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

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

UG OPEN ELECTIVES-II 2016 BATCH ONWARDS		
COURSE CODE	**COURSE**	**NOT APPLICABLE FOR PROGRAMMES**
BFOT0-F92	Data Process Analysis	B.Tech. Food Technology
BBAD0-F94	Engineering Economics & Management	BBA
BBAD0-F95	Entrepreneurship	
BBAD0-F96	Finance for Engineers	
BEEE0-F94	Non-Conventional Energy Resources	B.Tech. EEE
BEEE0-F95	High Volatge Engineering	
BEEE0-F96	Nano Science and Nano Technology	
BECE0-F94	Communication Systems	B.Tech. ECE
BECE0-F95	Robotics and Automation	
BECE0-F96	Electronic System Design	
BCIE0-F93	Building Maintenance	B.Tech. Civil Engineering
BCIE0-F94	Civil Engineering Materials	
BCIE0-F95	Fluid Mechanics	
BELE0-F94	Renewable Energy Sources	B.Tech. Electrical Engineering
BELE0-F95	Basics of Transformers	
BELE0-F96	Electrical Machines & Drives	
BELE0-F97	Electrical Machines and Power Utilization	
BMEE0-F91	Heat and Mass Transfer	
BCSE0-F91	Computer Programming and Data Structure	

DATA PROCESS ANALYSIS

Subject Code: BFOT0-F92 **L T P C** **Contact Hrs. 36**
3 0 0 3

UNIT-I

Introduction: The meaning of quality and quality improvement, Statistical methods for quality control and improvement.
Food Quality System: The link between quality and productivity, Quality costs, Legal aspects of quality, implementing quality improvement.
Control Charts for Variables: Statistical basis of the charts, Development and use of x and R, Charts based on standard values, Interpretation of x and R charts, The effect of non-normality on x and R charts.

UNIT-II

Sampling: Population and sampling distributions, Sampling and non-sampling errors, Mean and standard deviation of x, Shape of the sampling distribution of x, Applications of the sampling distribution of x, Population and sample proportions, Mean, standard deviation.
Test Methods: Hypothesis tests, Estimation and hypothesis testing: two populations, Chi-square tests, Analysis of Variance, Simple linear regression, Non-parametric methods.

UNIT-III

Statistical Process Control (SPC) Techniques: SPC for short production runs, Modified and acceptance control charts, SPC with auto correlated process data, Economic design of control charts.
Multivariate Process Monitoring and Control: Description of multivariate data, The Hoteling T2 control chart, The multivariate EWMA (Exponentially Weighted Moving Average) control chart, Latent structure methods.

UNIT-IV

Process Capability Analysis (PCA): PCA using probability plot, Process capability ratios, PCA using a control chart, PCA using designed experiments.
Design of Experiments and Process Optimization: Guidelines for designing experiments, Factorial experiments, the 2k factorial design, Fractional replication of the 2k design, Response surface methods and designs
Six Sigma: Introduction, Six-sigma control chart, Six-sigma quality performance.
Recommended Books:

1. Jerome D. Braverman, 'Fundamentals of Statistical Quality Control', Brady and Prentice Hall, **1981**.
2. P.S. Mann, 'Introductory Statistics', John Wiley and Sons, **2010**.
3. D.C. Montgomery, 'Statistical Quality Control', 7th Edn., John Wiley & Sons, **2012**.
4. M. Jaya Chandra, 'Statistical Quality Control', CRC Publisher, **2001**.

ENGINEERING ECONOMICS & MANAGEMENT

Subject Code: BBAD0-F94 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Course Objectives: To run an organization, Finance and Human resources are the key factors. Their proper utilization decides its success. This course will give the basic understanding of both these resources.

UNIT-I (8 Hrs.)

Introduction: Scope of economics for engineers; Concept of: Goods, Utility, Value, Price, Capital, Money, Income; Law of Demand & Supply, Basic Management Principles

UNIT-II (11 Hrs.)

Cost Analysis: Cost classification: Prime cost, Overhead cost, Selling and Distribution Cost, Fixed cost, Variable cost, Implicit cost, Explicit cost, Replacement cost, Opportunity cost, Marginal cost and Sunk cost; Break Even Analysis; Economic order quantity.

Depreciation: Causes and Methods: Straight line method, Reducing balance method, Repair provision method, Annuity method, Sinking fund method, Revaluation method, Sum of the digit method.

UNIT-III (10 Hrs.)

Replacement Analysis: Reasons and factors for replacement; Determination of economic life of an asset.

Inventory Management: Introduction, Factors & Techniques.

UNIT-IV (11 Hrs.)

Human Resource Management: Definition; Functions of HRM; Process of Human Resource Planning**;** Methods of Recruitment; Meaning of Placement and Induction, Difference between Training and Development; Methods of Training and Development.

