

**MRSPTU UNDER GRADUATE OPEN ELECTIVES-III 2016 BATCH ONWARDS
(UPDATED ON 27.08.2019)**

UG OPEN ELECTIVES-III 2016 BATCH ONWARDS		
Internal	External	Total
40	60	100

NOTE: MORE COURSES MAY BE ADDED IN THIS LIST LATER ON

UG OPEN ELECTIVES-III 2016 BATCH ONWARDS		
COURSE CODE	COURSE	NOT APPLICABLE FOR PROGRAMMES
BECE0-F97	Advance Process Control	B. Tech. ECE
BECE0-F98	Digital Signal Processing	
BECE0-F99	Antenna and Wave Propagation	B.Tech. Electrical Engineering
BELE0-F97	Energy Management	
BELE0-F98	Special Electrical Machines	
BELE0-F99	Microcontrollers	B.Sc. (Hons. School) in Maths
BMAT0-F93	Partial Differential Equations and Special Functions	
BCIE0-F98	Design of Concrete Structure-I	B. Tech. Civil
BCIE0-F99	Surveying	
BCIE0-F9A	Environmental Engineering - I	B. Tech. CSE
BCSE0-F97	Internet Web Development	
BCSE0-F98	Cloud Computing & BigData	
BBAD0-F98	Banking and Insurance Operations	Management
BBAD0-F99	Corporate Strategy	
BBAD0-F9A	Marketing Management	
BEEE0-F98	Soft Computing	B. Tech. EEE
BEEE0-F99	Image Processing	
BTEX0-F91	Apparel Merchandising	B. Tech. Textile
BTEX0-F92	Intellectual Property Rights & Patenting System in India	
BMEE0-F94	Material Science & Engineering	B. Tech. Mechanical Engg.
BMEE0-F95	Robotics Engineering	
BMEE0-F96	Engineering Metrology	
BMEE0-F97	Operations Research	

ADVANCE PROCESS CONTROL

Subject Code: BECE0-F97

L T P C
3 0 0 3

Duration: 36 Hrs.

Learning Objectives:

1. To outline the review & limitations of single loop control, need for multi-loop systems
2. To introduce the concept of advanced process control techniques.
3. To illustrate the concept of programmable logic controls.

Learning Outcomes:

Students will be able to:

1. Represent and read the instrumentation scheme using P / I diagrams.
2. Analyze and implement selective & auctioneering control system.
3. Design of control systems for multivariable process.

UNIT-I

Introduction: Review & limitations of single loop control, need for multi-loop systems P / I diagrams, standard instrumentation symbols for devices, signal types, representation & reading of instrumentation scheme using P / I diagrams.

UNIT-II

Advanced Process Control Techniques: principle, analysis & applications of cascade, ratio, feed forward, override, split range, selective & auctioneering control system with multiple loops, dead time compensation, adaptive control, inferential control.

UNIT-III

Design of Control Systems for Multivariable Process: multivariable control system, interaction in multiple loops, RGA method for minimizing interactions, Distillation column, absorbers, heat exchangers, furnaces and reactors.

UNIT-IV

Introduction to Computer Control Systems in Process Control: DCS configuration, control console equipment, communication between components, local control units, DCS flow sheet symbols, DCS I/O hardware & set point stations. Supervisory control & data acquisition system
Programmable logic controls: Introduction, relative merits over DCS & relay, programming languages, hardware & system sizing, PLC installation, maintenance & troubleshooting.

Recommended Books:

1. C.D. Johnson, 'Process Control Instrumentation Technology', PHI.
2. Krishan Kant, 'Computer based Industrial Control', PHI.
3. Andrew Parr, 'Pneumatic & Hydraulic', PHI.
4. D. Considine, 'Process Industrial Instruments & Control Handbook', McGraw Hill.
5. B.G. Iptak, 'Instrument Engineers Handbook', CRC Press.

DIGITAL SIGNAL PROCESSING

Subject Code: BECE0-F98

L T P C
3 0 0 3

Duration: 37 Hrs.

Learning Objectives:

1. To study the concept of digital signal processing and its characteristics.

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2. To learn discrete Fourier transform and its properties
3. To know the characteristics of IIR and FIR filters and learn the design of infinite and finite impulse response filters for filtering undesired signals
4. To understand Discrete Time Fourier Transform and Fast Time Fourier Transform

Learning Outcomes:

Upon completion of the Course, students will be able to

1. Apply DFT for the analysis of digital signals & systems.
2. Design IIR and FIR filters.
3. Design the Multi rate Filters.
4. Apply Adaptive Filters to equalization.

UNIT-I

Introduction to DSP, Time and Frequency domain description of different type of signals & systems, Discrete time sequences systems, Linearity unit sample response, Convolution, Time invariant system, Stability criteria for discrete time systems.

UNIT-II

Introduction to Fourier transform of Discrete Time Signal and its properties, Inverse Fourier transform, Sampling of continuous time signal, Reconstruction of continuous time signal from sequences, Z-Transform and its properties, complex Z-plane, ROC. Relationship between Fourier Transform and Z-Transform, Inverse Z-Transform.

UNIT-III

Discrete Time Fourier Transform and its properties, Linear convolution, Circular convolution, convolution from DFT, FFT, Inverse Fast Fourier Transform, Decimation in time and frequency algorithm.

UNIT-IV

Filter categories, Finite impulse response filters, various design techniques of FIR filters, FIR filter design by Windowing method, Rectangular, Triangular and Blackman window, Kaiser window. Design of IIR by Approximation of derivatives, Impulse invariant method and Bilinear Transformation method. Steps in Filter Design of Butter worth, Elliptic filter, Chebyshev filters, Frequency Transformation, Applications of DSP.

Recommended Books:

1. Oppenheim & Schaffer, 'Discrete time Processing', PHI.
2. Proakis & D.G. Monolakis, 'Digital Signal Processing', PHI.
3. S.K. Mitra, 'Digital Signal Processing', PHI.
4. E.C. Ifeacher, B.W. Jervis, 'Digital Signal Processing', Addison Wesley.

ANTENNA AND WAVE PROPAGATION

Subject Code: BECE0-F99

**L T P C
3 0 0 3**

Duration: 38 Hrs.

Learning Objectives:

1. To provide knowledge about the propagation of electromagnetic wave along different mediums like guided, unguided medias and in space with basic understanding of transmission lines and the method of solving different problems related to it.
2. Study of physical concept of radiation patterns and all the important Fundamental Parameters of antennas with antenna Arrays in the antenna terminology

Learning Outcomes:

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1. An ability and development of skill of students to design highly effective communication system.
2. After completion of the Course, students will be aware with the various performance parameters of the antenna system design and antenna arrays.
3. Understand various types of antennas such as microstrip and Yagi-uda antennas.
4. To understand Ground wave propagation.

