NOTIFICATION

No. 135 /2021 Date : 2/12/2021

Subject :- Implementation of new syllabi of Semester V & VI of B.E. (C.B.C.S.) as per A.I.C.T.E. Model Curriculum from the session 2021-2022 & onwards.

It is notified for general information of all concerned that the authorities of the University have accepted to implement the new syllabi of **V & VI** of various branches of B.E. in Civil, Mechanical, Computer Science & Engg., Computer Engg., Information Technology, Electrical Engg., Electrical (Electronics & Power) and Electrical & Electronics Engg. (C.B.C.S.) as per A.I.C.T.E. Model Curriculum to be implemented from the academic session 2021-2022 and onwards in phase wise manner as per **Appendix – A** :

Sd/-
(Dr.T.R.Deshmukh)
Registrar
Sant Gadge Baba Amravati University

Appendix – A

Syllabus Prescribed for V & VI Semester of B.E (Civil Engineering)

SEMESTER V

5CE01 : Design Of Reinforced & Prestressed Concrete Structures

Learning Objectives of Subject:

- To understand basic concept of limit state method.
- To understand behavior of slab under external loading.
- To understand behavior of staircase and retaining wall.
- To understand behavior of column and footing.
- To learn concept of grid slab and earthquake resistant construction.
- To introduce basic concept of prestressed concrete.

Course outcomes:

At the end of the subject the students will be able -

- To analyze and design of rectangular section.
- To analyze and design of slab.
- To analyze and design of staircase and retaining wall.
- To analyze and design of column and footing.
- To understand grid slab and ductile detailing.
- Explain the general behavior of PC sections under external load.

SECTION-A

Unit I:

1) Introduction to limit state method, basic concept and design of singly and doubly reinforced rectangular sections.
2) Analysis and design of flanged sections.

Unit II:

1) Analysis and design of one way continuous slabs
2) Analysis and design of two way slab.

Unit III:

1) Design of Dog legged staircase.
2) Design of cantilever retaining walls (Horizontal backfill only).

SECTION-B

Unit IV:

1) Analysis and design of columns for axial load, uniaxial and biaxial bending.
2) Design of isolated footings: square and rectangular subjected to axial load and uniaxial bending moment only (with uniform depth only).

Unit V:

1) Design of Grid Slab by I.S. code method.
2) Detailing for earthquake resistant construction. Introduction, Cyclic behavior of concrete and reinforcement, significance of Ductility, Ductile detailing for beams, columns, beam-column joint and footing.

Unit VI: 1. Introduction to Prestressed concrete: Materials and their characteristics, types of prestressing, Methods and various prestressing systems, Losses of prestress.
2. Analysis of Rectangular and flanged beams.

Notes:
1) Students should use IS 456:2000, IS 1343:2012, IS 1893:2016, IS 13920:2016.
2) Field visit on any RCC framed structure & report of the same.
3) Students must be shown video CD, slides, transparencies, and photograph of actual structures.

Books Recommended:

1. Ashok K Jain : Reinforced Concrete Limit state Design (Nem Chand & Bros Roorkee)
2. S.K.Sinha: Reinforced Concrete Design (M C Graw Hill Education India Pvt Ltd)
3. Devdas Menon, S. UnnikrishnaPillai :Reinforced concrete Design ;Third Edition; McGraw Hill Education
4. Dr.Shah V.L. &Karve S.R. : Limit State Theory & designof Reinforced concrete IS 456:2000(Structurs Publication)
5. Neelam Sharma :Reinforced Cement Concrete design (S.K.Kataria& Sons)
6. S.S.Bhavikatti :Design of R.C.C. Structural Element (R.C.C. Vol. I)(New Age International Publishers)
7. Lin, T. Y. and Burns N. H., Design of Prestressed Concrete Structures, John Wiley and Sons.
8. Krishna Raju, N.; Prestressed Concrete Structures; TMH; Delhi

5CE02: SURVEYING & GEOMATICS

Learning Objectives of Subject:
- To prepare the student to understand applications of curves.
- To enable the students to establish accurate control for photogrammetric survey and to determine accurate locations of points in engineering works
- To equip the candidate with the art, science and technology of cartography and applications of GIS in Mapping Resources.
- To develop the skills in surveying and thematic mapping.

Course Outcomes:
At the end of the course students will be able to
- Understand the use of different types of curves and their field implications.
- Understand the triangulation adjustment.
- Understand the hydrographic survey.
- Acquire skills in handling spatial data base warehousing and mining.
- Understand the surveying with advance instrument like remote sensing, GPS and GIS.

SECTION- A

Unit-I: Curves: Classification, degree of curve, elements of circular and compound curves, theory and methods of setting out simple curves, Instrumental method of setting out compound curves.
Unit-II: Triangulation: principles, classification of triangulation system, triangulation figures, their choice of station, phase of signals, towers, satellite station, reduction to center, field work, reconnaissance, Inter-visibility, angular measurements. Basenet, extension of Basenet.
Unit-III: Hydrographic surveying: necessity, controls, shore line surveys, gauges, sounding equipmentôs and procedure of taking soundings, methods of location of sounding, three-point problem in hydrographic surveying, analytical and graphical methods. Underground Surveying: surface alignment, correlation of surface and underground surveys; Weisbach triangle, transferring levels and alignment underground.

SECTION – B

Unit-IV: Elements of photogrammetry: Basic definitions, terrestrial and aerial photography, scale of vertical photograph, Relief and relief displacements, heights from parallel measurements, flight planning, photographs required.
Unit-V:1.Remote sensing: Introduction, definitions, remote sensing systems, advantages over conventional system, energy interaction in the atmosphere, Indian remote sensing satellite series and their characteristics 2. GPS: Global positioning system (GPS) introduction, definitions, GPS receivers, antenna, advantages of GPS.

Unit-VI: 1. Geographical Information System: Definition and history, Components of GIS, Data structure and formats, Spatial data models ï Raster and vector, Data base design- editing and topology creation in GIS, Linkage between spatial and non-spatial data, Introduction to QGIS software. 2. GIS application: Application in Geological Investigations, water resources management, environmental studies, EIA based studies, Land use planning, soil studies and transportation planning.

Books Recommended:

1. D. Clark.: Plane and Geodetic Surveying Vol II, CBS Publishers & Distributors Pvt. Ltd,
2.T.P. Kanetkar & S.V.Kulkarni: Surveying and Leveling Part II, Pune Vidyapetth GrahaPrakashan.
3. B.C.Punmia: Surveying Vol. II and III, Tata McGraw-Hill Publishing Company Limited,
4. Kang-tsung Chang: Introduction to Geographic Information Systems, McGraw-Hill Book Company, 2006.
5. B.C. Punmia, Ashok Jain, Arun k. Jain: Higher surveying, Laxmi publications (P), Ltd,
6. Dr. S. Kumar: Basics of remote sensing and GIS, Laxmi publications (P), Ltd

5CE03: NUMERICAL METHODS AND COMPUTER PROGRAMMING

Learning Objectives of Subject:
- To learn the basics of spreadsheets.
- To learn the basic concepts of computing.
- To know the methodology of problem solving.
- To develop skills in programming using C language.

Course outcomes:

At the end of subject the students will able -

- To use spreadsheet software for solving civil engineering problems.
- To impart knowledge to analyze, solve, design and code numerical method problems using C language.
- To impart knowledge to analyze, solve, design and code civil engineering problems using C language.

SECTION – A

Unit-I:

Spreadsheet software basics, Expressions, Mathematical Functions, Conditional Execution Functions like IF, COUNT, COUNTIF, SUM, SUMIF, AVERAGE, AVERAGEIF, LOOKUP, HLOOKUP. Application to the Civil Engineering Problems.

Unit-II:

1. Basic structure of C program, use of library functions, input output statements, flowchart.
2. Decision Control structures and loop Control structures conditional loop and unconditional loop: WHILE, DOWHILE, FOR, IF, IFELSE, NESTEDIF, LADDER IFELSE etc.

Unit-III :

1. Type casting, single dimensional and multi-dimensional array, subscripted variables
2. Functions in C

SECTION-B

Computer Programming using C:

Unit-IV:

1. Matrix operations such as:
    a. Addition and subtraction
    b. Multiplication
    c. Transpose
    d. Testing summary etc.
2. Fourth order, Runge - Kutta method for solution of first order, second order differential equations and two simultaneous equations.

Unit-V:

1. Solution of quadratic equation
2. Numerical integral using Trapezoidal and Simpson rule
3. Finding root of equation f (x) = 0 by Newton ï Raphson , Regula -Falsi and Bisection method.

Unit VI:

1. Centre of gravity, moment of inertia & radius of gyration of Tee section.
2. Bending moment and shear force ordinates for simply supported beam subjected to point and uniformly distributed load only.
3. Design of singly reinforced beam by limit state method.
4. Determination of coefficient of permeability in parallel and perpendicular direction of bedding plane
5. Reduce level by height of instrument method.
6. Determination of Chezyôs constant.

BOOKS RECOMMENDED :

1.E Balagurusamy, Programming in ANSI C
2.Yashavant P. Kanetkar, Let Us C
3. Pradeep Dey & Manas Ghosh ñComputer Fundamentals &Programming in Cò Oxford University Press 2006.
4. Herbert Schildt - C Complete Reference (Tata-McGraw Hill)
5. Gottfried ï Problem Solving in C (Schaum Outline Series- McGrawHill)
6. Noel Kalicharan - C by Example (Cambridge University Press)

5CE04 : (PROFFESSINAL ELECTIVE - I) (I) HIGHWAY CONSTRUCTION AND MANAGEMENT

Learning Objectives of Subject:

- To know the development of transport, various road development plans and policies in India and test procedures for highway materials.
- To understand the principles of highway geometric design as per IRC standards.
- To study the different types of pavement its construction, maintenance & design by different methods.
- To understand the Traffic engineering & different types of traffic control devices.
- To study the causes, preventions, better planning & design of highway to prevent accidents.
- To study various types of equipments, their working principles & limitations for flexible and rigid pavement.

Course outcomes:

At the end of the subject the students will be able ï

- Explain the basic concepts about highway engineering
- To design geometric elements of the highway.
- To design the various types of road pavements with construction and maintenance of highway.
- To carry out traffic studies and implement traffic regulation and control measures and intersection design.
- To apply the knowledge to prevent the road accidents.

SECTION A

Unit I: Highway: Development and Planning, Road Transport characteristics, classification of Roads, Road development plans & Salient features, Road pattern, Alignment principles, Egg. Survey for highway. Material and Testing. Various properties of aggregates and bituminous materials and Test, IRC, IS Specifications, bituminous mix design.

Unit II: Geometric Design : cross sectional elements, Right of way, Camber, Gradient, Typical Highway cross section in embankment and in cutting, PIEV Theory, stopping sight distance, Overtaking sight distance, Horizontal alignment - curves, super elevation, Extra widening, transition curves, vertical alignment, Design of summit and valley curves, IRC Standards for Geometric design.

Unit III: Pavement Design: Components of Flexible and Rigid pavement, Design factors, ESWL, Flexible pavement design by C.B.R. Method. Westergards analysis for wheel load & Temperature stresses in rigid pavement, Rigid pavement by IRC method (As per IRC-37), Combination of stresses, Joints in Rigid Pavement, Construction And Maintenance ï WBM Surface dressing, Bituminous roads, cement concrete Pavement, construction procedure, construction of roads in expansive soil .

SECTION B

Unit IV: Traffic Control Devices: Traffic signs, markings, islands and signals. Different methods of signal design; redesign of existing signal including case studies. Signal system and co-ordination. Evaluation and design of road lighting.

Unit V: Road Safety: Road accidents, Causes, scientific investigations and data collection. Safety in Road Design ï Accident prevention through better planning and design of roads ï planning road networks by land use planning. Traffic calming techniques and innovative ideas in road safety.

Unit VI: Equipment in Highway Construction: Various types of equipment for excavation, grading and compaction - their working principle, advantages and limitations. Special equipment for bituminous and cement concrete pavement and stabilized soil road construction.

Books Recommended:

1. Kadiyali L.R., ñ Principles & Practice of Highway Engineeringò Khanna Publisher
2. ñHighway Engineeringò, Khanna & Justo, (Nem Chand & Poros, Roorkee.1997)
3. E.J. Yoder, ñPrinciples of Pavement Design,ò John Wiley & Sons lnc., New York
4. Chakroborty P Das ñPrinciples & Practice of Highway Engineeringò (Khanna Publisher 2000)

REFERENCE BOOKS:

1. Highway Material Testing ï S K Khanna- C.E.G. Justo, Nemchand Bros- Rookee, 2000
2. S.K.Khanna & Justo C.E.G., Highway Material Testing Manual
3. A.K. Duggal and Vijay P.Puri, ñLaboratory Manual in Highway Engineering,ò.

5CE04: (II) REPAIRS & REHABILITATION OF STRUCTURES

Learning Objectives of Subject:

- To learn various distress and damages to concrete and masonry structures
- To understand the importance of maintenance of structures
- To study the various types and properties of repair materials
- To assess the damage to structures using various tests
- To learn the importance and methods of substrate preparation
- To learn various repair techniques of damaged structures, corroded structures

Course outcomes

At the end of the subject the students will be able ï

- Various distress and damages to concrete and masonry structures
- The importance of maintenance of structures, types and properties of repair materials etc
- Assessing damage to structures and various repair techniques

SECTION A

Unit I : Introduction: General Consideration, Distresses monitoring, Causes of distresses, Quality assurance, Defects due to climate, chemicals, wear and erosion, inspection, Structural appraisal, Economic appraisal Structural Health, factors affecting health of structures, effect of leakage, age, creep, corrosion, fatigue on life of structure.

Unit II: Structural health monitoring, various measures, regular maintenance, structural safety in alteration. Quality control & assurance of materials of structure, durability of concrete, Factors affecting durability of concrete, Corrosion in structures, Testing and prevention of corrosion, fire safety.

Unit III : Structural Audit, Assessment of health of structure, study of structural drawings, nature of distress, visual observations, Collapse and investigation, limitations of investigator, tools for investigation, Various NDT Methods for assessing strength of distressed materials, investigation management, review of assimilated information, interviews and statements, evaluation and reporting, presentation of report, communication gap among client, architect, consulting engineer & contractor.

SECTION B

Unit IV: Retrofitting of Structures, parameters for assessment of restoration strategies, selection of construction chemicals during restoration, Specification for important items of work in restoration, Structural detailing for restoration, and various techniques of retrofitting. Waterproofing of RCC water retaining structures.

Unit V: Safety during construction, formwork and staging, material handling, Existing methods of formwork, Modular formwork, Structural aspects for formwork in buildings & bridges.

Unit VI: Demolition of Structure, study of structural system and structural drawings, need and importance for demolition, outline of various demolition methods and their evaluation, partial and controlled demolition, role of safety measures, temporary support structures in demolition. Recycling of demolished materials

Books Recommended:

1. Deananmmer: "Handbook of Material Management"; McGraw Hills.
2. Gopalkrishnan: "Fundamentals of Material Management"; Tata McGraw Hills.
3. M Y Khan and Jain: "Financial Management"; Tata McGraw Hills
4. A M Neville: "Properties of Concrete"; Longman
5. R N. Raikar: "Durable Structures", R & D Centre, (SDCPL), RaikarBhavan, Sector 17, Vashi, Navi Mumbai.
6. R.N. Raikar: "Learning from Failures", R & D Centre, (SDCPL), RaikarBhavan, Sector 17, Vashi, Navi Mumbai.
7. R.N. Raikar: "Diagnosis and treatment of structures in Distress", R & D Centre, (SDCPL), RaikarBhavan, Sector 17, Vashi, Navi Mumbai.
8. Hanbook on Seismic Retrofit of building , Central public works Department & Indian Building Congress In Association with IIT - Madras

5CE04 : (III) SUSTAINABLE CONSTRUCTION METHODS

SECTION A

Learning Objectives of Subject:

- Student should learn about the present demand supply gap of various construction resources and resource forecasting.
- Student should be able to understand various pollutions and its impact, rules and regulation related to pollution control.
- Student should be able to understand the concept of Sustainability , strategy to achieve it .
- Student should turn aware about various organizations working for implementing sustainability, Green rating agency and process to achieve it.
- Student should be able to determine use of waste material by proper process and percentage.
- Student should learn about sustainable construction like – Green roofs, Green walls etc.
- Student should be able to understand thermo resistive property of construction material and its effect on utilization.
- Student should learn about sustainable Illumination, ventilation techniques.
- Student should know to manage domestic water resources.

Course outcomes:

At the end of the subject the students will be able -

- To understand present condition and need for replacement of non renewable resources.
- To understand concept of sustainability and strategy to achieve it.
- To understand various criteria's and considerations to achieve sustainable construction according to Green Rating Agencies.
- To decide application of sustainable methods in construction for Roof, Wall, thermo resistivity etc.
- To reduce water need and reuse of house hold waste water.

SECTION A

Unit I: Role of Construction sector in Global Resource Consumption, Resource like sand , water , aggregates , cement etc. demand supply gap analysis. Construction & Demolition waste. Environmental pollution related terms like Global warming, Carbon credit, Resource exploitation, Land pollution, Urban Heat Island, Air and water Pollution. Rules and Act related to waste management and pollution mitigation.

Unit II: Concept of Sustainability, Its origin, Legislation related to Sustainable construction , Reduce – Reuse – Recycle (3 R) Strategy , Various Green Rating Agency worldwide, Detail study of criteria's and process under GRIHA (Green Rating for Integrated Habitat Assessment), IGBC (Indian Green Building Council), LEED, India (Leadership in Energy and Environmental Design).

Unit III: Concept of Manufacturing cost, operational cost and life time cost, Payback Period. Thermo resistive property of construction materials and its importance. Implementation of Waste and recycled materials in construction – Case study of some projects like Use of Plastic in Road construction, recycled aggregate utilization and similar to this. Various types of Renewable Energy and its application.

SECTION B

Unit IV: Concept of Green/ Sustainable Roofs, Its types, geometry, material, methodology and Limitations. Concept, material & methodology and limitation of Green walls, various methods like implementation of Cavity wall, Rattrap bond wall, thermo resistive material wall, Green vegetative wall etc.

Unit V: Sick Room, Need and types of windows & ventilations, active and passive ventilation concept, Role of opening location and dimension in Ventilation and air circulation. Sustainable ventilation techniques.

Unit VI: Illumination terms :- Glare , Glare Index ,dark room, comfortable illumination , Lux value for various rooms as per utilization as in latest Building Code of India , Role of Solar direction, season and location for direction and provision of openings. Sustainable Illumination Techniques (Natural & Artificial methods) ,
Water Management – Re Use of domestic water, Grey water ï Concept and some Grey water treatment units example, Ground water recharging techniques, Rain water harvesting.

Books Recommended:

1. Moore F: Environmental Control System McGraw Hill, Inc., 1994.
2. K S Jagadish, B V Venkataramana Reddy, K. S. NanjundaRao : Alternative Buildings Materials and Technologies, New Age International Publishers, New Delhi, 2007
3. "Construction Materials, Methods & techniques" (3e) by William P Spence, Yesdee Publication 2012, pvt.ltd, Chennai, India
4. "Concrete Structure Properties & Materials" by mehataP.K&MantreioP.J.M, Prentice hall.
5. "Building Materials" ny M. L. Gambhir, NeaJamwal, Tata McGraw Hill Publication.
6. Building Reuse ,Sustainability preservation and value of life by Kathrin Rogers Mrilino.
7. Sustainable Construction Engineering & Management by Dr. S.K.Deshmukh & Dr. Abhinandan R.Gupta, LAP academic Publishing Mauritius
8. Energy Efficient Construction Materials, Key Engineering Material, Elsevier by Dr. S.K. Deshmukh & Dr. Abhinandan R.Gupta
9. Handbook of GRIHA for Green Rating
10. Handbook of LEED , India for Green Rating.

5CE04 :(IV) WATERSHED ENGINEERING AND MANAGEMENT

Learning Objectives of Subject:

- To study the different hydrological parameters.
- To understand hydrological statistics and design.
- To characterize and mitigate natural and man-made hazards.

Course Outcome: Student shall be able to

- Explain the hydrology and hydrological data.
- Analyze the hydrological methods for runoff.
- Evaluate the ground water hydrological problems.

SECTION - A

UNIT I: Introduction: Watershed, Definitions, Concept of watershed development, objectives of watershed development, and need for watershed development, Integrated and multidisciplinary approach for watershed management.
UNIT-II: Characteristics of Watersheds: Size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, socio-economic characteristics, basic data on watersheds.
UNIT-III: Hydrology in water resources development, statistical analysis of rainfall and runoff, different distributions methods, Estimation of Unit Hydrograph-flood flow formulae, Storm hydrograph, Storage and regulation of runoff-safe yield of streams

SECTION - B

UNIT-IV: Hydrology of ground water : Common aquifers-Exploration for ground water, hydraulics of ground water flow- Measurement of permeability of formations, flow nets and their constructions, Boundary conditions ï Unconfined and Confined, steady and unsteady flow into wells, Method of images ï Types, design, construction and maintenance of wells and infiltration galleries, Development of wells ï well strainer ï functions and selections, Ground water recharge
UNIT-V: Practice of watershed management: rehabilitation, protection and enhancement, non-point sources of pollution: the legal basis, the process of non point source pollution control, best management practices principles, Applications of Geographical Information System and Remote Sensing in Watershed Management
UNIT-VI: Storm water management, design of drainage system, flood routing through channels and reservoir, flood control and reservoir operation. Drought assessment and classification, drought analysis techniques, drought mitigation planning. Water conservation by recycle and reuse .

Books Recommended:

1. Watershed Hydrology by Peter E. Black.
2. Water Resources Systems, Planning and Management by R. N. Chaturvedi.

5CE05 (OPEN ELECTIVE) (I) BASICS OF BUILDING CONSTRUCTION

Learning Objectives of Subject:

- To understand the basic concepts of structures and types of foundation of civil structure.
- To learn about the different type of masonry, types of bonds and construction methodology.
- To understand various levels in building ï Types of floorings and floors,
- To understand the type and need of openings for access and circulation.
- To make aware of knowledge and importance of stairs, plastering and painting of structures.
- To understand the aspects of construction.