Recommended Books:

1. T.R. Jain, 'Micro Economics', V.K. Publication.
2. P. Khanna, 'Industrial Engineering and Management', Dhanpat Rai Publication Pvt. Ltd.
3. M.S. Mahajan, 'Industrial Engineering and Production Management', Dhanpat Rai & Co. Pvt. Ltd.
4. T.N. Chhabra, 'Human Resource Management', Dhanpat Rai & Co.
5. P.L. Mehta, 'Managerial Economics', Sultan Chand & Sons.

ENTERPRENEURSHIP

Subject Code: BBAD0-F95 **L T P C** **Duration: 40 Hrs.**

3 0 0 3

Course Objectives: The purpose of this paper is to prepare a ground where the students view Entrepreneurship as a desirable and feasible career option. In particular, the paper seeks to build the necessary competencies and motivation for a career in Entrepreneurship.

UNIT-I

Foundations of Entrepreneurship: Concept, Need, Definition & Role of Entrepreneurship, Definition, Characteristics & Scope of Entrepreneur, Concepts of Entrepreneur, Intrapreneur, Entrepreneurial Culture, Reasons for The Failure of Entrepreneurial Ventures, Various Case Studies, Successful, Failed and Turnaround Ventures.

UNIT-II

Women Entrepreneurs & Entrepreneurship Development: Meaning, Role, Problems & Reasons for Less Women Entrepreneurs, Role of The Following Agencies in The Entrepreneurship Development DIC, SISI, EDII & NIESBUD.

UNIT-III

Small& Medium Enterprises - Small & Medium Industry: Meaning and Importance, Role & importance of SME in India Economy, Search for a Business Idea, Source of Ideas, Idea

Processing, Selection Idea, Input Requirements, Nature and Components of SME Environment, SME Funding.

UNIT-IV

Financial Schemes Offered by Various Financial Institutions like Commercial Banks, IDBI, ICICI, SIDBI, SFCs, Role of Central Government and State Government in Promoting Entrepreneurship Relevant case studies related to the topics should be discussed.

Recommended Books:

1. Vasant Desai, 'Management of Small Scale Industries', Himalaya Publishing.
2. Angadi, Cheema, Das, 'Entrepreneurship, Growth, and Economic Integration', Himalaya Publication.
3. Rizwana and Janakiran, 'Entrepreneurship Development', Excel Books.
4. Murthy, 'Small Scale Industry and Entrepreneurial Development', Himalaya Publishing.

FINANCE FOR ENGINEERS

Subject Code: BBAD0-F96 **L T P C** **Duration – 40 Hrs.**
3 0 0 3

Course Objectives: To provide an understanding of the function, the roles, the goals and the Processes of corporate financial management, covering the sourcing of finances and their issues in investment and operations. Problem-solving methodology will be used to illustrate the theories and tools in financial decision making.

Unit-I (10 Hrs.)

Nature, Scope and Objectives of Financial Management, Profit Maximization Vs Wealth Maximization, Financial Planning, Forms of Business Organization, Role of Financial Manager.

Unit-II (10 Hrs.)

Capital Structure – Introduction, Factors Affecting Capital Structure, Liquidity Ratios
Capital Structure Theories: Net Income Approach, Net Operating Income Approach, Traditional Approach, Modigliani-Miller Model (MM), Criticisms of MM Models, Financial Distress & Agency Cost, Asymmetric Information Theory.

Unit-III (10 Hrs.)

Working Capital Decision: Meaning, Nature and Scope of Working Capital - Component of Working Capital – Factors affecting Working Capital, Working Capital Strategies,
Capital Budgeting Techniques: Discounted and Non-Discounted Methods (Pay Back, ARR, NPV, IRR, Benefit Cost Ratio), Long Term and Short Term Sources of Funds

Unit-IV (10 Hrs.)

Long Term Sources of Funds: Equity share, Preference shares, Debentures, Bonds, Warrants, Venture capital and Ploughing back of profits
Short Term Sources of Funds: Commercial Paper, Certificate of Deposit, Treasury Bills
Financial Markets: Nature and Significance of Primary and Secondary Markets, Objectives and Functions
Course Outcomes: After completing this course the students should be able to make optimum decisions pertaining to raising funds, making investments & managing the assets of a corporation, big or small, with an ultimate goal of creating value.

Recommended Books:

1. Brigham, 'Financial Management: Text & Cases', Cengage Learning.
2. Brealy & Myres, 'Principles of Corporate Finance', Tata McGraw Hill.

