Vivekananda Global University

B.Tech in Robotics Engineering **Semester III**

MAT 104 ADVANCED ENGINEERING MATHEMATICS

3L-1T-0P-3.5C **MM 100**

Module I

Fourier Series and Method of Separation of Variables (Boundary Value Problems):Expansion of simple functions in Fourier series, half range series, change of interval, harmonic analysis, application to the solution of wave equation and diffusion equation in one dimension and Laplace's equation in two dimensions by method of separation of variable.

Module II

Laplace transform, Inverse transform, properties, Transforms of derivatives and integrals,Unit step function, Dirac's delta function, Differentiation and integration of transforms,Applications to differential equations.

Module III

Errors and significant digits, Roots of algebraic equations Bisection method, secant method,NewtonRaphson method, Graff's root- squaring method, Iterated synthetic division withquadratic factors method for finding complex roots.

Module IV

Forward, Backward, Central and Divided differences, Newton's formula of interpolation forequal and unequal intervals. Lagrange's interpolation formula, Stirling's and Bessell'sformula, Solutions of systems of equations (Gauss elimination, Gauss Jordan and Partitionmethod for linear system of equations, power method for partition, method for linear systemof equations, power method for finding Eigen values).

Module V

Numerical solution of simultaneous algebraic equation by Gauss elimination and GaussSeidel method. Numerical differentiation, Numerical integration- Trapezoidal rule,Simpson's one third and Simpson's three eight rule. Numerical solution of ordinarydifferential equation of first order-Picard's method, Euler's method, and Modified Euler'smethod, Milne's methods and RungaKutta fourth order method.

Text/Reference Books:

1 Numerical Method, DrB.S.Gravel, Khanna Publication, DARYA GANJ, Delhi - 110003, India
2 Numerical Methods, S.uha, R.Shrinivasan, Oxford Publication.
3 Numerical Methods, M.K.Jain ,R.K.Jain, New Age Publication, new delhi.
4 Higher Engg Mathematics, B.V.Ramana, TATA MCGRAW HILL PUBLISHING COMPANY; Place: New Delhi.
5 Higher Engineering Mathematics, B.S. Grewal, Khanna Publication, DARYA GANJ, Delhi – 110003.

Vivekananda Global University

B.Tech in Robotics Engineering **Semester III**

BME 301 ENGINEERING THERMODYNAMICS

3L-1T-0P-3.5C **MM 100**

Module I: Introduction:- Dimensions and units, Microscopic and Macroscopic approaches, Systems, surroundings and universe, Concept of continuum, Control system boundary, control volume and control surface, Properties and state, Thermodynamic properties, Thermodynamic path, process and cycle, Thermodynamic equilibrium, Reversibility and irreversibility, Quasi static process, Energy and its forms, Work and heat, Gas laws, Ideal gas, Real gas, Zeroth law of thermodynamics, Temperature and its measurement, Temperature scales.

Module II: First law of thermodynamics:- thermodynamic definition of work, Thermodynamic processes, Calculation of work in various processes and sign convention, Non-flow work and flow work, Joules' experiment, First law of thermodynamics, Internal energy and enthalpy, First law of thermodynamics applied to open systems

Steady flow systems and their analysis: - Steady flow energy equation, Boilers, Condensers, Turbine, Throttling process, Pumps etc. First law analysis for closed system (non flow processes), Analysis of unsteady processes such as filling and evacuation of vessels with and without heat transfer, Limitations of first law of thermodynamics

Module III: Second law of thermodynamics:- Devices converting heat to work, Thermal reservoir, Heat engines, Efficiency, Devices converting work to heat, Heat pump, refrigerator, Coefficient of Performance, Reversed heat engine, Kelvin Planck statement of second law of thermodynamics, Clausius statement of second law of thermodynamics, Equivalence of two statements of second law of thermodynamics, Reversible and irreversible processes, Carnot cycle and Carnot engine, Carnot theorem and it's corollaries, thermodynamic temperature scale, PMM II.

Module IV: Entropy :- Clausius inequality, Concept of Entropy, Entropy change in different thermodynamic processes, T-ds equations, Principle of entropy increase, T-S diagram, Statement of the third law of thermodynamics.

Availability & Irreversibility: Available and unavailable energy, Availability and Irreversibility, Second law efficiency, Helmholtz & Gibb's function.

Module V: Properties of steam :- Pure substance, Property of steam, Triple point, Critical point, Sub-cooled liquid, Saturation states, Superheated states, Phase transformation process of water, Graphical representation of pressure, volume and temperature, P-T & P-V diagrams, T-S and H-S diagrams, use of property diagram, Steam-Tables &Mollier charts, Dryness factor and it's measurement, processes involving steam in closed and open systems, Working of simple Rankine cycle.

Text/Reference Books:-

1. Fundamentals of Thermodynamics, Sonntag, Wiley India Pvt. Ltd.
2. Thermodynamics, J.P. Holman, McGraw Hill.
3. Engineering Thermodynamics,P.K.Nag, Tata McGraw Hill Pub.
4. Fundamental of Engineering Thermodynamics, E. Rathakrishnan, publisher. PHI
5. Thermodynamics – An Engineering Approach, Y.A. Cengel and M.A. Boles, McGraw Hill.

Vivekananda Global University

B.Tech in Robotics Engineering **Semester III**

BME 302 STRENGTH OF MATERIALS

3L-1T-0P-3.5C **MM 100**

Module I

STRESS & STRAIN: Concepts and analysis of stresses and strains; Stress-strain relationships; mechanical properties; ductile and brittle materials; Hooke's law; relations of Elastic constants for a isotropic and hookean material, thermal stresses,hoop stress & strains in pressure vessels, composite bars; simple elastic, stress due to self weight ,bar of uniform strength, Concept of factor of safety & permissible stress,Tensors.

Module II

SHEAR FORCE & BENDING MOMENT: Theory of simple bending, bending moment and shear force diagrams for different types of static loading and support conditions on beams. Bending stresses, Section modulus. Transverse shear stress distribution in circular, hollow circular, I, Box, T, angle sections etc.

Module III

PRINCIPLE STRESSES: Principle planes, stresses & strains: Members subjected to combined axial, bending & Torsional loads, maximum normal & shear stresses; Concept of equivalent bending & equivalent twisting moments. Mohr's circle of stress & strain.

THEORIES OF ELASTIC FAILURES: The necessity for a theory, different theories, significance and comparison, applications.

Module IV

TORSION: Torsional shear stress in solid, hollow and stepped circular shafts, angular deflection and power transmission capacity.

COLUMNS: Instability & elastic stability. Long & short columns, ideal strut, Euler's formula for crippling load for columns of different ends, concept of equivalent length, eccentric loading, Rankine formulae and other empirical relations.

Module V

TRANSVERSE DEFLECTION OF BEAMS: Transverse deflection of beams and shaft under static loading, area moment method, direct integration method, method of superposition and conjugate beam method.

ELASTIC STRAIN ENERGY : Strain energy due to axial, bending and Torsional loads; stresses due to suddenly applied loads; use of energy theorems to determine deflections of beams and twist of shafts. Castigliano's theorem.Maxwell's theorem of reciprocal deflections.

Text/Reference Books:

1 Mechanics of Materials, James M. Gere, Cengage Learning (Brooks\Cole).
2. Mechanics of Material, Pytel and Kiusalaas, Thomson (Brooks\Cole).
3. An Introduction to the Mechanics of Solids, Crandall, Dahl and Lardner, Tata McGraw Hill.
4. Mechanics of Materials, Beer, Johnston, Dewolf and Mazurek, Tata McGraw Hill.
5. Strength of Materials, Ryder G.H., Macmillan India.
6. Strength of Materials, Sadhu Singh, Khanna Publishers.
7. Mechanics of Material, Punmia, Jain and Jain, Laxmi Publications.

Vivekananda Global University

B.Tech in Robotics Engineering **Semester III**

BCE 303 FLUID MECHANICS

3L-1T-0P-3.5C **MM 100**

Module I

BASIC DEFINITIONS & FLUID PROPERTIES: Definition of Fluid, Incompressible and compressible fluids, Fluid as a continuum, mass, density, specific weight, relative density, specific volume, bulk modulus, velocity of sound Ideal fluid viscosity, Newtonian and Non Newtonian fluid, kinematic viscosity, effect of temperature and pressure on viscosity, surface tension capillarity, vapour pressure and cavitation.

Module II

FLUID STATICS: General differential equation, hydrostatics manometry, fluid forces on submerged surfaces, curved surfaces, aerostatics, Isothermal atmosphere, polytropic atmosphere, static stability, the international atmosphere, submerged bodies, floating bodies.

Module III

KINEMATICS & CONSERVATION OF MASS: Flow classifications, Fluid velocity and acceleration, streamlines and the stream function, pathlines and streak lines, deformation of a fluid element, vorticity and circulation. Irrotational and rotational flow, flow net, laplace equation, conservation ofmass and the continuity equation for three dimensions.

FLUID MOMENTUM: The Momentum theorem, applications of the momentum theorem, equation of motion, Euler's equation of motion, Integration of Euler's equation of motion, Bernoulli's equation, applications of Bernoulli's pilot tube, equation of motion for viscous fluid, NavierStoke's equation.

Module IV

ORIFICE DISCHARGING: Free Jet, vena contracts, co-efficient of contraction, velocity and discharge, coefficient of resistance, orifices and mouthpieces, nozzles and weires.

FLOW THROUGH PIPES: Reynold's experiment, Darcy's Weisback equation, loss of head due to sudden enlargements, contraction, entrance, exit obstruction, bend, pipe fittings, total and hydraulic gradient lines, Flow through pipe line, pipes in series, parallel, transmission of power through pipes.

Module V

LAMINAR FLOW: Simple solution of Navier Stokes equations, Hagen – Poiseuille flow, Plans Poiseuille flow and coutte flow.

TURBULANT FLOW: Variation of friction factor with Reynold's number, Prandtl mixing length hypothesis applied to pipe flow, velocity distribution in smooth pipes, sough pipes, Universal pipe friction laws, Colebrook White formula.Introduction to boundary layer theory.

Text/Reference Books:

1. Fluid Mechanics, Frank M. White, McGraw-Hill Publications.
2. Fluid Mechanics, Cengel and Cimbala, Tata McGraw-Hill, New Delhi.
3. Hydraulics and Fluid Mechanics, Modi and Seth, Standard Book House.
4. Fluid Mechanics, Jain A.K., Khanna Publishers.
5. Introduction to Fluid Mechanics, Fox and McDonald, John Wiley and Sons.

Vivekananda Global University

B.Tech in Robotics Engineering **Semester III**

BEC 301 ELECTRONICS DEVICES AND CIRCUITS

3 L-0T-0P-3C **M.M. 100**

Module1: Junction Diode: Diode clipping and clamping circuits, voltage multipliers, Schottky barrier diode
Filters: constant K-section, Ladder type, π-section, T-section filter, m-derived filter sections, Lattics filter section. Explanation of L-type, Π-type and analysis of RC-filters

MODULE II:Transistors: h-parameters, hybrid-pi model of BJT, Ebers-Moll model, transients in diodes and transistors, low and high frequency models of JFET, MOS Devices: NMOS, PMOS and CMOS

Module3:Feedback Amplifiers: Feedback concepts, positive feedback and negative feedback, Block diagram of four types of feedback, analysis of voltage-series feedback.
Small Signal Amplifiers at Low Frequency: Coupling schemes for multistage amplifiers, frequency response, differential amplifiers, cascaded transistor amplifiers, Darlington and cascade circuits.

Module4:Oscillators: Classification criterion for oscillation, tuned collector, Hartley, Colpitts, RC phase shift, Wien Bridge and Crystal Oscillators, Astable, Monostable and Bistable multivibrators, Schmitt trigger, Blocking Oscillators.

Module5:Power Amplifiers: Power amplifier circuits, class-A, class-B and class-AB output stages, class-C amplifiers, push pull amplifiers with and without transformers, complementary symmetry and quasi-complementary symmetry amplifiers.

Text/Reference Books:

1.“Integrated Electronics Analog and Digital Circuits & Systems” Millman J. &Halkias C.C., McGraw Hill.
2.“Electronic Devices and Integrated Circuits” B. P. Singh and Rekha Singh, , Pearson Education
3.“Application of Analog Integrated Circuits” Soclof, SPrentice Hall of India.
4. Electronics Devices & Circuit Theory” Boylestad&Nashelskey, Prentice Hall of India.
5. “Electronics Principles” Albert Malvino, Mc Graw Hill Education.

Vivekananda Global University

B.Tech in Robotics Engineering **Semester III**

BCS 302 OBJECT ORIENTED PROGRAMMING WITH C++

3L-0T-0P-3C **MM 100**

MODULE I

Different paradigms for problem solving, need for OOP, differences between OOP and Procedure oriented programming, Abstraction, Overview of OOP principles, Encapsulation, Inheritance and Polymorphism.

Module2

C++ Basics: Structure of a C++ program, Data types, Declaration of variables, Expressions, Operators, Operator Precedence, Evaluation of expressions, Type conversions, Pointers, Arrays, Pointers and Arrays, Strings, Structures, References.
Flow control statement- if, switch, while, for, do, break, continue, goto statements. Functions-Scope of variables, Parameter passing, Default arguments, inline functions, Recursive functions, Pointers to functions.

Module3

Dynamic memory allocation and de-allocation operators-new and delete, Preprocessor directives. C++ Classes And Data Abstraction: Class definition, Class structure, Class objects, Class scope, this pointer, Friends to a class, Static class members, Constant member functions, Constructors and Destructors, Dynamic creation and destruction of objects, Data abstraction, ADT and information hiding.

MODULE IV

POLYMORPHISM - Function overloading, Operator overloading, Generic programming necessity of templates, Function templates and class templates.Inheritance: Defining a class hierarchy, Different forms of inheritance, Defining the Base and Derived classes, Access to the base class members, Base and Derived class construction, Destructors, Virtual base class.