UNIT-I

Antenna Basics Directional properties of antennas, Radiation patterns, antenna gain and aperture, antenna terminal impedance, self and mutual impedance, front to back ratio, antenna beam width and bandwidth, antenna efficiency, antenna beam area, polarization, antenna temperature and Reciprocity properties of antennas.

UNIT-II

Antenna Arrays: Classification of arrays, linear arrays of two point sources, linear arrays of n-point sources, pattern multiplication, array factor, linear arrays of equal amplitude and spacing (Broadside and end fire arrays) of n-point sources, directivity and beam width, non-uniform arrays excitation using Binomial series.

UNIT-III

Special Antennas: VLF and LF antennas (Hertz and Marconi antennas), effects of antenna height and effect of ground on performance of antenna, Rhombic antennas, Loop antennas, receiving antenna and radio direction finders. Folded dipole antennas, Yagi-uda antenna, horn antennas, microwave dish, helical antennas, frequency independent antennas, microstrip antennas, fractal antennas.

UNIT-IV

Ground Wave Propagation: Characteristics for ground wave propagation, reflection at the surface of a finitely conducting plane and on earth, Attenuation Calculation of field strength at a distance.

Ionosphere Propagation: The ionosphere, formation of the various layers, their effective characteristics, reflection and refraction of waves by ionosphere, virtual height, maximum frequency, skip distance, regular and irregular variation of ionosphere, Fading and Diversity reception, ordinary and extraordinary waves.

Space Wave Propagation: Space wave, range and effect of earth, Troposphere waves-reflection, refraction, duct propagation, Troposphere scatter propagation link

Recommended Books:

1. J.D. Kraus, 'Antennas', McGraw Hill.
2. C.A. Balanis, 'Antennas Theory and Design', Wiley.
3. K.D. Prasad, 'Antenna & Wave Propagation', Satya Parkashan, New Delhi.
4. E.C. Jordan & B.C. Balmain, 'Electromagnetic waves & radiating System', PHI.
5. R.E. Collins, 'Antennas and Radio Propagation', McGraw Hill.

ENERGY MANAGEMENT

Subject Code: BELE0-F97

**L T P C
3 0 0 3**

Duration: 38 Hrs.

Learning Objectives:

1. To understand the importance of energy management and audit.
2. To study various types of energy dissipating elements in electrical system.
3. To understand energy audit processes of these systems used in the industry.

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Course Outcomes:

1. Students will gain the knowledge about various types of energy dissipating systems.
2. Students will get knowledge about various types of losses occurring in electrical systems.
3. Students will become aware about the Energy and load management.

UNIT-I (12 Hrs.)

Energy Scenario: Energy needs of growing economy, Long term energy scenario, Energy pricing, Energy sector reforms, Energy and environment: Air pollution, Climate change, Energy security, Energy conservation and its importance, Energy strategy for the future, Energy conservation Act-2001 and its features.

UNIT-II (12 Hrs.)

Electrical System: Electricity tariff, Load management and maximum demand control, Power factor improvement, Distribution and transformer losses. Losses in induction motors, Motor efficiency, Factors affecting motor performance, Rewinding and motor replacement issues, energy efficient motors. Light source, Choice of lighting, Luminance requirements, and Energy conservation avenues

UNIT-III (11 Hrs.)

Energy Management and Audit: Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution.

UNIT-IV (10 Hrs.)

Financial Management: Investment-need, Appraisal and criteria, Financial analysis techniques- Simple payback period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis, Financing options, Energy performance contracts and role of ESCOs.

Recommended Books:

1. Y.P. Abbi and S. Jain, 'Handbook on Energy Audit and Environment Management', T E R I Press, 2006.
2. Doti Steve, PE, CEM, 'Commercial Energy Auditing Reference Handbook', CRC Press, Taylor & Francis Group, 2010.
3. Desai Sonal, 'Handbook of Energy Audit', McGraw Hill Education, New Delhi, 2017.
4. Al-Shemeri Tarik, 'Energy Audits, A Workbook for Energy Management in Buildings', John Wiley & Sons, 2011.
5. Capehart, Turner and Kennedy, 'Guide to Energy Management', CRC Press, Taylor & Francis Group, 2008.

SPECIAL ELECTRICAL MACHINES

Subject Code: BELE0-F98

**L T P C
3 0 0 3**

Duration: 38 Hrs.

Learning Objectives:

To impart knowledge on construction, principle of operation, performance, control and applications of

1. Synchronous Reluctance motors and Switched Reluctance motors.
2. Permanent magnet brushless D.C. motors and permanent magnet synchronous motors.

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3. Stepper motors.

Course Outcomes:

1. Students will come to know about construction, types and principle of operation of synchronous reluctance motors, switched reluctance motors, permanent magnet brushless D.C. motors, permanent magnet synchronous motors and stepping motors.
2. They will develop understanding about performance characteristics of all these motors.
3. They will learn about control and applications of these motors.

UNIT-I (15 Hrs.)

Synchronous Reluctance Motors: Constructional features, Types, Axial and Radial flux motors, Operating principles, Variable Reluctance and Hybrid Motors, SYNREL Motors, Voltage and Torque Equations, Phasor diagram Characteristics, applications.

Switched Reluctance Motors: Constructional features, Rotary and Linear SRMs, Principle of operation, Torque production, Steady state performance prediction, Analytical method, Power Converters and their controllers, Methods of Rotor position sensing, Sensor less operation, Closed loop control of SRM, Characteristics, applications.

UNIT-II (10 Hrs.)

Permanent Magnet Brushless D.C. Motors: Permanent Magnet materials, Magnetic Characteristics, Permeance coefficient -Principle of operation, Types, Magnetic circuit analysis, EMF and torque equations, Commutation, Power controllers, Motor characteristics, control and applications.

UNIT-III (10 Hrs.)

Permanent Magnet Synchronous Motors: Principle of operation, Ideal PMSM, EMF and Torque equations, Armature reaction MMF, Synchronous Reactance Sine wave motor with practical windings, Phasor diagram, Torque/speed characteristics, Power controllers, Converter Volt-ampere requirements.

UNIT-IV (10 Hrs.)

Stepper Motors: Constructional features, Principle of operation, Variable reluctance motor, Hybrid motor, Single and multi-stack configurations, Torque equations, Modes of excitations, Characteristics, Drive circuits, Microprocessor control of stepping motors, Closed loop control.

Recommended Books:

1. T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford, 1989.
2. T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press, London, 1984.
3. A.F. Fitzgerald, Kingsley Charles, Umans Stephen, 'Electric Machinery', McGraw Hill Education, 2017.
4. E.G. Janardanan, 'Special Electrical Machines', PHI, 2014.
5. R. Srinivasan, 'Special Electrical Machines', Lakshmi Publications, 2013.

MICROCONTROLLERS

Subject Code: BELE0-F99

**L T P C
3 0 0 3**

Duration: 38 Hrs.