3. Ambrish Gupta. 'Financial Accounting for Management', 2nd Edn., Pearson Education.
4. I.M. Pandey, 'Financial Management', Vikas Publishers.
5. S.P. Jain and K.L. Narang, 'Principles of Accounting', Kalyani Publishers, New Delhi, **2004**

COMMUNICATION SYSTEMS

Subject Code: BECE0-F94 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Learning Objectives:
1. To understand the basic concept of communication and amplitude modulation.
2. To understand the concept of angle modulation.
3. To understand theory of digital modulation.
4. To understand working of radio receivers.

Learning Outcomes:
At the end of the Course the student shall be able to:
1. Understand the fundamentals of communication systems and to perform amplitude and angle modulation and demodulation of analog signals
2. Perform and analyze PAM, PCM and PWM
3. Analyze FDM and TDM systems.
4. Design and conduct experiments, using modern communication tools necessary for various engineering applications.

UNIT-I

Introduction: Basic elements of communications. Noise Modulation and frequency translation, Need for modulation.
Amplitude Modulation (AM): Expression for AM, modulation index for AM, amplitude waveform and bandwidth of amplitude modulated signal, power distribution in amplitude modulated signal. Double sideband suppressed carrier (DSB-SC), single sideband (SSB), and vestigial sideband (VSB) AMs.
AM Modulators: Introduction. Circuit diagrams and operational principles of square law modulator, switching modulator, balanced modulator, ring modulator.
AM Demodulators: Introduction. Circuit diagrams and explanations of envelope detector and square law detector.]

UNIT-II

Angle Modulation: Introduction to Phase modulation (PM) and frequency modulation (FM). Relationship between PM and FM. Phase and frequency deviation. Power distribution in angle modulated signal. Spectral characteristics of angle modulated signals. Effect of noise on angle modulation, role of limiter, pre-emphasis and de-emphasis in FM. Comparison of FM with AM in communication systems.

UNIT-III

Introduction to Digital Signals: Comparison of Analog and Digital Signals; Advantages and disadvantages of Digital Communications, Elements of Digital Communication Systems. Pulse Amplitude Modulation, Pulse Code Modulation (PCM); Quantization Noise, Commanding Sampling Theorem, Concept of aliasing & flat top sampling, PCM bandwidth, Differential PCM, Delta Modulation(DM), Pulse width Modulation(PWM), Adaptive Delta Modulation (ADM).

UNIT-IV

Line Coding Schemes: Introduction, properties, general methods for derivation of power spectral density of a broad class of line coding scheme: ON-OFF signaling, polar signaling, bipolar and comparison among them. Pulse shaping, introduction to equalizer and eye diagram.

Recommended Books:

1. Taub and Schilling, 'Principles of Communication Systems', McGraw Hill.
2. G. Kennedy, 'Electronic Communication System', PHI.
3. Roddy and Coolen, 'Electronic Communications', PHI
4. Thiagrajan Vishwanathan, 'Communication Switching Systems and Networks', PHI Pub.
5. Proakis, 'Communication System Engineering', Pearson.

ROBOTICS AND AUTOMATION

Subject Code: BECE0-F95 **L T P C** **Duration: 36 Hrs.**

3 0 0 3

Learning Objectives:

The student should be made to:

1. Learn the fundamentals of robotics and robot kinematics
2. Be familiar with robot dynamic analysis and forces
3. Learn about the concepts of actuators and sensors.
4. Learn robot programing and applications.

Learning Outcomes:

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

1. Apply various robot kinematics.
2. Analyse the robot dynamic, differential motions and inverse manipulator kinematics.
3. Understand methods of trajectory planning, actuators and sensors.
4. Understand the lead through programming methods.

UNIT-I

Fundamentals: historical information, robot components, Robot characteristics, Robot anatomy, Basic structure of robots, Resolution, Accuracy and repeatability

Robot Kinematics: Position Analysis forward and inverse kinematics of robots, Including frame representations, Transformations, position and orientation analysis and the Denavit Hartenberg representation of robot kinematics, The manipulators, The wrist motion and grippers.

UNIT-II

Differential motions, Inverse Manipulator Kinematics: Differential motions and velocity analysis of robots and frames.

Robot Dynamic Analysis and Forces: Analysis of robot dynamics and forces, Lagrangian mechanics is used as the primary method of analysis and development.

UNIT-III

Trajectory Planning: Methods of path and trajectory planning, both in joint space and in Cartesian space.

Actuators and Sensors: Actuators, including hydraulic devices, Electric motors such as DC servomotors and stepper motors, Pneumatic devices, as well as many other novel actuators, It also covers microprocessor control of these actuators, Mechatronics, Tactile sensors, Proximity and range sensors, Force and torque sensors, Uses of sensors in robotics.

