capital), Cash-Flow Analysis, Investment Appraisal, Management Control, and Costing.

Books Recommended:

1. Personal Management - C.B. Memorria
2. Financial Management - Khan & Jain
3. Management for Engineers: Technologists and Scientists - W Nel, John Wiley & Sons.
4. Management for Engineers - AC Payne, JV Chelson and LRP Reavill, Wiley and Sons.

Semester-V (Third Year First Semester)

ROB 301: Artificial Intelligence – 3 Credit

Introduction: Agents and Environment, Problem Solving by Searching: Un-Informed Search Strategies: Breadth First Search, Uniform Cost Search, Depth-First Search, Iterative Deepening and Bidirectional Search. Informed Search Algorithms: Best-First Search, A* Search, Beam Search, Heuristic Searching, Memory Bounded Search. Local Searches: Hill Climbing, Simulated Annealing, Constraint Satisfaction Problems. Genetic Algorithm: Selection, Crossover, Mutation and Fitness. Game Playing: Motivation, Min-max Search, Resource Limits and Heuristic Evaluation, α-β Pruning. Logic: Propositional, FOL: Quantifiers, Model, Validity, Inference, Substitution, Unification and Herbrand Theorem. Machine learning: Supervised Learning, Decision Trees, Reinforcement Learning, Q-learning, Neural Networks, Planning: Planning Problems, Partial Order Planning, Planning as Logical Inference Planning, Probabilistic Reasoning: Uncertainty, Probability,

Independence, Bayes' Rule, Bayesian Network, Exact Inference in Bayesian Network and Approximate Inference, Knowledge Representation: Ontological Engineering, Categories and Objects, Events, Reasoning Systems for Categories, Application: Robotics: Hardware, Perception, Learning, Interaction.

Books Recommended:

1. Artificial Intelligence: A Modern Approach – Russell S. & Norvig P., Pearson Education.
2. Artificial Intelligence – Rich E. & Knight K., Mc-Graw Hill
3. Natural Language Understanding, Allen, J., Benjamin Cummings.
4. Artificial Intelligence, Winston, P.H., Addison-Wesley.
5. Programming in Prolog for Artificial Intelligence, Addison-Wesley

ROB 302: Artificial Intelligent lab – 1.5 Credit

Practical classes based on the topics covered in **ROB 301**

MTE 301: Advanced Mechatronics Engineering – 3 Credit

Software into Mechatronics Systems, Identification, Advanced Applications of PLC, Advanced applications of Microcontroller, Identify Types of Industrial Sensors in Mechatronics System, Actuation Principles in Mechatronics Systems, Control and its Role in Mechatronics. Introduction to Nanotechnology; Microelectromechanical Systems (MEMS), Machine Vision, Industrial Automation and Robotics, Case Studies.

Books Recommended:

1. Mechatronics Engineering - Sastry, Tata McGraw Hill.
2. Mechatronics - Sabri Cetinkunt, Wiley.
3. Automatic Control Engineering - F.H.Raven, McGraw Hill International.
4. Modern Control Engineering - K.Ogata, Prentice Hall.

MTE 302: Advanced Mechatronics Engineering lab – 1.5 Credit

Practical classes based on the topics covered in **MTE 301**

RME 301: Simulation and Modeling – 3 Credit

Systems: System Environment and System Components. Simulation Basics: Handling Stepped and Event-based Time in Simulations, Discrete versus Continuous Modelling, Numerical Techniques, Sources and Propagation of Error. Dynamical, Finite State, and Complex Model Simulations: Graph or Network Transitions Based Simulations, Actor Based Simulations, Mesh Based Simulations, Hybrid Simulations. Converting to Parallel and Distributed Simulations: Partitioning the Data,

Partitioning the Algorithms, Handling Inter-partition Dependencies. Probability and Statistics for Simulations and Analysis: Introduction to Queues and Random Noise, Random Variates Generation, Sensitivity Analysis. Simulations Results Analysis and Viewing Tools: Display Forms - Tables, Graphs, and Multidimensional Visualization; Terminals, X and MS Windows, and Web Interfaces, Validation of Model Results.

Books Recommended:

1. Discrete-Event System Simulation - Banks J., Carson J.S., Nelson B.L., Nicol D.M., Prentice Hall.
2. Simulation Modeling and Analysis - Law A.M., Kelton W.D., McGraw Hill International Series.
3. Queuing Analysis - William Stallings.

RME 302: Control Systems Design – 3 Credit

Introduction to Control Systems and their Representation by Different Equations. Control Systems: Open Loop and Closed Loop Control, Block Diagrams, Transfer Functions, Laplace Transforms; Mathematical Model of Physical System; PI and PID Controllers, Hydraulic and Pneumatic Controllers; Time Domain Analysis, Transient Response of First and Second Order Systems; Introduction to Nonlinear Control; State Space Analysis, Optimal and Adaptive Control; Introduction to Discrete-time Systems and Z-transform. Design and Fabrication of Mechatronics Systems. Electric Motors and DC Motor Drive Circuits, DC Motor Speed Control and PWM, H – Bridge and DC Motor Direction Control, DC Servo Motor and its Control, Stepper Motor and its Control, Relays, or Bluetooth, Controller and Final Control Element: Control Valves, Controller Configuration, System Control, System Design. Common Control Methodologies - P, D, I, PI, PD and PID.