Course outcomes:
At the end of the subject the students will be able -

- To understand Load bearing and Frame structure with their foundations.
- To recognize various types of construction material and its suitability
- To recognize the various levels in building and its need.
- To know types of openings, doors, windows and other related fixtures.
- To recognize types of rock and minerals and its construction properties.
- To understand the basic concepts of DPC, fireproof, soundproof and expansion joints in structure.

SECTION –A

Unit I: Introduction: Definition of building as per national building code, components of buildings and their function , Types of structure-load bearing structure and frame structures, their relative advantages and disadvantages, load bearing walls and partition walls. Types of foundation- Definition and necessity and types of foundations, precautions to be taken against failure of foundations

Unit II: Stone Masonry- Technical term, general principles to be observed during construction, selection of stone masonry. Brick Masonry Construction- Technical term, general principles to be observed during construction, commonly used types of bonds such as Stretcher, Header, English bond Flemish bond and their suitability.

Unit III: Floors- Types of floors-Basement floor, ground floor and upper floor. Types of upper floors-R.C.C. slab floor, R.C.C. slab and beam floor, R.C.C. grid floor, R.C.C. flat slab floor. Floor Finishes Types of flooring material, Shahabad , Kota, Granite, Ceramic tiles, Plain tiles, mosaic tiles glazed tiles ,different types of floor finishes , their suitability. Method of construction, criteria of selection. Roofs-Flat and pitched roof, steel roof trusses-types and suitability ,fixing details at supports ,types of roof covering, AC and GI sheets, acrylic sheets, fixing details of roof covering.

SECTION –B

Unit IV: Door ï Purpose, criteria for location, size of door, door frames and its types, method of fixing Windows-Purpose, criteria for location, size and shapes of windows, types of windows and their suitability. Ventilators ï Types and their suitability. Fixtures and Fastening for doors and windows. Glass- Types of glass and their suitability. Arches and Lintels - Types and their suitability. Details of R.C.C. lintels and chajja, precast lintels and arches.

Unit V: Stairs- Function, technical terms, criteria for location, types of staircases and their suitability. Painting and Coloring ï Necessity, types, processes of painting and coloring to the wall surface, wooden surfaces, iron and steel surfaces, types of paints and their uses Scaffolding- Purposes, types, suitability.

Unit VI: Special Aspects of Construction, Damp proofing-causes of dampness, its effects, various methods of damp proofing, material used for damp proofing. Fire proof construction- Points to be observed during planning and construction. Fire protection requirement for a multistoried building, Sound proof construction ï Sound absorbents and their characteristic. Joints Expansion and construction joints necessity, details of expansion joint at foundation level and roof level of load bearing structure and framed structure, Provision of construction joints in slabs, beams and columns.

Books Recommended:

1. Deshpande R.S... And Vartak C.V.: A Treatise on Building Construction.
2. Sharma S.K. Kaul and B.K.:A.T.B. Building Construction, S Chand and co.
3. Sane L.S.: Construction Engineering, Manak Talas, Mumbai
4. Chudley R.: Construction Technology, Volume I.II.III. And IV, Longmans Group Ltd.
5. Basics of Civil Engineering, Vol. I by Dr A.R.Gupta , Google book publishers ltd.
6. Gurucharan Sing: Building Construction Engineering, Standard Book House, Delhi-06
7. Sushilkumar :Building construction ,Standard publisher distributors.
8. B.C.Punmia ,A.K. Jain,: Building construction. ISE National Building code of India, 1970

5CE05 : (II) DISASTER MANAGEMENT

Learning Objectives of Subject:

- Student should learn about the term Disaster and definitions associated with it.
- Student should know various types , reasons for happening and preventive measures for Natural Disasters .
- Student should know various types , reasons for happening and preventive measures for Artificial Disasters
- Student should know about Impact and mitigation measures against disasters.
- Student should know about Disaster Risk Reduction and its utility practices.
- Learner should know about various Government and NG organization working for Disaster Management.
- Student should know role and responsibility of individual and group for managing Disaster.

Course outcomes:
At the end of the subject the students will be able -

- To understand concept and terms related to Disaster.
- To understand various types of Natural and Artificial Disaster .
- To decide and take actions to mitigate impact of disaster.
- To know roles and responsibility of organizations ï public and private, individual and group to manage disaster.

SECTION A

Unit I: Introduction - Concepts and definitions: disaster, hazard, vulnerability, risks severity, frequency and details, capacity, impact, prevention, mitigation. Study about natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.);

Unit II: Study about manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

Unit III: Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

SECTION B

Unit IV: Disaster Risk Reduction (DRR) - Disaster management cycle ï its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures, vulnerability and capacity assessment; early warning systems, Post disaster environmental response.

Unit V: Institutional mechanism for Disaster Management**,** Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, Disaster Management Policy Environment and local Action, Funding for Disaster Management, Capacity Building, Disaster Management Act 2005.

Unit VI:. Disaster Management practices at working and residential places. Key responsibility of engineers in disaster reduction techniques, medical preparedness aspect of disaster, plan to counter, threats to water supply.

Books Recommended:

1. Cuny, Fred C; Disasters and management, oxford Uni. Press.
2. Alexander, David; Principles of emergency planning and management, Terra publishing, ISBN 1-903544-10-
3. National Disaster Management Authority, Govt. of India, Report.
4. A.S. Arya Action Plan For Earthquake, Disaster, Mitigation in V.K. Sharma (Ed) Disaster Management IIPA Publication New Delhi, 1994

5CE05 :(III) SOFT SKILLS AND INTERPERSONAL COMMUNICATION

Learning Objectives of Subject:

- Student should learn about the methods and measures to develop the interaction skills.
- Student should be able to have strong decision making and lateral thinking skills.
- Should know the doôs and donôts for being good leader.
- Should be able to understand about conflict and be able to manage it.
- Should understand need of Negotiation and strategy to handle it wisely.
- Should be able to recognize the type, ways and barriers in Communication so as to develop it.
- Should be able to conduct effective correspondence process and shall have knowledge of documentation and formal writing skills.

Course outcomes:

At the end of the subject the students will be able -

- Interact in developed way so as to handle the situations .
- To take analyzed decisions over the problem and will effectively carry out wok in time.
- To handle task with developed leadership skills.
- To determine the reasons and solutions over conflict and will be able to manage it.
- To understand need for negotiation and strategy negotiate things.
- To have strong communication.
- To carry out formal documentation process and will have proper guideline for writing formal basic documents.

SECTION A

Unit I : Individualôs Basic Interaction Skills ï Within family, Society Personal and interpersonal intrapersonal skills . Types of skills; conceptual, supervisory, technical, managerial and decision making skills. Problem Solving, Lateral Thinking. Self Awareness and Self Esteem Group Influence on Interaction Skills Human relations examples through role ï play and cases.

Unit II : Leadership Skills Working individually and in a team Leadership skills Leadership Lessons through Literature Team work & Team building . Interpersonal skills ï Conversation, Feedback, Feed forward Interpersonal skills ï Delegation, Humor, Trust, Expectations, Values, Status, Compatibility and their role in building team ï work. Conflict Management ï Types of conflicts, how to cope with them Small cases including role ï plays will be used as teaching methodology.

Unit III : Negotiation Skills (To be Taught through Role Plays and Cases) Types of Negotiation Negotiation Strategies Selling skills ï Selling to customers Selling to Superiors Selling to peer groups, team mates & subordinates Conceptual selling, Strategic selling Selling skills ï Body language

SECTION B

Unit IV : Introduction, Need for Communication, Process of Communication - Written and Verbal Communication, Visual communication, Signs, Signals and Symbols, Silence as a Mode of Communication - Inter-cultural, Intra-cultural, Cross-cultural and International communication - Communications skills, Communication through Questionnaires, Business Letter Writing, Electronic Communication.

Unit V : Barriers to Communication Improving Communication Skills -Preparation of Promotional Material -Non-verbal communication -Body language -Postures and gestures -Value of time -Organizational body language - Importance of Listening -Emotional Intelligence.

Unit VI : -Business Cases and Presentations, Letters within the Organizations, Letters from Top Management, Circulars and Memos - Business Presentations to Customers and other stakeholders, Presenting a Positive Image through Verbal and Non-verbal Cues, Preparing and Delivering the Presentations, Use of Audio-visual Aids .

Book Recommended:

1. Personality Development & Soft Skills by Barun K. Mitra.
2. Soft Skills and Interpersonal Communication by S. Balsubhramanium.

5CE06 : DESIGN OF REINFORCED & PRESTRESSED CONCRETE STRUCTURES - LAB

Practicals:
1. Candidates are required to prepare at least two designs based on theoretical course detailed working drawings are necessary.
2. A journal/report on design shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.
3. Field visit on any RCC framed structure & report of the same.

5CE07: SURVEYING & GEOMATICS – LAB

Following is the list of practical to be conducted. Minimum 8 practical out of the given should be carried out. Practical examination shall consist of field exercise and viva-voce examination based on theory & practical.

List of Practicals: (Any Eight)

1. Ranging circular curve by offset from long chord.
2. Ranging circular curve by offset from tangent.
3. Ranging circular curve by offset from chord produced.
4. Ranging circular curve by Rankineôs method.
5. Triangulation by satellite station.
6. Base line measurement in triangulation system.
7. To Find horizontal distance and difference in elevation between two points by using Total station.
8. To plot a layout using Total station.
9. Study on Stereoscope.
10. Application of GPS ï Distance and Coordinate Measurement using GPS tool.

5CE08 : NUMERICAL METHODS AND COMPUTER PROGRAMMING -LAB

Practicals: Preparation and execution of at least **six** computer programs using C language. Solution of at least **two** civil engineering problems using spreadsheet software. A journal/report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.

5CE09 : (I) HIGHWAY CONSTRUCTION AND MANAGEMENT –LAB.

List of Practicals :-

Any **Five** of the following should be conducted and a report there of should be submitted:
1. Field CBR Test.
2. Pavement Evaluation by Benkelman Beam Method.
3. Road Unevenness Measurement by Bump-Integrator.
4. Valuation of Pavement Roughness by Roughometer / Profilometer.
5. Design of Flexible Pavements for Highway.
6. Design of Flexible Pavements for Runway.
7. Design of Rigid Pavements For Highway.
8 . Design of Rigid Pavements For Runway
9. Design of Overlays.
10. Marshal Stability Test
11. Transportation management (**field studies)**
12. Parking management (**field studies)**
13. Road accident studies (**field studies)**
14. Rotary design

Field Visit:

1. Hot ï mix plant visit,
2. Road construction site visit: Earth work construction procedure and bituminous mix laying, spreading and rolling procedure.

5CE09 :(II) REPAIRS & REHABILITATION OF STRUCTURES – LAB

List of Experiments: (Any Three)

1. To perform a non-destructive and semi-destructive testing on the cast specimens of the beams using set up of Rebound hammer, UPSV, Core drilling etc. and there by prepare a report on the interpretation of the strength i.e quality of concrete based on NDT test results.
2. Take up Conditional Assessment of 5 different structures including Residential, Commercial, Industrial, and Government buildings, Private structures (old & new construction both). Prepare Rapid visual inspection data sheets of the same.
3. Prepare a report of the buildings surveyed, to highlight all the defects/deterioration seen through proper resolution photographs. The report must clearly indicate the distress ï its source and symptoms.
4. Perform experiment to evaluate the Compatibility between the substrate material concrete and any repair material. (For instance comparing the Bond strength of Polymer modified mortar and Conventional Mortar with Concrete).
5. Experimental investigation to carry out the efficacy of repair material/ technique of enhancing the strength of concrete beam post cracking. (For instance, Cast a RCC beam, simulate cracking and then filling the crack with repair material and check the post-repair strength results).

Major Equipment: Compression Testing Machine, Concrete Mixture, NDT equipment like USPV, Rebound Hammer, Corrosion Meter, Rebar Locator, Engineerôs inspection Kit.

5CE09 : (III) SUSTAINABLE CONSTRUCTION METHODS – LAB.

1. Experimentation to check the corresponding strength of material by mixing waste material for Concrete work : Casting of 2 sets of specimen only with each set of 3 cubes , for percentage replacement of concrete elements with any suitable waste material like ï Recycled aggregate, waste vehicle tire etc.
2. Experimentation to check the corresponding strength of material by mixing waste material for Brick work : Study of cavity wall and rattrap wall for thermo resistive property.
3. Student can work out and prepare report on installation plan , process ,budget, payback period and maintenance required for renewable energy source like solar / wind for small residential house of around 5 rooms.
4. Study and Preparation of Isolux mapping for room using Lux meter, for understanding illumination area and pattern.
5. Case Study : Students should visit to nearby sustainable construction like old existing monumental structure like Palace, religious place, well , fort **or** any Green rated structure by valid Rating agency like GRIHA , LEED India etc. **or** any undergoing sustainable project in vicinity for better understanding and needs to prepare the short report over learningôs.

5CE09:(iv) Watershed Engineering And Management – Lab.

Minimum 8 practicalôs out of the given should be performed. The Site visit is compulsory. The Graphs and sheets are to be drawn whenever are necessary. The practical examination shall consist of viva-voce based on theory and Practical.

List of Experiments:

1. Study of watershed management technologies.
2. Watershed planning and development.
3. Surveying and preparation of watershed map.
4. Analysis of hydrologic data for planning of watershed development.
5. Water budgeting of watersheds.
6. Grid survey of watershed area.
7. Study of Aquifer (Working, Types, Flow net)
8. Study of infiltration galleries. (Types, Design, Construction, Maintenance)
9. Study of unit hydrograph, Storm hydrograph
10. Design of storm water drainage system.
11. Visit to watershed development project.

SEMESTER SIXTH

6CE01: DESIGN OF STEEL STRUCTURES

Learning Objectives of Subject:

- To introduce steel structures and its basic components
- To understand methods of design of steel structure.
- To introduce structural steel fasteners like welding and bolting
- To introduce design method of tension & compression members.
- To introduce design method of beams, Column, Base Plate.
- To introduce design load on a typical steel roof trusses.

Course outcomes:

At the end of the subject the students will be able -

- To explain the methods of design of steel structure.
- To design bolted and welded connection.
- To identify the different failure modes of bolted and welded connections, and determine their design strengths.
- To design the Tension and compression member.
- To identify and compute the design loads on a typical steel roof trusses.
- To design basic elements of steel structure like beams, column and bases.

(By Limit State Method IS 800:2007)

SECTION – A

Unit I:

- Introduction to WSM, LSM & Plastic analysis of steel structure, plastic hinge, plastic moment capacity, shape factor, plastic section modulus.
- Design of bolted & welded connections subjected to axial and eccentric loading (In the plane of group of Bolts & Weld).

Unit II:

- Design of Compression & Tension member.
- Design of Industrial shed.

SECTION – B

Unit III:

- Design of simple & compound columns for axial loading.
- Design of column bases (Slab base & Gusseted base) subjected to axial load.

Unit IV:

- Design of simple Beams (laterally supported).
- Design of compound Beams (laterally supported).

Books Recommended:

1. Duggal, S. K., Design of Steel Structures, Tata McGraw Hill Pub. Company Ltd.
2. N. Subrramanyam, Design of Steel Structures, Oxford University Press, 2008.
3. V L Shah & Veena Gore: Limit State Design of steel structures IS 800-2007
4. M. R. Shiyekar, Limit state design in Structural Steel (Second Edition); PHI Learning Pvt. Ltd.
5. Bhavikatti, Design of Steel Structures: By Limit State Method as Per IS: 800 ï 2007; I K International Publishing House Pvt. Ltd.
6. M. L. Gambhir, Fundamentals of Structural Steel Design ; McGraw Hill Education.

6CE02: ENVIRONMENTAL ENGINEERING – I

Learning Objectives of Subject:

- To make the students conversant with sources and its demand of water
- To understand the basic characteristics of water and its determination
- To expose the students to understand the design of water supply lines
- To provide adequate knowledge about the water treatment processes and its design
- To have adequate knowledge on operation and maintenance of water supply

Course Outcomes: -

At the end of the subject the students will be able -

- Define and explain the significance of terms and parameters frequently used in water supply engineering.
- Evaluate the influence of the different parameter in design and treatment of water treatment plant (water quality parameters).
- Basic methodology for water treatment (viz., sedimentation, coagulation, flocculation, filtration, disinfection and water softening.)
- An understanding of water quality criteria and standards, and their relation to public health.

SECTION – A

Unit-I : Quantity Estimation of water: Demand of water. Consumption for various purposes. Fire Demand, Per capita demand. Factors affecting consumption. Fluctuation in demand. Design period, forecasting population.
Sources: Surface sources, ground water sources, Infiltration Galleries, Relative merits of sources, assessment & suitability, selection.

Unit-II :Water quality: Impurities in water, their effects and significance water borne diseases, collection of water samples. Water analysis- physical, chemical and bacteriological. Water quality standards: I.S. & WHO, Flow diagrams and layouts of different water treatment works. Intakes- type, location, requirement & features.

Unit-III: Aeration: Purpose, types of gravity aerators & spray aerators.
Sedimentation: Plain and with coagulation, different coagulants used, dose of coagulant, Jar test, Flocculation, clarrifloculator. Design criteria for sedimentation tanks, surface loading, simple problems on design of sedimentation tanks.

SECTION – B

Unit-IV: Filtration: - Rapid sand and slow sand filters, filter media, Rate of filtration, under drainage system and washing process. Control system, Negative head, operating difficulties, pressure filter; Simple design problems on rapid sand filters.

Unit V: Disinfection: - Requirement of good disinfectant, methods of disinfection. Chlorination: Methods, prechlorination, post chlorination. Break point chlorination and super chlorination, forms of chlorine. Use of bleaching powder - Simple problems. Introduction to tertiary treatments-Softening and Defloridation.

Unit-VI: Distribution system: - Types of supply: Continuous, and intermittent. Types of system: Gravity, Pumping and combined gravity and pumping, Layouts of distributions system. Maintenance of distribution system. Equalizing storage, Type of storage reservoirs, capacity. Types of conduits, joints, appurtenances. Pipe laying and testing.

Books Recommended:

1. Steel E. W., ñWater Supply and Sewerageò, Mc-Graw Hill.
2. Kshirsagar S. R., ñWater Supply Engineeringò, Roorkee Pub house, Roorkee.
3. Birde G. S. , ñWater Supply and Sanitary Engineeringò, Dhanpat Rai and Sons, Delhi.
4. Punmia B. C. ñwater Supply Engineeringò. Laxmi publication.
5. Garg S.K. Water Supply Engineering, Khanna Publishers.

6CE03: FLUID MECHANICS

Learning Objectives of Subject:

1. To study the basic behavior of fluids and fluid system and the laws governing this behavior
2. To understand and apply the basic concepts Mechanics to carry out professional engineering activities in the field of fluids.
3. To apply scientific strategies to analyze qualitatively and quantitatively the problems and give solutions.

Course Outcomes:

At the end of the subject the students will be able -

1. Describe basic properties of fluid flow.
2. Apply the knowledge to fluid flow problems.
3. Analyze the type of flow by using basic of mathematical principle.
4. Solve and modeling the pipe flow problems.

SECTION - A

Unit I: Properties of fluids: Introduction, properties of fluids, viscosity, surface tension, & capillarity, related problems. Pressure and its measurement: Fluid pressure at a point, Pascalôs Law, pressure variation in a fluid at rest, absolute gauge, atmospheric & vacuum pressures, measurement of pressure, simple manometers, differential manometers, related problems.

Unit II: Hydrostatic forces on surfaces: Introduction, total pressure & centre of pressure, vertical, horizontal plane surface submerged in liquid, related problems.
Buoyancy & floatation**:** Introduction, buoyancy, centre of buoyancy, metacentre, metacentric height, analytical method of metacentric height, conditions of equilibrium of a floating & submerged bodies, related problems.

Unit III: Kinematics of flow :Introduction, methods of describing fluid motion, types of fluid flows, continuity equation in three dimensions, velocity & acceleration, velocity potential function & stream function, related problems.
Dynamics of fluid flow: Introduction equation of motion, Eulerôs equation of motion, Bernoulliôs equation from Eulerôs equation, its assumptions, related problems.

SECTION - B

Unit IV: Measurement of fluid flow, Horizontal venturimeter, V and Rectangular Notches, Darcyôs equation (no proof), major and minor losses in pipes, pipes in series and parallel, pipe network. Momentum equation and its application to horizontal pipe bends.

Unit V: Dimensional Analysis; Buckinghamôs Pie theorem, itôs application, similitude, Dimensionless numbers, Re, Fr, We, Predominant forces & their ratio, Model Analysis - Geometrically similar models, Reynolds law, Froudes law, Model study of spillways.

Unit VI: Uniform flow, Open channel flow, Types of flow, geometric elements of rectangular & trapezoidal sections, Chezyôs &Mannings equations, most efficient rectangular & trapezoidal section, Energy & momentum principles, Normal & critical depth, specific energy diagram, discharge diagram.

Books Recommended:

1) Modi P.N. & Seth S.M.: Hydraulics & Fluid Mechanics, SI Edition, Standard book house.
2) Dr. Jain A.K.: Fluid Mechanics, Khanna publication.
3) Subramanya K.: Fluid Mechanics, Tata Mc-Graw Hill.
4) Streeter: Fluid Mechanics, Mc-Graw Hill.
5) Fluid mechanics by R.K.Bansal, Laxmi publication.
6) Garde&Mirajgaonkar: Fluid Mechanics, Scitech publication.

6CE04: PROFESSIONAL ELECTIVE – II (I) ADVANCED CONSTRUCTION MATERIALS

Learning Objectives of Subject:

- To understand the special type of concrete and supplementary cementatious materials.
- To learn about the different type of metals and new alloy steels.
- To learn different composite materials and Thermal and Sound insulating materials.
- To understand different types of construction chemicals and wastes.
- To learn different types of shoring and formwork materials.
- To understand the concept of smart materials.

Course outcomes:

At the end of the subject the students will be able -

- To understand special type of concrete and supplementary cementitious materials.
- To recognize various types of metals and new alloy steels.
- To understand Thermal and Sound insulating materials.
- To know types of construction chemicals and wastes.
- To recognize types of shoring and formwork materials.
- To understand the elementary concept of smart materials.

SECTION A

UNIT I: Cement, Mortar And Concrete Ceramic Materials
Study of Special Purpose Cement, Mortar, Concrete - High Strength And High Performance Concrete, Self Compacting Concrete, supplementary cementitious material - Fly Ash, Red Mud, Gypsum, Various Types of Finishes & Treatments, Engineering Grouts, Mortar plaster, Gypsum, Glass. GGBS, micro silica etc. Replacement of aggregates; stone dust, light weight aggregates, recycled aggregate.