UNIT-IV

Robot Programming, Systems and Applications: Robot languages, Method of robots programming, Lead through programming methods, A robot programs as a path in space, Motion interpolation, WAIT, SIGNAL and DELAY commands, Branching capabilities and limitation of lead through methods and robotic applications.

Recommended Books:

1. Stauguard A.C. & Eagle wood clif, 'Robotic & AI', Prentice Hall.
2. Lee C.S.G., Fu K.S., Gonzalez R.C, 'Robotic control, Sensing and Intelligence', Mcgraw Hill.
3. Parent M. and Laugreau C, 'Robot Technology, Logic 7 Programming', Kogan Page, London.

ELECTRONIC SYSTEM DESIGN

Subject Code: BECE0-F96 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Learning Objectives:

1. To understand the stages of product (hardware/ software) design and development.
2. To learn the different considerations of analog, digital and mixed circuit design.
3. To understand the importance of sinusoidal oscillators. `
4. To understand the constant current sources.

Learning Outcomes:

1. After successfully completing the Course students will be able to:
2. Understand various stages of hardware, software in electronic system design.
3. Designing of Class A, AB, Audio power amplifier.
4. Special design considerations of filters.

UNIT-I

Design of Power Supply System: Unregulated D.C. power supply system with rectifiers and filters. Design of emitter follower regulator, series regulators, overload protection circuits for regulators. Design of SMPS: Step up and step down.

UNIT-II

Design of Class A Small Signal Amplifiers: Emitter follower, Darlington pair amplifiers with and without Bootstrapping, Two stage direct coupled amplifier. Design of class A, Class AB audio power amplifier with drivers.

UNIT-III

Design of Sinusoidal Oscillators: OPAMP based Wein bridge and Phase Shift oscillators with AGC circuits, Transistor based Hartley, Colpits and Crystal oscillators, Evaluation of figure of merit for all above oscillator circuits.

UNIT-IV

Design of Constant Current Sources, Design of function generators, Design of tuned amplifiers. Design of Butterworth, Chebyshev filters up to sixth order with VCVS and IGMF configuration.

Recommended Books:

1. Anielo. 'Electronics: BJT's, FETS and Microcircuits'.
2. Goyal & Khetan, 'Monograph on Electronic Circuit Design'.
3. 'Regulated Power Supply Handbook', Texas Instruments.

BUILDING MAINTENANCE

Subject Code: BCIE0-F93 **L T P C** **Contact Hrs. 36**
3 0 0 3

UNIT-I

Importance of Maintenance, Deterioration and Durability: Factors affecting decision to carryout maintenance, agencies causing deterioration, effect of deterioration agencies on materials. Factors to reduce maintenance at design stage, consideration of maintenance aspects in preparing tender document and specifications, sources of error in design which enhances maintenance, importance of working drawings and schedules, provision of access for maintenance and its importance at design stage. Economic consideration in maintenance: physical life, functional life, economic life of different types of buildings, discounting technique for assessment of economic life.

UNIT-II

Maintenance Management: Definition, organization structure, work force for maintenance, communication needs, building inspections, maintenance budget and estimates, property inspections and reports, specification for maintenance jobs, health and safety in maintenance, quality in maintenance, maintenance manual and their importance.

Materials for Maintenance: Compatibility of repair materials, durability and maintenance, types of materials, their specification and application, criteria for selection of material, use of commercial available materials in maintenance.

UNIT-III

Investigation and Diagnosis for Repair of Structures: Basic approach to investigations, physical inspection, material tests, non-destructive testing for diagnosis, estimation of actual loads and environmental effects, study of design and construction practices used in original construction, retrospective analysis and repair steps. Maintenance Problems and Root Causes:

Classification of defects, need for diagnosis, type of defects in building elements and building materials defect location, symptoms and causes.

UNIT-IV

Remedial Measures for Building Defects: Preventive maintenance and special precautions - considerations, preventive maintenance for floors, joints, wet areas, water supply and sanitary systems, termite control, common repair techniques, common methods of crack repair.

1. Repair of existing damp proofing systems in roofs, floors and wet areas.
2. Protection, repair and maintenance of RCC elements.
3. Repair, maintenance of foundations, basements and DPC
4. Repair of finishes.
5. Repair of building joints.
6. Repair of water supply and sanitary systems, underground and overhead tanks.
7. Common strengthening techniques
8. Maintenance of Industrial Floors

Maintenance of Multi-Storey Buildings: Specials features for maintenance of multi-storey buildings, including fire protection system, elevators booster pumps, generator sets.