Books Recommended:

1. Modern Control Systems - Dorf R C & Bishop R H, Addison Wesley
2. Control System - B. C. Kuo
3. Control System – Mess
4. Control System – Obat

MATH 301: Multivariate and Vector Calculus – 3 Credit

Vectors and Geometry of Space: Three Dimensional Coordinate Systems; Dot Product and Cross Product of Vectors; Lines and Planes in 3-space; Cylindrical and Quadric Surfaces. Vector Valued Functions: Calculus of Vector Valued Functions; Arc Length; Unit Tangent, Normal and Binormal Vectors; Curvature; Motion in Space. Partial Derivatives: Functions of Two or More Variables; Limit and Continuity; Partial Derivatives; Chain Rule; Taylor Series; Directional Derivatives; Tangent Planes and Normal Vectors; Maxima and Minima of Functions of Two Variables; Lagrange Multipliers. Multiple Integral: Double Integrals (Over Rectangular and Nonrectangular Regions and in Polar Coordinates); Triple Integrals in Rectangular Coordinates, Cylindrical Coordinates and Spherical Coordinates; Change of Variables in Multiple Integrals. Vector Calculus: Vector Fields; Line Integrals; Conservative Vector Fields; Green's Theorem; Surface Integrals; Divergence Theorem; Stokes' Theorem.

Books Recommended:

1. Calculus: Early Transcendentals - H. Anton, I. Bivens and S. Davis, Wiley.
2. Calculus and Analytic Geometry - G. B. Thomas and R. L. Finney, Addison Wesley.
3. Calculus: Early Transcendentals - J. Stewart, Thomson Brooks/Cole.
4. Calculus - R.T. Smith & R. B. Minton.

Semester-VI (Third Year Second Semester)

ROB 303: Intelligent Systems and Robotics - 3 Credit

Introduction to Intelligent Systems (current and future), Potential Applications of Intelligent Systems and Robotics, Knowledge Based Systems, expert systems, Agents and Agent Systems, Robotics and Control Systems, Artificial Neural Networks, hybrid intelligent systems, uses and limitations. Robot Behaviours, Behaviours Based Architecture, Clustering & Classification Techniques, Philosophy and Ethics of Intelligent Systems in Robotics.

Books Recommended:

1. An Introduction to AI Robotics – Robin R. Murphy, Bradford Book.
2. Artificial Intelligence: A Modern Approach – Russell S. & Norvig P., Pearson Education.
3. Robotics: Control, Sensing, Vision And Intelligence - Ralph Gonzalez, C.S.G. Lee and K. S. Fu, McGraw Hill India.
4. Intelligent Systems and Robotics - George Zobrist, C Y Ho, CRC Press.

ROB 304: Intelligent Systems and Robotics lab – 1.5 Credit

Practical classes based on the topics covered in **ROB 303**.

MTE 303: Instrumentation and Measurement - 3 Credit

Working Principles, Characterization and Behavior of Typical Measuring Systems. Basic on Measurement Techniques of Displacement, Temperature, Heat, Motion, Vibration, Force, Torque, Strain. Industrial Pressure and Level Measurements: Industrial Pressure Measurement, Definition of Pressure, Types of Pressure Measuring Element, Example and Application, Definition of Level, Types of Level Measuring Element, Examples and Applications. Measurement of Power and Energy: Induction and Electrodynamometer, Induction Type Watt Hour, Maximum Demand Indicator. Power Factor Meter. Error in Measurement and their Statistical Analysis: Types of Error, Statistical Treatment of Measurement Data, Probability of Errors and Gaussian Error Curve, Limiting Errors. Case Study on Temperature Measurement and Flow Measurement.

Books Recommended:

1. Principles of Measurement Systems – Bentley JP, Longman Scientific and Technical.
2. Intelligent Sensor Systems – Brignell JE and White NM, IOP Publishing.
3. Electrical Measurement – A. K. Swaney.

MTE 304: Instrumentation and Measurement Lab – 1.5 Credit

Practical classes based on the topics covered in **MTE 303**.

ME 301: Manufacturing Process with CNC Programming – 3 Credit

Basic Concepts of Manufacturing Processes, Metal Casting, Forming and Shaping, Joining Methods, Different Machining Processes: Grinding, Welding, Brazing, Soldering, Adhesive Bonding, Sheet Metal Forming Process, Glass Manufacturing Process, Punching, Blanking, Drawing. CNC Concepts: Hardware, Input-Output Systems and Interfacing in CNC Machine Tools. Principles of CNC Machine Tool Elements: Actuators, Feedback Devices, Interpolators, Machine Control Unit, and Micro-Electro-Mechanical Systems (MEMS). Control systems of CNC Machine Tools: Point-to-point System, Contouring System, Adaptive Control. Case Study of a CNC Machine Tool.