MODULE V

VIRTUAL FUNCTIONS AND POLYMORPHISM - Static and Dynamic bindings, Base and Derived class virtual functions, Dynamic binding through virtual functions, Virtual function call mechanism, Pure virtual functions, Abstract classes, Implications of polymorphic use of classes, Virtual destructors.

Text/Reference Books:

1. Problem solving with C++, The OOP, 4th Edition, Walter Savitch, Pearson Education.
2. C++, The Complete Reference, 4th Edition, Herbert Schildt, TMH.
3. C++ Primer, 3rd Edition, S.B.Lippman and J.Lajoie, Pearson Education.
4. The C++ Programming Language, 3rd Edition, B.Stroutstrup, Pearson Education.
5. OOP in C++, 3rd Edition, T.Gaddis, J.Walters and G.Muganda, Wiley DreamTech Press.
6. Object Oriented Programming in C++, 3rd Edition, R.Lafore, Galigotia Publications pvt ltd.

Vivekananda Global University

B.Tech in Robotics Engineering **Semester III**

BME 305 THERMAL ENGINEERING. LAB.

0L-0T-2P-1C **MM 100**

LIST OF EXPERIMENTS:

1. Study of 2 stroke IC (SI & CI) engines (cut models) and Performance parameters.
2. Study of 4 stroke IC (CI & SI) engines (cut models) and Performance parameters.
3. To tudy & draw valve timing diagram for a single cylinder diesel engine.
4. To perform constant speed load test on a single cylinder diesel engine and to plot performance curves: brake thermal efficiency v/s Brake power, specific fuelconsumption v/s Brake power.
5. To prepare heat balance sheet of a four stroke diesel engine.
6. Morse Test: To estimate the Indicated Power, Friction Power and Mechanical Efficiency of a multi-cylinder Petrol Engine.
7. Study of fire tube boilers-its mountings and accessories.
8. Study of water tube boiler-its mountings and accessories.
9. Study of two stage reciprocating air compressor.
10. To Plot P-θ diagrams for constant speed C.I.Engine.

B.Tech in Robotics Engineering **Semester III**

BME 306 STRENGTH OF MATERIALS LAB.

0L-0T-2P-1C **MM 100**

1. Izod Impact testing.
2. Rockwell/Vickers/BrinellHardness Testing of a given material
3. Spring Testing
4. Column Testing for buckling
5. Torsion Testing
6. Tensile Testing
7. Fatigue testing

Text/Reference Books:

1. Vander Voort, Metallography: Principles and Practice, McGraw-Hill, 1984
2. Prabhudev K.H., Handbook of Heat Treatment of Steels, Tata McGraw-Hill, 2000.
3. Suryanarayanan, A.V.K. "Testing of Metalic materials" TataMcGraw Hill,1993

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B.Tech in Robotics Engineering **Semester III**

BCE 307 FLUID MECHANICS LAB.

0L-0T-2P-1C **MM 100**

LIST OF EXPERIMENTS:

1 Determine Metacentric height of a given body.
2 Determine Cd, Cv and Cc for given orifice.
3 Determine flow rate of water by V-notch.
4 Determine velocity of water by pitot tube.
5 Verify Bernoulli's theorem.
6 Determine flow rate of air by Venturi meter.
7 Determine flow rate of air by orifice meter.
8 Determine head loss of given length of pipe.
9 Determine flow rate of air by nozzle meter.

Vivekananda Global University

B.Tech in Robotics Engineering **Semester III**

BEC 306 ELECTRONICS DEVICES AND CIRCUITS LAB

0L-0T-2P-1C **M.M.100**

1. Plot gain-frequency characteristics of BJT amplifier with and without negative feedback in the emitter circuit and determine bandwidths, gain bandwidth products and gains at 1 kHz with and without negative feedback.

2. Study of series and shunt voltage regulators and measurement of line and load regulation and ripple factor.

3. Plot and study the characteristics of small signal amplifier using FET.

4. Study of push pull amplifier. Measure variation of output power & distortion with load.

5. Study Wein bridge oscillator and observe the effect of variation in R & C on oscillator frequency

6. Study transistor phase shift oscillator and observe the effect of variation in R & C on oscillator frequency and compare with theoretical value.

7. Study the following oscillators and observe the effect of variation of C on oscillator frequency: (a) Hartley (b) Colpitts

8. To plot the characteristics of MOSFET and CMOS.

9. Plot frequency response curve for single stage amplifier and to determine gain bandwidth product.

10. Plot drain current - drain voltage and drain current – gate bias characteristics of field effect transistor and measure of Idss&Vp

11. Plot gain- frequency characteristic of two stages RC coupled amplifier & calculate its bandwidth and compare it with theoretical value.

Vivekananda Global University

B.Tech in Robotics Engineering **Semester III**

BCS 305 OBJECT ORIENTED PROGRAMMING WITH C++ Lab.

0L-0T-2P-1C **MM 100**

1. Create a user defined function (any) and use it inside the program.
2. Implement "call by value" & "call by reference " function call techniques by using any user defined functions.
3. Implement the working of classes and objects by using any real world object.
4. Create a Stack object model in C++ & also make use of default and parameterized constructor to make the class more flexible in use.
5. Make all the member functions, including constructors, non-inline in the above class.
6. Create any user defined class using the concept of static data and member functions.
7. Create a Class or program implementing the concept of passing and returning object to/from member functions.
8. WAP to implement polymorphism through function overloading (Area of different shapes).
9. Create a user defined type Complex and do all the Complex number arithmetic. And also make use of operator overloading.
10. Implement single level inheritance by using Student and Marks class.
11. Implement multilevel inheritance by using the Stack class.
12. Demonstrate the calling mechanism of constructors and destructors in Multilevel Inheritance.
13. Create generic Stack model for storing different types of data.
14. Create a user defined type Matrix and perform all matrix operations. Also make use of operator overloading.
15. Implement the concept of Abstract classes and virtual functions by using Shape, Rectangle and Triangle class.

Vivekananda Global University

B.Tech in Robotics Engineering **Semester III**

ENG 115 SOFT SKILL & PROFESSIONAL APTITUDE

0L- 0T- 2P - 1.0C **MM 100**

Module I

INTERPERSONAL RELATIONSHIP MANAGEMENT-Importance & Benefits of IPR, Developing Interpersonal Abilities, Team Building- Definition and Types, Team work skills, Qualities of a Team Player, Leadership- Understanding the qualities of a Good Leader, 4 Factors of Leadership, Bring out the Leader in You

Module II

RESUME WRITING- Concepts of Resume, Curriculum Vitae and Bio-data, Resume – Information and Details, Sample Resume and Template, Cover Letter- Cover letter Writing, Sample Cover letter and Template

Module III

PERSONAL GROOMING AND INTERVIEW ETIQUETTE- Basic Personal Hygiene, Professional Attire – Men& Women, Interview Etiquette Guide, Telephonic Interview- Importance and Preparation, Advantages and Disadvantages, Things to Remember, Video Interview- Preparation and Practice, Guide to a Successful Video Interview, Importance and Types of Personal Interviews, FAQs with Answers

Module IV

GROUP DISCUSSION- Group Discussion Guide, Topics for Group Discussion, Mock GD

Module V

EXTEMPORE-Guide to Successful Extempore, Extempore Topics, Practice Session

Text/Reference Books:

1. Business communication Design, Angell, Pamela, Mcgraw-Hill, New York.
2. Grammar Finder, Eastwood, John, Oxford university press.
3. Effective technical communication, Mitra, K. Barun,Oxford university press.
4. Communicate to conquer: A handbook of group discussion and interviews, PHI learning, New Delhi.

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B.Tech in Robotics Engineering **Semester IV**

BEE 402 ELECTRICAL AND ELECTRONICS MEASUREMENT AND INSTRUMENTATION

3L-1 T-0P -3.5C **MM 100**

MODULE I: INTRODUCTION - Functional elements of an instrument – Static and dynamic characteristics, Accuracy & precision, Repeatability, Limits of errors, Systematic & random errors Modeling of errors, Probable error & standard deviation, Gaussian error analysis, Combination of errors – Errors in measurement – Statistical evaluation of measurement data – Standards and calibration.

MODULE II: ELECTRICAL AND ELECTRONIC INSTRUMENTS - Principle and types of analog and digital voltmeters, ammeters, multi-meters – Single and three phase watt-meters and energy meters – Magnetic Measurement - Ballistic Galvanometer, **f**lux meter, determination of hysteresis loop, measurement of iron losses. Instrument transformers – Instruments for measurement of frequency and phase.

MODULE III: MEASUREMENT OF PARAMETERS - D.C & A.C potentiometers, Electronic Voltmeter, Electronic Multimeters, Digital Voltmeter, Vector Impedance meter, RF Power & Voltage Measurements. Different methods of measuring low, medium and high resistances**,** measurement of inductance, frequency & capacitance with the help of AC Bridges, Q Meter.

MODULE IV: DISPLAY DEVICES AND SIGNAL GENERATION - CRT display, digital CRO, LED, LCD & dot matrix display. Sine wave generators, Frequency synthesized signal generators, Sweep frequency generators. Signal Analysis – Measurement Technique, Wave Analyzers, and Frequency - selective wave analyzer, heterodyne wave analyzer, Harmonic distortion analyzer, and Spectrum analyzer.

MODULE V: TRANSDUCERS - Construction, Working Principles, Application of following Transducers RTD, Thermocouples, Thermistors, LVDT, RVDT, Strain Gauges, Bourdon Tubes, Bellows, Seismic Accelerometers, Tacho generators, Load Cell, Piezoelectric Transducers, Ultrasonic Flow Meters.

Text/Reference Books:

1. "Electrical Measurement &Measuring Instrument", E.W. Golding & F.C. Widdis A.H. Wheeler& Co. India.
2. "Electrical & Electronic Measurement & Instrument", A.K. Sawhney, Dhanpat Rai & Sons
3. "Electrical Measurement", Forest K. Harries, Willey Eastern Pvt. Ltd. India .
4. "Basic Electrical Measurement", M.B. Stout, Prentice hall of India.
5. "Electronic Instrument & Measurement Technique", W.D.Cooper Prentice Hall International.
6. "Electrical Measurement &Measuring Instrument", Rajendra Prashad, Khanna Publisher.
7. "Electrical Measurements and Measuring Instruments", J.B. Gupta, S.K. Kataria & Sons.

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B.Tech in Robotics Engineering **Semester IV**

BEC 405 ANALOG COMMUNICATION

3L-1T-0P-3.5C **M.M.100**

MODULE I: INTRODUCTION -Elements of Communication System and its Limitations, Mismatch between Signal & Channel- Modification of Channel or Modification of Signal, Modulation Benefits and Application, An Overview of Different types of Modulations- Analog & Digital, In Analog- Amplitude & Angle (Frequency & Phase) Modulation**Amplitude (Linear) Modulation:** Generation and Detection of AM, DSB, SSB and VSB, Carrier Acquisition, AM Transmitter and Receiver, Time domain and frequency domain description

MODULE II:ANGLE MODULATION - Basic concepts, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Waves, Direct FM, Detection of FM Waves: Balanced Frequency discriminator, Zero crossing detector, Phase locked loop, Comparison of FM & AM.

MODULE III: NOISE - Noise in Analog communication System-Resistor noise, Networks with reactive elements, Noise temperature, Noise bandwidth, effective input noise temperature, Noise figure. Noise figure & equivalent noise temperature in cascaded circuits. Calculation of signal-to-noise ratio in SSB-SC, DSB-SC, DSB with carrier, Noise calculation of square law demodulator & envelope detector. Noise in Angle Modulation System, Threshold effect in Angle Modulation System, Pre-emphasis & de-emphasis

MODULE IV: TRANSMITTERS - Radio Transmitter - Classification of Transmitter, AM Transmitter, Effect of feed back on performance of AM Transmitter, FM Transmitter – Variable reactance type and phase modulated FM Transmitter, frequency stability in FM Transmitter. RECEIVERS : Radio Receiver - Receiver Types - Tuned radio frequency receiver, Superhetrodyne receiver, RF section and Characteristics - Frequency changing and tracking, Intermediate frequency, AGC, FM Receiver, Comparison with AM Receiver, Amplitude limiting.

MODULE V:PULSE MODULATION - Time Divison Multiplexing, Types of Pulse modulation, PAM (Single polarity, double polarity) PWM: Generation & demodulation of PWM, PPM, Generation and demodulation of PPM

Text/Reference Books:

1. Principles of Communication Systems - Simon Haykin, John Wiley
2. Electronics & Communication System – George Kennedy and Bernard Davis, TMH 2004.
3. Communication Systems Second Edition – R.P. Singh, SP Sapre, TMH, 2007.
4. Fundamentals of Communication Systems - John G. Proakis, Masond, Salehi PEA, 2006
5. Principles of Communication Systems – H Taub& D. Schilling, GautamSahe, TMH, 2007

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B.Tech in Robotics Engineering **Semester IV**

BME 403 THEORY OF MACHINES - I

3L-1T-0P-3.5C **MM 100**

Module I

KINEMATICS: Elements, pairs , mechanisms, four bar chain and its inversions, velocity and acceleration, Klein's construction, coriolis component, instantaneous center method, Synthesis of mechanisms, panto graph, scott-Russel, Tchbeicheff straight line, indicator diagram mechanisms. Automotive vehicle mechanisms: Overhead valve mechanism, Davis and Ackerman steering mechanism, Trifler suspension and Hookes joint.

Module II

POWER TRANSMISSION: Introduction, Types of Flat belt drives, Velocity ratio, Slip of belt, Creep of belt, Length of an open and cross belt drive, Power transmitted by a belt, Ratio of driving tension, Centrifugal tension, condition for the transmission of maximum power, initial tension in the belt, Chain drives.

Module III

BRAKES & DYNAMOMETERS: Band, block and band & block brakes, braking action, absorption and transmission type dynamometers, prony, rope and hydraulic dynamometers braking system of automobiles.