Recommended Books:

1. A.C. Panchdari, ‘Maintenance of Buildings’, New Age International (P) Limited Publishers.

CIVIL ENGINEERING MATERIALS

Subject Code: BCIE0-F94 **L T P C** **Contact Hrs. 36**
3 0 0 3

UNIT-I

STONES – BRICKS – CONCRETE BLOCKS: Stone as building material – Criteria for selection Tests on stones – Deterioration and Preservation of stone work – Bricks – Classification – Manufacturing of clay bricks – Tests on bricks – Compressive Strength – Water Absorption – Efflorescence – Bricks for special use – Refractory bricks – Cement, Concrete blocks – Light, weight concrete blocks.

UNIT-II

LIME – CEMENT – AGGREGATES – MORTAR: Lime – Preparation of lime mortar – Cement – Ingredients – Manufacturing process – Types and Grades – Properties of cement and Cement mortar – Hydration – Compressive strength – Tensile strength – Fineness– Soundness and consistency – Setting time – Industrial byproducts – Fly ash – Aggregates – Natural stone aggregates – Crushing strength – Impact strength – Flakiness Index – Elongation Index – Abrasion Resistance – Grading – Sand Bulking.

UNIT-III

CONCRETE: Concrete – Ingredients – Manufacturing Process – Batching plants – RMC – Properties of fresh concrete – Slump – Flow and compaction Factor – Properties of hardened concrete – Compressive, Tensile and shear strength – Modulus of rupture – Tests – Mix specification – Mix proportioning – BIS method – High Strength Concrete and HPC – Self compacting Concrete – Other types of Concrete – Durability of Concrete.

UNIT-IV

TIMBER AND OTHER MATERIALS: Timber – Market forms – Industrial timber– Plywood – Veneer – Thermacole – Panels of laminates – Steel – Aluminum and Other Metallic Materials – Composition – Aluminium composite panel – Uses – Market forms – Mechanical treatment – Paints – Varnishes – Distempers – Bitumens.

MODERN MATERIALS: Glass – Ceramics – Sealants for joints – Fibre glass reinforced plastic – Clay products – Refractories – Composite materials – Types – Applications of laminar composites – Fibre textiles – Geomembranes and Geotextiles for earth reinforcement.

Recommended Books:

1. P.C. Varghese, 'Building Materials', PHI Learning Pvt. Ltd, New Delhi, **2012**.
2. R.K. Rajput, 'Engineering Materials', S. Chand and Company Ltd., **2008**.
3. M.S. Shetty, 'Concrete Technology (Theory and Practice)', S. Chand and Company Ltd., **2008**.
4. M.L. Gambhir, 'Concrete Technology', 3rd Edn., Tata McGraw Hill Education, **2004.**
5. S.K. Duggal, 'Building Materials', 4th Edn., New Age International, **2008**.

Reference Books:

1. K.S. Jagadish, 'Alternative Building Materials Technology', New Age International, **2007**.
2. M.L. Gambhir & Neha Jamwal, 'Building Materials, Products, Properties and Systems', Tata McGraw Hill Educations Pvt. Ltd, New Delhi, **2012**.
3. IS456 – 2000: Indian Standard Specification for Plain and Reinforced Concrete, **2011.**
4. IS4926–2003: Indian Standard Specification for Ready–Mixed Concrete, **2012.**
5. IS383–1970: Indian Standard Specification for Coarse and Fine Aggregate from Natural Sources for Concrete, 2011 6. IS1542–1992: Indian Standard Specification for Sand for Plaster, **2009.**

FLUID MECHANICS

Subject Code: BCIE0-F95 **L T P C** **Contact Hrs. 36**
3 0 0 3

Course Objectives:
To provide the fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows.

Course Outcomes:
At the end of the course, students will be able to-
1. State the Newton's law of viscosity and explain the mechanics of fluids at rest and in motion by observing the fluid phenomena.
2. Examine energy losses in pipe transitions and sketch energy gradient lines.
3. Examine the possibility of a flow using continuity equation.
4. Understand the concept of rotational, irrigational flows; stream functions, velocity potentials. Laplace equation etc.

Unit – I (12 Hrs.)

Fluid and their Properties: Concept of fluid, difference between solids, liquids and gases; ideal and real fluids; Continuum concept of fluid: density, specific weight and relative density; viscosity and its dependence on temperature; surface tension and capillarity, vapor pressure and cavitations; Newtonian and non-Newtonian fluids. Rotational flows- Rotational velocity and circulation.

Unit - II (10 Hrs.)

Kinematics of Fluid Flow: continuity equation, path lines, streak lines and streamlines, stream tube, stream function, velocity potential function, and flow net. Types of fluid flow, translation, rotation, circulation and vorticity, Vortex motion; Dynamics of fluid flow, Bernoulli's theorem, venturimeter, orifice-meter, Introduction to orifice and notch.

Unit - III (10 Hrs.)