Books Recommended:

1. Manufacturing Processes and Materials for Engineers – Laurence E. Doyle, Prentice Hall
2. Manufacturing Processes – Stuad, B., Amsteard, H., McGraw Hill
3. Manufacturing Process – B.H. Amstead & Philip F. Ostwald, John Wiley and Sons

MTE 302: Manufacturing Process with CNC Programming Lab – 1.5 Credit

Practical classes based on the topics covered in **ME 301**.

MATH 302: Numerical Methods - 3 Credit

Solutions of Equations in One Variable: Bisection Method; Method of False Position; Fixed Point Iteration Method; Newton-Raphson Method; Error Analysis. Interpolation: Newton's Forward and Backward Difference Interpolating Polynomials; Newton's Divided Difference Interpolating Polynomials; Lagrange Interpolating Polynomials. Numerical Differentiation and Integration: Numerical Differentiation; Richardson's Extrapolation; Numerical Integration: General Quadrature Formula, Trapezoidal Rule, Simpson's Rule, Weddle's Rule. Solutions of Linear System: Gaussian Elimination; Pivoting Strategies; LU Decomposition Method; Jacobi and Gauss-Siedel Iterative Technique. Initial Value Problems for ODE: Euler's and Modified Euler's Method; Runge-Kutta Method.

Books Recommended:

1. Numerical Analysis - R. L. Burden & J. D. Faires.
2. Numerical Methods for Engineers - S. C. Chapra & R. P. Canale.
3. Introductory Methods of Numerical Analysis - S. S. Sastry.

HUM 301: Bangladesh Studies – 2 Credit

Introduction: Historical Background of Bangladesh, Ancient Bengal, the Medieval Bengal, Mughal Period, British Rule in Bangladesh, Pakistan Period, The Impact of British and Pakistan Rules on the Economy and Education of the People, Language Movement of 1952, Events Leading to the Mass Upsurge of 1969, War of Independence and the Emergence of Bangladesh in 1971. Geophysical Condition: Position of Bangladesh in Global Map, Current District and Thana Administrations and Locations, Rivers in Bangladesh and their Importance. Cultural Development: Development of Bengali Cinema, Drama, Literature Movement, Socio-cultural Development In Recent Bangladesh. Industrial Development: Introduction of Industries, Structure of Industries, Export Development, Industrial Export-Import Policies of Bangladesh. Educational Development: Education Structure in Primitive and Present Situation, Educational Policies, Crisis of Implementation, Literacy Rate, Current Situation of Educational Environment in Bangladesh, Computer Literacy. Economic Activities: Major Economic Sectors, Trends of Economic Growth, Recent Development in Various Sectors, Rule Agricultural Sector, RMG Sector, Leather Sector, Frozen Foods and other Potential Sectors in Bangladesh, Transport and Port Facilities.

Books Recommended:

1. History of Bangladesh (1704-1971): Vol 1,2,3, Asiatic Society of Bangladesh
2. History of Bengal: Vol 1,2, Dhaka University
3. History of Bengali speaking people - Nitish Sen Gupta
4. Banglapedia: Asiatic Society of Bangladesh

Semester-VII (Fourth Year First Semester)

ROB 401: Robotics System Design – 3 Credit

Review of Major Design Components such as Actuators, Sensors, and Controllers, System Interface, Engineering Tools to Design Robots, Concept for a Model, Model Analysis, Kinematic and Structural Robot Design, Programming of Microcontrollers to Control a Robotic System, a Case Study to Design a Robotic System.

Books recommended:

1. Robotics: Designing the Mechanisms for Automated Machinery - Ben-Zion Sandier.
2. Modern Robotics: Building Versatile Machines, Herry Henderson.

ROB 402: Robotics System Design Lab – 1.5 Credit

Practical classes based on the topics covered in **ROB 401**

RME 401: Digital Signal Processing – 3 Credit

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: Discrete Fourier Series, Discrete-time Fourier series, Discrete Fourier Transform (DFT) and Properties, Fast Fourier transform (FFT), Inverse Fast Fourier Transform, Z Transformation - Properties, Transfer Function, Poles and Zeros and Inverse Z Transform. Correlation: Circular Convolution, Autocorrelation and Cross-correlation. Digital Filters: FIR Filters - Linear Phase Filters, Specifications, Design using Window, Optimal and Frequency Sampling Methods.

Books Recommended:

1. Digital Signal Processing- John G. Proakis, Dimitris G. Manolakis
2. Digital Signal Processing – Probess
3. Digital Signal Processing – Oppnim
4. Digital Signal Processing - Scrinet

RME 402: Digital Signal Processing Lab– 3 Credit

Practical classes based on the topics covered in **RME 401**.