Learning Objectives:

1. To acquire knowledge about architecture of 8051 microcontroller.

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2. To understand program development tools and programming methods of 8051 microcontroller.
3. To interface peripheral devices with microcontrollers.

Course Outcomes:

1. The students will become familiar with architecture of 8051 microcontroller.
2. The students will learn about instruction set and assembly language programming of 8051 microcontroller.
3. Students will learn how to interface 8051 with peripheral devices.

UNIT-I (10 Hrs.)

8051 Microcontroller Architecture: Introduction to MCS -51 Family microcontrollers, Architectural block Diagram, Pin diagram and Pin Functions, General Purpose and Special Function Registers, Oscillator and clock circuit, Reset circuit, I/O Port circuits, Memory organization, Internal program and data memory.

UNIT-II (14 Hrs.)

Introduction to Program Development Tools (IDE): Concept of IDE, Editor, Assembler, Compiler, Linker, Simulator, Debugger and assembler directives.

8051 Assembly Language Programming: Programming model of 8051, Addressing modes, data transfer instructions, I/O Port programming, Arithmetic and Logical instructions, Bit level instructions, Branching instructions (Jump and loop Jump and call), Concept of stack, subroutine and related instructions, writing programs (like time delay using loop, data conversions HEX to ASCII, BCD to ASCII, use of look up table etc.) in assembly language 8051 and testing the same using IDE.

UNIT-III (12 Hrs.)

External Memory Interfacing: Memory address decoding, interfacing 8031/8051 with ROM/EPROM and Data ROM

8051 Timer/Counter and Programming: Use of counter as timer, Timer/Counters and associated registers, Various modes of timer/counter operations, Time delay programs in Assembly language/ Embedded C

8051 Serial Port and Programming: Basics of serial communication, RS232 standards, 8051 connection to RS232, Serial data input/output and associated registers, Various modes of serial data communication, serial data communication programs in Assembly language/ Embedded C.

8051 Interrupts: Concept of Interrupt, interrupt versus polling, Types of interrupts in 8051, Reset, interrupt control and associated registers, interrupt vectors, Interrupt execution, RETI instruction, software generated interrupt, interrupt handler subroutine for timer/counter and serial data transmission/reception in Assembly language/ Embedded C.

UNIT-IV (9 Hrs.)

Applications and design of microcontroller based systems: Interfacing of LEDs, 7 Segment display device, LCD display, DIP Switches, Push Button switches, Key debounce techniques, Keyboard connections, load per key and matrix form, Interfacing A/D converter, D/A converter, Relay, Opto-isolator, stepper motor and DC motor

Recommended Books:

1. M.A. Mazidi, J.G. Mazidi and R.D. Mckinlay, 'The 8051 Microcontroller and Embedded Systems: using Assembly and C', Pearson Education, **2007**.
2. Sunil Mathur, 'MICROPROCESSOR 8085 & ITS INTERFACING', 2nd Edn., Prentice Hall of India, **2011**.

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3. Mandal Soumitra Kumar, 'Microprocessors and Microcontrollers: Architecture, Programming and Interfacing Using 8085, 8086 and 8051', McGraw Hill Education, 2017.
4. B. Ram, 'Fundamentals of Microprocessors and Microcontrollers', Dhanpat Rai Publications Pvt. Ltd., 2008.
5. R.S. Gaonkar, 'The 8085 Microprocessor-Architecture, Programming and Interfacing', 6th Edn., Penram International Publishing (India) Pvt. Ltd., 2013.
6. D.V. Hall, S.S.S.P. Rao, 'Microprocessors and Interfacing', 3rd Edn., McGraw Hill Education, 2012.

PARTIAL DIFFERENTIAL EQUATIONS AND SPECIAL FUNCTIONS

Subject Code: BMAT0-F93

**L T P C
3 1 0 4**

Duration: 45 Hrs.

UNIT I (10 Hrs.)

Definition of PDE, Formation of partial differential equations, Linear partial differential equations, Homogeneous partial differential equations with constant coefficients, Cauchy's method of characteristic, Compatible system of first order PDE, Charpit's method of solution, Solutions satisfying given conditions, Jacobi's method of solution.

UNIT II (12 Hrs.)

Separation of variables in a PDE, Laplace, Wave and Diffusion equations, Elementary solutions of Laplace equations, Elementary solutions of one dimensional wave equation, Vibrating membranes, Diffusion equation, Resolution of boundary value problems for diffusion equation, Elementary solutions of diffusion equation.

UNIT-III (12 Hrs.)

Power series solution of differential equations, Frobenius method, Bessel's equation, Bessel functions of the first and second kind, Recurrence relations and orthogonal properties, Series expansion of Bessel Coefficients, Modified Bessel function.

UNIT-IV (11 Hrs.)

Legendre's differential equations, Legendre Polynomials, Rodrigue's formula, Recurrence relations and orthogonal properties, Hermite polynomials, Chebyshev's polynomial, Lagrange's polynomial, Recurrence relations, Generating functions and Orthogonal properties.

Recommended Books:

1. I.N. Sneddon, 'Elements of Partial Differential Equations', 3rd Edn., McGraw Hill Book Company, 1998.
2. E.T. Copson, 'Partial Differential Equations', 2nd Edn., Cambridge University Press, 1995.
3. Walter A. Strauss, 'Partial Differential Equations: An Introduction', 2nd Edn., 2007.
4. J.N. Sharma and K. Singh, 'Partial Differential Equations for Engineers and Scientists', 2nd Edn., Narosa Publication House, New Delhi, 2009
5. Jain, Iyenger Jain, 'Numerical Methods for Scientific and Engineering Computation', New Age International, New Delhi, 2010.
6. B.S. Grewal, 'Higher Engineering Mathematics', Khanna Publishers, 42nd Edn., 2016.

Design of Concrete Structure-I

Subject Code: BCIE0-F98

L T P C
3 0 0 3

Contact Hrs. 36

- Note: 1. IS 456, Indian Standard. Plain and Reinforced Concrete -Code of practice is permitted in examination.**
2. Examiner requested to provide requisite data for Mix Design Problems; if any.

Unit-I

CONCRETE MIX DESIGN: Introduction, Selection of mix proportions, Quality Control of concrete, Introduction of various mix proportion methods, Proportioning of concrete mixes by BIS method of mix design.

Unit-II

RCC Design Philosophies: Introduction, Objectives & methods of analysis & Design, Properties of Concrete and Steel. Philosophies of Working Stress Methods (WSM) & Limit State Method (LSM) in RCC design.

Shear, Torsion & Bond (Only Theory/Concept): Types of shear & torsion, importance in RCC Design Structures, IS Provisions for Shear & Torsion, Bond-types of bonds, Anchorage Bond, Development length & its determination.

Unit-III

RCC Beams: Types of beams, Behaviour in Flexure-Singly reinforced beam, Doubly reinforced beam, Flanged beam, Neutral Axis, Neutral Axis Depth, Moment of Resistance, Design of beams-Singly reinforced beam, Doubly reinforced beam.