Laminar Flow: shear stress distribution and velocity distribution in circular pipes and two parallel plates; kinetic energy correction factor and momentum energy correction factor, average velocity, shear stress and pressure gradient; Turbulent flow in pipes, Darcy equation

Unit - IV (8 Hrs.)

Dimensional Analysis and Similitude: Rayleigh's method and Buckingham's π-theorem, types of similarities, dimensionless numbers, model's law.

Recommended Books & References:
1. R.K. Bansal, 'A Textbook of Fluid Mechanics', 1st Edn., Laxmi Publications, **2016.**
2. Yunus Cengel, 'Fluid Mechanics in SI Units**',** McGraw Hill Education, 3rd Edn., **2017.**
3. Biswas, 'Introduction to Fluid Mechanics and Fluid Machines', 3rd Edn., McGraw Higher Education, **2011.**

RENEWABLE ENERGY SOURCES

Subject Code: BELE0-F94 **L T P C** **Contact Hrs. 36**
3 0 0 3

Course Objectives:
1. To obtain knowledge about renewable energy sources and solar energy and their utilization.
2. To introduce to wind energy conversion and bio-mass energy conversion systems.

3. To introduce to geothermal energy and energy from ocean. To make them aware about hydrogen energy sources.

Course Outcomes:

1. Students will get knowledge about utilization of renewable energy sources and solar energy.
2. They will learn about wind energy conversion and bio-mass energy conversion systems.
3. They will become aware about geothermal energy, energy from ocean and hydrogen energy sources.

UNIT-I (13 Hrs.)

Solar Energy: Conventional energy sources and availability, Introduction to new energy techniques& renewable energy sources; Solar Energy, Solar constant, Radiation geometry, Solar energy collectors, Concentrated and flat plate, Energy balance and collector efficiency, Solar energy storage, Application to space heating, distillation, cooking and greenhouse effect.

UNIT-II (12 Hrs.)

Wind and Bio-Energy: Basic principle of wind energy conversion, site selection, analysis of aerodynamic forces acting on wind mill blades and estimation of power output, Biomass conversion technology, photosynthesis, biogas plant, thermal gasification.

UNIT-III (10 Hrs.)

Geothermal Energy: Sources- hydrothermal, hot dry rock, geothermal fossil system, prime movers for geothermal energy.

Energy from Ocean: Ocean thermal electric conversion, energy from tides, small-scale hydroelectric development.

UNIT-IV (10 Hrs.)

Hydrogen Energy Sources: Introduction, hydrogen production methods, storage, utilization, magneto hydrodynamic power, thermionic generation, nuclear fusion energy.

Recommended Books:

1. G.D. Rai, 'Non-Conventional Energy Sources', Khanna Publishers, Delhi, **2011**.
2. S. Rao, B,B. Parulekar, 'Energy Technology: Non-Conventional Renewable and Conventional', Khanna Publishers, Delhi,
3. H.P. Garg and Jai Prakash, 'Solar Energy: Fundamentals and Applications', Tata McGraw Hill.
4. Saeed S. Hasan and D.K. Sharma, 'Non-Conventional Energy Resources', Katson Publishers, **2014**.
5. R.K. Rajput, 'Non-Conventional Energy Sources and Utilization', S. Chand Publishers, **2012**.
6. S.P. Sukhatme, 'Solar Energy: Principles of Thermal Collection and Storage', Tata McGraw Hill, N Delhi, **1984**.

BASICS OF TRANSFORMERS

Subject Code: BELE0-F95 **L T P C** **Contact Hrs. 36**
3 0 0 3

Course Objectives:

1. To aware the students about the basics of Transformer.
2. To provide basic concepts of different types of transformer connections and their applications.
3. To impart knowledge of single phase transformer, auto transformer and three phase transformer.

Course Outcomes:

1. Students will become familiar with different types of transformers.
2. Students will get Knowledge of different types of insulating materials used in transformers.

3. Students will get knowledge of applications of different types of transformer.

UNIT-I (13 Hrs.)

Single Phase Transformer: Construction, working principle of operation, E.M.F. equation, phasor diagram under loaded and unloaded condition, rating of transformers, losses in transformer, transformer testing, open and short circuit tests, voltage regulation and efficiency, condition for maximum efficiency, applications of transformers.

UNIT-II (10 Hrs.)

Auto-Transformers: Construction, working principle of operation, phasor diagram, saving of conductor material, comparison of auto transformer and two winding transformer, advantages, disadvantages and applications.

UNIT-III (12 Hrs.)

Three Phase Transformer: Three winding transformer, construction of three phase transformer, three phase transformer connections: Star-star connection, delta-delta connection, delta-star connection, star-delta connection, phasor groups, three phase to two phase and six phase conversion, scott connection three phase to two phase conversion, phase shifting from primary to secondary windings.

UNIT-IV (10 Hrs.)