MTE 401: Electromechanical Engineering – 3 Credit

Detail Design of all Power Transmission Elements e.g. Levers, Gears, Chains, Belts, Cams, Sprockets, Intermittent Motions, Brakes and Clutches etc including Selection and Relevant Calculations. Basic Power Transmission Systems, Efficiency, Power Conversion between Modes; Component Familiarization. Detail Design of Bearings and Seals Layout, Giving Types Sizes and including Relevant Calculations. Converters: Fluid, Electrical, Mechanical; Overall Layout Including Differential Cage Together with Input, Output and Intermediate Shaft Sizes and Calculations. Case Studies based on Applications.

Books Recommended:

1. The Characteristics of Mechanical Engineering Systems – R Holmes, Pergamon
2. Total Design – S Pugh , Addison Wesley
3. Handbook for Engineering Design – PER Mucci , BSI.

CSE 401: Digital Image Processing – 3 Credit

Introduction to Image Processing, Differences between Image Processing, Image Analysis, and Computer Vision, Image Representation, Color Space, Image Sampling and Quantization, Image Quality Measurement, Image Quality Enhancement: Intensity Transformations, Contrast Stretching, Histogram Equalization, Spatial Domain Filtering - Mean and Median Filters, Sharpening Filters - Laplacian and Sobel, Discrete Fourier Transform, Image Transform - Discrete Cosine Transform, Wavelet Transform, Introduction to Image Restoration - Noise Models, Spatial and Frequency Filters, Morphological Image Processing, Image Feature Extraction and Representation: Edge and Line, Region Segmentation and Representation, Image and Video Compression.

Books Recommended:

1. Digital Image Processing - Rafael C. Gonzalez, Richard E. Woods, Pearson.
2. Computer Vision: Algorithms and Applications - Richard Szeliski, Springer.

CSE 402: Digital Image Processing Lab– 3 Credit

Practical classes based on the topics covered in **CSE 401**.

RME 403: Research Methodology, Technical and Scientific Writing – 1.5 Credit

Definition of Research, Types of Research, Fundamental research, applied research, Engineering research, Methodologies to solve engineering problems, Research proposals, Research planning, Legal research, Copyright, Research ethics. Making effective Charts, Graphs, Tables, How to write scientific papers/report/thesis, Articles, Presentation Skills, Communication Skills, Editing and Proofreading strategies.

Books Recommended:

1. An introduction to research method - M. Nurul Islam.
2. Research Methods In Social Science - Dr. Neaz Ahmed.
3. Research planning & proposal writing skill - Dr. Subrota Kumar Saha.

RME 409: Project/Dissertation – 2 Credit

Semester-VIII (Fourth Year Second Semester)

ROB 403: Human Robot Interaction – 3 Credit

Introduction, HRI Today, HCI and Human Factors, Human-Robot Relations, Sensors and Perception for HRI, Expression and Gaze, Multi-modal Human-Robot Communication, Human-Robot Interaction Architectures, HRI Design Principles, Metrices for HRI, Social Robotics, Motivation and Emotions in Robotics, Museum Robotics, Educational Robotics, Assistive Robotics, Case Studies.

Books Recommended:

1. Human-Robot Interactions: Principles, Technologies and Challenges - Diana Coleman, Nova Science Pub Inc.
2. Human-Robot Interaction in Social Robotics - Takayuki Kanda, Hiroshi Ishiguro, CRC Press.

RME 410: Project/Dissertation – 4 Credit

Optional Courses

RME 411: Engineering Mechanics - 3 Credit

Basic Concepts of Mechanics, Rigid Body Static: Equivalent Force System. Equations of Equilibrium, Free Body Diagram, Reaction, Static Indeterminacy and Partial Constraints, Two and Three Force Systems. Structures: 2D Truss, Method of Joints, Method of Section. Frame, Beam, Types of Loading and Supports, Shear Force and Bending Moment diagram. Friction: Dry Friction (Static and Kinematics), Wedge Friction, Disk Friction (Thrust Bearing), Belt Friction, Square Threaded Screw, Journal Bearings (Axle Friction), Wheel Friction, Rolling Resistance. Center of Gravity and Moment of Inertia: First and Second Moment of Area and Mass, Radius of Gyration, Parallel Axis Theorem, Product of Inertia, Rotation of Axes and Principal M. I., Thin Plates, M.I. by Direct Method (Integration), Composite Bodies. Kinematics of Particles: Rectilinear Motion, Curvilinear Motion Rectangular, Normal Tangential, Polar, Cylindrical, Spherical (Coordinates), Relative and Constrained Motion, Space Curvilinear Motion. Kinetics of Particles: Force, Mass and Acceleration, Work and Energy, Impulse and Momentum, Impact. Kinetics of Rigid Bodies: Translation, Fixed Axis Rotation, General Planner Motion, Work-energy, Power, Potential Energy, Impulse-momentum and Associated Conservation Principles, Euler Equations of Motion and its Application.