Unit-IV

RCC Slabs: Types of slab systems, Guidelines for Design, Design of One Way and Two Way Slab.

Recommended Books:

1. Concrete Technology by M.S.Shetty. – S.Chand & Co.
2. Properties of Concrete by A.M.Neville – Prentice Hall
3. Concrete Technology by M.L. Gambhir. – Tata Mc. Graw Hill Publishers, New Delhi
4. Reinforced Concrete Design; Pillai & Menon; Tata McGraw-Hill Education
5. Advanced Design of Structures N. Krishna Raju

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Surveying

Subject Code: BCIE0-F99

**L T P C
3 0 0 3**

Contact Hrs. 36

Unit - I

Definition, principles of surveying, different types of surveys, topographical map, scale of map, Measurement of distances with chain and tape, direct & indirect ranging, offsets.

Instruments used in traversing, bearings, meridians, declination, dip of magnetic needle, bearing of lines from included angles, local attraction.

Unit-II

Principle of plane table survey, setting up the plane table and methods of plane tabling, Setting up a dumpy level, booking and reducing the levels by rise & fall method and height of instrument method, correction due to curvature and refraction, characteristics of contours, methods of contouring, uses of contour maps.

Unit – III

Temporary and permanent adjustments of theodolite, measurement of horizontal and vertical angles, closed & open traverse, Latitudes and Departures, closing error- Bowditch & Transit rules, Different cases of omitted measurements.

Unit – IV

Determination of tachometer constants, Measurement of horizontal & vertical distances with tachometer, Elements of curves, different methods of setting out of curves, transition curve.

Recommended Books:

1. B.C. Punmia, Ashok Kumar Jain, and Arun Kumar Jain, 'Surveying', Vol. I, II, Laxmi Publications, **2005**.
2. S.K. Duggal, Surveying Vol-I, Tata McGraw Hill, New Delhi.
3. R. Agor, 'Surveying', Khanna Publishers, **1982**.
4. S.S. Bhavikatti, 'Surveying & Levelling Vol. I, II, **2009**.
5. Narinder Singh, 'Surveying', Tata McGraw Hill.
6. N.N. Basak, 'Surveying and leveling', Tata McGraw Hill, New Delhi, **2000**.

Environmental Engineering-I

Subject Code: BCIE0-F9A

**L T P C
3 0 0 3**

Contact Hrs. 36

Unit - I

Introduction: Beneficial uses of water, water demand, per capita demand, variations in demand, water demand for firefighting, population forecasting and water demand estimation.

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Water sources and development: Surface and ground water sources, Selection and development of sources.

Unit - II

Pumps and pumping stations: Types of pumps and their characteristics and efficiencies; Pump operating curves and selection of pumps.

Quality and Examination of Water: Impurities in water, sampling of water, physical, chemical and bacteriological water quality parameters, drinking water quality standards and criteria.

Unit - III

Water treatment: Water treatment schemes, Basic principles of water treatment, Design of Plain sedimentation, coagulation, flocculation & filtration – slow sand, rapid filters disinfection units, break point chlorination, Fundamentals of water softening, fluoridation, dechlorination and defluoridation, taste and odour removal.

Unit - IV

Water Supply Systems: Pipes for transporting water and their design, water distribution systems and appurtenances; Water supply network design and design of balancing and service reservoirs; operation and maintenance of water supply systems.

Recommended Books:

1. Water Supply Engineering- Environmental Engg. (Vol. – I) by S.K. Garg, Khanna Publishers, Delhi.
2. Water Supply Engineering- Environmental Engg. (Vol. – I) by B.C. Punmia, Ashok Jain, Arun Jain, Laxmi Publications, New Delhi.
3. Environmental Engg. - A design Approach by Arcadio P. Sincero and Gregoria P. Sincero, Prentice Hall of India, New Delhi.
4. “Environmental Engg.” By Howard S. Peavy, Donald R. Rowe & George Tchobanoglous, McGraw Hill, International Edition
5. Water Supply and Sewerage by Steel EW and McGhee, Terence J.; McGraw Hill.

INTERNET WEB DEVELOPMENT

Subject Code BCSE0-F97

L T P C

Duration – 45 hrs

3 0 0 3

COURSE OBJECTIVE: The proposed Course exposes the CS/IS students to Web Technology. The Core Modules of this course includes Client/Server concepts, Introduction to Web Technology, Object Oriented concepts, User Experience design, Client tier using HTML, Java Script and XML, Business tier using POJO, Presentation tier using JSP. This program is independent of any organization / product / technology.

COURSE OUTCOMES

CO1: Understand the complexity of the real world objects

CO2: Learn the best practices for designing Web forms and Usability Reviews

CO3: Understand the Principles behind the design and construction of Web applications

CO4: Develop and Deploy an Enterprise Application

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COURSE CONTENT

UNIT-I (11 Hrs)

Objected oriented concepts – object oriented programming (review only), advanced concept in OOP, relationship, inheritance, abstract classes, polymorphism, Object Oriented design methodology, approach, best practices. UML class diagrams, interface, common base class

UNIT-II (12 Hrs)

Internetworking – Working with TCP/IP, IP address, sub netting, DNS, VPN, proxy servers, firewalls, Client/Server concepts - World Wide Web – components of web application, MIME types, browsers and web servers, types of web content, URL, HTML, HTTP protocol, Web applications, performance, Application servers, Web security.

User Experience Design, Basic UX terminology, UXD in SDLC, Rapid prototyping in Requirements

UNIT-III (11Hrs)

Client Tier using HTML5 – Basic HTML tags – Look and feel using CSS3, Client side scripting using Java Script(JS) and Validations - Document Object Model (DOM) - JQuery

UNIT-IV (11 Hrs)

Business tier using POJO (Plain Old Java Objects) – Introduction to Frameworks, Introduction to POJO, Multithreaded Programming, Java I/O, Java Database Connectivity (JDBC)

Presentation tier using JSP, Role of Java EE in Enterprise applications, Basics of Servlets, To introduce server side programming with JSP - Standard Tag Library

NOTE: This Subject is common to all branches. Only Introduction of the concepts is given to the students.