Transformer Materials: Different types of insulting material for transformer core, winding, insulation, need for bushings, various cooling techniques, effect of temperature on the performance of transformer.

Recommended Books:

1. P.S. Bhimbra, 'Electrical Machinery', 7th Edn., Khanna Publishers, Delhi, **2004**
2. A.E. Fitzerald, C. Kingsley and S.D. Umans, 'Electric Machinery', 6th Edn., TMH, **2002.**
3. A.S. Langsdorf, 'Theory of AC Machinery', 2nd Edn., Tata McGraw Hill, **1955.**
4. Ashfaq Hussian, 'Electrical Machines', 2nd Edn., Dhanpat Rai and Company, **2002**.
5. S.J. Chapman, 'Electrical Machinery Fundamentals', 2nd Edn., McGraw Hill, New York, **1991.**

ELECTRICAL MACHINES & DRIVES

Subject Code: BELE0-F96 **L T P C** **Contact Hrs. 36**

3 0 0 3

Course Objectives:

1. To make the students aware about the basics and need for energy efficient machines.
2. To make them familiar with the energy efficient motors and their applications.
3. To make them to understand the drive systems.

Course Outcomes:

1. The students will become aware about the need for energy efficient machines.
2. They will come to know about the energy efficient motors and their applications.
3. They will understand the adjustable speed systems.

UNIT-I (13 Hrs.)

Energy Efficient Motors: Review of induction motor characteristics, Standard motor efficiency, energy efficient motor, efficiency determination methods, Direct Measurement method, Loss segregation method, Comparison, motor efficiency labeling, energy efficient motor standards.

UNIT-II (10 Hrs.)

Power Factor: The power factor in sinusoidal systems, power factor improvement, power factor with nonlinear loads, Harmonics and power factor.

UNIT-III (12 Hrs.)

Application of Electric Motors: Varying duty applications, Voltage variation, Voltage Unbalance, over motoring, Poly-phase induction motors supplied by adjustable frequency power supplies.

UNIT-IV (10 Hrs.)

Induction Motors and Adjustable Drive Systems: Energy Conservation, adjustable speed systems, Application of adjustable speed systems to fans, pumps and constant torque loads.

Recommended Books:

1. Andreas John C., 'Energy Efficient Electric Motors', CRC Press, **1992**.
2. Emadi Ali, 'Energy Efficient Electric Motors', 3rd Edn., CRC Press, **2004**.
3. Thuman Albert, 'Introduction to Efficient Electric Systems Design', The Fairmount Press Prentice Hall, **1991.**
4. S.C. Tripathi, 'Electric Energy Utilization and Conservation', Tata McGraw Hill, **1991**.
5. Charles Belove, 'Handbook of Modern Electronics and Electrical Engineering', John Wiley and Sons, **1986**.

ELECTRICAL MACHINES AND POWER UTILIZATION

Subject Code: BELE0-F97 **L T P C** **Contact Hrs. 36**
3 0 0 3

Course Objectives:

To study different electrical power machines and their use in various applications in agricultural operations.

Course Outcomes:

Students will be able to acquire knowledge about:

1. Different types of circuits and their applications.
2. Principles and operation of transformers, DC machines and motors.
3. Various methods of power measurement.

Unit – I (10 Hrs.)

Electro motive force, reluctance, laws of magnetic circuits, determination of ampere-turns for series and parallel magnetic circuits, hysteresis and eddy current losses; Transformer- principle of working, construction of single phase transformer, EMF equation, phasor diagram on load.

Unit – II (12 Hrs.)

Leakage reactance, transformer on load, equivalent circuit, voltage regulation, power and energy efficiency, open circuit and short circuit tests, principles, operation and performance of DC machine (generator and motor), EMF and torque equations, armature reaction, commutation, excitation of DC generator and their characteristics.

Unit – III (12 Hrs.)

D.C. motor characteristics, starting of shunt and series motor, starters, speed control methods-field and armature control, poly-phase induction motor: construction, operation, equivalent circuit, phasor diagram, effect of rotor resistance, torque equation, starting and speed control methods.

Unit – IV (10 Hrs.)

Single Phase Induction Motor: Double field revolving theory, equivalent circuit, characteristics, phase split, shaded pole motors, disadvantage of low power factor and power factor improvement, various methods of single and three phase power measurement.