UNIT II: Metals
Steels - HYSD, TMT, Tendons, Light Gauge Steel, Steel Fastenings, New Alloy Steels ï Aluminum and Its Products, Protective Coatings to Reinforcement.

UNIT III: Composites
Polymer and its composites, Ceramic and its composite, FRC, Ferro cement etc., Timber, bamboo, veneer, Laminates, Particle boards, Thermal and Sound insulating materials.

SECTION B

UNIT IV: Construction Chemicals and Waste: Chemical Admixtures and Adhesives, Water Proofing Compounds ï Non Weathering Materials, GeoSynthetics, Geo-Membranes,, Asphalt, Tar & Bituminous Materials, Agro Waste Materials, Industrial Waste Materials, Disposable Materials.

UNIT V: Shoring & Formwork Materials : Materials, Accessories and Proprietary Products - Lumber - Types - Finish - Plywood -Types and grades, Reconstituted wood -Steel -Aluminum Form lining materials, Design Considerations, Building and Erecting the formwork, Causes of Failure of Formwork.

UNIT VI: Elementary Concept Of Smart Material :
Smart and Intelligent Materials-Piezoelectric Materials, Shape Memory Alloys & Polymers, Magnetostrictive Materials, Temperature Responsive Polymer, Halo chromic Materials, Smart Hydrogels, Chromomeric Systems, Photomechanical Materials, Self Healing Materials, Dielectric Elastomers. Bio cement, Phase change material.

Text Book: Building Materials, P.C. Varghese, Prentice-Hall India, 2555.

Reference Books:
1. Materials Science and Engineering: An introduction, W.D. Callister, John Wiley, 1994.
2. Materials Science and Engineering, V. Raghavan, Prentice Hall, 1990.
3. Properties of Engineering Materials, R.A. Higgins, Industrial Press, 1994.
4. Construction materials: Their nature and behaviour, Eds. J.M. Illston and P.L.J. Domone, 3rd ed., Spon Press, 2551.
5. The Science and Technology of Civil Engineering Materials, J.F. Young, S. Mindess, R.J. Gray & A. Bentur, Prentice Hall, 1998.
6. Engineering Materials 1: An introduction to their properties & applications, M.F. Ashby and D.R.H. Jones, Butterworth Heinemann, 2553.
7. The Science and Design of Engineering Materials, J.P. Schaffer, A. Saxena, S.D. Antolovich, T.H. Sanders and S.B. Warner, Irwin, 1995.
8. Concrete: Microstructure, properties and materials, P.K. Mehta and P.J.M. Monteiro, McGraw Hill, 2556.
9. Properties of concrete, A.M. Neville, Pearson, 2554.
10.Materials for Civil and Construction engineers by Michael S. Mamlouk, John P. Zaniewski, Pearson Publication

6CE04 :(II) GEOGRAPHIC INFORMATION SYSTEM & SCIENCE

Learning Objectives of Subject:

- To prepare the student to understand remote sensing, itôs techniques and interpretations.
- To introduce the concepts of image processing and basic analytical methods to be used in image processing
- To familiarize students with image enhancement, restoration techniques, and to understand different image compression techniques.
- To gain a basic, practical understanding of GIS concepts, techniques and real-world applications

Course Outcomes:
At the end of the course students will be able to

- Explain and communicate quantitative remote-sensing principles and integrate different tools for remote sensing data analysis
- Perform image corrections, enhancements and generate high-level remote sensing products.
- Apply basic graphic and data visualization concepts such as colour theory, symbolization, and use of white space.
- Demonstrate proficiency in the use of GIS tools to create maps that are fit-for-purpose and effectively convey the information they are intended to.
- Apply mathematical concepts, including statistical methods, to data to be used in geospatial analysis.
- Review the fundamental concepts of a digital image processing system.

SECTION – A

Unit I: Definition and scope of remote sensing: electromagnetic energy and its wavelengths. Remote sensing systems, sensors and scanners, resolution of sensors, multi-spectral, thermal and radar scanners, radiometers spectral response curve and spectral signatures.

Unit II: Elements of sensing system: Terrestrial, airborne and space borne platforms, Sun-synchronous and geo-stationary satellites, advantages and disadvantages. Various earth Resources satellites, Indian remote sensing program. Remote sensing data products and their types: analogues and digital data formats, Thermal and radar imageries.

Unit III: Interpretation techniques: Elements of interpretation and methods, interpretation key, interpretation instruments. Relief displacement, image parallax and vertical exaggeration, Determination and calculation of elevation from RS data.

SECTION - B

Unit IV: Digital image processing: image rectification and restoration, image enhancement-contrast manipulations, spatial feature manipulation, multi-image manipulation, image classification supervised and unsupervised classification, accuracy assessments and data merging.

Unit V: Applications: Integrated approach of RS and GIS application: Application in Geological Investigations, water resources management, environmental studies, EIA based studies, Land use planning, soil studies and transportation planning. Application in civil engineering projects damns and bridges, site investigations, landslide studies.

Unit VI: Geographical Information System: Raster and vector data, concepts and basic characteristics of vectorization, topology generation, attribute data attachment, editing and analysis. Global Positioning System: Introduction to Global Positioning System (GPS) - Fundamental concepts, GPS system elements and signals, Classification of GPS receivers.

Books Recommended:

1. Remote sensing Geology: Ravi P Gupta, Springer publication
2. Remote sensing and GIS: Anji Reddy ISBN publication.
3. Remote Sensing: Sabins, Floyd F
4. Higher surveying volume III: Dr. B C Punmia.

6CE04 PROFESSIONAL ELECTIVE – II (III) MASONRY STRUCTURES

Learning Objectives of Subject:

This course will enable students to

- Understand properties of masonry units, strength and factor affecting strength
- Understand design criteria of various types of walls subjected to different loads system
- Impart the culture of following the codes, for strength, serviceability and durability as an ethics.
- Provide knowledge in analysis and design of masonry elements for the success in competitive examination

Course Outcomes:

At the end of the subject the students will be able -

- Explain engineering properties and use of masonry units defect and cracks in masonry and its remedial measures
- Summaries various formulas for finding compressive strength of masonry units.
- Explain permissible stress and design criteria as per IS: 1905 and SP-20.
- Design different types of masonry walls for different load considerations.

SECTION A

Unit -I :- Masonry unit materials, types and masonry construction : brick, stone and block masonry unit- strain, modulus of elasticity and water absorption of masonry materials, classification and properties of Mortar. Defect and errors in masonry construction- cracks in masonry, types, reason for cracking, methods of avoiding cracks.

Strength and stability: strength and stability of axially loaded masonry walls, effects of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of aging, workmanship. Compressive strength formulae based on elastic theory and empirical formulae.

Unit II:-Permissible stresses: Types of walls, permissible compressive stress, stress reduction and shape modification factors, increase in permissible stresses for eccentric vertical and Lateral load, permissible tensile stress and shear stresses.

Design consideration: Effective height of wall and columns, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. problems on design considerations for solid walls, cavity walls, walls with pillar.

Unit – III : Load consideration and design of Masonry walls subjected to axial loads: - Design criteria, Design of wall subjected to concentrated axial loads: - Solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers,

SECTION B

Unit – IV: Design examples of walls under UDL, Solid walls ,cavity walls ,solid walls supported at the end by cross walls, walls with piers .

Unit – V : Design of wall subjected to eccentric loads: - Design criteria - stress distribution under eccentric loads -problems on eccentrically loaded solid walls, cavity walls, walls with piers.

Design of laterally and transversely loaded walls: Design criteria, design of solid wall under wind loading, design of compound walls.

Unit –VI: Confined Masonry
Confined masonry construction, difference between confined masonry and RC frame construction. Earthquake resistance of confined masonry Structures. Earthquake-Resistant Confined Masonry Construction guidelines

TEXT BOOKS:
1. Dayaratnam P, Brick and Reinforced Brick Structures, Scientific International Pvt. Ltd.
2. M. L. Gambhir, Building and Construction Materials, McGraw Hill education Pvt. Ltd.
3. Anand S. Arya, Masonry and Timber Structures Including Earthquake Resistant Design Published by Nem Chand and Bros.
4. Svetlana Brzev , Earthquake-Resistant Confined Masonry construction , National Information center of earthquake engineering Indian Institute of technology Kanpur.

REFERENCE BOOKS:
1. Materials for Civil and Construction engineers by Michael S. Mamlouk, John P. Zaniewski, Pearson Publication
2. Design of Masonry Structures By A.W. Hendry, B.P. Sinha, S.R. Davies
3. Design of Reinforced Masonry Structures, Second Edition, Narendra Taly, McGraw Hill education Pvt. Ltd

6CE04 :(IV) SOLID AND HAZARDOUS WASTE MANAGEMENT

Learning Objectives of Subject:
- To provide an overview of waste generation, waste characterization and waste management processes.
- To impart knowledge on solid waste management with particular emphasis on municipal solid waste management which includes different waste processing options such as pyrolysis, composting, and incineration; designing and operating sanitary landfill.
- To enrich knowledge about characteristics of hazardous wastes and their management.
- To impart knowledge on industry specific solid waste management practices.
- To provide an overview about the concept of land degradation and land reclamation

Course Outcomes:
At the end of the subject the students will be able -
- To identify and interpret the criteria for the classification of a substance as a solid/hazardous wastes.
- An ability to recognize waste minimization and source reduction, assess and describe the procedure for solid and hazardous waste identification and characterization and various waste processing options.
- Define and elucidate the management, treatment and disposal of hazardous wastes.
- Skill to assess and develop physical/chemical/biological treatment techniques for the control of hazardous wastes.
- Skill to address and describe solid waste management including landfill operation.
- Ability to design and execute land reclamation projects.

SECTION A

Unit I: Municipal solid waste: Definition, Sources and types of solid waste, composition and its determinants of Solid waste-factors influencing generation, quantity assessment of solid wastes, methods of sampling and characterization.

Unit II: Collection and Transfer Collection: Collection of Solid waste, collection services , collection system, equipments, time and frequency of collection. Transfer and Transport: Need for transfer operation, transport means and methods, Optimization of Transport Cost.

Unit III: Disposal of Solid Wastes Refuse disposal : various methods, incinerations, principle features of an incinerator, site selection and plant layout of an incinerator, sanitary landfill- methods of operation, advantages and disadvantages of sanitary land fill, site selection, reactions accruing in completed landfills, gas and leachate movement and control, equipments necessary, Energy Recovery.

SECTION B

Unit IV: Introduction: Definition, Need for hazardous waste management, Sources of hazardous wastes, Effects on community, terminology and classification. Storage and collection of hazardous wastes, Problems in developing countries, Protection of public health and the environment.

Unit V: Management of hazardous wastes: Identifying a hazardous waste, methods, Quantities of hazardous waste generated, Components of a hazardous waste management plan, Hazardous waste minimization, Disposal practices in Indian Industries, Future challenges.

Unit VI: Nuclear wastes and E-waste: Characteristics, Types, Health and environmental effects, Audit of E-Waste. Biomedical and chemical wastes: Biomedical wastes, Types, Management and handling, control of biomedical wastes & Chemical wastes.

Books Recommended:
1) George Techobanoglous et al, ñIntegrated Solid Waste Managementò McGraw - Hill, 1993.
2) Techobanoglous Thiesen Ellasen; Solid Waste Engineering Principles and Management, McGraw - Hill 1997.
3) R.E.Landreth and P.A.Rebers,ò Municipal Solid Wastes-Problems & Solutionsò. CRC press.
4) J. Glynn Henry and Gary. W. Heinke, ñEnvironmental Science and Engineeringò, Pearson publication.
5) A. D.Bhide and B.B.Sundaresan, ñSolid Waste Management ï Collection, Processing and disposalò Mudrashilpa Offset Printers, Nagpur, 2001.
6) Biomedical waste (Management and Handling) Rules, 1998.

6CE04 :(V) TRAFFIC ENGINEERING & MANAGEMENT

Learning Objectives of Subject:
1. To understand traffic planning & characteristics for urban roads.
2. To understand different surveys and methods of traffic volume study.
3. To understand the design of different intersections and use visual aids
4. To understand the Traffic safety & control devices to prevent road accidents.
5. To understand the traffic system management.
6. To know advanced technology used in traffic engineering.

Course outcomes:
At the end of the subject the students will be able ï
1. To explain the road characteristics & traffic planning.
2. To analyze traffic capacity of roads & intersection by different methods.
3. To design different types of road intersections & use of visual aids for roads.
4. To use knowledge of traffics safety & environmental hazards.
5. To recommend suitable traffic management system and traffic regularity measures.
6. To apply the knowledge of Intelligent Transportation System to traffic management system.

SECTION A

Unit I: Traffic Planning & Characteristics:
Road Characteristics ï Road User Characteristics ï PIEV theory ï vehicle ï Performance Characteristics ï Fundamental of traffic flow ï Urban Traffic problems in India ï Integrated planning of town, country, regional and all urban infrastructure ï towards sustainable approach ï Land use & transport and model integration.

Unit II : Traffic surveys:
Traffic surveys ï Speed, Journey time and delay surveys ï vehicles volume survey including non-motarized transport ï methods and interpretation ï origin destination survey ï accident analyses methods , interpretation and presentation ï statistical applications in traffic studies and traffic forecasting ï level of service ï concept, application and significance.

Unit III : Traffic design and visual aids:
Intersection Design ï channelization, Rotary intersection design ï signal design ï coordination of signals ï grade separation ï traffic signs including VMS and road markings ï significant roles of traffic control personnel ï networking pedestrian facilities & cycle tracks.

SECTION B

Unit IV: Traffic Safety and Environment :
Road Accident ï Causes, effects, prevention, and cost ï street lighting ï traffic and environment hazards ï air and noise pollution, causes, abatement measures ï promotion and integration of public transportation ï Promotion of non-motorized transport.
Unit V: Traffic Management:
Area Traffic management system ï traffic system management (TSM) with IRC standards _ Traffic Regulatory Measures ï Travel Demand Management (TDM) ï Direct and Indirect Methods - congestion and parking pricing ï all segregation methods ï coordination among different agencies
Unit VI : ITS : Intelligent transport system for traffic management, enforcement and education, Application of ITS to Traffic Management System- Public Transportation Management System.

(Open Elective II)
6CE05 : (i)Environmental Management

Learning Objectives of Subject:
The objective of the course is to provide skills and an improved understanding of how firms and organisations work with sustainability issues such as environmental and natural resource management in order to protect our eco system.

Course Outcomes:

At the end of the course the student will be
- Aware of different environmental problems, their causes and effects.
- Have knowledge regarding different environmental policies & management plans.
- Have thorough knowledge about Environmental Legislation and Acts.
- Acquire information about various agencies for Environmental Managements in India.
- Have knowledge regarding different systems working for Environmental Management.

SECTION – A

Unit I: Different environmental problems - Energy and the environment, Agriculture and the environment, the atmosphere and human activities, etc. Need for environmental management, the nature, scope and components of environmental management.
Unit II: Environmental policy analysis- micro level and macro level, methods of policy analysis, steps involved. : Operational methods, quantitative methods, statical analysis public policy analysis resource allocation, environmental economics etc.

Unit III: Environmental management plan (EMP): components of Environmental Management Plan, Preparation of Environmental Management Plan.

SECTION – B

Unit IV: Environmental Legislation and Acts: Water (prevention and control of pollution) Act1974,Air (prevention and control of pollution) Act 1981, environmental protection Act (EPA) 986, Hazardous waste rules1989, Factory Act 1984 amendments in 1987, Environmental Management System: ISO 14000(EMS) Environmental Audits: methods, components and preparation.

Unit V: Various agencies for Environmental Managements in India: Ministry of environment and forest, central pollution control boards, state pollution control boards, local bodies, - their scopes, organizational and functional issues, their working etc.

Unit VI: Basics of Data Base Management System (DBMS), Geographic Information System (GIS) and remote sensing in Environmental Management.

Books Recommended:

1. Environmental Impact Analysis- a decision Making Tool: By R KJain, McGraw ï Hill.
2. Theory and Practice of Environmental Impact Assessment: By Abbasi and Ramesh, Discovery publishing house pvt. ltd.

6CE05 :(II) HUMAN RESOURCE DEVELOPMENT & ORGANIZATIONAL BEHAVIOR

Learning Objectives of Subject:

- Student should learn about concept of Management and its utility.
- Student should learn about various types of Organization and its structure.
- Learner should be able to understand the concept of Human Resource Management .
- Learner should understand self development process and its fixity for Organizational need .
- Student should be able to understand and develop skills of Leadership , Team Work , Professional behavior , Job analysis and ethics .
- Student should be able to analyze job , opportunities and growth criteriaôs.

Course outcomes:

At the end of the subject the students will be able -

- To understand the concept of Management and Organization.
- To understand types of Organization and Its structure.
- To develop himself/ herself as per the need and requirement of work and self updation.
- To develop better skills related to leadership, team behavior, ethics at working place .
- To analyze job opportunity and future in it .
- To understand expectations for job evaluation , assessment of work and growth in the field.

SECTION A

UNIT I:- Understanding the Term Management and Organization. Learning about various types of Organizations and Organizational chart. Concept and need for Human Resource Management (HRM) and Human Resource Development (HRD) . Concept, Origin and Need, for HRD as a Total System; Approaches to HRD; Human Development and HRD; Introduction to Organizational Behavior (OB) .

Unit II :- Knowing and Managing Yourself Individual Behaviour: MARS model of individual behaviour Values: Values across cultures (Hofstedeôs framework); Personality: Big five model; MBTI; Use of personality tests; Personality attributes influencing OB Emotions: Understanding emotions; Emotional labour; Emotional Intelligence Attitudes: Attitudes v/s values; Job Satisfaction; Organizational Commitment Perception: Factors influencing perception; Perceptual errors; Self-fulfilling prophecy; Know yourself: Johari window

Unit III :- Motivation in the workplace , What is motivation; Types of Motives; Theories of Maslow; Herzberg, McGregor, Alderfers, Porter and Lawlerôs Model; Job Enlargement, Job Enrichment, Behaviour Modification.

SECTION B

Unit IV :- Communication What is communication; Organizational communication: Formal networks and Grapevine; Electronic communications; Barriers to effective communication; non- verbal communication; Improving Interpersonal communication: Empathy and Active listening

Unit V :- Leadership Difference between managers and leaders; Perspectives of leadership: Trait, Behavioural, Contingency; Inspirational leadership: Transactional, Transformational, Charismatic; NGO leadership

Unit VI :- Job Analysis, Job description; Job Specification; Job Evaluation, Recruitment, Selection, Orientation Sources of recruitment: Internal and external; Steps in selection process; Performance Management , What is performance appraisal; Purposes, Process and Uses.
Compensation Management ï Need, Objectives and factors determining compensation; Developing pay structures, Executive remuneration; components of compensation; Incentives

Prescribed Books :

1. Nadler, Leonard : Corporat Human Resource Development, Van Nostrand Reinhold, ASTD, New York .
2. Rao, T.V and Pareek, Udai: Designing and Managing Human Resource Systems, Oxford IBH Pub. Pvt.Ltd., New Delhi , 2005.
3. Rao, T.V: Readings in HRD, Oxford IBH Pub. Pvt. Ltd., New Delhi, 2004.
4. Viramani, B.R and Seth, Parmila: Evaluating Management Development, Vision Books, New Delhi.

5. Rao, T.V.(et.al): HRD in the New Economic Environment, Tata McGraw-Hill Pub.Pvt, Ltd., New Delhi , 2003.
6. Management & Organisation , Dr A. R Gupta , Google book Publishers.
7. ILO, Teaching and Training Methods for Management Development Hand Book, McGraw-Hill, New York .
8. Rao, T.V: Human Resource Development, Sage Publications, New Delhi.
9. Kapur, Sashi: Human Resource Development and Training in Practice, Beacon Books, New Delhi.
10. Lynton, Rolf. P and Pareek, Udai: Training for Development, Vastaar Publishers, New Delhi
11. Viramani, B.R and Rao, Kala: Economic Restructuring, Technology Transfer and Human Resource Development, Response Books, New Delhi .
12. Jaya Gopakl, R: Human Resource Development : Conceptual analysis and Strategies, Sterling Publishing Pvt. Ltd., New Delhi .
13. Truelove, Steve. A: hand book of Training and Development, Beacon Books, New Delhi . 14. Goldstein, Irwin : Training in Organisations, Cole Publishing Co., California .

6CE05 : (III) INTRODUCTION TO EARTHQUAKE ENGINEERING

Learning Objectives of Subject:
This course will cover the basics of seismology and Earthquake engineering. Students will learn
1. Basic seismology, earthquake phenomenon and its characteristic.
2. Earthquake resistant concept.
3. Use of earthquake bands in masonry structure.
4. Behavior of buildings during earthquakes.

Course outcomes:
At the end of the subject the students will be able to -
1. Identify type of earthquake, its properties
2. Earthquake resistance planning
3. Apply knowledge of seismic bands in masonry structure construction
4. Solve engineering problems in the context of Earthquake Engineering.

SECTION A

Unit I: Interior of earth, engineering geology of earthquakes, plate tectonics, Seismicity of the world, tectonics features of India, Faults, and Propagation of earthquake waves.

Unit II: Quantification of earthquake (magnitude, energy, intensity of earthquake), Measurements of earthquake (accelerograph, accelerogram recording), Determination of magnitude, Epicenter distance, Ground motion and their characteristics, Factors affecting ground motions.

Unit III: Guidelines for achieving efficient seismic resistant planning, selection of sites, importance of architectural features in earthquake resistant buildings.

SECTION B

Unit IV: Projections & suspended parts, special construction features like separation of adjoining structure, crumble section, stair case etc., twisting of building, seismic effects on structures, inertia forces, horizontal & vertical shaking.
Unit V: Behavior of masonry structure during earthquake, bands & reinforcement in masonry building opening in walls, importance of flexible structures.
Unit VI: Behavior of R.C. building in past earthquakes. Concept of earthquake Resistant design, Introduction to IS: 1893.