Books Recommended:

1. Engineering Mechanics: Statics and dynamics - I. H. Shames, PHI.

2. Vector Mechanics for Engineers, Vol I - Statics, Vol II – Dynamics F. P. Beer and E. R. Johnston , Tata McGraw Hill, 2011.
3. Engineering Mechanics, Vol I – Statics, Vol II – Dynamics - J. L. Meriam and L. G. Kraige, John Wiley.
4. Engineering Mechanics: Principles of Statics and Dynamics - R. C. Hibbler, Pearson Press.
5. Introduction to Statics and Dynamics - Andy Ruina and Rudra Pratap, Oxford University Press.

RME 412: Engineering Mechanics Lab – 1.5 Credit

Practical classes based on the topics covered in R**ME 411**

RME 413: Mechanics of Solids - 3 Credit

Fundamentals of Kinematics of Solid Bodies; Equivalent Force Systems; Free-body Diagrams; Equilibrium Equations; Analysis of Determinate Trusses and Frames; Friction; Simple Relative Motion of Particles; Force as Function of Position, Time and Speed; Force Acting on a Body in Motion; Laws of Motion; Law of Conservation of Energy; Law of Conservation of Momentum. Stresses and Strains; Principal Stresses and Strains; Mohr's Circle; Generalized Hooke's Law; Thermal Strain; Theories of Failure. Axial, Shear and Bending Moment Diagrams; Axial, Shear and Bending Stresses; Deflection (for Symmetric Bending); Torsion in Circular Shafts; Thin Cylinders; Energy Methods (Castigliano's Theorems); Euler Buckling. Free Vibration of Single Degree of Freedom Systems.

Books recommended:

1. Advanced Mechanics of Materials - Cook, R. D. and Young, W. C., Prentice Hall.
2. Advanced Strength and Applied Elasticity - Ugural, A. C. and Fenster, S. K., Prentice Hall.

RME 414: Mechanics of Solids Lab – 1.5 Credit

Practical classes based on the topics covered in R**ME 413**

RME 415 : VLSI Design - 3 Credit

VLSI Technology: Top Down Design Approach, Technology Trends and Design Styles. Review of MOS Transistor Theory: Threshold Voltage, Body Effect, I-V Equations and Characteristics, Latch-up Problems. NMOS Inverter, CMOS Inverter, Pass-transistor and Transmission Gates. CMOS Circuit Characteristics and Performance Estimation: Resistance, Capacitance, Rise And Fall Times, Delay, Gate Transistor Sizing And Power Consumption. CMOS Circuit And Logic Design: Layout Design Rules and Physical Design of Simple Logic Gates. CMOS Subsystem Design: Adders, Multiplier and Memory System, and Arithmetic Logic Unit. Programmable Logic Arrays. I/0 Systems. VLSI Testing. VLSI MOS System Design: Layout Extraction and Verification, Full and Semi-full Custom Design Styles and Logical and Physical Positioning. Design Entry Tools:

Schematic Capture and HDL. Logic and Switch Level Simulation. Static Timing. Concepts and Tools of Analysis, Solution Techniques for Floor Planning, Placement, Global Routing and Detailed Routing. Application Specific Integrated Circuit Design including FPGA.

Books Recommended:

1. Basic VLSI Design- Douglas A Pucknell
2. Principles of CMOS VLSI Design- Neil H.E. Waste

RME 416: VLSI Design Lab – 1.5 Credit

Practical class based on the topics covered in **RME 415**

RME 417: Solid State Device and Semiconductor - 3 Credit

Semiconductors In Equilibrium: Energy Bands, Intrinsic and Extrinsic Semiconductors, Fermi Levels, Electron and Hole Concentrations, Temperature Dependence of Carrier Concentrations and Invariance of Fermi Level. Carrier Transport Processes and Excess Carriers: Drift and Diffusion, Generation and Recombination of Excess Carriers, Built-infield, Einstein Relations, Continuity and Diffusion Equations for Holes and Electrons and Quasi-Fenni Level. PN Junction: Basic Structure, Equilibrium Conditions, Contact Potential, Equilibrium Fermi Level, Space Charge, Non-equilibrium Condition, Forward and Reverse Bias, Carrier Injection, Minority and Majority Carrier Currents, Transient and ac Conditions, Time Variation of Stored Charge, Reverse Recovery Transient and Capacitance. IC, IC Design and Manufacturing Techniques. Bipolar Junction Transistor: Basic Principle of pnp and npn Transistors, Emitter Efficiency, Base Transport Factor, and Current Gain, Diffusion Equation in the Base, Terminal Currents, Coupled-diode Model and Charge Control Analysis, Ebers-Moll Equations and circuit Synthesis.