Module IV

CAMS: Type of cams, Types of followers,displacement, velocity and acceleration curves for different cam followers, consideration of pressure angle and wear, analysis of motion of followers for cams with specified contours.

Module V

FRICTION: Laws of static, dynamic and rolling friction,dry& viscous friction,inclined plane & screw jack,pivots& friction axis,bearing,clutches,theory of film lubrication.

Text/Reference Books:

1. Kinematic analysis and synthesis of mechanisms A.K.Mallik,,A.Ghosh., & G. Dittrich, CRC Press.
2. Theory of machines and mechanisms J.J.Uicker, G.R.Pennock, &J.E.Shigley, Oxford University Press
3. Kinematics and Dynamics of Machinery Robert L. Norton, , TMH
4. Theory of Machine ,S. S. Rattan, TMH , New delhi
5. The Theory Of Machines Through Solved Problems J.S.Rao,: New Age International.

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B.Tech in Robotics Engineering **Semester IV**

BEC 402 MICROPROCESSOR AND INTERFACING

3L-1T-0P-3.5C **M.M.100**

Module1:INTRODUCTION TO MICROPROCESSOR-Overview of microprocessor structure and its operation, Microprocessor evaluation and its types, Address bus , Data bus, Control bus, Demultiplexing and buffering of system bus, peripheral devices and memory organization.

MODULE II: 8085 MICROPROCESSOR - 8085 MPU, Pins and Signals, Microprocessor Architecture, internal data operations and Registers, Memory mapped I/O and Peripheral mapped I/O, 8085 Microprocessor Programming model, Interrupts of 8085, Addressing modes of 8085.

MODULE III: ASSEMBLY LANGUAGE PROGRAMMING USING 8085 - Instruction set, Classification of instructions, Programming technique, Assembly language programs involving logical, Branch & Call instructions, sorting, evaluation of arithmetic expressions, string manipulation, Machine cycle, T-state, Timing Diagram.

MODULE IV: MICROPROCESSOR SYSTEM PERIPHERAL AND INTERFACE - Introduction to interfacing, 8155, 8255, 8253, 8257, 8259, 8279, DMA Controller, A/D Conversion, Memory and Keyboard interface.

MODULE V: -MICROPROCESSOR – 8086 - Pins and Signals, Internal architecture , 8086 system configuration and timing, minimum and maximum mode, memory segmentation, Addressing modes of 8086, Instructions set of 8086, Interrupts of 8086.

Text/Reference Books:

1. "Microprocessor Architecture, Programming and application with the 8085 by Ramesh Gaonkar, Wiley.
2. "Introduction to Microprocessor" by B. Ram.
3. "Microprocessor Interfacing, programming and hardware" by D. V. Hall, TMH.
4. "Fundamental of Microprocessor", Udaykumar, Pearson.
5. "Microprocessor 8085 and its Interfacing", Sunil kumar, PHI

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B.Tech in Robotics Engineering **Semester IV**

BEC 406 SIGNALS AND SYSTEMS

3L-0T-0P-3C **M.M.100**

MODULE I: SIGNALS - Definition, types of signals and their representations: continuous -time/ discrete-time, periodic/non-periodic, even/odd, energy/power, deterministic/ random, one-dimensional/ multidimensional; commonly used signals (in continuous-time as well as in discrete-time): unit impulse, unit step, unit ramp (and their interrelationships), exponential, rectangular pulse, sinusoidal; operations on continuous-time and discrete-time signals (including transformations of independent variables).

MODULE II: SYSTEMS - Classification, linearity, time-invariance and causality, impulse response, characterization of linear time-invariant (LTI) systems, unit sample response, convolution summation, step response of discrete time systems, stability. convolution integral, co-relations, signal energy and energy spectral density, signal power and power spectral density, properties of power spectral density,

MODULE III: FOURIER TRANSFORMS (FT) - (i) Definition, conditions of existence of FT, properties, magnitude and phase spectra, Some important FT theorems, Parseval's theorem, Inverse FT, relation between LT and FT (ii) Discrete time Fourier transform (DTFT), inverse DTFT, convergence, properties and theorems, Comparison between continuous time FT and DTFT.

MODULE IV: LAPLACE-TRANSFORM (LT) AND Z-TRANSFORM (ZT) - (i) One-sided LT of some common signals, important theorems and properties of LT, inverse LT, solutions of differential equations using LT, Bilateral LT, Regions of convergence (ROC) (ii) One sided and Bilateral Z-transforms, ZT of some common signals, ROC, Properties and theorems, solution of difference equations using one-sided ZT, s- to z-plane mapping.

MODULE V: SAMPLING - Mathematical theory of sampling. Sampling theorem. Ideal & Real sampling. Interpolation technique for the reconstruction of a signal from its samples. Aliasing. Sampling in freq. domain. Sampling of discrete time signals. Discrete time processing of Continuous-time signals, continuous time processing of discrete-time signals, changing the sampling rate using discrete-time processing.

Text/Reference Books:

1. Signals and Systems by J.P.Agrawal, Paragon International New delhi
2. Principles Of Linear Systems And Signals, 2e (Intl. Version), Lathi 2nd, Oxford
3. Signal & Systems 3e, Chen 3rd, Oxford
4. Signals And Systems, P Rao, TMH
5. Signals And Systems: A Simplified Approach, Ganesh Rao, 4e, Pearson
6. Signals And Systems: Continuous And Discrete, Roger E Ziemer, 4e, PHI

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B.Tech in Robotics Engineering **Semester IV**

MAT 130 NUMERICAL METHODS

3L-0T-0P-3C **MM 100**

MODULE I: Errors: Relative, Absolute, Round off, Truncation. Transcendental and Polynomial equations: Bisection method, Newton's method, Secant method, Regula Falsi Method, Iteration Method, Rate of convergence of these methods.

MODULE II: System of linear algebraic equations, Factorization, Cholesky decomposition. Diagonal dominance, ill conditioned matrices, Gaussian Elimination and Gauss Jordan methods. Gauss Jacobi method, Gauss Seidel method and their convergence analysis.

MODULE III: Difference operators (shift, forward, backward and central difference), Application of finite difference operators to solve initial and boundary value problems, Interpolation, Lagrange and Newton's methods, Error bounds, Gregory forward and backward difference interpolation. Stirling's and Bessel's formula for interpolation, Gauss forward formula, Gauss backward formula.

MODULE IV: Numerical Differentiation, Numerical Integration, Trapezoidal rule, Simpson's rule, Simpsons 3/8th rule, Boole's Rule, Composite Trapezoidal rule, Composite Simpson's rule, Weddle rule.

MODULE V: Numerical integration of Ordinary Differential Equations of first order, Picard's method, Euler's method, Euler's modified method, Runge-Kutta methods of orders two and four.

Text/Reference Books:

1. Numerical Method for Scientific and Engineering, M.K. Jain, S.R.K. Iyenger
2. Numerical Methods for Engineers, S.K. Gupta, Wiley Eastern Ltd.
3. Numerical Methods, B.S. Grewal, Khanna Publications
4. Numerical Methods, A.D. Booth, Academic Press, NY
5. An Introduction to Numerical Analysis , K.E.Atkinson , John Wiley & Sons, NY
6. Introduction Methods of Numerical Analysis , S.S. Sastry,Prentice Hall of India
7. Elementary Numerical Analysis, S.D. Conte, McGraw Hill

B.Tech in Robotics Engineering **Semester IV**

BEE 406 : ELECTRICAL AND ELECTRONICS MEASUREMENT AND INSTRUMENTATION LAB

0L-0T-2P-1C **MM 100**

1. Calibration of AC Voltmeter and AC Ammeter.
2. Measurement of phase difference and frequency of a sinusoidal ac voltage using C.R.O.
3. Measurement of Earth resistance using fall of potential method and low resistance by Kelvi's double bridge
4. Measurement of Voltage, Current and Resistance using dc potentiometer.
5. Measure unknown inductance capacitance resistance using following bridges
   (a) Anderson Bridge (b) Maxwell Bridge
6. Measurement of capacitance by Owe's bridge, De Sauty bridge, Schering bridge.
7. Measurement of temperature by RTD, Thermocouple and Thermistor.
8. Measurement of displacement using LVDT, strain gauge based Displacement transducer and strain gauge based load cell.
9. Measurement of flow rate by Anemometer.

B.Tech in Robotics Engineering **Semester IV**

BEC 407 MICROPROCESOR & INTERFACING LAB

0L-0T-2P-1C **M.M.100**

1. Study the hardware, functions, memory structure and operation of 8085 microprocessor kit.
2. Program to perform integer division: (i) 8-bit by 8-bit (ii) 16-bit by 8-bit.
3. Transfer of a block of data in memory to another place in memory in the direct and reverse order.
4. Searching a number in an array and finding its parity.
5. Sorting of array in: (i) Ascending (ii) Descending order
6. Programme to perform following conversion: (i) BCD to ASCII (ii) BCD to Hexadecimal
7. Programme to multiply two 8-bit numbers.
8. Programme to generate and sum 15 fibanocci numbers.
9. Programme for rolling display of message "INDIAN".
10. To insert a number at correct place in a sorted array.
11. Serial and Parallel data transfer on output port 8155 & 8255 & designing of disco light, running light, and sequential lights on off by above hardware.
12. Generation of different waveform on 8253/ 8254 programmable timer.

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B.Tech in Robotics Engineering **Semester IV**

BME 410 THEORY OF MACHINE LAB.-I

0L-0T-2P-1C **MM 100**

PERFORM FIVE EXPERIMENTS:

1. To plot slider displacement, velocity & acceleration against crank rotation for single slider crank mechanisms.
2. To study various types of cam and follower arrangements.
3. To study various types of Gear Trains- Simple, Compound, Reverted, Epicyclic and differential Gear Trains.
4. To study various types of steering mechanisms.
5. To study the working of screw jack and determine its efficiency.
6. Create various types of linkage mechanisms in CAD and Simulate for motion output and study the relevant effect.
7. To determine radius of gyration of compound pendulum.
8. To determine natural frequency of free torsional vibrations of single rotor system.
    i. Horizontal rotor
    ii. Vertical rotor
9. To conduct experiment of trifler suspension.
10. Determination of resonant frequencies of cantilever beam in Harmonic excitation using electro-dynamic shaker.

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B.Tech in Robotics Engineering **Semester IV**

BEC 410 SIGNAL PROCESSING LAB USING MAT LAB-I

0L-0T-2P-1C **M.M.100**

Simulation in MATLAB Environment:

1. Generation of continuous and discrete elementary signals (periodic and non-periodic) using mathematical expression.
2. Generation of Continuous and Discrete Unit Step Signal.
3. Generation of Exponential and Ramp signals in Continuous & Discrete domain.
4. Continuous and discrete time Convolution (using basic definition).
5. Adding and subtracting two given signals. (Continuous as well as Discrete signals)
6. To generate uniform random numbers between (0, 1).
7. To generate a random binary wave.
8. To generate random sequences with arbitrary distributions, means and variances for following

(a) Rayleigh distribution (b) Normal distributions: N(0,1).

(c) Gaussion distributions: N (mx, óx2)

9. To plot the probability density functions. Find mean and variance for the above distributions

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B.Tech in Robotics Engineering **Semester IV**

MGT 101 SOCIOLOGY AND ELEMENTS OF ECONOMICS

0L-0T-2P-1C **MM 100**

Objective: The objective of this course is to equip the students with the basic understanding of Economics and sociology and to provide an insight into the application of modern analytical tools and techniques for the purpose of management decision-making.

MODULE I: Introduction to sociological concepts-structure, system, organization, social institutions, Culture social stratification (caste, class, gender, power). State & civil society. Social change in contemporary India: Modernization and globalization, Secularism and communalism, Nature of development.

MODULE II: Socialization: Meaning, Types, Agents & Process. Social Group: Concepts, Characteristics and Types. Ecology and Environment.

MODULE III: Basic Principles and Methodology of Economics. Demand/Supply-elasticity-. Theory of the Firm and Market Structure. Basic Macroeconomic Concepts (including GDP/GNP/NI/Disposable Income)

MODULE IV: Public Sector Economics – Welfare, Externalities, Demand & Supply of Labor.
Monetary and Fiscal Policy Tools & their impact on the economy – Inflation and Phillips Curve

MODULE V: Liberalization, Privatization & Globalization (LPG): Concept, Reasons for implementation of LPG and Pros & Cons of Liberalization, Privatization & Globalization (LPG) , Indian economy Brief overview of post independence period – plans

TEXT BOOK

1	Dutt Gaurav & Mahajan Ashwani, Indian Economy, S Chand	2015
2	B Shalini, K Aman, T Deepika, Sociology and element of Economics for engineers, Neelkant Publications	2014

REFERENCE BOOKS

S.No.	**Name of Authors / Books /Publisher**	**Year of Pub.**
1	Giddens, A, Sociology, Polity, 6th edn.	2009
2	Robert S.Pindyck & Daniel L. Rubinfield: Microeconomics, Printce hall	
3	Xaxa, V, State, Society and Tribes Person	2008
4	Chandoke, Neera & Praveen Priyadarshi, Contemporary India: Economy, Society and Politics, Pearson	2009
5	Mohanty, M, Class, Caste & Gender- Volume 5, Sage	2004
6	M.C. Petersen &W.Cris Lewis, Managerial economics(II Edn), Macmillan publishing co. Newyork.	
7	Bhowmik, S (ed.) Street Vendors in the Global Urban Economy, Routledge	2010
8	Misra, S.K. and Puri, Indian Economy, Himalaya	2009

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B.Tech in Robotics Engineering **Semester IV**

MGT 110 GENERAL APTITUDE

0L-0T-2P-1.0C **MM 100**

Module I

LEVEL 1:- Number System:-Number Series, HCF and LCM of Numbers, Fractions and Decimals, Square Root and Cube Roots, Indices and Surds, Simplification and Approximation,

Module II

LEVEL-2 Problems on Ages and Numbers Percentage, Profit, Loss and Discount, Average, Ratio and Proportion, Time, Work and Wages, Pipes and Cisterns, Simple Interest, Compound Interest,

Module III

LEVEL-3 Growth and Depreciation, Time and Distance, Trains, Boats and Streams, Races, Clocks, Calendar

Module IV

LEVEL-4: Area of Plane Figures, Volume and Surface Area of Solid Figures Elementary Algebra, Linear Equations, Quadratic Equations and In-equation, Progression,

Module V

LEVEL-5: Permutation and Combination, Probability, Geometry, Trigonometry, Data Interpretation, Data Sufficiency

Text/Reference Books:

1. R. S. Agarwal- Aptitude Mathematics
2. Mathuria- Quicker Mathematics

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B.Tech in Robotics Engineering **Semester V**

BEE 501 : POWER ELECTRONICS

3L+1T+0P+ 3.5C **MM100**

MODULE I

POWER SEMICONDUCTORS: - Construction and characteristics, specification and ratings, of SCR, TRIAC, MOSFET, IGBT and Power Transistor. Triggering Method of SCR, Protection of SCR- Protection against over voltage, over current, dv/dt, di/dt, Gate protection. Methods of turn on of SCR : R, RC, UJT relaxation oscillator, Drive snubber circuits for MOSFET and Turn-on and turn-off characteristics and switching losses.