Books Recommended:

1. Duggal S. K., Earthquake Resistant Design of Structures, Oxford University Press 2007
2. Amita Sinvhal; Understanding Earthquake Disasters, Tata McGraw Hill
3. P. N. Agraval; Engineering Seismology Oxford & IBH Publishing
4. C.V.R. Murty; Earthquake Tips National Information Centre of Earthquake Engineering IIT Kanpur
5. Pankaj Agrawal & Manish Shrikhande ; Earthquake Resistant Designof Structures Prentice- Hall of India

6CE06 : DESIGN OF STEEL STRUCTURE– LAB

List of Experiments:
1. Candidates are required to prepare at least **two** designs of steel structures based on theoretical course detailed working drawings are necessary.
2. A compulsory **site visit** for studying the various aspect and prepare a report. A Journal/report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.

6CE07: ENVIRONMENTAL ENGINEERING LAB – I

Minimum Eight (8) practicals out of the list given should be carried out. The practical examination shall consist of viva voce based on theory & practical. Graphs are to be drawn wherever necessary.

List of Experiments:
1. Determination of Turbidity of water sample
2. Determination of Electrical Conductivity water sample
3. Determination of pH of water sample
4. Analysis of Dissolved, Suspended and Total solids

5. Analysis of Volatile and Fixed solids
7. Optimum coagulant dose
8. Determination of Temporary and Permanent Hardness of water sample
9. Determination of Acidity & Alkalinity of water sample
10. Determination of Iron and Manganese
11. Determination of residual chlorine in the given water sample
12. Total Count of Bacteria Test.

6CE08 : FLUID MECHANICS – LAB

Suggested Fluid Practicals :
Minimum 8 practical out of the list given should be carried out. The practical examination shall consist of viva voce based on theory & practical. Graphs are to be drawn wherever necessary.

1. Verification of Bernoulliôs theorem.
2. Determination of coefficient of discharge for Venturimeter.
3. Verification of Reynoldôs Number with respect to type of flow.
4. Determination of metacentric height.
5. Determination of friction factor for GI pipe.
6. Determination of coefficient of discharge for rectangular notch.
7. Determination of coefficient of discharge for triangular notch.
8. Determination of Chezyôs coefficient.
9. Determination of coefficient of discharge of Venturiflume.
10. Verification of momentum equation.
11. Study of hydraulic jump, calculations of height of jump, length & energy loss.

6CE09: MINI PROJECT

Any one Group Project in details:
1) Irrigation Project
2) Rehabilitation of Village / Town
3) Water Supply Project
4) Sewerage System
5) Bridge on River
6) Flood Relief Structures
Students should conduct a detailed survey in a seven day camp.
Data Analysis, Design & Submit Report & Drawing sheets.

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SYLLABUS PRESCRIBED FOR SEMESTER V & VI OF B.E. (MECHANICAL ENGG.)

SEMESTER – V

5ME01 HEAT TRANSFER

Course Learning Objectives (CLOs):

1. To provide details of heat transfer involving conduction, convention and radiation mechanisms.
2. To carry out heat transfer analysis and to demonstrate different techniques used in solving a heat transfer problem.
3. To impart basics of designing heat transfer equipment.

Course Outcome (COs) :
At the end of Heat Transfer course the student will be able to:

1. Solve steady state heat transfer problems of 1-D heat conduction with and without internal heat generation.
2. Design and to analyze the performance of extended surfaces.
3. Apply Lumped heat capacity method for analysis of unsteady state heat transfer.
4. Explain the laws of radiation and its applications.
5. Predict heat transfer coefficients for forced and free convection heat transfer applied to internal and external flow conditions.
6. Design and analyze the performance of heat exchangers using NTU and LMTD methods.

UNIT - I : Introduction, heat transfer in engineering, modes of heat transfer, basic laws of heat transfer and their basic equations. Conduction-thermal conductivity and thermal diffusivity effect of phase &temperature on thermal conductivity, one dimensional steady state heat conduction through slab, cylinder & sphere-simple and composite. Combined conduction- convection, overall heattransfer coefficient. General heat conduction differential equation. One dimensional steady state conduction with internal heat generation for infinite slab, wire & cylinder. **(**8 Hrs**)**

UNIT II : Insulations, critical radius of insulation, Conduction through extended surfaces, analysis of a uniform C.S. fin, fin efficiency, fin effectiveness, Biot number. Introduction to unsteady state heat conduction, Newtonôs law of cooling, lumped heat capacityanalysis. **(8 Hrs)**

UNIT III : Radiation-general concepts and definitions, black body & greybody concept. Laws of radiation - Kirchoffôs Plankôs, Stefan- Boltzmanôs, Wienôs law. Concept of shape factor, emissivity factor and radiation heat transfer equation. (No numericals).Radiation errors in temperature, measurement, radiation shield. (7 Hrs)

UNIT IV: Forced convection- heat convection, forced and natural convection, boundary layer theory, hydrodynamic & thermal boundary layers, boundary layer thickness. Laminar & turbulent flow over flat plate and through pipes & tubes (only concept, no derivation & analytical treatment). Dimensionless number and their physical significance Reynold, Prandtl, Nusselt, Grashoff number, empirical correlations for forced convection for flow over flat plate, through pipes & tubes & their applications in problem solving. **(8 Hrs)**

UNIT V: Free convection- velocity and thermal boundary layers for vertical plate, free convection over vertical cylinder and horizontal plate/cylinder (only concept, no derivation & analytical treatment). Use of empirical correlations in problem solving. Condensation & Boiling - introduction to condensation heat transfer, film & drop condensation. Boiling heat transfer, pool boiling curves. **(7 Hrs)**

UNIT VI : Heat exchanger - applications, classification, overall heat transfer coefficient, fouling. L.M.T.D. & E.N.T.U. methods, temperature profiles, selection of heat exchangers. Introduction to working of heat pipe with and without wick. **(7 Hrs)**

Books Recommended:

Text Books:-

1. Heat and Mass Transfer; R.K Rajput; S. Chand, New Delhi.
2. Heat and Mass Transfer; V.M. Domkundwar; Dhanpat Rai & Co. Delhi.
3. Heat Transfer; A. F.Mills, V. Ganesan, Pearson Publication.

Reference Books:-

1. Heat Transfer; J.P. Holman; McGraw Hill
2. Heat Transfer; P.K. Nag; TMH.
3. Heat and Mass Transfer Data book, V.M. Domkundwar, Dhanpat Rai & Co.
4. Heat and Mass Transfer Data book; C.P. Kothandaraman; New age International.

5ME02 METROLOGY & QUALITY CONTROL

Course Learning Objectives:

1. To study generalized production technology, applications, general configuration and functional elements of inspection instruments.
2. To study about quality in production and services and quality management.
3. To study application of non destructive test for increasing productivity and efficiency of the work.
4. To study design and applications of various gauges and comparators used in inspection.
5. To study various techniques for the inspection of gears and threads.
6. To study various techniques for angular measurement, surface texture measurement, and geometric features measurement.
7. To study advance inspection techniques CMM, profile projector etc.

Course Outcomes:

1. Create & apply the concept of inspection, quality control and its importance to industry.
2. Demonstrate the skills of controlling various out of control processes using statistical quality control tools.
3. Understand the importance of improving production and productivity using work study approach.
4. Apply the knowledge of various measurement standards and techniques in the industry to measure various parameters related to metrology.

UNIT I : Concept of quality and quality control, quality of design and quality of conformance, Quality characteristics, Cost of quality & Value of quality, Specification of quality, quality control & inspection.
Concept of TQM & Quality assurance, Concept of variation, variable and attribute data, Frequency distribution, Measures of Central tendency - Mean, mode & median, Measures of dispersion. -Range, std.deviation & variance. (8 **Hrs**)

UNIT II : Concept of universe and population, Normal distribution curve; Control charts for variables, process capability, Control charts for attributes; comparison between variable charts and attribute charts; precision & accuracy, Sampling plans,Operating Characteristic curve, Quality circle (7 **Hrs**)

UNIT III : Introduction to Non-Destructive testing, Ultrasonic testing, X-ray or Radiography Testing, Liquid Penetrant testing, Magnetic Particle Testing, Eddy current testing, itôs applications, Advantages & Disadvantages. (7 **Hrs**)

UNIT IV : Standards of measurements: line standards, end standard, wave length standard. Limits, fits and gauges: terminology of limits, Fits and gauges, concept of interchangeability, allowance tolerance, Indian Standard Specification for limits, fits and gauges, B.S. System. Limit gauging - design of Go, No Go gauges. (8 **Hrs**)

UNIT V : Linear measurement: various comparators such as mechanical, electrical, optical, pneumatic comparators, their principle, operations and applications.
Angular measurements: vernier, optical, bevel protractor universal bevel protector, Sine bar level clinometers, taper gauges. Thread measurement: screw thread limit and fit limits gauging of screw threads (8 **Hrs**)

UNIT VI : Gear measurement : alignment error, master gear, Parkinson tester. Study and use of optical dividing head, auto collimator, tool makers microscope. Interferometry, flatness testing, squareness testing. Surface texture testing. Coordinate measuring machine- types, role and application. **(7 Hrs**)

Books Recommended:

Text Books:

1. Engineering Metrology ï R.K.Jain - Khanna Publishers.
2. Statistical Quality Control- M. Mahajan ï Dhanpatrai & Co. Pvt.Ltd.
3. Non Destructive Testing techniques by Ravi Prakash, New Age Publications.

Reference Books:

1. Quality Control - By Juran - Mc. Graw Hill Pub. Company.
2. Statistical Quality Control- By Grant E.L. ï R.S.L.Leavgen Worth-.Mc. Graw Hill Pub. Company
3. Statistical Quality Control- By Gupta - Dhanpatrai & Com. Pvt. Ltd

5ME03 KINEMATICS OF MACHINES

Course Learning Objectives:

1. To get the basic Knowledge about the mechanism used in automobiles, industrial machines etc.
2. To study about the synthesis and analysis of the mechanism used in machines.
3. To get the operational knowledge about the power transmitting devices used in automobiles.
4. To study the designing and importance of cams in machines.
5. To study the most effective power transmission device used in automobiles, industrial equipment, toys, etc**.**

Course Outcomes:

Students will be able to-

1. Understand & apply the concept and its applications of link, mechanisms and machines.
2. Demonstrate the ability to analyze the mechanisms and machines on the basis of velocity and acceleration and they will show the ability to solve analytical methods.
3. Show the ability to use graphical and analytical methods for synthesis of mechanisms to develop mini projects in the course duration.
4. Understand the practical for study of brake, clutch, dynamometer, gear train etc.

Unit I: 1. Introduction to study of mechanisms, machines, different types of links, kinematic pairs. Grashofôs law-class-I and class ï II mechanisms. Grublerôs criterion, Kutzbachôs criterion for planer mechanism. Inversions of four bar, single slider, double slider mechanisms.

2. Transmission angle, Mechanical Advantage, Transmission angle and Mechanical Advantage of 4-bar mechanism. **(7 Hrs)**

Unit II: 1**. Velocity analysis**: - Relative velocity method, method of equivalent mechanisms, Instantaneous centre of rotation method for 4-bar mechanism, body and space centroids.

2**. Acceleration analysis**:- Relative acceleration method and analytical method. **(8 Hrs)**

Unit III: Synthesis of Mechanisms:- Introduction to type, number and dimensional synthesis, graphical method of two position, three position and four position synthesis for input output coordination, Freudenstienôs equation, Blochôs method. **(7 Hrs)**

Unit IV: Frictional torque in pivot and collar bearing. Clutches and Dynamometers: types, constructional details, operation. **(7 Hrs)**

Unit V: Special purpose mechanisms:- Steering mechanisms, Geneva wheel mechanism. **Cams**:- Introduction, types of cam & follower, different motions of followers, graphical layout of cam profiles, cam with specified contours. (8 Hrs)

Unit VI: 1. **Gear**: Introduction, terminology, gear tooth profiles, law of gearing, involumetry, interference of spur gears, minimum number of teeth to avoid interference.

2. **Gear Trains**:- Types of gear trains and its speed ratio applications. **(7 Hrs)**

Books Recommended:

Text Books:

1) Theory of Machines, P.L.Ballaney, Published by Dhanpat Rai and sons-N Delhi.
2) Theory of Machines, S.S.Ratan, Published by Tata Mc Graw Hill.
3) Theory of Machine, R.S.Khurmi and Gupta J.K., Published by Eurasia Publishing house-N Delhi.

Reference Books:

1) Theory of Machines and Mechanisms, J.E.Shigley, Uicker and Gordon, Published by Oxford University press-New York.
2) Theory of Machines, V.P.Singh, Published by Dhanpat Rai-N Delhi.
3) Theory of Machines and Mechanisms, Ghosh and Amitabh, Published Affiliated East West Press, N-Delhi.

5ME04 MEASUREMENT SYSTEMS

Course Learning Objectives:

1. To study the generalized measurement system and the general performance characteristics of measuring instruments, applications, general configuration and functional elements of measuring instruments.
2. To study the strain gauges, their types, strain gauge circuits for strain measurement and to study the pressure measurement methods and devices
3. To study the types, constructional details and working of force, torque and flow measuring devices.
4. To study the different types of temperature measuring devices, standards, construction details and their working and to study the different types of liquid level measuring devices.
5. To study the mechanical and electrical types of speed measuring devices, contact and contactless speed measuring devices and their applications.
6. To study the methods of vibrations measurement and methods of linear and angular displacements.

Course Outcomes:

At the end of Measurement System course, the student will be able to:

1. Analyze different measurement systems.
2. Calculate different types of errors in the measurement system.
3. Use strain gauges and pressure measurement devices for several applications.
4. Compare different methods of force, Power and flow measurement using different methods.
5. Select appropriate liquid level and temperature measurement devices for given applications.
6. Measure speed of motors and rotating shafts by using tachometers, stroboscope.

UNIT I : 1. Generalized Measurement system: Significance of measurement, generalized systems. application of measuring instruments. Types of measuring instruments.
2. General configuration and functional elements of measuring instruments, types of inputs, various methods of correction for interfering and modifying inputs. (6 Hrs)

UNIT II : General performance Characteristics:-

1. Static characteristics, different types of errors, combination of component errors in overall systems.
2. Dynamic characteristics: General mathematical model of zero order, first order and second order instruments, response of first and second order instruments to following inputs step, ramp, impulse and frequency. (8 Hrs)

UNIT III : Strain Measurement :

1. Types of strain gauges, strain gauge circuits, calibration, Temperature compensation, use of strain gauges on rotating shafts, selection and installation of strain gauges.
2. Pressure Measurements:- Basic methods of pressure measurement: strain gauge pressure cell, High pressure measurement Bridgeman type, low pressure Measurement - Mcleod, Knudsen, ionisation, Thermal conductivity gauges. **(8 Hrs)**

UNIT IV : 1. Force Measurement: Various mechanical. Hydraulic, pneumatic and electrical methods.
2. Torque and Power Measurements: Various mechanical, hydraulic & electric methods.
3. Flow Measurements: Construction- orifice, Rota meter. Pressure probes- Pitot static tube, turbine meter, electro-magnetic flow meter. **(6 Hrs)**

UNIT V : 1. Temperature Measurements : Standards, Various temperature measuring devices, Bimetallic strip, pressure thermometers, thermo couples, electrical resistance thermometers, Thermistors, radiation Thermometers.
2. Liquid Level Measurements : Various methods such as- single float, displacement or force transducers. Pressure sensitivity, bubbler or Page system, capacitance variation type (for both conducting and non conducting type liquids) Resistance variation type. **(8 Hrs)**

UNIT VI: 1. Speed Measurements: Various mechanical type tachometers, electrical types tachometers, stroboscope etc.
2. Vibration Measurements : Seismic, Strain gauge and piezoelectric accelerometers.
3. Displacement measurements : Linear and angular displacement measurements, LVDT, LDR, Capacitive & inductive pick ups. **(8** Hrs)

BOOKS RECOMMENDED:

Text Books:-

1. Measurement Systems : - By Erenest O. Doebelins - MC Graw Hill.
2. Mechanical Measurement & Control: By D.S.Kumar.

References Books:-

1. Mechanical Measurements :- By T.G.Beckwith & N.L.Bulk - Addison Werllv.
2. Instrumental Measurement & Analysis : By Nakra Choudhari Tata Mc Graw Hill.
3. Mechanical Measurement & Instrumentation : By R.K.Rajput,Katsons Books Publications.

5ME05 OPEN ELECTIVE - I (1) PRODUCTION MANAGEMENT

Course Learning Objectives:

1. To study the new product design & manufacturing process technology.
2. To study the objectives of forecasting, factors affecting forecasting.
3. To study method study, work measurement.
4. To study objectives and functions of Production Planning and Control.
5. To study inventory control & inventory control application
6. To study quality management, quality related costs, quality function deployment & total quality management.

Course Outcomes:

1. Apply the knowledge of operations management and its applications in industrial environment.
2. Demonstrate the knowledge of advanced manufacturing technologies and philosophies.
3. Students will demonstrate the importance of inventory control, JIT in manufacturing.
4. Apply the basic concept of quality management, TQM etc.

UNIT I: Designing products, services and processes; Historical evolution of productions and operations management, newproduct designs, manufacturing process technology.
Flexible manufacturing systems (FMS) and computer integrated manufacturing (CIM). **(9 Hrs.)**

UNIT II: Sales Forecasting: Objectives, types of forecasting, factors affecting forecasting, process of sales forecasting, methods of sales forecasting. **(7 Hrs.)**

UNIT III : Work study: method study, recording techniques of method study, principles of motion economy. Work measurement techniques. **(7 Hrs.)**

UNIT IV: Production planning and control: Objectives and functions of PPC, types of production systems, principles of sound production control system. **(7 Hrs.)**

UNIT V: Inventory Control: Demand and control system characteristics, inventory concepts, costs Modeling, Deterministic inventory models, stochastic inventory models, inventory control application, just-in-time manufacturing. **(7 Hrs.)**

UNIT VI: Quality Management: Quality and quality related costs, quality function deployment(QFD), Taguchiôs off-line quality control methods, managerial responsibility in managing for quality products & services. TQM. Failure analysis, bath tub curve, Reliability of system. **(8 Hrs.)**

Books Recommended:

Text Books:

1. Production and operations management- concepts models and Behaviour by Everett E. Adam,Jr., & Ronald J. Ebert (Prentice- Hallof India)
2. Industrial engineering & production Management by M. Mahajan(Dhanpat Rai & Co.)

References Books:

1. Production and operations management ï Total Quality and responsiveness by Hamid Noori & Russell Radfort (Mc Graw Hill, Inc.)
2. Industrial engineering & management by O. P. Khanna (Dhanpat Rai& Co.)
3. Production and Operations Management; J.P. Saxena; McGraw Hill.

5ME05 OPEN ELECTIVE-I

(2) MANUFACTURING TECHNIQUES

Course Learning Objectives:

1. To study the fundamentals of different manufacturing processes and various activities in manufacturing.
2. To study the fundamentals of metals & alloys, properties of engineering materials like ferrous, non- ferrous metals and their alloys
3. To study different machine tools. cutting tools used in machine shop , various operations performed with working principles of these machine tools
4. To study the activities related to mechanical working of metals, various hot working & cold working operations fundamentals of metal forming ; sheet metal working processes with different tools and equipment
5. To study the necessary details regarding pattern making, moulding, core making and casting with foundry tools & equipment, also melting practice by cupola furnace.
6. To study different Joining processes, basic terms of welding processes tike arc welding, gas welding, resistance welding. friction welding , soldering ; brazing processes with tools & processes.
7. To study the methods of producing metal powders
8. To study plastic part manufacturing by different processes like extrusion. Injection, blow, compression, and transfer moulding processes.

Course Outcomes:

1. Apply the knowledge of various manufacturing techniques and its applications in engineering.
2. Understand the knowledge of machining operations, sheet metal working and processes.
3. Students will show the ability to apply various joining methods in practice.
4. Students will exhibit the knowledge of powder metallurgy.

Unit I : Overview of manufacturing: Classification of manufacturing processes, selection of manufacturing processes, types & properties of materials, selection of materials, Introduction to conventional and non-conventional machining processes. (6Hrs)

Unit II : Introduction to cutting type shaping processes, Basic concept of metal cutting, Types of cutting tools, Orthogonal & oblique cutting, General purpose machines Vs Special purpose machines. (8Hrs)

Unit III: Introduction & application of various metal cutting operations ï Turning, drilling, boring, milling, shaping, planning and grinding process. (8Hrs)

Unit IV: Introduction to metal forming and sheet metal process: Forming process- Forging, rolling, extrusion, wire drawing. Sheet metal processes- Forming, bending, drawing, coining, embossing. Cutting process: Punching, blanking, shearing, lancing. (7Hrs)

Unit V : Metal casting: Steps involved in casting, advantages of casting, pattern, difference between pattern and casting, pattern allowances, material used for patterns, molding sand, sand mould making core, types of cores, defects of castings, melting furnace(Cupola), casting process and its applications. (6Hrs)

Unit VI: Joining process with its types, advantages and disadvantages of riveting, soldering, brazing. Arc welding, gas welding, resistance welding, friction welding. (6Hrs)

Books Recommended:

Text Books:

1. Manufacturing processes ï Workshop practice, R.A. Khan, Ali Hassan, Scitech Pub.
2. Workshop Technology - Hajra Chaudhary, Dhanpat Rai and Sons.

Reference Books :

1. Processes and materials of manufacture E.P. Degarmo, Prentice Hall of India (PHI)
2. Material and processes in manufacturing Lindberg, Tata McGraw Hill Pub.

5ME06 HEATTRANSFER - LAB.

Course learning objective: The lab work should clear the vision about all the modes of heat transfer. The practical knowledge should enhance the approach of student towards real life applications of the subject.

Course Outcomes:

Upon successful completion of lab Course, student will be able to:

i) Understand various modes of heat transfer
ii) evaluate various parameters of the heat transfer process

List of Practicals (Any six of the following):-

1. Determination of thermal conductivity of a metal bar.
2. Determination of thermal conductivity of insulating powder.
3. Study of heat transfer through composite wall.
4. Study of heat transfer through composite cylinders.
5. Determination of fin efficiency.
6. Verification of Stefan-Boltzmanôs law.
7. Determination of emissivity of grey body.
8. Determination of heat transfer coefficient for forced convection.
9. Determination of heat transfer coefficient for natural convection.
10. Study of pool & nucleate boiling.
11. Trial on double pipe heat exchanger.
12. Determination of efficiency of cross flow heat exchanger.
13. To write a computer program for conduction heat transfer problem.

Practical Examination:- The practical examination shall consist of oral on the termwork and syllabus.