Books Recommended:

1. Solid State Devices – Streetman
2. Solid State Electronics – Rutkowski, Oleksy
3. Principles of CMOS VLSI Design- Neil H.E. Waste

RME 418: Solid State Device and Semiconductor Lab – 1.5 Credit

Practical class based on the topics covered in R**ME 417**

RME 419: Introduction to Biomedical Engineering - 3 Credit

Electromagnetic and Biology: Fundamentals of Electric and Magnetic Fields; Electric and Magnetic Fields in Biological Systems; Electric and Magnetic Field Effects in Organisms; Electric Fields and Cells; Electrical Properties of the Membrane; Cell Motion in Time-varying Fields. Nuclear

Medicines. Biosensors, Bio-electrodes, Ultrasonography, Blood Pressure Measurement. X-rays, Crystallography. Applications of Electric Fields for Bio-analysis Methods Applied to Genomic and Protomic Research: Electrophoresis and Isoelectric Focusing; Mass Spectrometry of Bio-molecules; Electrocardiograph (ECG): Waveform, ECG Preamplifiers, Systolic, Diastolic and Mean Detector Circuits. Electro Encephalography (EEG): Electrode, Frequency Bands, EEG Patterns and EEG Preamplifiers. Blood Flow Measurement. ICU / CCU Central Monitoring System. Radiation, Radioactivity and their Effects on Human Body.

Books Recommended:

1. Electrostatics Principles, Problems and Applications - Cross, JA.
2. Electromagnetics with Applications - Kraus and Fleisch, McGraw Hill.
3. Electricity and Magnetism in Biological Systems - Edmonds, D.T., OUP.

RME 420: Introduction to Biomedical Engineering Lab – 1.5 Credit

Practical class based on the topics covered in R**ME 419**

RME 421: Material Science and Engineering - 3 Credit

Engineering Materials: Materials Classification, Engineering Requirements of Materials, Advanced Materials and Modern Materials. Properties of Engineering Materials: Mechanical Properties, Factors Affecting Mechanical Properties, Physical, Thermal, Electrical, Optical, Magnetic and Chemical Properties of Materials. Factors Affecting the Selection of Materials for Engineering Purposes, Materials Selection and Design Considerations. Fundamentals of Structures of Crystalline Solid, Imperfections in Solids (Vacancies and Self-interestials), Impurities in Solids, Imperfections in Ceramics, Interfacial Defects, Polymer Defects. Mechanical Properties of Metals: Types of Metals and Alloys (Ferrous, Non-ferrous and Thermal Processing of Metals), Deformation (Concept of Stress-strain, Plastic, Elastic Deformations and Hardness), and Failure of Metals (Fracture, Fatigue and Creep: Types and Principles). Polymers and Composites: Characteristics of Polymers, Different Types of Polymeric Materials (Plastics, Elastomers and Fibers). Mechanical Behaviors of Polymers, Miscellaneous Application of Polymers. Classification of Composite Materials, Fiber Reinforced Composites, Hybrid Composites, Structural Composites, Reinforced Concrete, Polymer-matrix Composites, Metal Matrix Composites, Carbon-carbon Composites, Concrete Polymer Composites. Nature and Types of Ceramic Products, Comparison of Ceramic and Nonceramic Phases, Silicate Structures, Polymorphism and Allotropy, Application of Ceramics, Mechanical and Glass Properties of Ceramics.

Books Recommended:

1. A Text Book of Material Sciences and Metallurgy - O. P. Khanna
2. Materials Science and Engineering: An Introduction - William D. Calliste

RME 422: Material Science and Engineering Lab - 1.5 Credit

Practical class based on the topics covered in R**ME 421**

RME 423: Machine Design & System Dynamics - 3 Credits

Introduction to Design, Stress Analysis, Pressure Vessel, Stress in Curved Members, Deflection and Stiffness Consideration, Failure Machines in Design, Design for Fatigue Strength, Mechanical Spring, Rolling Contact Bearing, Rope, Belt, Chain Drives. Dynamics and Vibration of Discrete Systems with more than One Degree of Freedom (dof). Methods for Writing the Equations of Motion of Multi Degree of Freedom. Non-linear Systems and Linearization of the Equation of Motion Around a Steady-state Solution, Free and Forced Motion of A Linear Multi Degree of Freedom System, Effect of Harmonic, Periodic, and Non-periodic Forces. Techniques for Identification of Modal Parameters from Measurements of System's Dynamics Behavior, Modal Superposition Theorem, Continuous and Discrete Systems, Finite Element Method (FEM) in the Study of Continuum Dynamics.

Books Recommended:

1. Shigley's Mechanical Engineering Design - Budynas &Nisbett, McGraw Hill.
2. System Dynamics - Ogata, K., Prentice Hall.
3. System Dynamics - Vu, Hung V, Ramin S. Enfandiari, McGraw-Hill.