MODULE II

PHASE-CONTROLLED CONVERTERS - 2-pulse, 3-pulse and 6-pulse converters with R, RL and RLE load, Effect of freewheeling diode, Effect of source inductance, Distortion and displacement factor, Ripple factor.

MODULE III

DC TO DC CONVERTERS - Step-down and step-up choppers – Type A, B, C, D, and E Chopper, Time ratio control and current limit control, Switching mode regulators: Buck, boost, buck-boost and buck converter. Voltage commutated chopper and current commutated chopper.

MODULE IV

INVERTERS - Single phase and three phase (both 120 and 180 degree mode) inverters – PWM techniques: Sinusoidal PWM, modified sinusoidal PWM and multiple PWM – Voltage and harmonic control - Series resonant inverter - Current source inverters.

MODULE V

AC TO AC CONVERTERS - Single – phase AC voltage controllers, Integral cycle control, single Phase step up and step down cycloconverters (continuous and discontinuous mode), Three phase cycloconvertor- three phase to single phase convertor, three phase to three phase convertor, output voltage equations.

Text/Reference Books:

1. Power Electronics: Circuits, Devices and Applications, Muhammad H. Rashid, Pearson Education, Third edition, 2004 / PHI.
2. Power Electronics: Converters, Applications and Design, Ned Mohan, John Wiley and sons, third edition, 2003.
3. Power Electronics, Cyril.W.Lander, McGraw Hill International, Third edition, 1993.
4. Modern Power Electronics and AC Drives, Bimal K. Bose, ' Pearson Education, 2003.
5. Introduction to Power Electronics, Mr. Jaganathan, ' Prentice Hall of India, 2004.
6. Power Electronics M D Singh and K B Khanchandani, TMH, 2008.
7. Elements of Power Electronics, Krein P. T, Oxford.
8. Power Electronics, P C Sen, Tata McGraw-Hill, India.
9. Power Electronics, C W Lander, McGraw Hill

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B.Tech in Robotics Engineering **Semester V**

BME 502 GAS DYNAMICS

3L-0T-0P-3C **MM 100**

Module I

BASIC CONCEPTS AND ISENTROPIC FLOWS: Energy and momentum equations of compressible fluid flows, Stagnation states, Mach waves and Mach cone, Effect of Mach number on compressibility, isentropic flow through variable ducts, Nozzle and Diffusers, Use of Gas tables.

Module II

FLOW THROUGH DUCTS: Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow), variation of flow properties, Use of tables and charts, Centralized gas dynamics.

Module III

NORMAL AND OBLIQUE SHOCKS: Governing equations, Variation of flow parameters across the normal and oblique shocks, PrandtlMeyer relations, Use of table and charts, Applications.

Module IV

JET PROPULSION: Theory of jet propulsion, Thrust equation, Thrust power and propulsive efficiency, Operation principle, cycle analysis and use of stagnation stale performance of mm jet, turbojet, turbofan and turbo prop engines.

ModuleV

SPACE PROPULSION: Types of rocket engines, Propellants-feeding systems, Ignition and combustion, Theory of rocket propulsion, Performance study, Staging, Terminal and characteristic velocity, Applications, space flights.

Text/Reference Books:

1. Anderson, J.D., "Modern Compressible flow", 3rd Edition, McGraw Hill, 2003.
2. Yahya, S.M. "Fundamentals of Compressible Flow", New Age International (P) Limited, New Delhi, 1996.
3. Hill. P. and C. Peterson, "Mechanics and Thermodynamics of Propulsion", Addison – Wesley Publishing company, 1992.
4. Zucrow. N.J., "Aircraft and Missile Propulsion", Vol.1 & II, John Wiley, 1975.
5. Zucrow. N.J., "Principles of Jet Propulsion and Gas Turbines", John Wiley, New York, 1970.
6. Ganesan. V., "Gas Turbines", Tata McGraw Hill Publishing Co., New Delhi, 1999.

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B.Tech in Robotics Engineering **Semester V**

BME 503 THEORY OF MACHINES-II

3L-0T-0P-3.0C **MM 100**

Module l:
GOVERNORS: Watt, Porter, Proell, Hartnell and spring controlled governors, governor effort, power, stability inertia effects.

Module II:
GYROSCOPE: Principle of gyroscopic couple, effect of gyroscopic couple and centrifugal force on vehicle taking a turn, stabilization of sea vessels. Inertia force analysis, Velocity and acceleration of slider crank and four bar mechanism, inertia force, piston thrust and forces on connecting rod, turning moment diagram, flywheel.

Module III:
GEARS: law of gearing, terminology. tooth form, standard interchangeable tooth profile, minimum number of teeth on pinion in contact with gear or rack, interference anti undercutting. Bevel, helical and spiral gears.

Module IV:
GEAR TRAINS: Simple, compound, reverted and epicyclic gear trains, analytical, tabular, graphical and vector methods for velocity ratio, gear boxes- sliding and constant mesh for automobiles.

Module V:
BALANCING: Balancing of rotating masses, balancing of reciprocating masses, locomotives. IC engines, balancing machines.

Text/Reference Books:
1. Theory of Machines, Rattan S.S.. Tata McGraw Hill.
2. Theory of Machines, Thomas Bevan, Pearson Education.
3 Theory of Machines and Mechanisms, Uicker, Pennocle and Shigley, Oxford University Press.Mechanism Ami Machine Theory, Ambekar A.G., Prentice-hall Of India

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B.Tech in Robotics Engineering **Semester V**

BEE 502 : CONTROL SYSTEM ENGINEERING

3L+0T+0P+ 3C

MODULE I: INTRODUCTION: Elements of control systems, concept of open loop and closed loop systems., Examples and application of open loop and closed loop systems, brief idea of multivariable control systems.

MODULE II: MATHEMATICAL MODELING OF PHYSICAL SYSTEMS: Representation of physical system (Electro Mechanical) by differential equations, Determination of transfer function by block diagram reduction techniques and signal flow method, Laplace transformation function, inverse Laplace transformation.

MODULE III: TIME RESPONSE ANALYSIS OF FIRST ORDER AND SECOND ORDER SYSTEM: Characteristic equations, response to step, ramp and parabolic inputs, transient response analysis, steady state errors and error constants, Transient & steady state analysis of LTI systems.

MODULE IV: STABILITY OF THE SYSTEM: Absolute stability and relative stability, Routh's stability criterion, root locus method of analysis, polar plots, Nyquist stability criterion. M and N Loci, Nichols chart.

MOUDLE 5: ELEMENTARY IDEAS OF COMPENSATION, NETWORKS: Lag, lead and log lead networks, brief idea of proportional, derivative and integral controllers.

Text/Reference Books:

1. Modern Control Engineering, K. Ogata, '4th edition, Pearson Education, New Delhi, 2003 / PHI.
2. Control Systems Engineering, I.J. Nagrath& M. Gopal New Age International Publishers, 2003.
3. Automatic Control Systems, B.C. Kuo, Prentice Hall of India Ltd., New Delhi, 1995.
4. Control Systems, Principles & Design, M. Gopal, Tata McGraw Hill, NewDelhi, 2002.
5. Control Engineering Theory and Practice, M.N. Bandyopadhyay, Prentice Hallof India, 2003

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B.Tech in Robotics Engineering **Semester V**

BME 505 MACHINE DESIGN-I

3L-1T-0P-3.5C **MM 100**

Module I

Introduction

Definition, Design requirements of machine elements, Design procedure, Standards in design, Selection of preferred sizes, Indian Standards designation of carbon & alloy steels, Selection of materials for static and fatigue loads. **Design for Static Load:** Modes of failure, Factor of safety, Principal stresses, Stresses due to bending and torsion, Theory of failure.

Module II

Design for Fluctuating Loads Cyclic stresses, Fatigue and endurance limit, Stress concentration factor, Stress concentration factor for various machine parts, Notch sensitivity, Design for finite and infinite life, Soderberg, Goodman & Gerber criteria. **Riveted Joints:** Riveting methods, materials, Types of rivet heads, Types of riveted joints, Caulking and Fullering, Failure of riveted joint, Efficiency of riveted joint, Design of boiler joints, Eccentric loaded riveted joint.

Module III

Shafts: Cause of failure in shafts, Materials for shaft, Stresses in shafts, Design of shafts subjected to twisting moment, bending moment and combined twisting and bending moments, Shafts subjected to fatigue loads.

Design for rigidity: Keys and Couplings Types of keys, splines, Selection of square & flat keys, Strength of sunk key, Couplings, Design of rigid and flexible couplings.

Module IV

Mechanical Springs:-Types, Material for helical springs, End connections for compression and tension helical springs, Stresses and deflection of helical springs of circular wire, Design of helical springs subjected to static and fatigue loading.

Module V

Power Screws

Forms of threads, multiple threads, Efficiency of square threads, Trapezoidal threads, Stresses in screws, Design of screw jack.

Text/Reference Books:

1. Bhandari, V. 13., Introduction to Machine Design, McGrnw Hill Education (India)
2. Shigley, Joseph E., Mechanical Engineering Design, McGraw Hill Education (India)
3. Sharma and Aggarwal, Machine Design, 5.K.Kataria and Sons, Delhi.
4. Sharma and Purohit, Design of Machine Elements, Prentice Hall I ndia.
5. Kulkarni S. G., Machine Design, Tata McGrnw Hill
6. Karwa A., A Text Book of Machine Design, Laxmi Publications.

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B.Tech in Robotics Engineering **Semester V**

BEC 502 MICROCONTROLLER & EMBEDDED SYSTEM

3L-0T-0P-3C **M.M. 100**

MODULE I
INTRODUCTION TO VARIOUS MICROCONTROLLER - Overview of Embedded System: Definition, Design Challenges and Characteristics, Difference between microprocessor, microcontroller, introduction of various microcontrollers, 8051 By Intel, PIC by Microchip, AVR by ATMEL, ARM by ARM, MSP430 by Texas, Use and application of 8051 .

MODULE II
8051 MICRO CONTROLLER - 8051 Microcontroller: Architecture, Addressing modes, I/O Port Programming, Single bit, Instructions and Programming

MODULE III
8051 PROGRAMMING - Interrupt Programming, Timers Programming, serial port Programming and interrupt programming in Assembly and C .

MODULE IV
ARM PROCESSORS - ARM Fundamentals: Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector table, Core Extensions, Instruction Set, Introduction to Thumb Instruction Set (Writing Programs not included in the theory Course)

MODULE V
APPLICATIONS OF EMBEDDED SYSTEMS - Concepts of system-on-chip, How modern-day system-on-chip (SoC) microcontrollers can Implement a whole signal chain. Applications of Embedded systems: Energy meters, Smoke detectors, Data acquisition system, wired sensor network, and wireless sensor networks with Chipcon RF interface.

Text/Reference Books:

1. Andrew N. Sloss et.al. ARM System Developers Guide, ELSEVIER
2. Muhammad Ali Mazidi et.al., The 8051 Microcontroller & Embedded Systems, Pearson
3. Embedded System Design, A Unified Hardware/Software Introduction, Frank
4. Vahid / Tony Givargis, 2006 reprint, John Wiley Student Edition.
5. Muhammad Ali Mazidi et.al., The PIC Microcontroller, Pearson

B.Tech in Robotics Engineering **Semester V**

BEE 506 : POWER ELECTRONICS LAB

0L+0T+2P+ 1C

1. Study of characteristics of the SCR (a) observe the terminal configuration (b) measure the breakdown voltage (3) measure the latching and holding current (d) plot V-I characteristics
2. Study the performance of single-phase half-wave and full-wave controlled rectifiers.
3. Study different firing circuits of SCR.
4. Study and perform Buck, Boost, and Buck boost regulator
5. Study protection circuits of SCR: (i) dv/dt (ii) di/dt (iii) Over voltage (iv) Over current
6. Study and obtain the characteristics of a DIAC and TRIAC.
7. Study firing circuit of SCR using ramp-comparator scheme.
8. Study firing circuit of SCR using cosine-wave scheme.
9. Study and obtain waveform for voltage and current commutated chopper
10. Study and perform experiments on single phase PWM Invertor.