5ME07 METROLOGY & QUALITY CONTROL - LAB.

Course learning objective:

The course aims at understanding the principles of metrology for precision measurement of various mechanical components using various measuring tools. Students shall also learn to use standard practices and standard data, learn to use statistical concept, control chart for variables, control chart for attributes.

Course Outcomes:

Upon successful completion of lab Course, students will be able to:

i) Explain the principles involved in measurement and inspection.
ii) Select and use appropriate measurement instrument for a given application
iii) Apply the basics of sampling in the context of manufacturing

Practicals : At least six from the below list.

1. Determination of Linear dimensions of a given specimen/part using Precision/Non-Precision Measuring instruments.
2. Determination of Angular Measurement using Precision/Non-Precision Measuring instruments.
3. Measurement of Gear Tooth Thickness by Gear Tooth VernierCaliper/Constant Chord/Span Micrometer.
4. Measurement of Circularity/Roundness of a given specimen.
5. Measurement of Screw Thread Element by Floating Carriage Micrometer.
6. Testing of Surfaces by using Optical Flat.
7. Measurements of various angles of single point cutting tool by usingProfile Projector and Tool Makerôs Microscope.
8. Preparation of Variable Control Charts for the given lot of sample.
9. Preparation of Attribute Control Charts for the given lot of sample.

Practical Examination:- The practical examination shall consist of oral on term work.

5ME08 KINEMNATICS OF MACHINES - LAB.

Course Learning Objectives: Objectives of this lab are to impart practical knowledge on design and analysis of mechanisms for the specified type of motion in a machine. With the study of rigid bodies motions and forces for the transmission systems, machine kinematics can be well understood.

Course Outcome: On successful completion of the course students will be able to:

Design linkage, cam and gear mechanisms for a given motion or a given input/output motion or force relationship, identify the basic relations between velocity & acceleration and use graphical and analytic methods to study the motions of various mechanisms

Practicals: - *At least eight practicals from the below list shall beperformed.*

1. To Study, Analyse and drawing of inversions of four bar mechanism to identify the types and number of links, types of motion and its mode of fixing arrangement for the required application.
2. To Study and analyse of inversions of slider crank mechanism using working models and graphical representations to find type & number kinematic pair , type of joint and Degree of freedom.
3. To Study and analyse of inversions of double slider crank mechanism using working models and graphical representations to find type & number kinematic pair , type of joint and Degree of freedom.
4. To determine Velocity and acceleration of links in mechanism by relative velocity method. (2 Problem)
5. To determine Velocity and acceleration of Piston of a reciprocating engine by cleinôs construction method. (2 Problem)
6. To find braking force, braking toque of internal expanding and external expanding brake .

7. To study, understand and observe the actual working and function of each part of single plate clutch by dismantling and assembling.
8. To study, understand and observe the actual working and function of each part of centrifugal clutch by dismantling and assembling.
9. Study of dynamometers.
10. To draw Cam profile for a given follower type and follower motion. (2 Problem.)
11. To Study and find train value and speed ratio of various types of gear trains
12. To study and drawing of Simple four bar Mechanism using position synthesis.
13. To Study and drawing of four bar mechanism by input-output coordination methods using Blochôs Synthesis and Freudensteinôs equation.
14. To study interference and undercutting of spur gear pair using graphical layout.
15. To study and drawing of Generation of Involute and Cycloidal Spur Gear Tooth Profile.

The practical examination shall consist of viva-voce on the above syllabus & practical work.

5ME09 MEASUREMENT SYSTEMS -LAB.

Course Learning Objectives :

i)To study various sensers and measuring instruments required to measure various properties and quantities occurring in a typical engineering system.

ii)To understand general performance characteristics of measuring instruments, applications and general configuration of the measuring instruments.

Course Outcomes: Upon completion of this course students will be able to:

i) Choose appropriate measuring device for measurement of various quantities
ii) Analyse the performance of various
iii) Analyse and execute the calibration process for measuring instruments

List of Practicals :

At least eight practicals from the following list:

1. Measurement of strain using strain gauges.
2. Calibration of pressure gauge with pressure gauge tester.
3. Measurement of linear displacement by LDR and inductive pick-uptransducers.
4. Performance of capacitance transducer as an angular displacementmeasuring device.
5. Performance of inductive Transducers.
6. Measurement of flow using optical flow meter and Rotameter.
7. Speed measurement by a stroboscope.
8. Speed measurement by magnetic pick up or photo electric pick up tachometer.
9. Pressure measurement by strains gauge type transducer.
10. Vibration measurement by using Seismic Transducer.
11. Measurement of Liquid level by using capacitive pickup transducer.
12. Temperature measurement using contact and non contact type instruments or various types of sensors.

*The practical examination shall consist of viva-voce on the above syllabus & practical work.

SEMESTER: SIXTH

6ME01 DESIGN OF MACHINE ELEMENTS

Course Learning Objectives (CLOs):

1. To study the concept of stresses and understand the design procedure of riveted and welded joints.
2. To study design procedure of knuckle joint, springs and power screw.
3. To analyze & select types of shafts, keys, couplings for various machines and industrial applications.

COURSE OUTCOMES (COs):

1. Understand the concept of various stresses and apply the design procedure to riveted joints and welded joints.
2. Understand design procedure of knuckle joint, springs and power screw.
3. Analyze & select types of shafts, keys, couplings for various machines and industrial applications.
4. Analyze the various types of bearings and understand the design procedure of IC Engine parts.

Unit I : (A) Meaning of design, Phases of design, Simple stresses, Thermal stresses, Impact Stress, Torsional stress, bending stresses in straight & curved beams, itôs applications, Hooks, C-clamps.
(B) Rivetted Joints- Design, failures, strength & efficiency of riveted joint.
(C) Welded Joint- Strength, of transverse & parallel fillet welded section. **(11 hrs)**

Unit II : (A) Design of knuckle joint.
(B) Design of spiral & leaf spring.
(C) Design of power screw- Torque required to raise loads, efficiency & helix angle, overhauling & self locking of screw, ACME threads, stresses in power screws. **(11 hrs)**

Unit III : (A) Design of Shaft ï Subjected to twisting, bending & combined twisting & bending loads, based on rigidity.
(B) Design of coupling, rigid coupling, sleeve, muff coupling, flange coupling & flexible coupling. **(**11 hrs**)**

Unit IV : (A) Antifriction bearing: Types of bearing, construction, life of bearings, selection of bearings.
(B) Journal bearing: Lubrication, selection of lubrication, design procedure & numerical.
(C) Design of IC Engine parts: Connecting rod, design of flywheel based on TM diagram. **(11 hrs)**

Books Recommended :-

Text Books:

1. Machine Design by Dr. P.C. Sharma & dr. D. K. Agrawal, Katsons Publications Ltd.
2. Machine Design by R.K.Jain ,Khanna Publisherôs
3. Machine Design, R.S. Khurmi, J.K. gupta, Eurasia Publications, New Delhi.
4. Machine Design Data book by PSG, Coimbtore
5. Machine Design data book by Mahadevan.

Reference Books:-

1. Design of Machine Element by V.B. Bhandari, Tata McGraw Hill Publuication.
2. Machine Design ï Jindal, Pearson Publication.
3. Design of Machine Element ï C. S. Sharma & Kamlesh Purohit, PHI Publication.

6ME02 DYNAMICS OF MACHINES

Course Learning Objectives:

1. To study Static force analysis and Dynamic force analysis of plane mechanisms.
2. To demonstrate the use of gyroscopic effect on ship, aeroplane, four wheeler and two wheeler
3. To determine natural frequency vibrations.
4. To seek the knowledge of static and dynamic balancing.

Course Outcomes:

Students will be able to:

1. Apply basic concept of static force analysis and lubrication mechanism.
2. Understand the knowledge of dynamic force analysis analytically and graphically.
3. Apply the knowledge of space mechanism and vehicle dynamics.
4. Understand concept of free vibration and force vibration, concept of Torsional vibration.
5. Analyze the concept of balancing of machinery.

Unit I: 1. Static equilibrium, superstition principle, Static force analysis applied to plane motion mechanisms, virtual work method, static force analysis without and with friction.

2. Theory of hydrodynamic lubrication, boundary lubrication, film lubrication, rolling friction, performance of bearing. (8 Hrs)

Unit II: 1. DôAlemberts Principle. Engine force analysis-piston effort, thrust along connecting rod, side of cylinder, on the bearings, crank effort and turning moment on the crank shaft.

2. Dynamic equivalent system of connecting rod.

3.Turning moment diagrams for two stroke, four stroke and multi cylinder engines, fluctuations of speed & energy, Flywheel requirements. **(7 Hrs)**

Unit III: 1**. Space mechanism**:- Gyroscope, gyroscopic effect as applied to ship, aeroplane, four wheeler, two wheeler, universal joint.

2**. Vehicle dynamics**: - Coefficient of adhesion, resistance to vehicle motion, relative drive effectiveness, braking of vehicles. **(7 Hrs)**

Unit IV: Types of vibrations, elements of mechanical vibrating systems, degree of freedom in mechanical vibratory system.

1. **Longitudinal vibrations**- Natural frequency of free longitudinal vibrations by equilibrium, energy and Rayleigh method. Effect of inertia constraint in longitudinal vibrations. Damped vibrations with mass, spring and dash pot. Definitions of logarithmic decrement, magnification factor, transmissibility, vibration isolation.

2. **Torsional vibration**-single rotor systems, Two Rotor system, three rotor system, geared systems. **(**8 Hrs**)**

Unit V: 1.**Transverse vibrations**- Natural frequency of free transverse vibrations. Effect of inertia constraints in transverse vibrations. Natural frequency of free transverse vibrations due to point load and uniform distributed load acting over a simply supported shaft. Frequency of free transverse vibrations of a shaft subject to a number of point loads by energy and Dunkerleyôs method.

2.**Whirling or critical speed shaft**. (6 Hrs)

Unit VI: Balancing :- Balancing of rotating masses in same and different transverse planes, Partial balancing of reciprocating masses & Study of its effect. **(**8 Hrs**)**

Books Recommended:

Text Books:

1) Theory of Machines, P.L.Ballaney, Published by Dhanpat Rai andsons-N Delhi.
2) Theory of Machines, S.S.Ratan, Published by Tata Mc Graw Hill.
3) Theory of Machines, V.P.Singh, Published by Dhanpat Rai-N Delhi.
4) Theory of Machine, R.S.Khurmi and Gupta J.K., Published by EurasiaPublishing house-N Delhi.

Reference Books:

1) Theory of Machines and Mechanisms, J.E.Shigley, Uicker andGordon, Published by Oxford University press-New York.
2) Theory of Machines and Mechanisms, Ghosh and Amitabh, published affiliated East West Press N-Delhi.

6ME03 CONTROL SYSTEM ENGINEERING

Course Learning Objectives:

1. To study the basics of control systems and their mathematical modeling along with reduction methods.
2. Study the basic control actions and Industrial controllers.
3. To study the analysis of control systems with respect to transient time response and their errors.
4. To study the different pneumatic controllers and prime movers and their actions.
5. To understand stability analysis, frequency analysis by using bode plot for analytical problems.
6. Study of important automatic speed control systems.

Course Outcomes:

1. Understand the basic system concept and study different types of systems.
2. Understand the concept Transient- Response analysis and will apply in numerical methods, the knowledge of basic control action and industrial controllers.
3. Understand the concept of Stability and exhibit the knowledge of root locus concept.
4. Understand the concept of Frequency Response method and use bode diagram in solving analytical problems.

Unit I: Introduction system concept, open & closed loop systems, Mathematical models of physical systems, transfer functions. Block diagrams reduction and signal flow graphs. (8 Hrs)

Unit II : Basic control actions and Industrial controllers :-Classification of industrial automatic controllers, control actions, proportional controllers, obtaining derivative and integral control action, effects of integral and derivative control action on systems performance. (7 Hrs)

Unit III : Transient Response Analysis :- Introduction Std. Test signals, steady state response of first and second order systems for stop, ramp and impulse input, transient response specifications, steady state error & error constants. (7 Hrs)

Unit IV: Concept stability, necessary condition for stability, Rauths stability criterion, Root locus concept, construction of Root loci, systems with transporation lag. (8 Hrs)

Unit V : Frequency Response methods :-Introduction, concept of Bode diagrams. (7 Hrs)

Unit VI : Study of important automatic speed control systems in machine tools, Prime movers, system generators, etc. Analysis of performance characteristics. (7 Hrs)

BOOKS RECOMMENDED:-

TEXT BOOKS :

1. Automatic Control Engineering by F. H. Ravan Mc-Graw-Hill.
2. Modern Control Engg. - by Katsuhiko Ogata, PHI, .
3. Control System Engg. - by Nagrath & Gopal.

REFERENCE BOOKS:

1) Automatic Control Engg. - by Kuo B.C. & F. Golnaraghi,
2) Modern Control System by Richard C. Dorf, Robert H. Bishop,

6ME04 PROFESSIONAL ELECTIVE-I (1) TOOL ENGINEERING

Course Learning Objectives (CLOs):

1) To study the basic geometries of different cutting tools, chip formation mechanism, tool force analysis etc. in metal cutting.
2) To understand the steps in designing and drawing of single and multipoint cutting tools and form tools.
3) To study the basic principles of workpiece positioning and clamping. To get acquainted with designs of locators, clamps, drill bushes and methods of location.
4) To understand the design and operation of various types of Jigs and Fixtures.
5) To develop a graphical design of a jig or fixture suitable to the requirements of a workpiece.
6)To understand the theory of metal cutting and how to estimate the required force and clearance amount in sheet metal cutting and forming operations.
7)To study construction and working of various types of dies used for different press working operations.
8) To study the steps in designing and drawing of different cutting, drawing and forming dies in press working.

Course Outcomes:

1. Create the design of single and multi-point cutting tools.
2. Apply the knowledge related to machining in order to estimate tool life and selection of cutting fluids.
3. Create the design of multipoint tools like twist drills, reamers, broach and milling cutters & press working dies like punching, blanking and drawing.
4. Analyze the real time problems of work holding by designing jigs and fixtures.

Unit I: Single Point cutting Tool: Shear angle, shear strain, velocity relations, un-deformed chip thickness, Merchant's circle, energy relations, nomenclature, single point cutting tool design, recommended speed, feed and depth of cut Form tools. Graphical approach of circular form tool design. (08 Hours)

Unit II: Jig & Fixture Design: Economics, principles of locations, types of locations, prevention of jamming, problems of chip & dust in location, use of dowels. Redundant location, Principles of clamping, types of clamps, power clamping, Tool guiding & tool setting, types of drill Jigs & fixtures, (07 Hours)

Unit III: Jig & Fixture Design: Design of Plate, Channel, Box, Turnover and Post type Drill Jigs. Design of Turning, Milling, Fixture, Broaching, Assembly & Welding Fixtures. (07 Hours)

Unit IV: Multi-point Cutting Tools: Types, Geometric elements and forces in various tools like Twist drills & Reamers, Circular Broaches, Milling Cutters, Taps and Dies, Gear shaper cutter & Gear Hobs. (07 Hours)

Unit V: Press tools: Classification of presses, Theory of sheet metal cutting, clearance, cutting force calculations, Methods of reducing cutting forces, Centre of pressure & its significance, Classification of press working operations, Theory of bending, spring back action in metals, drawing fundamentals, calculation of drawing & bending forces, planning for cupping operation, Stock layout. (07 Hours)

Unit VI : Design of Press working Tools: Types of die construction, function & nomenclature of die components, Cutting Dies- Blanking & Punching, Forming Dies-Forming, Drawing and Bending etc. Design of Compound, Combination and progressive dies miscellaneous dies- Horn die, Cam-action die, Rubber & Building die, Suppress die. (08 Hours)

Text Books:

1. Tool Design - Cyril Donaldson (Tata Mc-graw Hill)
2. Jigs & Fixtures - P.H.Joshi (Tata Mc-graw Hill)
3. Fundamentals of Metal Cutting & M/c Tools - Juneja (New Age International).
4. Fundamentals of Tool Design - A.Kumar (Dhanpatrai & Sons).
5. A Text book of Production Engineering- P.C.sharma (S.Chand Publication).

Reference Books :

1. Metal Cutting Theory & Cutting Tool Design- Arshinov (Mir Publications)
2. Tool Design - ASTME (ASTME)
3. Jigs and Fixture- Grantt.

6ME04 Professional Elective – I (2) NON-CONVENTIONAL ENERGY SOURCES

Course Learning Objectives (CLOs):

1. To study the introduction to renewable and non-renewable resources of energy.
2. To study the radiation transmission through covers & Solar Energy collections.
3. To study the solar energy utilisation and solar energy storage.
4. To study energy from ocean and energy from wind.
5. To study biomass energy resources like biomass and biodiesel.
6. To study photo voltaic cell, fuel cell and geothermal energy.

Course Outcomes (COs):

1. Able to study the concept of renewable and non-renewable sources.
2. Apply the basic concept of solar energy utilization and storage.
3. Apply the concept of energy from ocean and wind.
4. Study the concept of bio-mass energy resources.

UNIT I :

1. Introduction:- Global and Indian energy scenario, Need of Renewable energy, need, Renewable and non renewable energy sources, energy and environment,

2. Solar Radiation: Solar constant, Definitions of basic earth-sun angles. Types of Solar radiation, Measurement of solar radiation using Pyrheliometer, Pyranometer and Sunshine Recorder, estimation of solar radiation intensity. (7 hrs)

UNIT II :

1.Solar thermal systems : Low temperature applications: solar water heating, space heating, drying. High temperature applications, dish and parabolic collectors. Central tower solar thermal power plants. Solar energy storage and utilization: Methods of storage- mechanical, thermal, electrical storage systems.

2. Solar Photovoltaic Systems: Basic principle of power generation in a PV cell ; Types of photovoltaic cell, Application of PV; Brief outline of solar PV stand-alone system; Storage battery and Balance of system.(8 Hrs)

Unit III :

Wind Energy Systems: Potential of wind electricity generation in India and current scenario. Wind pattern and wind speed data, Types of turbines, Coefficient of Power, Betz limit. Wind electric generators, Power curve; wind characteristics and site selection; Windfarms for bulk power supply to grid. Application for pumping (7 Hrs.)

Unit IV :

Biomass Energy: Biomass: Sources and Characteristics; Wet biogas plants; Biomass gasifiers: Classification and Operating characteristics; Updraft and Downdraft gasifiers; Gasifier based electricity generating systems.

Biogas-Types of bio gas plants, factors affecting production rates. Introduction to biodiesel and ethanol as alternative fuels, (7 Hrs.)

Unit V : **Energy from Ocean:** Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy.

Ocean Thermal Electric Conversion (OTEC) systems like open cycle, closed cycle, Hybrid cycle, prospects of OTEC in India. Wave energy and power from wave, wave energy conversion devices, advantages and dis-advantages of wave energy (7 Hrs.)

UNIT VI : Fuel Cells: Introduction, working principle of fuel cell, Types of fuel cells, conversion efficiency of fuel cell, application of fuel cells.

Hydrogen Energy: Hydrogen as alternative fuel, Production methods, Hydrogen storage, **Geothermal Energy Resources:** Hot Dry Rock system, Vapor dominated, liquid dominated, flash steam, binary fluid and total flow concept of power generation. **(8Hrs)**

Books Recommended:

TEXT BOOKS:-

1. Solar Energy, S.P.Sukhatme, TMH.
2. Non-Conventional Energy Sources, G.D.Rai, Khanna Publications.
3. Non-Conventional Energy Sources, B. H. Khan

REFERENCE BOOKS:-

1. Treatise on Solar Energy : H.P. Garg; John Wiley & Sons.
2. Renewable Energy Conversion, Transmission and Storage, Bent Sorenson; Elsevier Publication
3. Renewalle Energy; GodfreyBoyle, Oxford University Press, Mumbai.

6ME04 PROFESSIONAL ELECTIVE-I
(3) COMPUTER AIDED DESIGN & SIMULATION

Course Learning Objectives (CLOs):

1. To study product cycle & fundamentals of CAD/CAM.
2. To understand the concept of representations of curves and surfaces.
3. To study the solid modeling techniques.
4. To study the geometric transformation techniques.
5. To study basic probability & statistics and physical modeling.
6. To study Simulation of Mechanical Systems & Simulation of manufacturing systems.

Course Outcomes (COs):

1. Understand the concept of CAD/ CAM and CIM .
2. Apply knowledge using CAD modeling for component design
3. Apply the knowledge of geometric transformation.
4. Understand the Mechanical & Manufacturing simulation systems.

Unit I: Fundamentals of CAD/CAM:
Product cycle and scope of CAD/CAM/CIM in product cycle, CAD/CAM, Hardware and software, selection of software, CAD workstation configurations. (6 Hrs)

Unit II: Representations of curves and surfaces:
Introduction to analytical curves, synthetic curves: Hermite cubic Spline, Bezier Curve, B- Spline curve. Surface Representation : Synthetic Surfaces, Applications of surface modeling. (6 Hrs)

Unit III: Solid Modeling :
2D Vs 3D modeling, Comparison of Wireframe, surface and solid modeling techniques, Geometry Vs Topology, Requirements of Solid Modeling Methods: Constructive Solid Geometry (CSG), Boundary Representation (B-rep), etc. (6 Hrs)

Unit IV: Geometric transformation
2D geometric transformations, Homogeneous co-ordinate representation, Composite Transformations, 3D transformations, Inverse transformations, geometric mapping. (8 Hrs)

Unit V: Introduction to statistics and physical modeling: A review of basic probability and statistics, random variables and their properties , Estimation of means variances and correlation. Physical Modeling- Concept of System and environment, Principles of modeling, types of models. (8Hrs)

Unit VI: Simulation of Mechanical Systems: Basic Simulation modeling, Role of simulation in model evaluation and studies, advantages of simulation Simulation of manufacturing Systems: Introduction to Flexible manufacturing systems, Simulation software for manufacturing. (8 Hrs)

Books Recommended :

Text Books:

1) P. N. Rao; CAD/CAM Principles and Applications; McGraw Hills Publications.
2) Mikel P. Groover and Emory W. Zimmers: Computer Aided Design and Manufacturing, Prentice hall.
3) Ibrahim Zeid: Mastering in CAD- CAM, Tata McGraw Hill Publication.
4) Geoffrey Gordon, System Simulation; Prentice Hall

Reference Books:

1) Mikell P. Groover: Automation, Production systems & Computer Integraded manufacturing, Prentice Hall.
2) Robert E. Shannon; System Simulation: The Art and Science ; Prentice Hall
3) J. Schwarzenbach and K.F. Gill Edward Arnold; System Modelling and Control
4) P. Radhakrishnan and Subramaniam: CAD/CAM/CIM, wiley Eastern Ltd.