Recommended Books:

4. Douglas E Comer, 'Internet Book, the Everything You Need to Know About Computer Networking and How the Internet Works', 4th Ed., Prentice Hall, 2007
5. Jeffrey C. Jackson, 'Web Technologies: A Computer Science Perspective', Prentice Hall, 2007
6. <http://www.ietf.org/>
7. <http://www.w3.org/>
8. <http://www.vpnc.org/vpn-standards.html>
9. Herbert Schildt, 'Java: The Complete Reference', McGraw-Hill Professional, 2006.
10. Michael Nash, 'Java Frameworks and Components', Cambridge University Press, 2002.
11. Ted Wugofski, XML Black Book 2nd Ed., Certification Insider Press
12. <http://java.sun.com/docs/books/tutorial/>
13. Developing Web Applications with JavaServer Faces found online at <http://java.sun.com/developer/technicalArticles/GUI/JavaServerFaces/>
14. Short introduction to log4j found online at <http://logging.apache.org/log4j/1.2/manual.html>
15. J. Unit Cookbook by Kent Beck, Erich Gamma at <http://junit.sourceforge.net/>
16. <http://java.sun.com/>
17. <http://www.junit.org/>

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18. Marty Hall and Larry Brown, 'Core Servlets and JavaServer Pages Vol. 1: Core Technologies', 2nd Ed., Sun Microsystems.
19. Bryan Basham, Kathy Sierra, and Bert Bates, 'Head First Servlets and JSP', SPD O'Reilly, 2005.
20. The Complete reference - JSP
21. Servlet Tutorial can be found online at <http://java.sun.com/docs/books/tutorial>
22. <http://java.sun.com/javaee/javaserverfaces/reference/docs/index.html>
23. JSF Tutorial can be found online at <http://java.sun.com/j2ee/1.4/docs/tutorial/doc/JSFIntro.html>

CLOUD COMPUTING & BIG DATA

Subject Code BCSE0-F98

**L T P C
3 0 0 3**

Duration – 45 hrs

COURSE OBJECTIVE: This course will help you in learning Big data with Cloud technology to understand what is cloud storage, Big data in the cloud, characteristics of cloud computing, cloud computing services and cloud hosting, cloud data storage and deployment models, cloud computing companies and cloud service providers, cloud infrastructure, advantages of cloud computing and issues with cloud computing.

COURSE OUTCOMES:

CO1: Ability to learn basics of Big data, Hadoop and Map Reduce

CO2: Able to learn the basics of Hive, HQL, HBase schema design, PIG and NoSQL.

CO3: Understand various basic concepts related to cloud computing technologies, architecture and concept of different cloud models: IaaS, PaaS, SaaS. Cloud virtualization, cloud storage, data management and data visualization.

CO4: Understand different cloud programming platforms & tools and familiar with application development and deployment using cloud platforms.

COURSE CONTENT

UNIT-I (11 HRS)

Big Data – Introduction, its importance, 5v's, Security Challenges, need for Big data analytics and its applications.

Hadoop - Apache Hadoop Architecture, Hadoop YARN, Comparison of Traditional system & Hadoop Ecosystem, Installation steps of Hadoop (1.x), Moving Data in and out of Hadoop, need for Record Reader and Record writer, understanding inputs and outputs file format of Map Reduce.

UNIT-II (12 HRS)

Hive - Introduction to Hive, Hive Architecture and Installation, HQL vs SQL, Introduction to PIG, NoSQL.

UNIT-III (11 HRS)

Cloud Computing Fundamentals: Introduction to Cloud Computing, private, public and hybrid cloud. Cloud types: IaaS, PaaS, SaaS. Benefits and challenges of cloud computing, public vs private clouds, Role of virtualization in enabling the cloud; Benefits and challenges to Cloud architecture.

UNIT-IV (11 HRS)

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(UPDATED ON 27.08.2019)**

Cloud Applications, Cloud Services Management: Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage cloud services deployment, computing infrastructures available for implementing cloud based services.

NOTE: This Subject is common to all branches. Only Introduction of the concepts is given to the students.

RECOMMENDED BOOKS

1. Chris Eaton, Dirk deRoos et al., 'Understanding Big data', 1st Ed., McGraw Hill, **2015**.
2. Tom White, 'HADOOP: The definitive Guide', 4th Ed., O Reilly, **2015**.
3. Gautam Shroff, 'Enterprise Cloud Computing Technology Architecture Applications', 1st Ed., Cambridge University Press, **2010**.
4. Toby Velte, Anthony Velte, Robert Elsenpeter, 'Cloud Computing, A Practical Approach', 1st Ed., Mcgraw Hill Education, **2009**.
5. Thomas Erl, 'Big Data Fundamentals', 1st ed., Pearson Education, **2016**
6. Srinivasan, 'Cloud Computing', 1st ed., Pearson Education, **2016**

BANKING & INSURANCE OPERATIONS

Subject Code: BBAD0- F98

L T P C

Duration: 45 Hrs.

3 0 0 3

Course Objectives: The purpose of this paper is to make students understand the applications of banking and insurance operations in the business.

UNIT-I (11 Hrs.)

Banking System and Structure in India, Types of Banks, Role of Reserve Bank as Regulator of Banking System, The Terms Banker and Customer, Types of Relationship Between Banker and Customer, Bankers Obligations to Customers, Right of Lien, Set off.

UNIT-II (12 Hrs.)

Customers' Accounts with Banks, Opening - Operation, KYC Norms and Operation, Types of Accounts and Customers, Nomination, Settlement of Death Claims, Banking Technology, Home Banking, ATMs, Internet Banking, Mobile Banking, Core Banking Solutions, Debit, Credit and Smart Cards, Inter Bank Transfer - EFD, RTGS.

UNIT-III (11 Hrs.)

Banker as Lender, Types of Loans, Overdraft Facilities, Discounting of Bills, Financing Book Dates and Supply Bills, Charging of Security Bills, Pledge, Mortgage, Assignment, Prudential Norms for Asset Classification and Capital Adequacy.

UNIT-IV (11 Hrs.)

Introduction to Insurance: Elements of Insurance Risk, Players in Life and Non-Life Insurance Sector, Insurance Documents, Role and Responsibilities IRDA, Insurance Ombudsman, Types of

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(UPDATED ON 27.08.2019)**

Insurance, Life Insurance and General Insurance Products including Unit Linked Plans, Re-Insurance, Nature of Re-Insurance Risk.

Course Outcomes: After completing the course student will be able to understand and explain the concept of banking and insurance services and its managerial perspective.

Recommended Books

1. L.M. Bhole, 'Financial Institutions & Markets', Tata McGraw Hill.
2. Sunderaram and Varshney, 'Banking Theory, Law and Practice', Sultan Chand & Sons, New Delhi.
3. W.Koch, Timothy & S. Scott, 'Bank Management', Thomson, New Delhi.
4. Gordon & Natarajan, 'Banking (Theory, Law and Practice)', Himalaya Publishing.
5. O.P. Agarwal, Banking and Insurance, Himalaya Publishing.
6. P.K. Gupta, 'Fundamentals of Insurance', Himalaya Publishing

CORPORATE STRATEGY

Subject Code: BBAD0–F99

L T P C

Duration: 45 Hrs.

3 0 0 3

Course Objectives: The course aims at providing fundamental knowledge and exposure to the strategies at corporate level. It will help student understand the relationship amongst goals, objectives, strategies, tactics, plans, programs, procedures, rules etc.

UNIT-I (12 Hrs.)