B.Tech Robotics Engineering **Semester V**

BME 508 GAS DYNAMICS LAB

0L-0T-2P-1C **MM 100**

LIST OF EXPERIMENTS

1. Study and Demonstration nm of thrust stand (entire class)
2. Study of Alignment of a Schlierensystem for viewing of thermal plumes
3. Tank Blow down

(a) Derivation (statement) of pressure/ time equations
(b) Measurement of tank pressure and temperature as a function of time

4. Nozzle Pressure Measurement -

(a) Review of prediction of wall pressure from1 D theory
(b) Measurement of nozzle.wall static pressure at varying total pressures

5. CfD Component -

(a) CfD Overview
(b) Compare results from Fluent Flow lab templates to theory and experiment

B.Tech Robotics Engineering **Semester V**

BEC 508 MICROCONTROLLER & EMBEDDED SYSTEM LAB

0L-0T-2P-1C **M.M. 100**

1. Flash a LED connected at a specified output port terminal
2. Interface a stepper motor – and rotate it clock wise or anti clock wise through
3. given angle steps
4. Using Keil software write a program to pick the smallest among a given set of numbers
5. Using Keil software write a program to pick the largest among a given set of numbers
6. Using Keil software write a program to arrange a given set of numbers in descending order
7. Using Keil software write a program to generate a rectangular wave form at a specified port terminal
8. Pseudo Random Binary Sequence (PRBS) and Sequence Generators using Shift registers
9. Digital I/O Experiments Using the Logic Interface Card of the 8085 Microprocessor Kit
10. Interface Experiments Using Dual DAC Card of the 8085 Microprocessor Kit

B. Tech Robotics Engineering **Semester V**

BME 510 MACHINE DESIGN SESSIONAL-I

0L-0T-2P-1C **MM 100**

1. Design & drawing of Cotter joint.
2. Design & drawing of Knuckle joint
3. Design of machine components subjected to combined steady and variable loads
4. Design of eccentrically loaded riveted joint
5. Design of boiler riveted joint
6. Design of shaft for combined constant twisting and bending loads
7. Design of shaft subjected to fluctuating loads
8. Design and drawing of flanged type rigid coupling
9. Design and drawing of flexible coupling
10. Design and drawing of helical spring
11. Design and drawing of screw jack

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B.Tech Robotics Engineering **Semester V**

BME 511 THEORY OF MACHINE LAB –II

0L-0T-2P-1C **MM 100**

1 To verify the relation $T=I_W W_P$ for gyroscope.
2. To plot force vs. radius and lift vs. Speed curves for governors.
3. To plot pressure distribution curves on a journal bearing.
4. To perform wheel balancing.
5. To perform static and dynamics balancing on balancing set up.
6. TO Determine the mass moment of inertia of flywheel.
7. Study of a lathe gear box.
8. Study of a sliding meshautomobilegear box.
9. Study of a Planetarygear box.

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B.Tech in Robotics Engineering **Semester V**

BME 512 SKILL DEVELOPMENT COURSE: AutoCAD

0L-0T-2P-1.0C **MM 100**

1) Introduction of Engineering Drawings, Views & AutoCAD, History, GUI, Units, Limits, Line, Circle, Erase, Trim, Extend. File Management- New, Open, Save, Close, Exit, Arc, Ellipse, Rectangle, Polygon, Move, Copy, Mirror, Offset.
2) CO-Ordinate System- Absolute, Relative- Rectangular, Polar, Zoom, Pan, Regenerate, Array- Rectangular, Polar, Path, Array Edit.
3) Ray Line, Construction Line, Multiline, Polyline, Spline. Rotate, Scale, Stretch, Lengthen, Isometric View, Hatch, Gradient, Hatch edit, Boundary, Region, Wipeout, Revision Cloud.
4) Fillet, chamfer, Break, Join, Explode, Object Properties- color, Line type, scale, lineweight
5) Block- Make, Save, Insert Block Editor, Table, Text, Helix, Donut, Match Properties,
6) Dimensions- Linear, Angular, aligned, radius, diameter, jogged, tolerance, center mark, inspection, Oblique, align text, Dimension Style- Modify, Override, Update,
7) tools- Workspace, tool Palettes, Dynamic Block, Clear Screen, Command Line, Quick Select, External Reference, Xbind, Xopen, PDF Underlay, Raster Image, Hyperlink, OLE Object., Mini Project 4, Field, Update Filed
8) Edit- Copy, Copy with base point, copy link, paste, paste as block, paste Special, Paste to Original Co-ordinate, Import, Export, Etansmit, Dwg Convert,
9) Page Setup, Plot, Publish, View- Zoom, Pan, Orbit, View Port, , Mini Project 4,
10) Introduction of 3D, 3D Views, Visual Style. √ Modeling- Box, Polysolid, Cylinder, Cone, Sphere, Pyramid, Wedge, Tours
11) Extrude, Revolve, Sweep, Loft, Union, Subtract, Intersect, Presspull,
12) 3D Operations'- move, rotate, align, mirror, array, Slice, Extract Edges, Extract Isolines,
13) Solid Editing-Face, Edge, Body, Material Browser, Render,

Text/Reference Books:

1. AutoCAD 2012 Instructor, James Leach, Thomas Bledsaw, McGraw-Hill Education, 15-Jun-2011
2. AutoCAD 2013 and AutoCAD LT 2013: (Autodesk Official Training Guides) by Donnie Gladfelter

B.Tech in Robotics Engineering **Semester VI**

BEE 612 ELECTROMECHANICAL ENERGY CONVERSIONS AND D.C. MACHINES

3L+0T+0P+3C **MM 100**

MODULE I

Review of Principles and Terminology: Ampere's law, Magnetic flux and flux density, Self-inductance and Mutual inductance, Properties of magnetic materials. Faraday's and Lenz's law, Generated and induced emf.

MODULE II

Direct and Alternating Current Excitation of Ferromagnetic Structures: Magnetization, Hysteresis and hysteresis loop, Methods of analysis of ferromagnetic circuits, Fringing and Leakage effects of air gap, Eddy current, eddy current and hysteresis losses, Equivalent circuits of iron core reactors, Saturable reactors.

MODULE III

Energy Conversion in Singly and Doubly Excited Electromagnetic Systems: Energy Balance in Nonlinear and Linear magnetic systems, Field energy and Mechanical force in singly excited systems, Doubly excited magnetic systems, Forces/torques in systems with permanent magnets, Dynamical equations of electromechanical systems.

MODULE IV

D.C. Generators**:** DC Generators, Construction, Basic principle of operation , Types of DC machines, Armature windings, single and double layers, windings & winding diagrams, E.M.F., characteristics of DC machines and their applications, various losses, efficiency and power flow diagrams. Armature reaction, Commutation.

MODULE V

D.C. Motor**:** Principle of operation, back emf**,** torque equations**,** characteristics, starting of shunt and series motor, starters, speed control methods-field and armature control, Ward Leonard method, Braking: plugging, dynamic and regenerative braking, Introduction of stepper motor, Universal motor, Reluctance motor.

Text/Reference Books:

1. Electric Machinery, A.E. Fitggerald, C.Kingsley Jr and Umans, 6th Edition McGraw Hill,
2. Electric Machines, Kothari & Nagrath 3/e,TMH
3. The Performance and Design of AC machines, M.G. Say, Pit man & Sons.
4. Electrical Machines, Husain Ashfaq , Dhanpat Rai & Sons
5. Electrical Machinery, P. S. Bimbhra, Khanna Pub.
6. Electric Machinery Fundamentals, Stephen J Chapman, McGraw-Hill

Vivekananda Global University

B.Tech in Robotics Engineering **Semester VI**

BEC 602 DIGITAL COMMUNICATION

3L-1T-0P-3.5C **M.M. 100**

MODULE I:
INTRODUCTION - Source and signal, Model of digital communication, channel of digital communication, Type of Digital Signal. Sampling, Type of Sampling, Sampling Theorem for Low Pass and Band Pass Signals, Aliasing, Aperture Effect. **Pulse Modulation:** Pulse Amplitude Modulation (PAM), Time Division Multiplexing (TDM), Channel Bandwidth for PAM-TDM Signal, Introduction to Pulse Position and Pulse Duration Modulation.

MODULE II:
PULSE CODE MODULATION: DIGITAL SIGNAL - Uniform and Non-uniform Quantization, Quantization Error, Pulse Code Modulation (PCM), Signal-to-Noise Ratio in PCM, Companding, Inter-symbol Interference, Differential PCM (DPCM), Delta Modulation (DM), and Adaptive Delta Modulation (ADM).

MODULE III:
DIGITAL MODULATION TECHNIQUES - Types of Digital Modulation Technique, Generation and Detection (Block Diagram), Spectrum and Bandwidth and probability of error of Amplitude Shift Keying (ASK), Binary Phase Shift Keying (BPSK), Binary frequency Shift Keying (BFSK), Differential Phase Shift Keying (DPSK), Offset and Non-offset Quadrature Phase Shift Keying (QPSK), M-ary PSK, M-ary FSK, Minimum Shift Keying, Quadrature Amplitude Modulation (QAM), Matched Filter, Optimum Filter.

MODULE IV:
SPREAD SPECTRUM MODULATION - Introduction to Spread Spectrum modulation, Generation and Characteristics of p-n Sequences, Direct sequence Spread Spectrum System, Code Division multiple Access with DS-SS, Frequency Hopping Spread Spectrum Type of frequency hopping.

MODULE V:
INFORMATION THEORY - Information, Entropy, Mutual Information, Channel Capacity, Shannon Theorem, Shannon- Hartley theorem. Coding: Type of coding, Shannon fano coding, Huffman coding, Linear block code, Minimum distance, Systematic & Non- Systematic form, Convolution code, code tree, Trellis Diagram, & State Diagram

Text/Reference Books:

1. Taub and Schilling: Principles of Communication System, TMH
2. Simon Haykins: Communication Systems, 4th Edition, John Wiley.
3. Singh and Sapre: Communication System, TMH
4. B.P. Lathi: Modern Analog and Digital Communication System, Oxford University Press
5. Tomasi: Advanced Electronics Communication Systems, 6th Edition, PHI
6. Couch: Digital and Analog Communication, Pearson Education.

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B.Tech in Robotics Engineering **Semester VI**

BEC 604 CMOS DIGITAL INTEGRATED CIRCUIT

3L-0T-0P-3C **M.M. 100**

MODULE I: Fabrication:- Fabrication process Flow: Basic steps, Mos Fabrication process, CMOS Fabrication process.MOS Transistor Theory: Current-voltage characteristics of MOSFETS, threshold voltage and body effect, MOSFET design equations, second order effects-body effect, Channel Length Modulation. MOSFET Capacitances

MODULE II: NMOS and CMOS Inverter: NMOS and CMOS inverters, W/L ratio for NMOS and CMOS inverters, β_n/β_p ratio, noise margin, NMOS and CMOS Voltage transfer Characteristics.

MODULE III: MOS Inverter's Switching Characteristics: Calculation of delay times, Inverter design with delay constraints, CMOS Delay and power dissipation-static power dissipation dynamic power dissipation.

MODULE IV: Stick Diagram & Layout: Stick diagrams: basics, CMOS design style, design rules: lambda based design rules, layout design. Combinational MOS Logic circuits: CMOS logic structure:- CMOS complementary logic, pseudo NMOS logic, Dynamic CMOS logic, CMOS Transmission gate (pass gate)

MODULE V: Introduction to VLSI System Design: Generalized VLSI Design flow, HDL based VLSI Design flow, Introduction to Verilog, Advantages of Verilog, Design Methodology-Top Up and Bottom UP Design methodology,Verilog modeling- Gate level, Data flow, behavioral modeling, and examples.Sequential MOS Logic circuits-SR Latch NAND and NOR based JK Latch.

Text/ Reference Books:

1.Sung-Mo Kang, Yusuf Leblebici, CMOS Digital Integrated Circuits Analysis and Design, Tata Mc-Graw-Hill
2. Jab M. Rabaey, Anantha Chandra kasan, Borivoje Nikolic, Digital Integrated Circuits A Design Perspective, PHI.
3.Neil H.E. Weste, Kamrau Eshraghian, Principles of C-MOS VLSI Design A systems Perspective, Pearson Education
4.Douglas A. Pucknell & Kamran Eshraghian, Basic VLSI Design, PHI.
5.Michal John Sebastian Smith, Application-Specific Integrated Circuits, Pearson Education

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B.Tech in Robotics Engineering **Semester VI**

BEC 615 INDUSTRIAL AUTOMATION SYSTEMS

3L-0T-0P-3C **M.M. 100**

MODULE I:

Nature of Industrial Process: continuous & discrete state sequential process, process variables and their classification.

Introduction to Process Control Philosophies: type of relays, ladder logic methodology, ladder symbols.

MODULE II:

Introduction to Programmable Logic Controllers: advantages & disadvantages of PLC with respect to relay logic, PLC architecture, Input Output modules, PLC interfacing with plant, memory structure of PLC.

MODULE III:

PLC arithmetic and logical functions: addition, subtraction, multiplication, division instructions, increment decrement, trigonometric and log functions, AND, OR, XOR, NOT functions, PLC compare and convert functions.

MODULE IV:

PLC programming methodologies: ladder diagram, STL, functional block diagram, creating ladder diagram from process control descriptions, introduction to IEC61131 international standard for PLC

MODULE V:

PLC functions: bit logic instructions, ladder diagram examples, interlocking, latching, inter dependency and logical functions, PLC Timer & Counter functions on-delay timer, off-delay timers, retentive on-delay timers, pulse timers, timer examples, up-counter, down-counter and up- down counter, counter examples, register basics.

PLC Data Handling: data move instructions, table and register moves, PLC FIFO & LIFO functions**.**

Text/Reference Books:

1. John Webb, Programmable Logic Controllers Principles & applications, PHI
2. T. A. Hughes, Programmable Controllers
3. C. D. Johnson, Process Control Instrumentation
4. Terry Bartlet , "Industrial Control Electronics Devices, Systems", Delma

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B.Tech in Robotics Engineering **Semester VI**

MGT 102 ENTREPRENEUR DEVELOPMENT

3L-0T-0P-3C **MM 100**

Module I

ENTREPRENEURSHIP: Historical perspective of entrepreneurship - Traits of Entrepreneurs - Types of Entrepreneurs – Intrepreneur -Difference between entrepreneur and intrepreneur - entrepreneurship in Economic growth - Factors affecting **e**ntrepreneurial growth, Major motives influencing entrepreneur.