6ME05 OPEN ELECTIVE -II
(1) NON-CONVENTIONAL ENERGY SOURCES

Course Learning Objectives(CLOs):

1. To study the introduction to renewable and non-renewable resources of energy.
2. To study the radiation transmission through covers & Solar Energy collections.
3. To study the solar energy utilisation and solar energy storage.
4. To study energy from ocean and energy from wind.
5. To study biomass energy resources like biomass and biodiesel.
6. To study photo voltaic cell, fuel cell and geothermal energy.

Course Outcomes (COs):

1. Understand concept of renewable and non-renewable sources.
2. Understand the basic concept of radiation transmission through covers and solar energy collections, the basic concept of Solar energy utilization and storage.
3. Demonstrate, concept of energy from ocean and wind.
4. Understand the concept of bio-mass energy resources, concept of direct energy conversion and fuel cell.

UNIT I :

1. **Introduction:-** Global and Indian energy scenario, Need of Renewable energy, need, Renewable and non renewable energy sources, energy and environment,
2. **Solar Radiation:** Solar constant, Definitions of basic earth-sun angles. Types of Solar radiation, Measurement of solar radiation using Pyrheliometer, Pyranometer and Sunshine Recorder, estimation of solar radiation intensity. (7 hrs)

UNIT II: Solar thermal systems. Low temperature applications: solar water heating, space heating, drying. High temperature applications, dish and parabolic collectors. Central tower solar thermal power plants.

Solar Photovoltaic Systems: Basic principle of power generation in a PV cell ; Types of photovoltaic cell, Application of PV ; Brief outline of solar PV stand-alone system ; Storage battery and Balance of system. (8 Hrs)

Unit III : Wind Energy Systems: Potential of wind electricity generation in India and current scenario. Types of turbines, Coefficient of Power, Wind electric generators, Power curve; wind characteristics and site selection; Windfarms for bulk power supply to grid. (7 Hrs.)

Unit IV : Biomass Energy: Biomass: Sources and Characteristics; Wet biogas plants ; Biomass gasifiers: Classification and Operating characteristics; Updraft and Downdraft gasifiers; Gasifier based electricity generating systems. Introduction to biodiesel and ethanol as alternative fuels, (7 Hrs.)

Unit V : **Energy from Ocean:** Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy. **Ocean Thermal Electric Conversion** (OTEC) systems like open cycle, closed cycle, Hybrid cycle, prospects of OTEC in India.

Wave energy and power from wave, wave energy conversion devices, advantages and disadvantages of wave energy. (7 Hrs.)

UNIT VI:

1. **Fuel Cells :** working principle, types of fuel cells, applications.
2. **Geothermal Energy Resources:** Hot Dry Rock system, Vapor dominated, liquid dominated, flash steam, binary fluid and total flow concept of power generation. (8Hrs)

BOOKS RECOMMENDED:

Text Books:

1. Solar Energy; S.P. Sukhatme; TMH
2. Non-Conventional Energy Sources; G.D. Rai; Khanna Publications
3. Non-Conventional Energy Sources; B. H. Khan.

Reference Books:

1. Treatise on Solar Energy; H.P. Garg; John Wiley & Sons.
2. Renewable Energy Conversion, Transmission and Storage; BentSorensen; Elsevier Publication
3. Renewable Energy; Godfrey Boyle; Oxford University Press, Mumbai
4. Renewable Energy Sources and Emerging Technology; D.P. Kothari, K.C. Singal, Rakesh Ranjan; PHI

6ME05 OPEN ELECTIVE-II (2) AUTOMOBILE ENGINEERING

Course Learning Objectives:

1. To study the Introduction of automobiles, engine types and working of SI and CI engines.
2. To study the fuel feed systems, their types and to understand the basics of cooling system.
3. To study the electrical system, Battery capacity and its ratings, starter motor drive and to understand the basics of Ignition system.
4. To study the basics of transmission system, clutches, gear boxes and to understand the principle of differential.
5. To study the braking system, steering system, wheel balancing and alignment and to study the introduction of power steering.
6. To study the basics of suspension system, shock absorbers and to study the types of lubricants and lubrication system, crankcase ventilation.

Course Outcomes (COs):

1. Understand the basics of automobile engineering and its components.
2. Analyze &develop about the cooling system and its function.
3. Understand basic concept of transmission system and types of gears box, basic concept of electrical system and ignition system.
4. Apply the knowledge of suspension and lubrication.

UNIT I : Introduction, Classification of automobiles, chassis layout, basic working of SI and CI engines, engine parts, engine types, Multiple cylinder engines. (7 Hrs)

UNIT II : Fuel feed systems- fuel feed systems for petrol and diesel engines, Basic principles of Multipoint Fuel Injection Systems(MPFI) and Common Rail Diesel Injection Systems(CRDI). Cooling system: purpose, Air cooling and liquid cooling system, radiator, by pass recirculation system, antifreeze mixtures. (7 Hrs)

UNIT III : The electrical system. Battery Capacity, standard capacity ratings, starter motor drive-Bendix drive. Ignition system:- Battery coil ignition system, Electronic ignition system. (7 Hrs)

UNIT IV: Transmission system:- Layout, Working principle of clutch, single plate friction clutch and multiplate clutch, Gear Boxes:- Sliding mesh, constant mesh gear box, Propeller shaft, Hotchkiss drive, torque tube drive, differential. (8 Hrs)

UNIT V: Braking system: Mechanical, hydraulic brakes, power brakes and vacuum brakes. Steering system:- Function, types of linkages, steering gears, wheel balancing, wheel alignment, camber, castor, king pin inclination, toe-in& toe-out & their effects, Introduction to power steering. (7 Hrs)

UNIT VI: Suspensions : shock absorbers, Rigid axle and independent suspension system, Auto lubrication :- Types of lubricants, their ratings, multi viscosity oils. Engine lubrication:- types of lubricating systems, full pressure system, dry sump system, crankcase ventilation. (6Hrs)

BOOKS RECOMMENDED:

Text Books:

1. Automobile Engineering- Vol. I & II; Kirpal Singh; Standard Publishers Distributors
2. Automobile Engineering; R.K. Rajput; Laxmi Publications, New Delhi

Reference Books:

1. Automotive Mechanics; Crouse & Anglin; TMH.
2. Automotive Mechanics; J. Heitner; East West Press
3. Automotive Mechanics; S. Srinivasan; TMH.

6ME06 DESIGN OF MACHINE ELEMENTS - LAB.

Course learning objectives:

1. To study the basic design principles
2. To familiarize with use of design data books & various codes of practice
3. To make conversant with preparation of working drawings based on designs

Course Outcomes: After successfully completion of this course students will be able to:

1. Design various machine elements like joints, springs, couplings etc, under various conditions
2. Convert design dimensions into working/manufacturing drawing
3. Use design data book/standard codes to standardize the designed dimensions

Practical Term Work: At least Six exercises based on the following:

1. Design of Cotter or Knuckle joint.
2. Design & drawing of screw jack.
3. Design & drawing of Riveted joints.
4. Design & drawing of leaf spring.
5. Design of shaft on the basis of various loading.
6. Design and drawing of Coupling (any one type).
7. Design and drawing of Journal Bearing Plumber Block Type).
8. Design and drawing of connecting rod in IC Engine.
9. Design and drawing of Flywheel.
10. Determine Hydrodynamic lubrication profile using Journal Bearing Apparatus.

Practical Examination:- The practical examination shall consist of oral on the termwork and syllabus.

6ME07 DYNAMICS OF MACHINES - LAB.

Course Learning Objectives:

1. To understand Static force analysis and Dynamic force analysis of plane mechanisms.
2. To demonstrate the use of gyroscopic couple and its effect.
3. To understand the phenomenon of vibrations.
4. To demonstrate the effect of static and dynamic balancing.

Course Outcomes:

Students will be able to :

1. Apply basic concept of force analysis and lubrication mechanism.
2. Understand the knowledge of dynamic force analysis analytically and graphically.
3. Apply the knowledge of space mechanism and vehicle dynamics.
4. Understand concept of vibrations.
5. Analyze the concept of balancing of machinery.

Practicals:- At least eight practical from the following list:

1. Study of static force analysis of mechanism. (any 2 problem)
2. Determining the inertia forces of connecting rod
3. Determination of gyroscopic couple using motorized gyroscope .
4. Study of vehicle dynamics.
5. To study the longitudinal vibration of helical spring and to determine the frequency and time period of oscillation theoretically and experimentally.
6. Experiment on free and damped vibration of systems with one degree of freedom.
7. Experiment on forced damped vibration of systems with one degree of freedom.
8. Experiment on free damped torsional vibration.
9. To verify the Dunkerleyôs rule.
10. To determine the natural frequency of free torsional vibration of single rotor system.
11. To determine the natural frequency of free torsional vibration of two rotor system.
12. Experiment on whirling speed of shaft.
13. Experiment on static balancing of rotating masses.
14. Experiment on dynamic balancing of rotating masses.

Practical Examination:- The practical examination shall consist of oral on the termwork and syllabus.

6ME08 PROFESSIONAL ELECTIVE -I - LAB (i) TOOL ENGINEERING –LAB.

Course learning objectives:

1. To study the basic geometries of different cutting tools
2. To study cutting forces involved in machining operation using tool dynamometer.
3. To understand the steps involved in designing and drawing of various tools.
4. To understand the design and operation of various types of Jigs and Fixtures.

Course Outcomes: On completion of this course students will be able to :

1. Create the design of single and multi-point cutting tools.
2. Create the design of multipoint tools like twist drills, reamers, broach and milling cutters & press working dies like punching, blanking and drawing.
3. Analyze the real time problems of work holding by designing jigs and fixtures.

TERM WORK: (Any Six of the following)

1. Design & Drawing of single point cutting tool.
2. Design & Drawing of Form Tools (Using Graphical Method).
3. Measurement of forces in Orthogonal cutting by Lathe Tool Dynamometer.
4. Measurement of forces & Torque in Drilling by Drill Tool Dynamometer.
5. Study of geometric Elements & Forces in Multi-Point Cutting Tool. 6. Design & drawing of Post Drill Jig.
7. Design & Drawing of Turnover Drill Jig.
8. Design & Drawing of Milling Fixture.
9. Design & Drawing of Turning Fixture.
10. Design & Drawing of Compound Die.
11. Design & Drawing of Progressive Die.
12. Design & Drawing of Drawing die.

Practical Examination : Practical exam shall consist of viva-voce based on the term work and theory syllabus.

6ME08 PROFESSIONAL ELECTIVE -I – LAB
(2) NON-CONVENTIONAL ENERGY SOURCES– LAB.

Course Learning Objectives (CLOs):

1. To study the introduction to renewable and non-renewable resources of energy.
2. To study the radiation transmission through covers & Solar Energy collections.
3. To study the solar energy utilisation and solar energy storage.
4. To study energy from ocean and energy from wind.
5. To study biomass energy resources like biomass and biodiesel.
6. To study photo voltaic cell, fuel cell and geothermal energy.

Course Outcomes (COs):

1. Understand concept of renewable and non-renewable sources.
2. Understand the basic concept of radiation transmission through covers and solar energy collections, the basic concept of solar energy utilization and storage.
3. Demonstrate, concept of energy from ocean and wind.
4. Understand the concept of bio-mass energy resources, concept of direct energy conversion and fuel cell.

List of practicals : Any six practicals will be based on the following topics :-

1. Study of Pyrheliometer and measurement of direct radiation.
2. Study of pyranometer and measurement of global and diffuse radiation.
3. Study of sunshine recorder and measurement of sunshine hours.
4. Study and testing of a flat plate recorder.
5. Study of biogas plant.
6. Study of photovoltaic system,
7. Study of various types of Wind mill.
8. Study of various solar equipment.

Practical Examination:- The practical examination shall consist of oral on the termwork and syllabus.

6ME08 PROFESSIONAL ELECTIVE -I – LAB
(1) COMPUTER AIDED DESIGN & SIMULATION

Course Learning Objectives (CLOs):

1. To understand fundamentals of CAD.
2. To study the solid modeling techniques.
3. To study the geometric transformation techniques.
4. To demonstrate Simulation of Mechanical Systems.

Course Outcomes (COs):

1. Understand the concept of CAD.
2. Apply knowledge using CAD modeling for component design
3. Apply the knowledge of geometric transformation.
4. Understand the Mechanical & Manufacturing simulation systems.

Practicals:- Any six practicals from the list should be performed.

1. Creation of 2D drawing (Sketching Module) of any mechanical machine component using any modeling/drawing software.
2. Creation of isometric view from given orthographic view of any mechanical machine part using any modeling software.
3. Creation of 3D drawing of any mechanical machine part using any modeling software.
4. Creation of assembly of Knuckle joint/ Cotter joint using any modeling software.
5. Creation of sheet metal component using any modeling software.
6. Simulation of Four bar chain mechanism using any modeling software.
7. Simulation of Slider crank chain mechanism using any modeling software.

Practical Examination:- The practical examination shall consist of oral on the termwork and syllabus.

6ME09 RESEARCH SKILLS – LAB

Course learning objectives:

1. Apply fundamental and disciplinary concepts and methods in ways appropriate to their principal areas of study.
2. Demonstrate skill and knowledge of current information and technological tools and techniques specific to the professional field of study.
3. Use effectively oral, written and visual communication.
4. Identify, analyze, and solve problems creatively through sustained critical investigation.
5. Integrate information from multiple sources.
6. Demonstrate an awareness and application of appropriate personal, societal, and professional ethical standards.
7. Practice the skills, diligence, and commitment to excellence needed to engage in lifelong learning.

Course Outcomes:

1. Demonstrate a sound technical knowledge of their selected research topic.
2. Undertake problem identification, formulation and solution.
3. Design engineering solutions to complex problems utilizing a systems approach.
4. Conduct an engineering research.
5. Demonstrate the knowledge, skills and attitudes of a professional engineer.

Students will have to perform any one task and prepare a report on it; from the following list:

1. A mini project involving mechanisms/ electromechanical systems/
2. CAD modeling/ simulation of any thermal, hydraulic or mechanical system.
3. IoT based system for any domestic/ rural/ agricultural/ industrial application
4. A system using non- conventional energy source
5. Market research for launching a new product.
6. Study of any Small Scale Industry.
7. Any other innovative concept for promoting research and innovation among students.

***Practical Examination:-** The practical examination shall consist of oral basedon the task and the report.

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SEMESTER V & VI B.E. ELECTRICAL, ELECTRICAL (ELECTRONICS & POWER) AND ELECTRICAL & ELECTRONICS

B.E. (ELECTRICAL ENGG.) SEMESTER - V

5EE01 CONTROL SYSTEMS

Course Outcomes:

After completing this course, the students will be able to:

1. Demonstrate the fundamental concepts of automatic Control and mathematical modeling of the Systems.
2. Determine the transfer function of control system components.
3. Analyze the time response of various systems and performance of controllers.
4. Evaluate the stability of linear systems using various methods.

Unit I: Introduction to automatic control : Open loop and closed loop system, servo-mechanisms, mathematical modeling of physical systems, transfer functions, block diagrams and signal flow graphs. Effect of feedback on sensitivity to parameter variation and reduction of the noise.

Unit II : Control System Components:

Electrical / Electro-mechanical components such as A.C./D.C. servomotors, stepper motors, synchros, potentiometers, tacho-generators, encoders, their functional analysis and operating characteristics and their application.

Unit III: Time response analysis:

Time response of first and second order systems to standard inputs. Time response specifications, types of system, error analysis, error coefficients, steady state errors, dynamic error series. Approximate methods for higher order system, proportional, derivative and integral control.

Unit IV: Stability:

Stability of control systems, characteristics equation, impulse response, Routh-Hurwitz stability criterion, relative stability. Root Locus: construction of root locus, determination of roots from root locus conditions on variable parameter for stability, effect of addition of poles and zeros.

Unit V: Frequency response methods

Frequency response of linear system, specification, Logarithmic frequency response (Bode) plots from transfer function for various systems. Polar plots for various systems. Estimation of approximate transfer functions from the frequency response.

Unit VI: Stability analysis from frequency response

Gain margin and Phase margin; Stability analysis from Bode plots. Nyquist criterion, Nyquist plots and stability analysis.

Books Recommended:

Text Book: Nagrath I.J., Gopal M.: Control System Engineering, Wiley Eastern.

Reference Books:

1. Control Engineering, D.Ganesh Rao, k. Chennavenkatesh, 2010, PEARSON
2. Ogata K.: Modern Control Systems, Prentice Hall of India.
3. Control Systems by K.R.Varmah TMH edition 2010
4. Linear Control Systems, Ashfaq Hussain, Haroon Ashfaq, Dhanpat Rai &Co.

5EE02 MICROPROCESSOR & MICROCONTROLLER

Course Outcomes:

After completing the course the students will be able to:

1. Recite Fundamentals and Architecture of Microprocessor 8085, Microcontroller 8051
2. Interpret Assembly Language Programming of Microprocessor 8085, Microcontroller 8051
3. Illustrate interfacing with Microprocessor 8085, Microcontroller 8051
4. Develop applications of Microprocessor 8085, Microcontroller 8051.

Unit I : 8085- architecture and Pin Diagram, Microprocessor Operations (Initiated, Internal and External) BUS organization and register structure, instruction set of 8085, addressing modes, Machine Cycles & Bus Timings.

Unit II : Assembly Language Programming of 8085, counters and time delays, stack and subroutines, Memory mapped I/O and I/O mapped I/O, address decoding techniques. Interrupt system of 8085, Data transfer schemes, serial data transfer through SOD and SID line.

Unit III : Programmable Interfacing devices: Internal architecture, programming and interfacing of Programmable Peripheral Interface PPI (8255), Programmable Interrupt Controller PIC (8259),Universal Synchronous Asynchronous Receiver Transmitter USART (8251) and Programmable Interval Timer PIT(8253)

Unit IV: Introduction to microcontroller: 8051 pin configuration and architecture, 8051 Internal resources, pin diagram, I/ O pins, ports and their internal logic circuits, counters, serial ports, interrupt structure, SFRs and their addressing, watch-dog timer, internal code memory, data memory, stack pointer, flags, bit addressable memory.

Unit V: Instruction set of 8051. Addressing modes. Various groups of instructions: data transfer. Arithmetic- logical group. Interrupt, timer counter related instructions. Interfacing of 8051with external memories. Programming 8051 with interfacing examples**.**

Unit VI: 8085 Microprocessors / 8051 Microcontroller Applications: hardware & software developments: signal conditioning & data acquisition system components. Measurement of Pulse width and Magnitude using 8085. Measurement of fundamental quantities -voltage, current, frequency, speed using 8051 Microcontroller.

Text Books:

1. Microprocessor Architecture, Programming, and Applications with the 8085, Ramesh Gaonkar PHI Publication-2006

2. The 8051 Microcontroller and Embedded SystemsMazidi, J.GMazidi, Mckinlay , Pearson Ed.

Reference Books:

1. An Introduction to Microcomputers, Adam Osborne Osborne-Mc-Graw Hill,
2. Advance Microprocessor and Peripherals, K.M.Bhurchandi & A.K.Ray, TMH, 2006.
3. Subrata Ghoshal ñ8051 Microcontrollerò Pearson Education.
4. Richard Barnett , The 8051Family of Microcontrollers Prentice-Hall, Inc-2000

5EE03 ELECTRICAL MACHINES –II

Course Outcomes:

After completing this course students will be able to:

1. Describe the construction, working operation & performance characteristics of the three phase Induction Motor
2. Analyze the starting, braking and speed control of three phase induction motors by various methods.
3. Describe the construction, working operation & performance characteristics of single ï phase Induction Motor
4. Demonstrate the construction, working operation & performance characteristics of synchronous machine.
5. Explain the construction & working of special motors like Universal, Reluctance, PMSM & BLDC Motor.

Unit I: Three phase induction motor-I:

Construction, Types (squirrel cage and slipring), Rotating Magnetic Fields, Principle ofoperation, Torque Slip Characteristics, Starting and Maximum Torque.Effect ofparameter variation on torque slip characteristics. Equivalent circuit, Phasor Diagram, Performance evaluation bydirect& indirect testing,circle diagram.

Unit II : Three phase Induction Motor (IM) –II:

Starters for squirrel cage & slip-ring type IM, Methods of speed control, electric braking,High Torque IM, single phasing, cogging and crawling, Doubly-FedInduction Machines.

Unit III: Single phaseInduction Motor:

Double revolving field theory, Constructional features, equivalent circuit, working, Split-phasestarting methods and applicationsof single-phaseInduction motors.

Unit IV: Synchronous Generator:

Constructional details, working principle, operation, armaturereaction, circuitmodel, determinations of parameters of the circuit model and phasordiagram, methods of determining the regulations and efficiency, Parallel operation of alternators-Synchronization.

UnitV: SynchronousMotor:

Construction, principle of operation, working, starting methods, torque equation - V-curve, Inverted V curve &power angle characteristics, hunting & damping, applications. Transient, subtransient & steady state reactanceofsynchronous machines.

Unit VI: Special Motors:

Construction, working principle, operation, characteristics and applications of Universal motor, Reluctance Motor, Permanent Magnet Synchronous Motor & BLDC Motor.

Text Books:

1. D.P.Kothari & I.J.Nagrath,ñElectrical Machinesò-5th Edition, TMH Publication.
2. S.Langsdorf,ñAlternating Current Machinesò, Mc-Graw Hill Publication.

Reference Books:

1. Fitzgerald and Kingsleyôs Electric Machineryò, 7th Edition, McGraw Hill.
2. M.G.Say,ñPerformanceanddesignofACmachinesò,CBSPublishers, 2002.
3. P.S.Bimbhra,ñElectricalMachineryò, KhannaPublishers,2011.
4. C L Dawes, ñA Course in Electrical Engineering (Volume -2)ò, McGraw Hill.