RME 424: Machine Design & System Dynamics Lab - 1.5 Credit

Practical class based on the topics covered in R**ME 423**

RME 425: Introduction to Nanoscience and Nanotechnology - 3 Credit

Importance of Nanotechnology, History of Nanotechnology, Properties of Nanomaterials, Difference between Bulk and Nanomaterial. Influence of Nano Structure on Mechanical, Optical, Electronic, Magnetic and Chemical Properties. Overview of Different Nanomaterials Available. Nanomaterials Synthesis, "Top-Down" and "Bottom-Up" Approaches of Nanomaterial (Nanoparticles, Nanoclusters and Quantum Dots) Synthesis. Self-assembly, Self-assembled Monolayers, Directed Assembly, Layer-by-layer Assembly. Pattern Replication Techniques: Soft Lithography, Nanoimprint Lithography. Quantum Dots, Gold, Silver, Different Types of Nano-oxides, Al2O3, TiO2, ZnO etc. Carbon Nanotubes, Preparation Properties and Applications Like Field Emission Displays. Characterization Techniques Related to Nanoscience and Nanotechnology. Application of Nanomaterials, Molecular Motors, Energy Storage, Electronic-nano Particles for Molecular Diagnostics, Nano Biosensors, Nanopharmaceuticals, Nanoparticle-Based Drug Delivery, Nanostructures for Tissue Engineering/Regenerative Medicine etc. Handling, Safety and Hazard of Nanomaterials Processing.

Books Recommended:

1. Nanocomposite science and technology - Pulikel M. Ajayan, Wiley.

2. Nanolithography and patterning techniques in microelectronics - David G. Bucknall, Wood head publishing.
3. Transport in Nanostructures - D.K. Ferry and S.M. Goodmick, Cambridge university press.
4. Micro and Nanofabrication - Zheng Cui, Springer.
5. Nanotechnology and nanoelectronics - W.R, Fahrner, Springer.
6. Hand book of Nano science, Engineering, and Technology - William A. Goddard, CRC press.
7. Nanomaterials: Risks and Benefits - Igor Linkov and Jeffery Steevens.

RME 426: Introduction to Nanoscience and Nanotechnology Lab - 1.5 Credit

Practical class based on the topics covered in **RME 425**

RME 427: Robot Learning – 3 Credit

Introduction, Supervised Learning, Linear Regression Learning, Gradient Decent Learning, Markov Process, Discrete HMM, HMM: Inference and Learning, Kalman Filter, Reinforcement Learning: MDP, Bellmont Equation, Value/Policy Iteration, Continuous State/ Finite Horizon, Maximum Likelihood, Kernel, Large Margin Classifier: SVM, SVM with Margin, Clustering, PCA and Particle Filters, Learning by Observation, Learning by Demonstration, Model Learning, Deep Learning, Meta-learning.

Books Recommended:

1. Robot Learning - Connell, J. H., Mahadevan, Sridhar (Eds.).
2. Embedded Robotics : Mobile Robot Design and Applications with Embedded Systems, MIT Press

RME 428: Robot Learning Lab – 1.5 Credit

Practical class based on the topics covered in R**ME 427**

RME 429: Autonomous Mobile Robotics – 3 Credit

Introduction to the Fundamentals of Mobile Robotics, Basic Principles of Locomotion, Kinematics, Sensing, Perception, and Cognition that are Key to the Development of Autonomous Mobile Robots. Perception and Planning for Autonomous Operation. Sensor Modeling, Vehicle State Estimation using Bayes Filters, Kalman Filters, and Particle Filters as well as Onboard Localization and Mapping. Vehicle Motion Modeling and Control, as well as Graph Based and Probabilistic Motion Planning, Case Study.

Books Recommended:

1. Autonomous Mobile Robots - Siegwart and Nourbakhsh, MIT Press.

RME 430: Autonomous Mobile Robotics Lab – 1.5 Credit

Practical class based on the topics covered in R**ME 429**

RME 431: Micro/Nano Robotics – 3 Credit

Basic Theory of Stiffness, Workspace, Kinematics and Dynamics Related to Micro/Nano Robot, Scaling Laws at Micro/Nano Scales, Electrostatics, Electromagnetism, Observation Tools, Materials and Fabrication Methods, Biologically Inspired Robots, Performance Analysis, Control Algorithm, Prototype Design, Precision Control and Calibration Works.

Books recommended:

1. Advanced Spatial Mechanism - Zhen Huang, Higher Education Press.
2. Robotics - Youlun Xiong.
3. The Types and Performances of Parallel Micro-Manipulators - Yi Yue, Shanghai Jiaotong University.

RME 432: Micro/Nano Robotics Lab – 1.5 Credit

Practical class based on the topics covered in **RME 431**

RME 433: Industrial Robotics – 3 Credit

Basic Principles of the Design and Control of an Industrial Robot Manipulator, Introduction (History of Robotics and General Concepts); Components and Structure of a Robotic System and of a Robot Manipulator; Classifications of Robot Manipulators; Sensors and Actuators Applied to Robotics; Manufacturing Cells using Robots (Applications, Features and Specifications); Kinematic Modeling of Robot Manipulators: Introduction to Robot Manipulators Dynamics; Trajectories Generation; Programming Robots Theory; Introduction to Position Control of Robot Manipulators, Case Study.