Module II

BUSINESS: Small Enterprises: Definition Classification - Characteristics Web and e business - Ownership structure -Project formulation - Sources of information - Steps involved in setting up a business – Identifying, selecting a good business opportunity - Market survey and research - Techno economic feasibility assessment – Preliminary Project report – Project appraisal – Project implementation.

Module III

FINANCING & ACCOUNTING: Sources of finance - Institutional Finance - Term loans - Capital structure - Management of working capital -Costing, Break even analysis – Taxation - Income Tax, Excise Duty - Sales Tax - Purchasing Policies and procedures - Methods of purchasing - Stores management - Book keeping

Module IV

MARKETING & GROWTH STRATEGIES: Principles of marketing - Assessment of market needs - Demand forecasting, Product life cycle – Sales promotion Strategies - Product mix – Advertising - Distribution Channels - Growth strategies – Expansion –Diversification - Joint venture, Merger - Sub-contracting

Module V

INSTITUTIONAL SUPPORT TO ENTREPRENEURS: Institutional support to entrepreneurs - Government policy for small scale industries - Institutions forentrepreneurial growth – Various schemes - Self Help Group - Sickness in industry – Causes - Steps forcorrection and rehabilitation

Text/Reference Books:

1. Entrepreneurial Development, Khanka, S. S., S.Chand and Co Ltd, New Delhi, 1999.
2. Principles of Marketing, Philip Kotler, Prentice Hall of India, 1995.
3. Purchasing and Materials Management, Lamer Lee and Donald W. Dobler, TMH
4. EDII–Faculty and External Experts, A Hand Book of new Entrepreneurs, Published by Entrepreneurship Development Institute of India, Ahmedabad, 1986.
5. Entrepreneurial Development, Saravanavel, P., Ess Pee Kay Publishing House, Chennai, 1997.
6. Hand book of Materials Management, Gopalakrishnan, P., Prentice Hall of India, 1996.

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B.Tech in Robotics Engineering **Semester VI**

BME 605 FINITE ELEMENT MEHOD

3L-0T-0P-3C **MM 100**

Module I

Introduction to FEM and its applicability, Review of:Matrix algebra,Gauss elimination method, Uniqueness of solution, Banded symmetricmatrix and bandwidth.Structure analysis: Two-force member element, Local stiffness matrix,coordinate transformation, Assembly, Global stiffness matrix, imposition of Boundary conditions, Properties of stiffness matrix

ModuleII

One-dimensional Finite Element Analysis: Basics of structuralmechanics, stress and strain tensor, constitutive relation, Principle ofminimum Potential, General steps of FEM, Finite element model concept / Discretization, Derivation of finite elements, equations usingpotential energy approach for linear and quadratic 1-D bar element, shape functions and their properties, Assembly, Boundary conditions,Computation of stress and strain.

ModuleIII

Two Dimensional Finite Element Analysis: Finite element formulationusing three nodded triangular (CST) element , Plane stress and Plainstrain problems, Shape functions, node numbering and connectivity, Assembly,Boundary conditions, Isoparametric formulation of 1-D bar elements, Numerical integration using gauss quadrature formula, computation ofstress and strain.

ModuleIV

Finite Element Formulation from Governing Differential Equation:Method of Weighted Residuals, Collocation, Sub domain method, Least Square method and Galerkin'smethod, Application to one dimensional problems, one-dimensional heattransfer, etc. introduction to variational formulation (Ritz Method.)

ModuleV

Higher Order Elements: Lagrange's interpolation formula for one andtwo independent variable, Convergence of solution, compatibility,element continuity, static condensation, p and h methods of meshrefinement, Aspect ratio and element shape,Application of FEM, Advantages of FEM, Introduction to concept ofelement mass matrix in dynamic analysis.

Text/Reference Books:

1. SeshuP.,"Text Book of Finite Element Analysis", Prentice Hall India
2. Dixit, U. S., "Finite Element Methods for Engineers" Cengage Learning
3. Finite Element Procedures in Engineering Analysis, Bathe K.J., Prentice Hall India.
4. An Introduction to the Finite Element Method, Reddy J.N., Tata McGraw-Hill, New Delhi.
5. Concepts & Applications of Finite Element Analysis, Cook and Plesha, Willey India New Delhi.
6. Introduction to Finite Elements in Engineering, Chandupatla and Belegundu, Prentice Hall India.

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B.Tech in Robotics Engineering **Semester VI**

BEC 610 DIGITAL COMMUNICATION LAB

0L-0T-2P-1C **M.M. 100**

1. (a) To observe sampling of analog signal. Identify & solve the aliasing problem.
   (b) To observe the Transmission of two signals over a single channel using sampling methods.
2. TDM-PAM: Modulation & demodulation.
3. Operation of a PCM encoder & decoder.
4 TDM-PCM: Modulation & demodulation.
5. Observe the performance of a Delta modulation system & to derive from it a delta sigma modulation system.
6. To generate and study the various data formatting schemes (Unipolar, Bi-polar, Manchester,AMI etc.).
7. Generate ASK signals, with and without carrier suppression. Demodulation of these two types of modulated signal.
8. Generate the FSK wave forms & demodulate the FSK signals based on the properties of (a) Tuned circuits (b) PLL
9. Generate the PSK signals and demodulate it.

Simulation using any virtual Instrumentation Software:

10. To carry out convolution in both continuous time and discrete time systems.
11. Companding and multiplexing of PCM signals.
12. Perform various keying Techniques: PSK, ASK, FSK & MSK.

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B.Tech in Robotics Engineering **Semester VI**

BEE 613 ELECTROMECHANICAL ENERGY CONVERSIONS AND D.C. MACHINESLAB.

0L+0T+2P +1C **MM 100**

1. To perform direct load test on a D.C. shunt motor and plot curve for efficiency variations
2. To obtain Speed-Torque Characteristics curve for D.C. Shunt Motor
3. To perform Speed Control of D.C. Shunt Motor by varying armature winding resistance.
4. To perform Speed Control of D.C. Shunt Motor by field control method.
5. To perform Speed Control of D.C. Shunt Motor by controlling supply voltage.
6. To open circuit and short circuit test on DC machine.
7. To perform Swinburne's Test on D.C. Shunt Motor.
8. To perform Hopkinson's regenerative Test on D.C. Shunt Motor.
9. To measure field winding and armature winding resistance. Plot the external characteristics of D.C. shunt generator.
10. To obtain magnetization characteristics of a D.C. Shunt Generator.

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B.Tech in Robotics Engineering **Semester VI**

BEC 612 VLSI AND VHDL LAB

0L-0T-2P-1C **M.M. 100**

PART-I

Schematic design and make Device Level Layout of following circuits.

1. BJT/FET Amplifier in various configuration..
2. Counters, Shift Registers & Sequence Decoders.
3. Various circuits with Op-Amp.

PART-II

Design of following ckt using appropriate software like VHDL/ FPGA.

4. Design all gates using VHDL.
5. Write VHDL programs for the following circuits, check the wave forms and the hardware generated:
   a. half adder b. full adder
6. Write VHDL programs for the following circuits, check the wave forms and the hardware generated:
   a. multiplexer b. demultiplexer
7. Write VHDL programs for the following circuits, check the wave forms and the hardware generated:
   a. decoder b. encoder
8. Write a VHDL program for a comparator and check the wave forms and the hardware generated
9. Write a VHDL program for a code converter and check the wave forms and the hardware generated
10. Write a VHDL program for a FLIP-FLOP and check the wave forms and the hardware generated
11. One mini project of VHDL & VLSI Design.

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B.Tech in Robotics Engineering **Semester VI**

BME 609 FINITE ELEMENT METHOD SESSIONAL

0L-0T-3P-1.5C **MM 100**

Laboratory work for the solution of solid mechanics problems, heat transfer problems, and free vibration problems

A: by using FE packages such as NASTRAN/ ANSYS/ SIMULIA/ ABAQUS

2 Introduction of GUI of the software in the above mentioned areas realistic problems.

3 Analysis of beams and frames (bending and torsion problems)

4 Plane stress and plane strain analysis problems

5 Problems leading to analysis of axisymmetric solids

6 Problems leading to analysis of three dimensional solids

(a) Heat transfer problems

(b) Modal analysis problem

B: by writing own code for finite element analysis using MATLAB for:

7 Plane stress and plane strain analysis problems

8 Modal Analysis problem

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B.Tech in Robotics Engineering **Semester VII**

BME 611 CAMPUS RECRUITMENT TRAINING (Technical)

0L-0T-2P-1.0C **MM 100**

Module I

Fluid Mechanics: Basic Concepts and Properties of Fluids, Manometry, Fluid Statics, Buoyancy, Equations of Motion, Bernoulli's equation and applications, Viscous flow of incompressible fluids, Laminar and Turbulent flows, Flow through pipes and head losses in pipes.

Module II

Thermodynamics and Heat transfer: Thermodynamic systems and processes; properties of pure substance; Zeroth, First and Second Laws of Thermodynamics; Entropy; analysis of thermodynamic cycles related to energy conversion: Rankine, Otto, Diesel and Dual Modes of heat transfer, Steady and unsteady heat conduction, Thermal resistance, Fins, Free and forced convection, Correlations for convective heat transfer.

Module III

IC Engines, Refrigeration and Air conditioning:
SI and CI Engines, Engine Systems and Components, Performance characteristics and testing of IC Engines; Fuels; Emissions and Emission Control. Vapor compression refrigeration, Refrigerants and Working cycles, Compressors.

Module IV

Engineering Materials: Basic Crystallography, Alloys and Phase diagrams, Heat Treatment, Ferrous and Non Ferrous Metals, Non metallic materials, Mechanical Properties and Testing, Corrosion prevention and control

Mechanisms and Machines: Types of Kinematics Pair, Mobility, Inversions, Kinematic Analysis, Velocity and Acceleration Analysis of Planar Mechanisms, CAMs with uniform acceleration and retardation, cycloidal motion, oscillating followers; Vibrations –Free and forced vibration of undamped and damped .

Module V

Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as riveted, welded and bolted joints. Shafts, Spur gears, rolling and sliding contact bearings, Brakes and clutches, flywheels.

Text/Reference Books:

1. Mechanical Engineering for Competitions, R. K. Jain, Khanna Publishers, New Delhi.
2. Questions & Answers in Mechanical Engineering, R.K.Rajput, S.Chand and Co Ltd, New Delhi.

Vivekananda Global University

B.Tech in Robotics Engineering **Semester VII**

BEC 716 ROBOTICS & FLEXIBLE AUTOMATION

3L-0T-0P-3C **M.M. 100**

MODULE I: Robot Coordinate System- Position and orientation of objects, Object coordinate frames, Rotations matrix, Euler angles , Roll pitch and yaw angles coordinate, Transformations, Joint variables and position of end effecter, Dot and Cross products, coordinates frames, Rotations, Homogeneous coordinates

MODULE II: Forward Kinematic -Introduction to Forward kinematic, Denavit-Hartenberg (D-H) representation (with examples), The arm equation, the arm matrix of serial link manipulators, forward/direct kinematic analysis for serial link manipulators.

MODULE III: Inverse Kinematic - Introduction to inverse kinematics, General properties of inverse kinematic solution, Tool configuration vector, Tool configuration of serial link manipulators with examples of five axis. Articulated robot and four-axis SCARA Robot. Inverse kinematics of a serial link manipulator

MODULE IV: Velocity and Static Analysis of robotic manipulators- Linear and angular velocity of links, Velocity propagation, Manipulator Jacobians for serial and parallel manipulators, Velocity ellipse and ellipsoids, Singularity analysis for serial and parallel manipulators, Loss and gain of degree of freedom, Statics of serial manipulators, work space analysis of serial link manipulators

Dynamics of serial manipulators- Mass and inertial of links, Lagrangian formulation for equations of motion for serial manipulators, Kinetic and potential energy, Lagrangian-Euller dynamic mode., Direct and inverse dynamics, Recursive dynamics using Newton-Euler formulation

MODULE V: Motion Planning and Control-Joint and Cartesian space trajectory planning and generation, Classical control concepts using the example of control of a single link, Independent joint PID control, Control of a multi-link manipulator, Non linear model based control schemes.

Robot programming- On line programming, teach pendant control, Lead through programming, Walk through programming, off line programming, Task programming.

Text/Reference Books:

1. Schilling, R. J., Fundamentals of Robotics Analysis & Control, Prentice Hall of India
2. Fu, K. S., Gonzalez, R. C. and Lee, C. S., Robotics: Control, Sensing, Vision, and Intelligence, McGraw Hill
3. Craig, J. J., Introduction to Robotics: Mechanics and Control, Pearson Education
4. Deb, S. R., Robotics and Flexible Automation. McGraw .
5. Saha, S. K., Introduction to Robotics, McGraw Hill

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B.Tech in Robotics Engineering **Semester VII**

BME 702 COMPUTER INTEGRATED MANUFACTURING

3L-0T-0P-3C **MM 100**

Module I

INTRODUCTION: Overview of manufacturing processes, types of manufacturing systems, the product cycle, computer's role in manufacturing, sources and types of data used in manufacturing. THE BEGINNING OF CAM: Historical Background, Basic components of NC systems, NC Procedure, NC coordinate system and machine motions, applications and economics of NC.

Module II

PART PROGRAMMING: Manual and computer assisted such as APT Language. COMPUTER CONTROLS IN NC SYSTEMS: Problems with conventional NC computer numerical control, Direct numerical control, combined CNC/ DNC systems, adaptive control machining system computer process interfacing, New development and latest trends.

Module III

COMPUTER AIDED PROCESS PLANNING: Traditional Process Planning, Retrieval process planning system, Generative Process Planning, Machinability data system, computer generated time standards. GROUP TECHNOLOGY: Introduction, part families, part classification and coding, coding system and machining cells.