5EE04 Professional Elective-I : POWER SYSTEM OPERATION AND CONTROL

Course Outcomes:

After completing this course student will be able to:

1. To impart knowledge to describe, calculate and analyze energy generation, unit commitment problem in thermal power plant, power system behavior and economics of generating costs.
2. To understand and analyze optimal dispatch with transmission losses, penalty factor and automatic load dispatch.
3. To learn the concept of real and reactive power flow and its control in power system.
4. To learn the automatic voltage regulator and automatic load frequency control.
5. To learn tie line interchange between interconnected utilities.
6. To illustrate various ways of interchange of power between interconnected utilities.
7. To impart knowledge about various advanced controllers such as FACTs controllers with itsevolution, principle of operation, circuit diagram and applications

Unit I : **Economic Operation – Part I:**

Meaning of optimum scheduling, UCP and LSP; Input ï Output characteristics, Heat rate characteristic, Incremental fuel rate, Incremental fuel cost; Methods of obtaining incremental fuel costs; Conditions for incremental loading; Optimum scheduling of generation between different units (Only Two plant system without transmission loss).

Unit II : **Economic Operation – Part II**

Transmission loss as a function of plant generation; Calculation of loss co-efficient (Two plant system); Incremental transmission loss; Optimum scheduling of generation between different plants including transmission loss; Concept and significance of penalty factor; Automatic load dispatch: Operation and Functions.

Unit III : **A. Generator Control Loops**

Concept of real and reactive power; Effect of real and reactive power on system parameters; Basic generator control loops.

B. Automatic Voltage Regulator (AVR)

Functions of AVR; Types of Exciter; Brushless AVR loop: Exciter modeling, Generator modeling, Transfer function block diagram representation, Static performance, dynamic response, Stability compensation, Effect of generator loading.

Unit IV : **Automatic Load Frequency Control**

Automatic generation control (AGC); Speed governing system; Transfer function modeling: Governor, Hydraulic valve actuator, Turbine, Generator, Load; Transfer function representation of an isolated generator; Static performance of speed governor; Closing of ALFC loop.

Unit V : **Control Area:** eaning; Primary ALFC Loop: Static response, Dynamic response, physical interpretation of results; Secondary ALFC loop; Integral Control; Pool operation; Tie-line Modeling; Two area system ï Dynamic response; Tie-line bias control.

Unit VI : **Energy Control of Power System :** Interchange of power between interconnected utilities, economy interchange evaluation, interchange evaluation with unit commitment, types of interchange, capacity and diversity interchange, energy banking, emergency power interchange, inadvertent power exchange, power pools, Circuit diagram and applications of FACTs Technology :- SVC, TCSC, STATCOM and UPFC.

Text Books :-

1. O. L. Elgerd Electric Energy Systems Theory: An Introduction ï 2nd edition, McGraw -Hill Book Comp. N. Y. 1987.
2. Power System Operation & Control, N.V.Ramana, PEARSON education, 2010.

Reference Books :

1. L. K. Kirchamayor ï Economic Operation of Power System- Wiley Estern Pvt. Ltd., New Delhi.
2. Hadi Saadat ï Power System Analysis ï WCB/McGraw-Hill International Edition 1999
3. I.J. Nagrath, D. P. Kothari ï Modern Power System Analysis ï Second edition, Tata Mc-Graw Hill Publishing Company, New Delhi
4. P. S. R. Murty ï Power System Operation and Control ï Tata Mc-Graw Hill Publishing Company, New Delhi.

5EE04 Professional Elective – I
ELECTRICAL ENGINEERING MATERIAL

Course Outcomes:

After completing this course student will be able to :

1. Understand importance of electrical engineering materials
2. Understand how electric conduction takes place in conductors
3. Understand importance of semiconductors and magnetic materials in electrical engineering.
4. Understand importance of dielectric materials in electrical engineering.
5. Identify the need of special materials in electrical engineering.

Unit-I Introduction to Electrical Engineering Materials: Importance of materials, Classification of electrical materials, Scope of electrical materials, Requirement of Engineering materials. Types of engineering materials, Levels of material structure.

Unit-II Conducting Materials: Review of metallic conduction on the basis of free electron theory. variation of conductivity with temperature and composition, materials for electric resistors- General Electric properties; material for brushes of electrical machines, lamp filaments, fuses and solder.

Unit-III Semi conductors: Semiconductors: Mechanism of conduction in semiconductors, types of semiconductors. Hall effect, compound semiconductors, basic ideas of amorphous and organic semiconductors.

Unit-IV Magnetic Materials:
Classification of magnetic materials- origin of permanent magnetic dipoles, magneto materials used in electrical machines, instruments and relays. Magnetic Circuit terminology, Relation between relative permeability and magnetic susceptibility. Classification of magnetic materials, Diamagnetic, Paramagnetic, Ferromagnetic, Anti ferromagnetic. Magnetization curve, Initial and maximum permeability. Hysteresis loop and loss, Eddy current loss.
Unit-V Dielectrics & Insulating Materials: Dielectrics, Factors influencing dielectric strength. Capacito rmaterials. Insulating materials. Insulating Materials: Inorganic materials (mica, glass, porcelain, asbestos), organic materials (paper, rubber, cotton silk fiber, wood, plastics and bakelite), resins and varnishes, liquid insulators (transformer oil) gaseous insulators (air, SF6 and nitrogen) and ageing of insulators.
Unit-VI Materials For Special Applications: Materials for solar cells, fuel cells and battery. Materials for coatings for enhanced solar thermal energy collection and solar selective coatings, Cold mirror coatings, heat mirror coatings, antireflection coatings, sintered alloys for breaker and switch contacts.

Text Book: Electrical Engineering Materials by Dekker A.J (PHI)
Reference Books:

1. S.P.Seth Electrical Engineering Materials (Dhanpat rai and Sons)
2. C. S Indulkar & S. Thiruvelgadam, an Introduction to Electrical Engineering Materials (S Chand Publication)

5EE04 Professional Elective – I
ELECTRONIC COMMUNICATION THEORY

Course Outcomes:
After successfully completing the course, the students will be able to:
1. Explain various types of signal & elements of communication system.
2. Analyze the signal using Fourier Transform
3. Apply Amplitude modulation & Frequency modulation on the communication signal
4. Compare Pulse communication & Digital communication
5. Describe microwave communication system

Unit I: Introduction to Electronics Communication Systems:
Signals: Analog & digital, Deterministic & Non-deterministic, Periodic & nonperiodic, Elements of Communication Systems, Transmitter, Receiver, Need for Modulation, band width requirements, Noise, External, internal noise, noise calculation, noise figure.

Unit II : Signal Analysis:
Fourier Series, Exponential Fourier Series, Fourier Transform, Properties of Fourier Transform, Dirac Delta Function, Fourier Transform of Periodic functions, Fundamental of Power Spectral Density & Energy Spectral Density.

Unit III: Amplitude Modulation
Amplitude Modulation Theory, Generation of Amplitude Modulation, Single Side band Communication, suppression of carrier, suppression of unwanted side band, AM receiver.

Unit IV: Frequency Modulation:
Theory of Frequency Modulation, characteristics of FM, Generation of FM, pre-emphasis, De-emphasis,wide &Narrow band FM Transmission, FM receiver.

Unit V: Pulse Communication :
Information Theory, Classification of pulse modulation, Sampling process, pulse amplitude modulation, PWM and PPM modulation pulse co-demodulation.
A: Digital Communication:
Fundamentals of data communication systems, data sets and inter-connection requirements.

Unit VI: Microwave communication system:
Analog microwave communication: LOS, OTH microwave system Satellite communication: Satellite orbits, frequencies, attitude, transmission path.
Text Book: Electronic Communication System by Kennedy, Davis,TMH.
Reference Books:
1. Electronics Communication by K.Shoenbcle PHI, India.
2. Electronics Communication Techniques, Paul Young,Willey Eastern Pub.
3. Principle of Communication Engineering, Taub Schilling. TMH.
4. Electronics Communication ï Robert Shrader Mc-Graw Hill.

5EE05 Open Elective – I POWER PLANT ENGINEERING

Course Outcomes:-
1) Describe different Sources of Energy Generation.
2) Explain the Working and layout of steam power plant & hydro power plant.
3) Discuss the working principle and basic component of Nuclear, Diesel & gas power plant
4) Illustrate various terms related to power plant economics & tariff.

Unit-I: Introduction:

Energy resources and their availability, types of powe rplants, selection of the plants, Introduction to basic thermodynamic cycles used in power plants, Conventional and non-conventional energy sources, Indian Energy Scenario.

Unit-II: Hydro-Electric Power Plant:
Rainfall and run-off measurements and plotting of various curves for estimating stream flow andsize of reservoir, Layout of Hydro power plant, operation of different components of hydro-electric power plant , classification of hydro Electric power plant, Pump Storage Plant, site selection,advantages & disadvantages

Unit-III: Steam Power Plants:
Flow sheet and working of modern-thermal power plants, super critical pressure steam stations, Layout of Thermal power plant, Site selection, coal storage, coal handling systems, ash Handling systems, working of various parts: Economizer, air pre-heater, condenser, cooling tower, Electrostatic Precipitator, advantages & disadvantages.

Unit-IV: Nuclear Power Plants:
Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working ofNuclear Reactors : Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANadaDeuterium- Uranium reactor (CANDU) fast breeder reactor, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

Unit-V: Diesel & Gas power plant:
Layout of Diesel power plant, functions of different components of diesel plant, advantages &disadvantages, Principle of Operation of Gas Turbine Plants, Open cycle gas turbine plant, closedcycle gas power plant, Combined gas and steam cycle.

Unit-VI: Power Plant Economics:
Load curve, energy load curve, energy duration curve, connected load, maximum demand, demand factor, load factor, diversity factors, plant capacity and utilization factor, types of loads, operating cost, annual plant cost, Generation cost, Depreciation, Objectives/Types of Tariff,

Text Books:

1. Generation of Electrical Energy by B.R.Gupta, Eurasia Publishing House, New Delhi.
2. Power Plant Engineering; R.K.Rajput; Laxmi Publications.

Reference Books:

1. Non-Conventional Energy Resources by G.D.Rai, Khanna Publishers, New Delhi.
2. Principles of PowerSystem byV.K.Mehta, S.Chand Publication.
3. Conventional energy technology by S.B.Pandya,Tata Mc-Graw Hill Publication.
4. Power Plant Engineering, P.K.Nag.

5EE05 Open Elective - ELECTRICAL DRIVES

Course Outcomes:

After completing this course, Students will be able to:

1. Explain the basic Concept of electrical drives
2. Describe Power Electronics devices & their Industrial Applications
3. Demonstrate various starting, braking and speed control methods of DC Motor Drivs
4. Demonstrate various starting, braking and speed control methods of three phase Induction Motor.
5. Describe the construction, working principle and applications of single phase Induction Motor & special motors

Syllabus:

Unit I: Electric Drive: Concept, classification, parts, and advantages of electrical dives. Types of Loads, Components of load toques, Fundamental torque equations, Equivalent value of drive parameters for loads with rotational and translational motion. Multi quadrant operation of drives. Load equalization**.**

Unit II: **Motor power rating:** Thermal model of motor for heating and cooling, classes of motor duty, determination of motor rating for continuous, short time and intermittent duty, equivalent current, torque and power methods of determination of rating for fluctuating and intermittent loads. Effect of load inertia & environmental factors.

Unit III: Starting & Braking of Electric Drives: Effect of starting on Power supply, motor and load. Methods of starting of electric motors. Acceleration time Energy relation during starting, methods to reduce the Energy loss during starting. Types of braking, braking of DC motor, Induction motor and Synchronous motor, Energy loss during braking**.**

Unit IV: **DC motor drives:** Modeling of DC motors, block diagram & Transfer function, Single phase, three phases fully controlled and half controlled DC drives. Dual converter control of DC drives. Power factor, supply harmonics and ripple in motor current, Chopper controlled DC motor drives**.**

Unit V: Induction motor drives: Stator voltage variation by three phase controllers, Speed control using chopper resistance in the rotor circuit, slip power recovery scheme. Pulse width modulated inverter fed induction motor drive. Volts / Hertz Control**.**

Unit VI: Industrial applications of Electric Drives: Introduction to Solar and Battery Powered Drive, Stepper motor, Switched Reluctance motor drive Industrial application: Drive consideration for Textile mills, Steel rolling mills, Cement mills, Paper mills, Machine tools. Cranes & hoist drives.

Text Books:
1. Fundamental of Electrical Drives, G.K. Dubey, New Age International Publication.
2. A first course on Electrical Drives, S.K. Pillai, , New Age International Publication.

Reference Books:
1. Electric Drives, Vedam Subrahmanyam, TMH
2. Bose, B.K., Modern Power Electronics and AC Drives, PHI
3. Electric Motor Drives, R. Krishnan, PHI
4. Sen, P.C., Thyristor DC Drives, John Wiley and Sons (1981).

5EE06 CONTROL SYSTEM - LAB

Student should perform minimum eight practicals based on the followings.

List of Experiments :
1. Study of Potentiometer
2. Study of A.C. Synchro and its characteristics
3. Determination of Transfer Function of D.C. Generator
4. Determination of Transfer Function of D.C.Servomotor and Its Characteristics
5. Performance Characteristics of a D.C. Motor Angular Position Control System
6. Determination of Frequency Response of Given R-C Network
7. Determination of Transfer Function of A.C. Tacho-Generator
8. Experimental Study of The Operating Characteristics of a Small Stepper Motor and Its Controller
9. Study Closed Loop PI Controller System and Its Time Response to Different Input.
10. Experimental Study of Position Control of DC Motor using Ardiuno
11. Experimental Study of Time Domain Analysis of Second Order Control System
12. Study AC Position Control System

Note : Above experiments may be conducted by using models, simulation, numerical, drawing sheets or experimentation.

5EE07 MICROPROCESSOR &MICROCONTROLLER- LAB

List of Experiments:
1. Write an Assembly Language Program for the Addition of two8-bit/16-bit numbers
2. Write an Assembly Language Program for the Subtraction of two 8-bit numbers
3. Write a Program for Finding the larger and smaller one among the two 8-bit numbers
4. Write a Program for Finding the largest/smallest number in array of 8-bit numbers
5. Write a Program for Masking and setting of nibbles
6. Write a Program for Block data transfer in same and reverse order
7. Write a Program for Sorting of even and odd numbers from an array of 8-bit numbers
8. Write a Program for Multiplication of two 8-bit numbers
9. Write a Program for Square wave generation using 8255 PPI
10. Write a Program for Stepper motor control using 8255 PPI
11. Write a Program for Interfacing ADC with 8085/8051 using 8255 PPI
12. Write a Program for Interfacing DAC with 8085/8051 using 8255 PPI
13. Write a Program for Lamp load control using 8255 PPI
14. Write a Program for measurement of DC Voltage /Current using ADC, 8255 PPI
15. Study of Architectural Differences: Microprocessor 8085, and Mcrocontroller 8051

5EE08 ELECTRICAL MACHINES - II LAB.

List of Experiments :
1. Perform the load test on three phase IM & plot its performance characteristics.
2. Perform the No load test on three phase IM to separate out its no load losses.
3. Estimate the performance parameters of three phase IM from its circle diagram.
4. Plot the equivalent circuit of three phase Induction motor.
5. Study of different types of starters used for three phase IM
6. Speed control of three phase squirrel cage Induction motor by various methods like stator voltage control method, frequency control method, changing number of poles.
7. Speed control of three phase Induction motor.
8. Perform the electric braking of three phase Induction motor.
9. Perform the load test on single phase IM & plot its performance characteristics.
10. Load test on three phase alternator to determine its performance parameters.
11. Synchronize the three ï phase alternator within finite bus-bar
12. Perform the OC & SC test on synchronous generator to estimate its regulation by EMF & MF methods
13. Estimate the regulation of three phase alternator using ZPF method.
14. Perform the load test on three phase Synchronous motor.
15. Plot the V& inverted V curves of synchronous motor.

5EE09 INFORMATION &COMMUNICATION TECHNOLOGY - LAB

Word Processing with MS-Word:
- Basic operations- Editing and Formatting text, paragraphs and pages, printing.
- Working with tables, figures, images.
- Mailmerge.Working with Charts, Equations, Symbols.

MS Excel: Working with work books / work sheets.

- Data Entry techniques & defining datas etasa Table.
- Setting, Previewing, and Printing under MS-Excel.
- Performing Calculations, using Excel Formulas, Functions and Charts.
- Sorting / Filtering data in excel sheet.

Working with MS Power Point.

- Presentation Basics. Adding more components to the slides, printing the slides.
- Formatting Presentations, backgrounds and layout. Applying Themes. Using SlideMaster.
- Working with Graphics, Images and Clips. Multimedia. Inserting Sound and Narration
- Delivering Presentations. Animating Objects. Adding Action effects.
- Live Presentation. Using Custom Shows.
- Saving / Protecting the Presentation.

Web Page Development:

- Introduction to HTML, CSS, JAVA Scripting
- Development of Webpage.

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SEMESTER : VI [ELECTRICAL ENGINEERING]

6EE01 POWER ELECTRONICS

Course Outcomes

After completing this course student will be able to

1. Explain the concepts and techniques used in power electronics
2. Apply the knowledge of series and parallel connection of SCRs in power control applications
3. Analyze various power converter circuits
4. Analyze the single phase and three phase Inverter circuits
5. Explain the operation of DC/DC converter circuits
6. Demonstrate the applications of power electronic circuits.

Syllabus

Unit I:SCR, Triac, Diac ï Construction and Applications, two Transistor Analogy of SCR, SCR turnON mechanism, different methods for turning ON SCR, turn OFF mechanism, Thyristor firing circuits, introduction to Power MOSFET and IGBT their construction and characteristics.

Unit II: Series-Parallel operation of SCRs, firing circuits for series and parallel operations, static and dynamic equalizing circuit, equalization of current in parallel connected SCRs,string efficiency, de-rating factors, protections of SCRs against di/dt, dv/dt, over-voltage/ over-current protection.

Unit III: Principle of phase control, half-wave-controlled rectifier, half controlled bridge and fully controlled bridge rectifier for R, RL and RLE load, derivation for output voltage and current, effect of freewheeling diode, effect of source inductance.

Unit IV: Classification of circuit for forced commutation, series inverter, improved series inverter, parallel inverter, single phase PWM inverters, principle of operation of three phase bridge inverter in 120^0 and 180^0mode.

Unit V: Basic principle of Chopper, Time ratio control and current limit controlled technique, Voltage commutated Chopper circuit, Jones Chopper, Step up Chopper, Step down Chopper and AC Chopper.

Unit VI: Speed control of DC series motor using chopper, Speed control of DC shunt motor using phase controlled rectifier. Speed control of three phase Induction motor by stator voltage control method, V/f control.

Text Book: Rashid Muhammad, H., ñPower Electronics: Circuits, Devices and Applicationsò, 4^{th} Edn., Pearson Education.

Reference Books:

1. Mohan Ned, Undeland Tore, M. and Robbins William, P., ñPower Electronics: Converter, Applications and Designò, John Wiley & Sons, 1994.
2. LandevCyrill, W., ñPower Electronicsò, McGraw Hills, London, 1981.
3. Dewan, S.B. and Satrughan A., ñPower Semiconductor Circuitsò, John Wiley & Sons,
4. M.D. Singh & K.B. Khanchandani, ñPower Electronics ñTata Mc-Graw Hill, New Delhi

6EE02 POWER SYSTEMS -II

Course Outcomes:

At the end of the course, students will be able to:

1. Understand Power Factor improvement, Capacitor bank installation in distribution system, metering system in Industries and Residential area.
2. Understand Positive Sequence, Negative & zero sequence system and fault analysis.
3. Create computational models for analysis of both symmetrical and unsymmetrical conditions in power systems,
4. Analyse the system performance where there is an unbalanced fault, and also calculate the corresponding fault current.
5. Examine the need of various analysis like fault analysis, short circuit analysis stability analysis, steady state and transient analysis.

Syllabus :

Unit I : Symmetrical Components : Definition and choice, Alpha operator, transformation matrices, sequence components, power invariance, line and phase sequence quantities relations, three phase delta/star transformer bank-sequence voltages and currents relationship.

Unit II: Power system elements ï sequence impedance and sequence networks ; Various three phase transformer connections ï zero sequence rules; Unbalanced load system - Power Factor improvement, Capacitor bank installation in distribution system, Metering system in Industries and Residential area

Unit III : Symmetrical Fault Analysis : Transmission line transients, three phase symmetrical short circuit at alternator terminals, Power system fault calculations, short circuit MVA, Current limiting reactors, ring system and tie bar system, Circuit breaker rating calculation.

Unit IV : Unsymmetrical Fault Analysis:L-G, L-L-G and L-L faults at unloaded generator terminals, Equivalent sequence network diagram, Fault impedance, Unsymmetrical faults through impedance, Power system faults- loaded and unloaded conditions.

Unit V : Over voltages : Causes ï internal and external; Voltage surge, Basic insulation level, Protection ï earthing screen, overhead ground wire, lightning arresters.

Unit VI : Corona Effect : Power loss due to corona, Practical importance of corona, use of bundled conductors in E.H.V transmission lines and its advantages, Overhead line insulators ,Voltage distribution in suspension type insulator, String efficiency , Grading . Sag and stress calculation of overhead conductance, Vibration dampers.

Text Book :- 1. Power System Analysis, N.V.Ramana, Pearson Education, 2010.

Reference Books:

1. Power System Analysis, Arthur R. Bergen, Vijay Vittal,2/e, PEARSON Education
2. I. J. Nagrath & D. P. Kothari ï ñModern Power System Analysisò, TMHPublishing.
3. Depriya Das, Electrical Power System

6EE03 COMPUTER AIDED ELECTRICAL MACHINE DESIGN

Course Outcome

After completing this course, student will be able to

1. Explain the Basics of Computer aided machine design & material selection.
2. Derive the design parameters of single & three phase transformer core.
3. Calculate the winding& cooling system parameters of the transformer
4. Develop the armature winding diagram for three phase Induction Motor
5. Determine the stator core dimensions of three phase Induction motor
6. Design the squirrel cage & wound type rotor for three phase Induction motor

Syllabus

Unit I: Introduction: Review of transformer & Induction motor constructional features, Major considerations in electrical machine design, optimization, electrical engineering materials: Conducting, Insulating & Magnetic Materials,Limitations of traditional design, need for CAD, analysis, synthesis and hybrid methods of CAD.