Strategic Management: Introduction, Nature & Scope, Need, Level at which Strategy Operates, Strategic Decision Making, Process of Strategic Management, Strategic Intent: Vision, Mission, Business Definition, Business Model Goals & Objectives, and Strategy Formulation & Process.

UNIT-II (11 Hrs.)

Environment Appraisal and Scanning: External & Internal Environment including PEST, Techniques for Environmental Scanning (SWOT, ETOP, And Quest), and Organizational Appraisal: Dynamics of Internal Environment.

UNIT-III (12 Hrs.)

Corporate Level Strategy: Concept, Stability, Expansion, Retrenchment, Combination, Strategy, Business Level Strategy: Concept, Porter's Generic Business Strategy, Strategic Choice: Concept, Process of Strategic Choice, BCG Matrix, GE Nine Cell Matrix.

UNIT-IV (10 Hrs.)

Strategic Implementation: Concept, Interrelationship between Formulation and Implementation, Aspects of Strategy Implementation (Behavioural Implementation, Resource Allocation), Strategic Evolution and Control: An Overview, Technique of Strategic Evolution and Control.

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Course Outcomes: The students will get acquainted with the various strategic issues such as strategic planning, implementation and evaluation etc. and preparation of project reports.

Recommended Books

1. Azhar Kazmi, 'Business Policy', Tata McGraw Hill.
2. Jouch & Gluick, 'Strategic Management & Business Policy', Tata McGraw Hill.
3. Wheelen & Hunger, 'Strategic management & Business Policy', Pearson Education.
4. Pearce & Robinson, 'Strategic Management' AITBS. 5. Hill & Manikutty, 'Strategic Management', Cengage Course.

MARKETING MANAGEMENT

Subject Code – BBAD0- F9A

L T P C

Duration: 45 Hrs.

3 0 0 3

Course Objectives: Marketing is one of the foremost functions of Management in present day corporate world, its understanding results in developing best products in terms of goods and services that brings consumer satisfaction. This course will imbibe the basic understanding among the students to become successful marketers.

UNIT-I (13 Hrs.)

Marketing: Nature and Scope of Marketing, Customer Needs, Wants and Demand. Various Marketing Concepts: Production, Product, Selling, Marketing and Societal Marketing, and Analysing Marketing Environment: Micro, Macro Environment.

UNIT-II (12 Hrs.)

Market Segmentation: Need, Concept, Nature, Basis and Strategies, Mass Marketing Vs. Segmentation. Marketing Mix: 4Ps of Products and 7Ps of Services, Components and Factors Affecting.

UNIT-III (11 Hrs.)

Product Decisions: Product Definition, New Product Development Process and Product Life Cycle, Positioning, Branding, Packaging and Labelling Decisions Pricing Decisions: Importance, Objectives, Designing Strategies, Pricing Techniques.

UNIT-IV (10 Hrs.)

Product Promotion: Promotion Mix-introduction, Importance, Advantages and Disadvantages of Various Components and Factors Affecting. Distribution: Types of Channel, Factors Affecting Decision, Designing and Managing Marketing Channel, Managing Retailing, Physical Distribution System and its Components, Digital Marketing.

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Course Outcomes: The students will be apt with the foundation terms and concepts that are commonly used in marketing. They will also be able to understand the essential elements for effective marketing practice in the industry. They will also enable to create a balance between marketing and other management functions.

Recommended Books

1. P. Kotler, K.L. Keller, A. Koshy and M. Jha, 'Marketing Management: A South Asian Perspective', Pearson Education.
2. Etzel, Walker, Stanton and Pandit, 'Marketing Management', Tata McGraw Hill,
3. Kurtz & Boone, 'Principles of Marketing', Cengage Course
4. Kotler & Koshy, 'Marketing Management', Pearsons Education.
5. Kotler & Armstrong, 'Principles of Marketing', Prentice Hall.

SOFT COMPUTING

Subject Code: BEEE0-F98

L	T	P	C
3	0	0	3

Duration: 48 Hrs.

Course Objectives:

The student should be made to:

1. Learn the various soft computing frame works
2. Be familiar with design of various neural networks
3. Learn genetic programming.

Course Outcomes:

Upon completion of the course, the student should be able to:

1. Apply various soft computing frame works.
2. Design of various neural networks.
3. Use fuzzy logic.
4. Apply genetic programming.

Unit-I (12 Hrs)

Introduction to Neural Networks: Human brain and Biological Neuron, Artificial Neural Network, ANN Terminology, McCulloch- Pitts Neural Model, Activation functions, Topology, Feedforward Neural Networks, ANN Learning: Supervised, Un-supervised, Competitive learning, Reinforcement learning, Knowledge representation.

Unit-II (12 Hrs)

Hopfield Neural Model Learning Laws: - Hebb's rule, Delta rule, Widrow & Hoff LMS learning rule, Correlation learning rule, Instar and Outstar learning rules, Back-propagation Neural Networks, K-means clustering algorithm, Kohonen's feature maps, Associative Memories

Radial Basis Neural Networks: Function Neural Networks, Basic learning laws in RBF Nets, Recurrent Networks, Recurrent Backpropagation, Counter-Propagation Networks, CMAC Networks, ART Networks.

Unit-III (12 Hrs)

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Fuzzy Logic Sets & System: Introduction to Fuzzy Logic, Fuzzy vs Crisp set, Linguistic variables, Membership functions, Fuzzy set operations, IF-THEN fuzzy rules, Mamdani & Sugeno inference techniques, Defuzzification techniques, Fuzzy Logic System: Block diagram, Implementation, Useful tools Fuzzy logic controller Vs PID controller, Antilock Braking System (ABS).

UNIT-IV (12 Hrs)

Genetic Algorithm: Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modelling: Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, Generational Cycle, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional method.

Recommended Books:

1. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Wiley publications.
2. Yagna Narayanan, "Artificial Neural Networks", PHI.
3. Bart Kosko, "Neural Networks & Fuzzy logic", PHI.
4. Simon Haykin, "Neural Networks", Pearson Publication.

IMAGE PROCESSING

Subject Code: BEEE0-F99

L	T	P	C
3	0	0	3

Duration: 45 Hrs.

Course Objectives:

4. Learn digital image fundamentals.
5. Be familiarizing with Morphological image processing.
6. To introduce Image Transforms & compression.
7. To show the computation and use of Image Processing Applications.

Course Outcomes: -

6. Discuss and analyse various digital image fundamentals
7. Apply image enhancement and restoration techniques.
8. To analyse model of image transformation and compression.
9. Extract and compare different image processing techniques

UNIT I (10hrs)

Digital Image fundamentals: Steps in image processing, Human visual system, Sampling & quantization, Representing digital images, Spatial & gray-level resolution, Image file formats, Basic relationships between pixels, Distance Measures. Basic operations on images-image addition, subtraction, logical operations, scaling, translation, rotation. Image Histogram. Color fundamentals & models – RGB, HSI YIQ.