Module IV

COMPUTER AIDED PRODUCTION MANAGEMENT SYSTEMS: Introduction to computer aided PPC, Introduction to computer aided inventory management, manufacturing resource planning (MRPII), computer process monitoring and shop floor control, computer process control. COMPUTER AIDED QUALITY CONTROL: Computer in quality control, contact inspection methods, Non-contact inspection methods, optical and non-optical computer aided testing. COMPUTER AIDED MATERIAL HANDLING: Computer control on material handling, conveying, picking. Ware house control, computerized material handling for automated inspection and assembly.

Module V

COMPUTER AIDED MANUFACTURING SYSTEMS: Introduction, types special manufacturing systems, flexible manufacturing systems (FMS). COLLABORATIVE ENGINEERING: Introduction, Faster Design throughput, Web based design, changing design approaches, extended enterprises, concurrent engineering, Agile and lean manufacturing.

Text/Reference Books:

1. Computer Aided manufacturing, Chang and Wang, Pearson Publisher.
2. Automation Production Systems and Computer Integrated manufacturing, Grover M.P., Pearson Publisher.
3. CAD/CAM: Principles and Applications, Rao P.N., McGraw-Hill Publication.
4. Computer Control of Manufacturing System, Koren Y., McGraw-Hill Publication.
5. Computer Aided Manufacturing, Rao and Khundra, McGraw-Hill Publication.
6. Computer Numerical Control: Machining and Turning Center, Ruesada and Jeyapoovan, PearsonPublisher

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B.Tech in Robotics Engineering **Semester VII**

BME 703 MECHANICAL VIBRATION

3L-1T-0P-3.5C **MM 100**

Module-I

Introduction, Classification of Vibration Systems, Harmonic motion, Vector re[presentation of harmonic motion, Natural frequency & response, Effects of vibration, superposition of simple harmonic motions, beats, Fourier analysis-analytical and numerical methods.

Single Degree Freedom System, Equation of motion, Newton's method, D'Alembert's principle, Energy method etc., Free vibration, Natural frequency, Equivalent systems, Displacement, Velocity and acceleration, Response to an initial disturbance, Torsional vibrations, Damped vibrations, Vibrations of systems with viscous damping, Logarithmic decrement, Energy dissipation in viscous damping.

Module-II

Single Degree Freedom: Forced Vibration Forced vibration, Harmonic excitation with viscous damping, steady state vibrations, Forced vibrations with rotating and reciprocating unbalance, Support excitation, Vibration isolation, Transmissibility, Vibration measuring instruments, Displacement, velocity and acceleration measuring instruments

Module-III

Two Degree Freedom systems Introduction, Principal modes, Double pendulum, Torsional system with damping, Coupled system, Principle of vibration absorber, Undamped dynamic vibration absorbers, Torsional vibration absorber, Centrifugal pendulum absorbers, Vibration isolators and Dampers.

Module-IV

Multi-degree Freedom system: Exact Analysis, Undamped free and forced vibrations of multi-degree freedom systems, influence coefficients, Reciprocal theorem, Torsional vibration of multi-degree rotor system, Vibration of gear system, Principal coordinates, Continuous systems- Longitudinal vibrations of bars, Torsional vibrations of circular shafts.

Module-V

Multi Degree Freedom system: Numerical Analysis by Rayleigh's method, Dunkerely's, Holzer's and Stodola methods, Rayleigh-Ritz method, Critical speed of shafts, Whirling of uniform shaft, Shaft with one disc with and without damping, Multi-disc shafts, Secondary critical speed.

Text/Reference Books:

1. Mechanical Vibrations – G. K. Groover, Jain Brothers, Roorkee.
2. Mechanical Vibrations-Theory & Practice, S Bhave, Pearson Education.
3. Mechanical Vibrations-Theory & Applications, Singhal, Katson Books.
4. Theory of Vibrations with Applications, Thomson&Dahleh, Pearson Education.
5. Elements of Vibration Analysis, L Meirovitch, McGraw-Hill Education.
6. Mechanical Vibrations – Tse, Morse & Hinkle
7. Mechanical Vibrations – V. Rama Murthy, Narosa Publications
8. Mechanical Vibrations – D. Nag, Wiley

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B.Tech in Robotics Engineering **Semester VII**

BME 704 THEORY OF COMBUSTION AND EMISSION

3L-0T-0P-3C **MM 100**

MODULE I

COMBUSTION PRINCIPLES : Combustion – Combustion equations, heat of combustion - Theoretical flame temperature - chemical equilibrium and dissociation - Theories of Combustion - Pre-flame reactions - Reaction rates - Laminar and Turbulent Flame Propagation in Engines.

Module II

COMBUSTION IN S.I. ENGINE: Initiation of combustion, stages of combustion, normal and abnormal combustion, knocking combustion, pre-ignition, knock and engine variables, features and design consideration of combustion chambers. Flame structure and speed, Cycle by cycle variations, Lean burn combustion, stratified charge combustion systems. After treatment devices for SI engines.

Module III

COMBUSTION IN C.I. ENGINE: Stages of combustion, vaporization of fuel droplets and spray formation, air motion, swirl measurement, knock and engine variables, features and design considerations of combustion chambers, delay period correlations, heat release correlations, Influence of the injection system on combustion. Direct and indirect injection systems. After treatment devices for diesel engines.

Module IV

EMISSIONS: Main pollutants in engines, Kinetics of NO formation, NOx formation in SI and CI engines. Unburned hydrocarbons, sources, formation in SI and CI engines, Soot formation and oxidation, Particulates in diesel engines, Emission control measures for SI and CI engines, Effect of emissions on Environment and human beings.

Module V

Combustion and Flames: Gaseous fuel flames: laminar and turbulent premixed flames, explosion limits, flame ignition and quenching, diffusion flames, simple models Combustion of liquid fuels: fuel spray (formation and size distribution),evaporation of a single droplet, simple model of droplet burningCombustion of solid fuels: simple models of carbon combustion.

Text/Reference Books:

1. Ramalingam, K.K., Internal Combustion Engines, Scitech Publications (India) Pvt. Ltd., 2004.
2. Ganesan, V, Internal Combustion Engines, Tata McGraw Hill Book Co., 2003.
3. John B.Heywood, Internal Combustion Engine Fundamentals,McGraw Hill Book, 1998
4 Mathur,M.L., and Sharma,R.P., A Course in Internal Combustion Engines, DhanpatRai Publications Pvt. New Delhi-2, 1993.
5 Obert,E.F., Internal Combustion Engine and Air Pollution, International Text Book Publishers, 1983.
6 Cohen,H, Rogers,G,E.C, and Saravanamuttoo, H.I.H., Gas Turbine Theory, Longman

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B.Tech in Robotics Engineering **Semester VII**

BME 705 TRIBOLOGY

3L-0T-0P-3C **MM 100**

Module I: Introduction to trobological systems and their characteristic features; analysis and assessment of surface; topography; deterministic and stochastic tribo-models for asperity contacts; techniques of surface examination; technological properties of surfaces.

Module II: Quantitative laws of sliding friction, causes of friction, adhesion theory, laws of rolling friction, measurement of friction

Module III: Introduction, mechanism of wear, types of wear, quantitative laws of wear, measurement of wear, wears resistance materials

Module IV: Introduction, dry friction, boundary lubrication, hydrodynamic, hydrostatic and elasto-hydrodynamic lubrication, functions of lubricants, types and properties, lubricant additives. Principles, application to rolling contact bearings, cams, Gears

Module V: Geometry and pressure equation of journal bearing, hydrostatic bearings, thrust bearings, porous bearings and hydrodynamic gas bearings. Journal bearings with specialized applications.General requirements and different types of bearing materials.

Text/Reference Books:

1 Tribology in Indertrion- By Sushil Kumar Srivastava
2 Introduction to Tribology of Bearings- By B.C. Majumdar ;A.H.Wheeler
3 Principles of Tribology – By J. Halling, Macmillan
4 Mechanics and Chemistry in Lubrication- By Dorinson and Ludema , Elsevier
5 Friction and wear of Materials- By E. Robinowicz, Johan Wiley
6 Principles of Lubrication-By A. Cameron, Longmans

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B.Tech in Robotics Engineering **Semester VII**

BME 706 WELDING TECHNOLOGY

3L-0T-0P-3C **MM 100**

Module I

Laser Beam Welding: Types of lasers, equipment, power calculation, applications, dual laser beam welding, use of fibre optics in LBW. Friction Stir Welding; Details of process and process parameters, specific applications.Electron Beam Welding; The interaction of electron beam with matter, mode of heat generation, mode of energy losses, details of the equipment, product design for EBW, case studies. Ultrasonic Welding; Propagation of ultrasonic waves in matter, mode of joint formation, joint types and design of product for ultrasonic welding, details of equipment and case studies cutting and gauging, flame cutting plasma arc welding, laser assisted cutting.

Module II

Heat flow in Welding: Significance, theory of heat flow cooling rate determination, selection of welding parameters based on heat flow analysis, residual stresses and distortion. Joint design, analysis of fracture and fatigue of welded joints.Automated welding systems.

Module III

Investment casting, shell moulding, squeeze casting, vacuum casting, counter-gravity flow-pressure casting, directional and monocrystal solidification, squeeze casting, semisolid metal casting, rheocasting.

Module IV

Solidification Gating and Risering, Nucleation and grain growth, solidification of pure metals, short and long freezing range alloys. Gating and riseringdesing calculations, Fluidity and its measurement.

Module V

CAE Of Welding And Casting: Design of weldment, application of finite element method in welding – determination of distortion in weldments, modeling of temperature distribution – case studies. Design for casting, application of finite element method in casting- determination of hot spots, location of turbulence and other defects, modeling of flow in molds, modeling of heat transfer in castings- casestudies.

Text/Reference Books:

1. John Campbell, "Casting Practice" Elsevier Science Publishing C0.,2004
2. Larry Jeffus, " Welding Principles and Applications" Delmar Publishers, 2004.
3. John Campbell " Casting Butterworth Heinemann, 2003.
4. KlasWeman, :Welding Processes Handbook", 2003.
5. Ravi B, "Metal Casting: Computer Aided Design and Analysis" Prentice Hall ,2005.
6. Richard L Little, "Welding and Welding Technology" Tata McGraw Hill, 2004.

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B.Tech in Robotics Engineering **Semester VII**

BME 707 INTRODUCTION OF BIO-MECHANICS

3L-0T-0P-3C **MM 100**

Module I

Introduction of Mechanics: Review of the principles of mechanics, Vector mechanicsResultant forces of Coplaner&Noncoplaner and Concurrent & non-concurrent forces, parallel force in space, Equilibrium of coplanar forces, Newton's laws of motion, Work and energy, Moment of inertia.

Module II

Biomechanics of Joints: Skeletal joints, forces and stresses in human joints, Analysis of rigid bodies in equilibrium, free body diagrams, types of joint, biomechanical analysis of elbow, shoulder, spinal column, hip knee and ankle.

Biofluid Mechanics: Introduction, viscosity and capillary viscometer, Rheological properties of blood, laminar flow, Couette flow and Hagen-poiseuille equation, turbulent flow.

Module III

Hard Tissues: Bone structure & composition mechanical properties of bone, cortical and cancellous bones, viscoelastic properties, Maxwell&Voight models – anisotropy.

Soft Tissues: Structure and functions of Soft Tissues: Cartilage, Tendon, Ligament, and Muscle; Material Properties: Cartilage, Tendon, Ligament, and Muscle; Modeling: Cartilage, Tendon, Ligament, and Muscle Cardiovascular Mechanics: Cardiovascular system, artificial heart valves, biological and mechanical valves development, testing of valves.

Module IV

Respiratory Mechanics: Mechanism of air flow, respiratory cycle, lung ventilation model, methods of determining pressure, flow rate and volume; spirometry.

Module V

Biomechanics of Implants: Design of orthopedic implant, specifications for a prosthetic joint, biocompatibility, requirement of a biomaterial, characteristics of different types of biomaterials, manufacturing process of implants, fixation of implants.

Text/Reference Books:

1. Y C Fung, Biomechanics: Mechanical Properties of Living Tissues, springer, 2nd edition, 1993.
2. N. Ozkaya and M. Nordin, Fundamentals of Biomechanics-Equilibrium, Motion and Deformation, springer-verlag, 2nd edition 1999
3. J. G Webster, Medical instrumentation –Application & design, John Wiley and sons Inc. 3rd ed. 2003.
4. D. J. Schneck and J. D. Bronzino, Biomechanics- Principles and Applications, CRC Press, 2nd Edition, 2000.

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B.Tech in Robotics Engineering **Semester VII**

BME 708 COMPUTATIONAL FLUID DYNAMICS

3L-0T-0P-3C **MM 100**

Module I
Philosophy of Computational Fluid Dynamics, Forms of Governing equations particularly suitable for CFD , Mathematical behavior of Partial Differential Equations – Hyperbolic equations – Parabolic equations – Elliptical equations.

Module II
Discretization – Introduction to finite differences- Difference equations – Explicit and Implicit approaches- stability – Simple CFD Techniques- Lax-Wendroff – Mac Cormack's – Viscous flow-Conservation form – Space marching- The Relaxation Technique – Pressure correction – Stream function, Vorticity method of solution.

Module III
Finite Volume Method – One Dimensional steady state diffusion – Two and Three Dimensional diffusion problems – One Dimensional steady convection & diffusion – Central differencing scheme – Upwind differencing scheme – QUICK scheme – SIMPLE, SIMPLER, SIMPLEC, PISO

Module IV
Finite Volume Method for Unsteady flow – One Dimensional Steady heat conduction – Explicit scheme – Crank-Nicholson scheme – Fully implicit scheme – Turbulence models- K- εmodel – Reynolds stress equation model.

Module V
Time integration Methods: Single and multilevel methods; predictor corrector methods; stability analysis; Applications to transient conduction and advection diffusion problems
Numerical Grid Generation: Numerical grid generation; basic ideas; transformation and mapping.
Navier-Stokes Equations: Explicit and implicit methods; SIMPLE type methods; fractional step methods.