Recommended Books & References:

1. P.S. Bimbhra, 'Electrical Machinery', Khanna Publishers, New Delhi, **1991**.
2. H. Cotton, 'Advanced Electrical Technology', 7th Edn., Wheeler Publishing**, 1999.**
3. Nagrath, Kothari, 'Electric Machines', Tata McGraw Hill Publishing Company, New Delhi, **2010.**
4. A.K. Theraja and B.L. Theraja, 'A Textbook of Electrical Technology', Vol.-1, S. Chand Publisher, **2014.**

HEAT AND MASS TRANSFER

Subject Code: BMEE0-F91 **L T P C** **Contact Hrs. 36**
3 0 0 3

Course Objectives:

The course provides an introduction to heat and mass transfer and introduces practical application in industry. Basic tools to design process operations involving heat transfer and mass transfer are covered.

Course Outcomes:

After learning the Course, the students should be able to:

1. Understand basic concept of heat transfer.
2. To understand the concepts of heat transfer through extended surfaces.
3. Able to do basic calculations involving heat transfer as is typical for a engineer, this includes conduction, convection and radiation heat transfer as well as heat exchanger design.
4. Apply scientific and engineering principles to analyze and design aspects of engineering systems that relate to conduction, convection and radiation heat transfer.

Unit - I (8 Hrs.)

Introductory concepts, modes of heat transfer, thermal conductivity of materials, measurement. General differential equation of conduction; One dimensional steady state conduction through plane and composite walls, tubes and spheres with and without heat generation, Electrical analogy.

Unit - II (10 Hrs.)

Insulation materials, critical thickness of insulation, Fins, Free and forced convection; Newton's law of cooling, heat transfer coefficient in convection; Dimensional analysis of free and forced convection; Useful non dimensional numbers and empirical relationships for free and forced convection.

Unit - III (10 Hrs.)

Equation of laminar boundary layer on flat plate and in a tube, Laminar forced convection on a flat plate and in a tube; combined free and forced convection. Introduction- Absorptivity, reflectivity and transmissivity of radiation; Black body and monochromatic radiation, Planck's law, Stefan-Boltzman law, Kirchoff's law, grey bodies and emissive power, solid angle, intensity of radiation.

Unit - IV (12 Hrs.)

Heat transfer analysis involving conduction, convection and radiation by networks, Types of heat exchangers, fouling factor, log mean temperature difference, heat exchanger performance, transfer units. Heat exchanger analysis restricted to parallel and counter flow heat exchangers. Steady state molecular diffusion in fluids at rest and in laminar flow, Flick's law, mass transfer coefficients. Reynold's analogy.

Recommended Books & References:

1. R.K. Rajput, 'Heat and Mass Transfer', S. Chand Publication, **2008.**

2. P.K. Nag, 'Heat & Mass Transfer', McGraw Hill, **2011.**
3. Yunus Cengel, 'Heat and Mass Transfer Fundamentals and Applications', McGraw Hill**, 2017.**
4. Incropera and Dewitt, 'Fundamental of Heat and Mass Transfer', Wiley Publication.
5. Mills and Ganesan, 'Heat Transfer', Pearson Education.

COMPUTER PROGRAMMING AND DATA STRUCTURES

Subject Code: BCSE0-F91 **L T P C** **Contact Hrs. 40**
3 0 0 3

Course Objectives:
The objective of this course is to make students to learn basic principles of Problem solving, implementing through C programming language and to design & develop programming skills and to gain knowledge of data structures and their applications.

Course Outcomes:
On completion of this course, students are able to:
1. Design and develop modular programming skills.
2. Effective utilization of memory using pointer technology
3. Understands the basic concepts of pointers and data structures.

Unit – I (8 Hrs.)
Introduction to high level languages, Primary data types and user defined data types, Variables, type casting, Operators, Building and evaluating expressions, Standard library functions, Managing input and output.

Unit – II (12 Hrs.)
Decision making, Branching, Looping, Arrays and User defined functions, passing arguments and returning values, recursion, scope and visibility of a variable, String functions, Structures and union, Pointers, Stacks, Push/Pop operations, Queues, Insertion and deletion operations, Linked lists.

Unit – III (10 Hrs.)
Familiarizing with Turbo C IDE; Building an executable version of C program; Creating programs using decision making statements such as if, go to & switch; Developing program using loop statements while, do & for; Using nested control structures.

Unit – IV (10 Hrs.)
Familiarizing with one and two dimensional arrays; Using string functions; developing structures and union; Creating user defined functions; Using local, global & external variables; Insertion/Deletion in data structures.

Recommended Books & References:
1. A.S. Tanenbaum, Y. Langsam, and M.J. Augenstein, 'Data Structures Using C', PHI/Pearson Education.
2. Ashok N. Kamthane, 'Programming and Data Structures, Pearson Publisher, **2009.**
3. B.A. Forouzan and R.F. Gilberg, 'C Programming & Data Structures', 3rd Edn., Cengage Publisher.
4. Dharmender S. Kushwaha, A.K. Mishra, 'Data Structures: A Programming Approach with C', PHI Learning Publisher, **2014.**