UNIT II (15 hrs)

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(UPDATED ON 27.08.2019)**

Image Enhancement, Restoration and Compression: Spatial domain enhancement: Point Operations-Log transformation, Power-law transformation, Piecewise linear transformations, Histogram equalization. Filtering operations- Image smoothing, Image sharpening.

Frequency domain enhancement: 2D DFT, Smoothing and Sharpening in frequency domain. Homomorphic filtering.

Restoration: Noise models, Restoration using Inverse filtering and Wiener filtering

Image Compression: Types of redundancy, Fidelity criteria, Lossless compression – Run length coding, Huffman coding, Bit-plane coding, Arithmetic coding. Introduction to DCT, Wavelet transform. Lossy compression – DCT based compression, Wavelet based compression. Image and Video Compression Standards – JPEG, MPEG.

UNIT III (10 hrs)

Image Segmentation: Point Detections, Line detection, Edge Detection-First order derivative – Prewitt and Sobel. Second order derivative –LoG, DoG, Canny. Edge linking, Hough Transform, Thresholding – Global, Adaptive. Otsu’s Method. Region Growing, Region Splitting and Merging.

Morphological Operations: Dilation, Erosion, Opening, Closing, Hit-or-Miss transform, Boundary Detection, Thinning, Thickening, Skeleton.

UNIT IV (10 hrs)

Image Processing Applications: Applications of transforms in fingerprinting, Medical applications such as tumor detection. Magnetic Resonance Imaging analysis using transforms, Morphological applications

Recommended Books:

1. Gonzalez and Woods, “Digital Image Processing” 2nd edition, PHI, 1986.
2. Milan Sonka, “Image Processing, Analysis & Machine Vision” Thomson Publication, 1996.
3. Pratt W.K., “Digital Image Processing” John Wiley, 2001.
4. Jain A.K., “Fundamentals of Digital Image Processing” PHI, 2010.

APPAREL MERCHANDISING

Subject Code: BTEX0-F91

**L T P C
3 0 0 3**

Duration: 45 Hours

UNIT: I (10 Hours)

Merchandising – Functions of Merchandiser – Programming Accessories Arrangement - Approvals – Pattern Approvals – Size set Approvals – Pre Production follow up – Buyer Communication – Reporting – Record maintenance

UNIT-II (10 Hours)

Estimating, aims of estimating - costing, aims of costing - difference between estimating and costing - types of estimates. Elements of cost - material cost - Labour cost different types of expenses - cost of product - advertisement cost.

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(UPDATED ON 27.08.2019)**

UNIT-III (15 Hours)

. Material cost -cost of yarn, cost of fabric production, cost of processing width of fabric, and design affecting cost - lot size, and cost of components - cutting cost - making and trim cost [CMT cost]. Simple problems

Programming – fabric consumption calculation – Scheduling – Concepts of scheduling - Types of Scheduling.

Learn fitting and Construction in the industry. Seam Types-Introducing fullness-Pleats-Gathers-tucks-seam Finishes-Hem types.

UNIT-IV (10 Hours)

Export Procedures - Import/Export Documentation –FOB, C&F, CIF–Shipping mark– Certificate of Origin- - Letter of Credit - Bill of Lading – Export License- Packing list – Commercial Invoice.

REFERENCE BOOKS:

1. Laing, R.M and Webster, J.Stitches and Seams, The Textile Institute, Manchester, 1998.
2. Glock R.E. and Kunz G.I., apparel manufacturing; Sewn Product Analysis, Prentice Hall, 1995.
3. Mehta P.V. An Introduction to Quality Control for the Apparel Industry, Marcel Dekker, 1992.
4. Cooklin F. Garment Technology for Fashion Designers, Blackwell Science, 199

Intellectual Property Rights & Patenting System in India

Subject Code: BTEX0-F92

L T P C

Duration: 45 Hours

3 0 0 3

UNIT-I (10 Hours)

Introduction of Intellectual property rights, Need for Intellectual property rights, Introduction of Patent, objectives, history of Indian patent system,

UNIT-II (12 Hours)

Governing Laws of Intellectual property rights, Patent rules, Patent acts and amendments (Patent acts 1970, New Patent rule 2003, patent amendment rule 2005 and patent amendment rule 2006 and other amendments), other latest laws.

UNIT-III (11 Hours)

Patenting System in India, Invention and Innovation, Novelty and Inventiveness, Commercialisation of inventions, disclosing an invention.

UNIT -IV (12Hours)

Applying for a patent, who can apply for a patent. Patentable inventions, Documents required, patent specifications, Contents of patent application, Examination, Infringement, Patent grant.

Recommended Books & Sites:

1. V. K. Ahuja, Law relating to Intellectual property rights, 3rd edition
2. Makhan Saikia, Globalization and Intellectual Property rights, A comparative study of the Patent Governance System of India and the European Union (EU)
3. Laxman Prasad, Patenting in India, Policy, Procedure and Public Funding.
4. History of Indian Patent System, www.ipindia.nic.in
5. The patent system in India, www.gian.org

BMEE0-F94 Material Science & Engineering

Internal marks:40

External marks:60

Total marks:100

LTPC

3 0 0 3

Total Hrs 45

Unit I

Atomic structure of metals crystal structure, crystal lattice of (1) Body centered cubic (ii) face centered cubic (iii) closed packed hexagonal, crystallographic notation of atomic planes, polymorphism and allotropy, Solidification of crystallization (i) nuclear formation (ii) crystal growth (iii) crystal imperfection. Elementary treatment of theories of plastic deformation, phenomenon of slip. Twinning. Dislocation. Identification of crystallographic possible slip planes and direction in F.C.C. B.C.C. C.P.H., recovery, re-crystallization, preferred orientation causes and effects on the property of metals. (15)

Unit II

Introduction to Engineering materials; their mechanical behavior, testing and manufacturing properties of materials; physical properties of materials; classification of engineering materials. (5)

Unit III

General principles of phase transformation in alloys, phase rule and equilibrium diagrams, Equilibrium diagrams of Binary system in which the components form a mechanical mixture of crystals in the solid state and are completely mutually soluble in both liquid state. Equilibrium diagrams of a systems whose components have complete mutual solubility in the liquid state and limited solubility in the solid state and in which the solid state solubility decreases with temperature; Equilibrium diagram of alloys whose components have complete mutual solubility in the liquid state and limited solubility in solid state (Alloy with a peritectic transformation) Equilibrium diagrams of a system whose components are subject to allotropic change. Iron carbon equilibrium diagram, phase transformation in the iron carbon diagram: (i) Formation of Austenite (ii) Transformation of austenite into pearlite (iii) Martensite transformation in steel, time temperature transformation curves. (15)

Unit IV

Principles and applications of heat treatment processes viz annealing, normalizing, hardening, tempering; harden ability & its measurement, surface hardening processes. Defects in heat

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(UPDATED ON 27.08.2019)**

treatment and their remedies; Effects produced by alloying elements on the structures and properties of steel. Distribution of alloying elements (Si. Mn. Ni. Cr. Mo. TL. AL) in steel.(10)

Suggested Readings / Books:

- 1) Engg. Physical Metallurgy by Y. Lakhtin, (Mir Publishers)
- 2) Heat Treatment of Metals by B. Zakharv (Peace Publishers)
- 3) Engineering Metallurgy by V. Raghavan (PHI Learning Pvt. Ltd)
- 4) Introduction to Physical Metallurgy by Avner (Tata McGraw Hill)
- 5) Material Science & Metallurgy by O.P Khanna (Dhanpat Rai & Co.