Books Recommended:

1. Robotics, Vision and Control, Fundamental Algorithms in Matlab - Peter Corke.
2. Introduction to Robotics - Bajd, Tadej.
3. Robot Analysis and Control - Asada, H. and Slotine, J, Ed. John Wiley Professional, New York, USA.
4. Introduction to Robotics - Craig, J.J., Ed. Pearson Prentice Hall, New York, USA.
5. The Rise of the Machines - Guizzo, E.

RME 434: Industrial Robotics Lab – 1.5 Credit

Practical class based on the topics covered in **RME 433**

RME 435: Mechanics of Robot – 3 Credit

Background Material and Notation, Mathematics of Position and orientation, Forward Kinematics, Inverse Kinematics, Dynamics, Trajectory Planning, Mechanical Design Issues, Intro to Motion Control, Overview of Task Planning, Robot Programming (Laboratory Based), Animation (In-class Demos and Assignments)

Books Recommended:

1. Introduction to Robotics: Mechanics and Control - John J. Craig

RME 436: Mechanics of Robot Lab – 1.5 Credit

Practical class based on the topics covered in **RME 435**

RME 437: Introduction to Automobile Engineering - 3 Credit

Basic Concepts of Internal Combustion Engines (ICEs); their Operation and Testing, Exhaust Gas Analysis, Noise Characteristics. Introduction to Road Vehicles, Performance, Construction, Sales, Industry Structure, and Legislation. Introduction to Tractive Effort Curves. Fundamentals of Road Vehicle Performance: Basic Vehicle Equation. Engine Power, Rolling Resistance, Aerodynamic Drag, Gradients, Acceleration. Free Tractive Effort Diagrams. Vehicle Monograms. Prime Mover Performance, Torque, and Transmission Ratio. Power to Weight Ratio in Alternative Power Systems. Specific Power vs. Specific Work Diagrams. Equation of Motion and Maximum Tractive Effort for Front Wheel, Rear Wheel and Four Wheel Drive. Prediction of Vehicle Performance Acceleration, Time and Distance. Handling Characteristics of Road Vehicles: Braking Performance of Twin Axle Vehicles. Effect of Weight Distribution. Stability in Front and Rear Wheel Skids. Braking Efficiency and Stopping Distance. Leading and Trailing Brake Shoe Characteristics. Disc Brakes. Anti-lock Brake Systems (ABS). Tyre Characteristics: Theory of Frictional Coupling between Tyre and Road. Mechanisms of Rubber Friction. Longitudinal Slip, its Nature and Relation with Tractive and Braking Effort. Cornering Properties of Tyres, Slip and Cornering Force. Tyre to Wet Road Friction. Tyre Construction. Characteristics of Road Surface and Relation to Tractive (Skid) Effort. Tyre Noise. Handling Characteristics of Road Vehicles – Cornering: Steering Geometry. Ackerman Criterion. Steady State Handling Characteristics; and Slip Angle. Oversteer, Understeer, Neutral Steer. Lateral Acceleration Response, Yaw Velocity Response, Curvature Response. Transient Response Characteristics. Testing of Handling: Characteristics of Constant Radius, Constant Speed and Constant Steer Angle Test. CVT Transmissions: Design, Principles and Operation of Modern Small Car CVT Transmission Systems. Electrical Systems: Electrical Control System and Indicators.

Books Recommended:

1. Test Automotive Handbook 1996, Bosch GmbHd distributed by SAE.
2. Theory of Ground Vehicles, Wong JY, 2nd Edition, John Wiley Sons 1993.
3. Fundamentals of Vehicle Dynamics, Gillespie TD, SAE 1992.
4. Advanced Vehicle Technology, Heisler, H, Edwin Arnold 1989.

RME 438: Introduction to Automobile EngineLab – 1.5 Credit

Practical class based on the topics covered in R**ME 437**

RME 439: Power Plant Engineering - 3 Credit

Sources of Energy, Energy Planning, Production of Power, Types of Power Plants (Thermal, Hydro, Nuclear), General Layout, Design, Construction, Operation and Maintenance of Power Plants, Safety and Security of Power Plants, Power Transmission and Distribution, Grid System, Environmental Impact in case of Accidents. Coordination of Different Types of Power Plants, Survey of Power Plants in Bangladesh. Power Plants Economics: the Variable Load Problem, Base Load Plants and Peak Load Plants, Economic Analysis of Power Plants, Theory of Rates. Selection of Location: Technical, Economical and Environmental Factors. Probabilistic Approaches of Load Forecasting. Generation Scheduling: Deterministic and Probabilistic. Electricity Tariff: Formulation and Types.

Books Recommended:

1. Elements of Power System Analysis - D. Stevenson
2. Power System – Singh
3. Power System - Vopat
4. Power Plant Engineering – Frederick T. Morse

RME 440: Power Plant Engineering Lab – 1.5 Credit

Practical class based on the topics covered in R**ME 439**