Text/Reference Books:
1. John D Anderson Jr - "Computational Fluid Dynamics"– McGraw Hill
2. H.K Versteeg& W Malalasekera - "An Introduction to Computational Fluid Dynamics"–
3. S.V. Patankar Hemisphere - "Numerical Fluid Flow & Heat transfer"
4. HoftmanKlaw Vol-1 & 2 " Computational Fluid Dynamics"
5. T. Sundernajan- Narosa "Computational Fluid Flow and Heat Transfer"

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B.Tech in Robotics Engineering **Semester VII**

BME 709 PRODUCT DESIGN & DEVELOPMENT

3L-0T-0P-3C **MM 100**

Module-I

Introduction

Significance of product design, product design and development process, sequential engineering design method, the challenges of product development, Product Planning and Project Selection: Identifying opportunities evaluate and prioritize projects, allocation of resources

Module-II

Identifying Customer Needs: Interpret raw data in terms of customers need, organize needs in hierarchy and establish the relative importance of needs., Product Specifications: Establish target specifications, setting final specifications,

Module-III

Concept Generation: Activities of concept generation, clarifying problem, search both internally and externally, explore the output, Industrial Design: Assessing need for industrial design, industrial design process, management, assessing quality of industrial design, Concept Selection: Overview, concept screening and concept scoring, methods of selection.

Module-IV

Theory of inventive problem solving (TRIZ): Fundamentals, methods and techniques, General Theory of Innovation and TRIZ, Value engineering Applications in Product development and design, Model-based technology for generating innovative ideas Concept Testing: Elements of testing: qualitative and quantitative methods including survey, measurement of customers' response,

Module-V

Intellectual Property: Elements and outline, patenting procedures., claim procedure, Design for Environment: Impact, regulations from government, ISO system.,

Text/Reference Books:

1. Ulrich K. T, and Eppinger S.D, Product Design and Development, Tata McGraw Hill
2. Otto K, and Wood K, Product Design, Pearson
3. Engineering of creativity: introduction to TRIZ methodology of inventive Problem Solving, By Semyon D. Savransky, CRC Press.
4. Inventive thinking through TRIZ: a practical guide, By Michael A. Orloff, Springer.
5. Systematic innovation: an introduction to TRIZ ; (theory of inventive Problem Solving), By John Terninko, AllaZusman, CRC Press.

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B.Tech in Robotics Engineering **Semester VII**

BME 710 PROJECT

0L-0T-6P-3C **MM 100**

Objectives:

- To practice the steps involved for the selection, execution, and reporting of the project.
- To train the students for group activities to accomplish an engineering task.

Individual students are required to choose a topic of their interest. The subject content of the mini project shall be from emerging /thrust areas, topics of current relevance having research aspects or shall be based on industrial visits. At the end of the semester, the students should submit a report duly authenticated by the respective guide, to the head of the department.

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B.Tech in Robotics Engineering **Semester VII**

BME 711 PRODUCTION AND OPERATION MANAGEMENT AND OPTIMIZATION

3L-0T-0P-3C **MM 100**

Objective: The objective is to get the students acquainted with the design aspects of operations and material management and to develop relevant skill.

UNIT I : **Operations Management** – Meaning – Importance – historical contributions – System view of OM - Operation strategy and competitiveness - Functions of OM – types of production systems

UNIT II: Product design and process selection – Evaluation and Selection of appropriate Production and Operations technology, Product Design and process selection, Types of layout – analysis and selection of layout – Product and / or Process layout, **Transportation, Transshipment and Assignment problems.**

UNIT III : **Production planning and control** – meaning – functions – aggregate planning – master production schedule (MPS) – Material requirement planning (MRP) – BOM – Capacity requirement planning (CRP) – Techniques – problems in MRP and CRP – an introduction to MRP II and ERP – Business Process Re-engineering - Total Productive Maintenance (TPM)

UNIT IV : **Materials management** – functions – material planning and budgeting – Value Analysis - purchase functions and procedure - inventory control – types of inventory – safety stock – order point – service level – inventory control systems

Deterministic and Stochastic Inventory Models: Single and multi period models with continuous and discrete demands, Service level and reorder policy.

UNIT V :**Simulations:** Simulation Versus mathematical modelling, Monte Carlo simulation, simulation language ARENA, Example and cases.

Decision Theory: Decision under various conditions. **Total Quality Management Concept** (Case studies are compulsory)

Text/Reference Books:

1. Production and Operations Management – Everest E Adam & Ebert – PHI – publication forth edition.
2. Operations Management (Theory and Problems) – Joseph G Monks – McGraw Hill Intl.
3. Production and Operations Management – S N Chary – TMH Publications
4. Production and Operations Management – Pannerselvam, PHI
5. Lee J. Krajewski and Larry P. Ritzman, ―Operations Management: Process and value Chains‖, 7th Edition, PHI, 2007
6. Hunawalla and Patil – production and Operations Management, Himalaya.
7. Modern Production and operations management – E.S Buffa.
8. Lee J. Krajewski and Larry P. Ritzman, ― Operations Management: Strategy and Analysis‖, Addison Wesley.
9. Chase, Aquilano& Jacobs ―Production and Operations Management‖,Tata McGraw Hill..
10. Operations Research: Hira& Gupta, S. Chand. Publications

B.Tech in Robotics Engineering **Semester VII**

BME 712 MECHANICAL VIBRATION LAB

0L-0T-2P-1C **MM 100**

1. To study the forced vibration of the beam for different damping.
2. To determine the radius of gyration 'k' of a given compound pendulum.
3. To determine the radius of gyration of trifilar suspension.
4. To determine the radius of gyration of given bar using bi-filler suspension.
5. To verify the dunker lay's rule viz.
6. To study the pressure profile of lubricating conditions of load and speed.
7. To determine the natural frequency of undampedtorsional vibration of a single rotor shaft system.
8. To determine the natural frequency of undamped torsional vibration of two rotor shaft system.
9. To determine the frequency of undampedfree vibration of an equivalent spring mass system.
10. To determine the frequency of damped force vibration of a spring mass system.

B.Tech in Robotics Engineering **Semester VII**

BME 713 COMPUTER INTEGRATED MANUFACTURING LAB

0L-0T-2P-1C **MM 100**

1. Study of CNC Lathe including G Codes and M Codes.
2. Programming and Step turning on CNC Lathe.
3. Programming and Taper turning on CNC Lathe.
4. Programming and circular interpolation clock wise on CNC Lathe.
5. Programming and circular interpolation anti clock wise on CNC Lathe.
6. Programming and threading _16 mm on CNC Lathe.
7. Programming and drilling 8 mm x 20 mm depth on CNC Lathe.
8. Programming and grooving operation on CNC Lathe.
9. Programming and grooving on CNC Milling.
10. Programming and Drilling on CNC Milling.

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B.Tech in Robotics Engineering **Semester VII**

MGT 103 PROJECT FORMULATION AND APPRAISAL TECHNIQUES

0L-0T-2P-1C **MM 100**

Objective: The objective of this course is to help the students in understanding how project ideas are generated, how these ideas are translated into project report through the process of various appraisals and the tools for managing the project. The section on financial management aims to enlighten the students on appraising the projects from financial angle and the models to be considered for analyzing the financial risks of the project.

MODULE I Introduction – project attributes; project life cycle; role of managers; Management – scheduling; Gantt charts; CPM; PERT; crashing; Generation of project ideas – resource allocation; environment analysis – PEST analysis, porter's model; analysis of strategic capabilities – value chain, BCG matrix, flexibility

MODULE II Appraisal methods in project scanning and selection – market appraisal; technical appraisal; environmental appraisal; evaluating intangibles, social appraisal – SCBA, UNIDO, LM, CSR.

MODULE III Total quality management: Introduction - Need for quality - Evolution of quality - Definition of quality -Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, TQM principles , The seven traditional tools of quality – New management tools – Six-sigma.

MODULE IV **Financial Appraisal:** Time value of money; cost of capital – equity, debt, preference; weighted average cost; marginal and average cost; Capital budgeting – investment appraisal techniques; NPY; IRR; Payback period; replacement decisions; selection of exact discount factor – problems, inflation, taxation;

MODULE V: **Risk Analysis** models – single probability analysis; sensitivity analysis; break even analysis; certainty equivalent; uncertainty analysis, simulation; decision tree model; risk and utility.

Recommended Books

- Khatua Sitangshu. *Project Management and Appraisal*, Oxford University Press
- Pandey, I.M. *Financial Management*. Vikas Publishing House
- Prasanna, Chandra. *Financial Management*. Tata McGraw-Hill
- Maheshwari, S .N. & Maheshwari, S. K. *Advanced Management Accounting Vol.1 & Vol.2*. Vikas Publishing House
- Paresh Shah. *Management Accounting*. Oxford University Press

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B.Tech in Robotics Engineering **Semester VII**

BME 715 BASIC INDUSTRIAL ROBOTICS

0L-0T-2P-1.0C **MM 100**

Module-I

1. Robot Definition: Definition of robots, Evolution of robots, Laws of robots, International Robotic Standards, Why Robots? Types of robots, Selection of robots.

2. Robot Classifications: degrees of freedom; degrees of movements, robot configuration; accuracy and repeatability, specification of a robot ,actuators and sensors, drives and transmission systems used in robotics. Applications of robots.

Module-II

Coordinate Transformation: Direct kinematic problem in robotics, geometry based direct kinematic analysis coordinate & vector transformation using matrices, the orientation matrix & translator vector, homogeneous transformation matrices, three dimensional homogeneous transformations.

Module-III

Trajectory interpolation: Introduction, the necessity of interpolators, the generation of motion commands, the trajectory planning, basic structure of interpolators. The solvability of the inverse, kinematics problem. particular solutions for the inverse kinematics problem - two – axis planar mechanisms, example of three-axis spherical mechanism, specific solutions for six-axis manipulators.

Module-IV

Autonomous mobile robots: Introduction, locomotion - key issues for locomotion, legged mobile robots, leg configurations & stability , examples of legged robot locomotion , wheeled mobile robots, wheeled locomotion-the design space, wheeled locomotion: case studies.

Module-V

Mobile robot kinematics: introduction, kinematics models & constraints, representing robot position, forward kinematics models, wheel kinematics constraints, robot kinematics constraints, examples robot kinematics models & constraints. Mobile robot maneuverability- degree of mobility, degree of steerability, robot maneuverability. Mobile robot workspace-degree of freedom, holonomic robots, path & trajectory considerations. Motion control - open loop control, feedback control.

Text/Reference Books:

1) Robotics & Control – R.K. Mittal & I.J. Nagrath – TMH Publications
2) Robotics for engineers - Yoram Korean- McGrew Hill Co.
3) Industrial Robotics Technology programming and Applications - M.P.Groover, M.Weiss, R.N.Nagel, N.G.Odrey.
4) Robotics Control Sensing, Vision and Intelligence - K.S.Fu, R.C.Gonzalex, C.S.G.Lee- McGrew hill Book co.
5) Kinematics and Synthesis of linkages - Hartenberg and Denavit - McGrew Hill Book Co
6) Kinematics and Linkage Design - A.S. Hall - Prentice Hall

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B.Tech in Robotics Engineering **Semester VII**

BME716 SUSTAINABLE MANUFCATURING

3L-0T-0P-1.0C **MM100**

MODULE I:
Introduction: Concept of sustainability, manufacturing, operations, processes, practices, Resources in manufacturing, five M's, system approach to manufacturing, Basic experimental design, factor identification, quantification, comparison, selection.

Module2:
Life Cycle Analysis: product life cycles, life cycle of a manufacturing system Life Cycle Analysis: reduce, reuse, recycle; waste vs value approach, Life Cycle Analysis: remanufacture and disposal, tools for LCA, Optimization for achieving sustainability in unit manufacturing.

Module3:
Concept of lean manufacturing: Lean techniques for sustainable manufacturing Waste assessment, strategies for waste reduction in sustainable manufacturing, implementation of lean methods: validating requirements, Social aspects of Sustainable manufacturing: Long term and short term goals.

Module4:
Modern approaches for Sustainable Manufacturing Toxic substances in industry, and need of Renewable sources, Industry Symbioses for reducing Carbon footprint. Sustainable manufacturing systems: closed loop production systems, product acquisition management.

Module5:
Green manufacturing techniques: dry and near-dry machining , edible oil based cutting fluids Green manufacturing techniques: cryogenic machining for eco-efficiency Green manufacturing techniques: improving work environment.

Text/Reference Books:

1. Klemes, J., 2011. Sustainability in the process industry. McGraw-Hill.
2. Seliger, G., Khraisheh, M.M. and Jawahir, I.S. eds., 2011. Advances in sustainable manufacturing. Springer Science & Business Media.
3. Dornfeld, D.A. ed., 2012. Green manufacturing: fundamentals and applications. Springer Science & Business Media.

B.Tech in Robotics Engineering **Semester VIII**

BME 801 PRACTICAL TRAINING IN INDUSTRY (ONE SEMESTER)

0L+0T+0P+ 16C

Practical Training in industry is a need to interact with industry by student to understand working and culture of industries which helps the student to get practical experience.

Students will attend industrial training of six months in any industry or reputed organization in VIII semester.

The students will be assigned a faculty guide who would be the supervisor of the student. The faculty would be identified before the end of the VIII semester and shall be the nodal officer for coordination of the training.

Students will also be required to prepare an exhaustive technical report of the training during the semester which will be duly signed by the officer under whom training was taken in the industry/ organization. The covering format shall be signed by the concerned office in charge of the training. The officer-in-charge of the trainee would also give his rating of the student in the standard university format in a sealed to the higher authority.

The students will present his report about the training every month. A committee constituted by the Dean Engineering which would be comprised of at least three members comprising of the department coordinator, class coordinator and a nominee of the Dean Engineering. The students guide would be a special invitee to the presentation. The seminar session shall be an open house. The internal marks would be the average of the marks given is an open house session. The internal marks would be the average of the marks given be each member of the committee separately in a sealed envelope to the Dean Engineering

The marks by the external examiner would be based on the report submitted by the students which shall be evaluated by the external examiner and cross examination done of the student concerned.