BMEE0-F95 ROBOTICS ENGINEERING

Internal Marks: 40

External Marks: 60

Total Marks: 100

L T P C

3 0 0 3

Total Hrs: 45

Detailed Contents

1. **Introduction:** Concept and scope of automation: Socio economic consideration: Low cost automation. (5)
2. **Fluid Power Control:** Fluid power control elements and standard graphical symbols. Construction and performance of fluid power generators; Hydraulic and pneumatic cylinders - construction, design and mounting; Hydraulic and pneumatic valves for pressure, flow and direction control: Servo valves and simple servo systems with mechanical feedback, governing differential equation and its solution for step position input; Basic hydraulic and pneumatic circuits. (7)
3. **Pneumatic Logic Circuits:** Design of pneumatic logic circuits for a given time displacement diagram or sequence of operations. (6)
4. **Fluidics:** Boolean algebra; Truth tables; Conda effect; Fluidic elements – their construction working and performance characteristics: Elementary fluidic circuits. (5)
5. **Transfer Devices and Feeders:** their Classification: Construction details and application of transfer devices and feeders (Vibratory bowl feeder, reciprocating tube feeder and centrifugal hopper feeder). (5)
6. **Electrical and Electronic Controls:** Introduction to electrical and electronic controls such as electromagnetic controllers - transducers and sensors, microprocessors, programmable logic controllers (PLC); Integration of mechanical systems with electrical, electronic and computer systems. (7)
7. **Robotics;** Introduction, classification based on geometry, devices, control and path movement, End effectors - types and applications: Sensors - types and applications. Concept of Robotic/Machine vision, Teach pendent. (5)
8. **Industrial Applications** of Robots for material transfer, machine loading / unloading, welding, assembly and spray painting operations. (5)

Books

1. *A. K. Gupta, “ Industrial Automation and Robotics”, Laxmi Publication (P) Limited*
2. *Anthony Esposito, “Fluid Power with applications” Pearson prentice Hall*

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3. SR Majumdar, "Pneumatic Control", Tata McGral Hill
4. SR Deb, "Robotics and Flexible Automation", Tata McGral Hill
5. Harry Colestock, "Industrial robotics: selection, design, and maintenance.

BMEE0-F96 ENGINEERING METROLOGY

Internal Marks: 40
External Marks: 60
Total Marks: 100

L T P C
3 0 0 3
Total hours: 45

1. LIMITS FITS AND TOLERANCES

(5)

Concepts of interchangeability need for standards system of limits, fits and tolerances. BIS:919:1963 standard system, selection of limits and fits, exercise on limits, fits and tolerances, design principles for limit gauges, Taylor's principles, types of limit gauges, tolerances on limit gauges. Design of limit gauges

2. MEASURING AND GAUGING INSTRUMENTS

(8)

Mechanical linear and angle measuring instruments, vernier calipers, micrometers dial gauges, bevel protectors, sine bars, spirit level, optical instruments autocollimator tool room microscope. Comparators principle, types of comparators, mechanical, optical, pneumatic, electrical comparators.

3. SURFACE FINISH

(8)

Concepts of form errors; straightness, flatness, roundness errors and their measurements, concept of micro and macro errors, measurement of surface roughness, stylus method using, mechanical, optical, electrical magnification methods.

4. SCREW THREADS AND GEAR METROLOGY

(8)

Elements of screw threads metrology, measurement of major, minor and effective Diameters of external and internal screw threads, measurement of pitch and screw Thread angle, Elements of gear metrology, measurement of gear tooth thickness, Gear profile, pitch and run out for involute gears, gear rolling test.

6. TRANSDUCERS

(8)

Transducers, types, governing principles of transducers Examples Displacement Measurement, detailed study of various types of displacement transducers, Velocity Measurement linear and angular, study of velocity transducers

7. FORCE, TORQUE AND PRESSURE MEASUREMENT

(8)

Mechanical, pneumatic, and hydraulic load cells; torque measuring devices dynamometers types of strain gauges, factors affecting strain measurement Electrical strain gauges gauge material, fixing methods, Pressure measurement, types of pressure transducer differential pressure measuring devices, performance characteristics low and high pressure Measurement.

Books recommended:

1. R.K.Jain, "Engineering Metrology", S Chand and Company
2. I.C.Gupta, "Engineering metrology", Dhanpat rai & sons delhi

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3. D.S.Kumar, “Mechanical Measurement & Control”, Metropolitan Publishers
4. Doebelin, “Mechanical Measurement”, Mc graw Hill
5. Gharam T. smith, “Industrial Metrology” , Springer

BMEE0-F97 OPERATIONS RESEARCH

Internal Marks: 40
External Marks: 60
Total Marks: 100

LT P C
3 0 0 3
Total hrs :45

1. **Introduction:** Introduction, characteristics, objectives and necessity of operation research (OR), scope of OR in industry and management. Role of computers in OR, limitations of OR.(5)
2. **Linear Programming:** Introduction to linear programming, formulation of linear programming problems, graphical solution, simplex algorithm, computational procedure in simplex, duality and its concept, application of L.P. model to product mix and production scheduling problems, limitations of linear programming. (10)
3. **Transportation model:** Definition of transportation model, formulation and solution methods, and degeneracy in transportation problems. (7)
4. **Assignment Model:** Definition of assignment model, comparison with transportation model, formulation and solution methods, the travelling salesman problem. (8)
5. **Queuing Models:** Application of queuing models, characteristics of queuing models, single channel queuing theory, solution to single channel with poisson arrivals and exponential service infinite population model, Industrial applications of queuing theory. (10)
6. **PERT and CPM:** Work breakdown structure, network logic, critical path, CPM and PERT, slack and floats. (5)

Suggested Books

1. P.K. Gupta and D.S.Hira, "Operations Research “, S. Chand and company
2. A.H. Taha, “Operation Research”, Macmillan Publishing Company
3. W.D. Miller and M.K Starr, “Executive Decisions and operations Research”, ,Prentice Hall Inc, Eglewood Cliffs, N.J,
4. Vijay Gupta Bhushan Kumar K.K.Chawla, “Applied Operation research”,Kalyani Publishers
5. Dr. R. K. Gupta, “Operations Research”, Krishna publishers