Unit II: Transformer Design -I: Transformer Core Design - Material selection, type of construction, Specific magnetic & electric loadings, output equation, core and yoke cross sections, window dimensions, overall core dimensions calculations, core loss estimation from design data. Optimum core design for Minimum cost, Minimum losses, Minimum weight & Minimum volume.

Unit III: Transformer Design – II: Transformer Winding - types, and design calculation, Layout, no-load current calculation, primary and secondary winding resistance and leakage reactance from design data, mechanical forces ï types & causes. Estimation of efficiency & regulation from design data. Cooling methods for a transformer, design of transformer tank. Calculation of cooling tubes.

Unit IV: AC Winding Design: Concentrated & distributed winding, Integral slot & fractional slot winding, Full pitch & short pitch windings, Single layer& double layer winding, distribution factor, coil pitch factor and winding factor, EMF equation, Development of winding diagrams.

Unit V: Induction Motor Stator design: Specific electric and magnetic loadings selection, output equation, main dimensions (D&L) calculation, stator slot- numbers, shape and dimensions, stator teeth dimension, stator core dimensions.Air gap length calculation.

Unit VI: Induction Motor Rotor design::Squirrel cage rotor design ï selecting number of rotor slots, design of rotor bars & slots, design of end rings. **Wound type rotor design** - rotor winding design, rotor slots design, and rotor core design. Bearings, shaft design. estimation of no-load current, stator and rotor winding resistances from design data, dispersion coefficient & its effect on performance of IM.

Text Books:

1. A. K. Sawhney, ñA Course in Electrical Machine Designò Dhanpat Rai & Co Ltd, 2016
2. R.K.Agrawal, ñPrinciples of Electrical Machine Designò, S.K.Kataria and Sons, Delhi

Reference Books:

1. K.G.Upadhyay,ñDesign of Electrical Machinesò, New Age international Publishers,1st Edition 2008
2. S.K.Sen,ñPrinciples of Electrical Machine Design with Computer Programsò, Oxford and I.B.H. Company Pvt. Ltd., New Delhi
3. IndrajitDasgupta, ñDesign of Transformersò, TMH 1st Edition 2002
4. Indian Standards for Transformer & Three phase IM design from BIS websites

6EE04 Professional Elective - II
ADVANCED CONTROL SYSTEMS

Course Outcomes:

After completing this course students will be able to:

1. Design compensator using time domain and frequency domain specifications
2. Represent system using state space model
3. Analyze controllability and observability for systems.
4. Design state feedback controller.
5. Analyze digital systems using Z Transform
6. Develop the describing function for the nonlinearity to assess the stability of the system.
7. Analyzethe Nonlinear system using Phase plane Analysis

Syllabus :

Unit I: Compensation Techniques :

Introduction, preliminary consideration of classical design. Lead compensator, Lag Compensator, Lead-Lag compensator, Feedback compensation in frequency domain.

Unit II: State Space Technique I: State, state space and state variables ,SISO /MIMO linear systems state Variable models- differential equations, transfer functions, block diagrams And state diagrams. Transfer function decomposition ï Phase variable Forms, canonical forms and Jordan canonical forms, STM computation, L.T, Canonical transformation, and Cayley Hamilton theorem. Time Response ï SISO systems.

Unit III: State Space Technique II:

Concept-controllability and observability, SISO/ MIMO linear Systems Gilbertôs method and Kalmanôs test; SISO controllable Systems design ï state feedback.

Unit IV: Sampled Data Control Systems:

Representation, Z transform, Sampler and hold, ZOH, Open loop and closed loop SDCS, Z transfer Function, difference equation, solution, Pulse transfer function, Stability Analysis, S and Z domain relationship, Juryôs test, and bilinear Transformation. Root locus method.

Unit V: Non-Linear System Analysis I:

Non linear system behaviour, types and characteristics, Describing function Stability analysis limit cycles, Limitation of Describing function.

Unit VI: **Non-Linear System Analysis II**:
Linearization, Singular points, Classification and nature, Phase plane method, non linear system analysis, Phase trajectories, construction ï analytical and graphical method by isoclines, stability analysis, limit cycles, limitations ï phase plane method.

Text Books:

1. Nagrath and Gopal,ò Control system Engineeringò Wiley Eastern Ltd , New Delhi
2. K.Ogata,ò Modern Control Theory ñPrentice Hall Of India Pvt Ltd , New Delhi.

Reference Books:

1. Naresh Sinha. ñControl system Engineeringò Wiley Eastern Pvt. Ltd., New Delhi.
2. B.C. Kuo. ñAutomatic Control systemò Prentice Hall Of India Pvt Ltd Delhi.
3. D Roy Choudhury, ñModern Control EngineeringòPublisher: PHI Learning.

6EE04 Professional Elective – II:
DIGITAL COMMUNICATION SYSTEMS

Course Outcomes:

After Completing this course student will be able to:

1. To study basic building blocks of digital communication system.
2. To learn information theory and theoretical bounds on the data rates of digital communication.
3. To understand and analyze communication channel.
4. To study and analyze different digital modulation techniques.
5. To study baseband transmission of the signal.
6. To understand importance of channel encoding and decoding in digital communication.
7. To study multiple access schemes and spread spectrum communication.

Unit-I: Introduction to Digital Communication SYstem: Functional Blocks of Digital Communication System; Source Encoder and Decoder, Channel Encoder and Decoder, Modulator and Demodulator. Line Coding: Need for Line coding, Properties of Line Coding, Unipolar RZ and NRZ, Polar RZ and NRZ, Bipolar NRZ (AMI), Split Phase Manchester Coding, Polar Quaternary NRZ Coding, HDB3 Coding, Scrambler and Unscrambler.

Unit-2: Information Theory:
Measure of Information, Entropy and Information Rate of Long Independent and Dependent Sequences. Source Encoding: Huffman Encoding, Shannonôs Encoding Algorithm, Shannon- Fano Algorithm. Discrete Communication Channel: Noiseless Channel, Deterministic Channel, Binary Symmetric Channel, Rate of Information Transfer over Discrete Channel, Capacity of Discrete Memoryless Channel.Continuous Channel: Shannon Hartley Theorem for channel capacity, Signal to Noise Ratio ï Bandwidth Tradeoff.

Unit-3 : Bandpass Modulation and Demodulation techniques:
BPSK, BFSK, ASK and DPSK generation and reception, Signal space diagram, PSD and Bandwidth of BPSK and BFSK systems, QPSK. Transmitter and Receiver, Signal space diagram, PSD and Bandwidth of QPSK, Probability of Error of ASK, BPSK and BFSK systems, Comparison of Digital modulation systems. Coherent Detection: Matched Filter (Impulse response and Probability of Error).

Unit-4: Base Band Transmission:
Base Band Binary PAM systems, Inter Symbol Interference, Base Band Pulse Shaping and Nyquist Criterion, Eye Diagram, Correlative Coding: Duobinary Encoder with Pre-coder, Modified Duobinary Encoder, Modified Duobinary Encoder with Pre-coder. Equaliation: Need for equalization, Transversal Equalizer (Problems Expected), Preset Equalizer, Adaptive Equalizer, Clock and Carrier Synchronization.

Unit 5: Error Control Coding:
Introduction to Error Control Coding, Types of Errors, Methods of Controlling Errors, Linear Bloc Codes:Matrix Description of Linear Block codes, Hamming Distance, Hamming Weight, Minimum Hamming Distance, Hamming Codes, Encoder for Linear Block code, Syndrome Decoding, Syndrome Decoder for (n, k) Linear Block Code, Error Detection and Correction capability of Linear Block Codes (Derivation expected). Cclic Codes: Properties of Cyclic Codes, Systematic and Non-Systematic generator Matrix, Parity Check Matrices for Cyclic Codes, Encoders for Cyclic Codes, Syndrome Decoding for Cyclic Codes. Convolution Codes:Time Domain Approach and Transform domain approach for convolution code generation, Code Tree and Code Trellis for Convolution code.

Unit 6: Multiple Access Schemes and Spread Spectrum Communication:
Multiple Access schemes: Time Division Multiple Access, Frequency Division Multiple Access, Code Division Multiple Access, Space Division Multiple Access. Spread Spectrum Sytems: Notion of Spread Spectrum, PN Sequence Generation (Problems Expected), Direct Sequence Spread Spectrum (DSSS), Jamming Margin, Processing Gain, Eb/No Ratio, Frequency Hopped Spread Spectrum, Slow and Fast frequency Hopping

Text Book: Proakis J. K., ñDigital Communicationò, Mc-Graw Hill Book Co., London (Second Edition)

.**Reference Books:**

1. Shanmugam K.S., ñDigital & Analog Communication Systemsò, John Wiley & Sons, New York, 1996
.2. Taub, Herbert, Schilling D. L., ñPrinciples of Communication Systemsò, Mc-Graw Hill International Book Co., Tokyo.
3. W.C.Y. Lee, ñMobile Cellular Telecommunications Systemsò, Mc-Graw Hill International Editions, 1990.
4. Glover and Grant, ñDigital Communicationò, Prentice Hall Publication.

6EE04 Professional Elective – II
INDUSTRIAL ELECTRICAL SYSTEMS

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the electrical wiring systems for residential, commercial and industrial consumers.
2. representing the systems with standard symbols and drawings, SLD.
3. Understand various components of industrial electrical systems.
4. Analyze and select the proper size of various electrical system components.

Unit I: Electrical System Components:

LT system wiring components, selection of cables, wires, switches, distribution box, meteringsystem, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse currentcharacteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator,Relays, MPCB, Electric shock and Electrical safety practices

Unit 2: Residential and Commercial Electrical Systems:

Types of residential and commercial wiring systems, general rules and guidelines forinstallation, load calculation and sizing of wire, rating of main switch, distribution board andprotection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.

Unit 3: Illumination Systems: Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency,specific consumption, glare, space to height ratio, waste light factor, depreciation factor,various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED andtheir operation, energy saving in illumination systems, design of a lighting scheme for aresidential and commercial premises, flood lighting.

Unit 4: Industrial Electrical Systems – I:

HT connection, industrial substation, Transformer selection, Industrial loads, motors, startingof motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design,Power factor correction ï kVAR calculations, type of compensation, Introduction to PCC,MCC panels.Specifications of LT Breakers, MCB and other LT panel components.

Unit 5: Industrial Electrical Systems – II:

DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing theDG, UPS and Battery Banks, Selection of UPS and Battery Banks.

Unit 6: Industrial Electrical System Automation:

Study of basic PLC, Role of in automation, advantages of process automation, PLC basedcontrol system design, Panel Metering and Introduction to SCADA system for distributionautomation.

Text Book: S. L. Uppal and G. C. Garg, "Electrical Wiring, Estimating & Costing", Khanna Publishers.

Reference Books:

1. K. B. Raina, ñElectrical Design, Estimating & Costingò, New age International, 2007.
2. S. Singh and R. D. Singh, ñElectrical estimating and costingò, Dhanpat Rai and Co.,
3. Web site for IS Standards.
4. H. Joshi, ñResidential Commercial and Industrial Systemsò, McGraw Hill Education, 2008.

6EE05 OPEN ELECTIVE – II
ENERGY AUDIT AND MANAGEMENT

Course Outcomes:

After completing this course student will be able to:

1. Discuss energy scenario and itôs management.
2. Conduct the energy audit of different systems.
3. Determine the economics of energy conservation
4. Discussvarious energy Conservation methods & their case studies
5. Explain fundamentals of Harmonics.

Syllabus:

Unit I : Energy Scenario & Management:

Indian energy scenario, Energy needs of growing economy, Energy pricing in India Energy sector reforms, various forms of energy, Primary and secondary energy, commercial and non-commercial energy, Global primary energy reserves, Energy and environment, Necessity of conserving energy, Energy strategy for the future, Electrical energy management, Concept of supply side management and demand side management, Methods of implementing Demand side management and advantages to consumer, utility and society.

Unit II: Energy Audit:

Definition, Need of energy audit, Preliminary and detailed energy audit. Procedure for carrying out energy audit, Instruments used for energy audit, Data Analysis-Energyð production relationship, specific energy consumption, Sankey diagram, CUSUM Technique, Bench marking energy performance, Recommendations for energy conservation, Action plan, Executive Summary.

Unit III: Economics of energy conservation:

Cost factors, Budgeting, Standard costing and Sources of capital, Cash flow diagram and activity chart, Simple Payback period analysis, Time value of money, Net present value method, internal rate of return method, Profitability index for benefit cost ratio

Unit IV: Energy Conservation:

Energy conservation in motive power, Illumination, Heating & cooling systems, Pumping systems, thermal power stations and Transmission & Distribution Sector. Cogeneration &Waste heat recovery systems.

Unit V: Energy Audit Case Studies:

Energy Intensive Industries, Commercial, Industrial, Municipal and Agriculture Sector, IT industries, Hospitals.

Unit VI: Fundamentals of Harmonics:

Harmonic distortion, voltage versus current distortion, Power systems quantities under non sinusoidal conditions- active reactive and apparent power, displacement and true power factor, harmonic phase sequences, triplen harmonics, harmonic indices- Total harmonic distortion (THD), Total demand distortion (TDD) , Harmonic sources from commercial and industrial load.

Text Book: Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, Book-2, Book-3, Book-4 (available online BEE website)

Reference: Books:

1. S. C. Tripathy, ñUtilization of Electrical Energy and Conservationò, McGraw Hill, 1991.
2. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)
3. Energy Conservation and Audit ByThumman, Fairmont Press
4. Energy Audit and Conservation TERI.

6EE05 Open Elective – II

ELECTRICAL ESTIMATING & COSTING

Course Outcomes:

After completion of the course students will be able to

1. Understand methods of installation and estimation of service connection
2. Decide type of wiring, its estimation and costing for residential building
3. Carry out electrification of commercial complex, factory unit installations
4. Design & estimate for feeders & distributors
5. Understand contract, tendering and work execution process.

Syllabus:

Unit I: Electrical Installation:

Classification of Electrical Installation, General requirement of Electrical Installation. Important definitions related to Installation.

Service Connection: Concept of service connection, Types of service connection & their features. Methods of Installation of service connection.Estimation of service connection.

Unit II : Residential Building Electrification :

Procedures for designing the circuits and deciding the number of circuits.Selection of type of wiring and rating of wires &cables..Earthing of Residential Installation. Estimate and cost Preparation of Residential Installation.

Unit III:Electrification of commercial Installation:

Concept of commercial Installation. Differentiate between electrification of Residential and commercial Installation Deciding the size of cables, busbar and busbar chambers. Earthing of the electrical Installation Selection of type wire, wiring system.Preparation of detailed estimate and costing of commercial Installation.

Unit IV: Electrification of factory unit Installation:

Concept of Industrial load. concept of Motor wiring circuit.Important guidelines about power wiring and Motor wiring.Selection and rating of wire, cable size.Sequence to be followed to prepare estimate.Preparations of detailed estimate and costing of small factory unit/ workshop.

Unit V: Design & estimate for feeders &distributors:
Different schemes for feeders & distributors, estimates for different feeders & distributors, Distribution transformer, Deciding Size & location, Estimate for outdoor & indoor type distribution substation.

Unit VI:Contracts, Tenders and Execution:
Tender and tender notices. Procedure for submission and opening tenders. Comparative statements, criteria for selecting contractors, General conditions in order form. Principles of Execution of works administrative approval, technicalsanctions.Billing of executed work.

Text Book: Electrical Design; Estimating and costing by K.B. Raina, S.K.Bhattacharya New Age International (p) Limited, New Delhi.

Reference Books:

1. Electrical Estimating and costing by Surjit Singh Dhanpat Rai and company, New Delhi.
2. Electrical Estimating and costing by N. Alagappan S. Ekambaram, Tata Mc Graw Hill Publication New Delhi

6EE06 POWER ELECTRONICS - LAB.

List of Experiments:

1. To verify the V-I characteristics of SCR
2. To verify forward and reverse characteristics of DIAC
3. To verify forward and reverse characteristics of TRIAC
4. To study UJT as relaxation oscillator
5. AC voltage control using triac - diac combination
6. To verify the operation of half and full controlled converter
7. To verify the operation of SCR commutation circuits
8. To design & simulate dc-dc buck converter
9. To design & simulate dc-dc boost converter
10. Construct and test the dc chopper control circuit using thyristor
11. Study of PWM based step down dc chopper using MOSFET/IGBT
12. To verify the operation of Single phase single pulse / sinusoidal PWM inverter using MOSFET/IGBT
13. To verify the operation of Single phase parallel inverter using MOSFET/IGBT
14. To verify the operation of Single phase to single phase cycloconverter
15. To verify the operation of Single phase dual converter With R - RL loads
16. To verify the operation of Single phase ac voltage controller

6EE07 POWER SYSTEMS - II LAB

List of Experiments:

1. Determination of negative sequence reactance of a synchronous generator
2. Determination of zero sequence reactance of a synchronous generator
3. To study various types of current limiting reactors
4. To study the mechanism of lightning arrester
5. Introduction to use of Simulation package (Power World Simulator) for power systems
6. To study substation layout and its components
7. To study HVDC Transmission System
8. To simulate three phase fault for a given power system using MATLAB Simulink
9. To find the direct axis synchronous reactance, X_d& quadrature axis synchronous reactance, X_q of a salient pole synchronous machine by slip test
10. To find the direct axis subtransient reactance, X_dò & quadrature axis sub ï transient reactance, X_qò of a salient pole synchronous machine by conducting static test
11. TO study of corona on EHV lines.
12. To study of faults at overhead line insulators
13. To study of sag and stress on overhead conductors

6EE08 COMPUTER AIDED ELECTRICAL MACHINE DESIGN - LAB

Develop Minimum Eight (8) Computer programme:

List of Computer Programms:

1. Develop a computer programme for core design of a single-phase core type transformer
2. Develop a computer programme for core design of a single-phase shell type transformer
3. Develop a computer programme for core design of a three-phase core type transformer
4. Develop a computer programme for optimum core design of a three-phase core type transformer for minimum cost or maximum efficiency.

5. Develop a computer programme for Estimation of Iron losses in a three-phase core type transformer.
6. Develop a computer programme for windings design of a single-phase transformer
7. Develop a computer programme for windings design of a three-phase transformer
8. Develop a computer programme for calculating the No load current of a single-phase transformer.
9. Develop a computer programme for calculating the No load current of a three-phase transformer.
10. Develop a computer programme for tank design and calculating the number of cooling tubes required for three phase core type transformer.
11. Develop a computer programme to calculate Main dimensions (D & L) of a three phase Induction motor.
12. Develop a computer programme for stator core design of three phase induction motor.
13. Develop a computer programme for squirrel cage rotor design of three phase induction motor.
14. Develop a computer programme for wound type rotor design of three phase induction motor.
15. Develop a computer programme for estimating magnetizing current of a squirrel cage type three phase induction motor.

6EE09 COMPUTER TECHNOLOGY - LAB

Student needs to complete minimum eight assignments based on the following

- Computer Network: Basic Hardware and Terminology in networks, Classifications, The Internet, The Intranet and Extranet.
- Installation of Operating systems, Application software in Personnel Computer or laptop.
- Study of PLCs usedforIndustrial automation, developing the ladder diagram for given task in automation using PLC.
- Basics of IoT, IoT based Monitoring & Controlling of various Electrical Equipment.
- Develop the simulation models for various tasks in electrical engineering using Simulation software.
- Develop the computer programme for various tasks in electrical engineering using software.

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B.E. (ELECTRICAL & ELECTRONICS ENGG.) SEMESTER - V

5EX01/4EP03 CONTROL SYSTEMS

Course Outcomes:

After completing this course, student will be able to:

1. Demonstrate the fundamental concepts of automatic Control and mathematical modeling ofthe Systems.
2. Determine the transfer function of control system components.
3. Analyze the time response of various systems and performance of controllers.
4. Evaluate the stability of linear systems using various methods.

Unit I : Introduction to automatic control: Open loop and closed loop system, servo-mechanisms, mathematical modeling of physical systems, transfer functions, block diagrams and signal flow graphs. Effect of feedback on sensitivity to parameter variation and reduction of the noise.

Unit II : Control System Components: Electrical / Electro-mechanical components such as A.C./D.C. servomotors, stepper motors, synchros, potentiometers, tacho-generators, encoders, their functional analysis and operating characteristics and their application.

Unit III: Time response analysis: Time response of first and second order systems to standard inputs. Time response specifications, types of system, error analysis, error coefficients, steady state errors, dynamic error series. Approximate methods for higher order system, proportional, derivative and integral control.

Unit IV: Stability: Stability of control systems, characteristics equation, impulse response, Routh-Hurwitz stability criterion, relative stability. Root Locus: construction of root locus, determination of roots from root locus conditions on variable parameter for stability, effect of addition of poles and zeros.

Unit V: Frequency response methods: Frequency response of linear system, specification, Logarithmic frequency response (Bode) plots from transfer function for various systems. Polar plots for various systems. Estimation of approximate transfer functions from the frequency response.

Unit VI: Stability analysis from frequency response: Gain margin and Phase margin; Stability analysis from Bode plots. Nyquist criterion, Nyquist plots and stability analysis.

BOOKS RECOMMENDED:

Text Book: Nagrath I.J., Gopal M.: Control System Engineering, Wiley Eastern.

Reference Books:

1. Control Engineering, D.Ganesh Rao, k. Chennavenkatesh, 2010, PEARSON
2. Ogata K.: Modern Control Systems, Prentice Hall of India.
3. Control Systems by K.R.Varmah TMH edition 2010
4. Linear Control Systems, Ashfaq Hussain, Haroon Ashfaq, Dhanpat Rai &Co.

5EX02/ 5 EP02 MICROPROCESSORS & MICROCONTROLLER

Course Outcomes:

After completing the course the students will be able to

1. Recite Fundamentals and Architecture of Microprocessor 8085
2. Interpret Assembly Language Programming of Microprocessor 8085
3. Illustrate interfacing of programmable devices with Microprocessor 8085
4. Apply knowledge of Microprocessor 8085 for measurement of Electrical quantities
5. Discuss Fundamentals and Architecture of Microprocessor 8086
6. Explain Fundamentals and Architecture of Microcontroller 8051

Unit I: 8085-architecture and Pin Diagram, Microprocessor Operations (Initiated, Internal and External) BUS organization and register structure, instruction set of 8085, addressing modes, Machine Cycles & Bus Timings

Unit II: Assembly Language Programming of 8085, counters and time delays, stack and subroutines, Memory mapped I/O and I/O mapped I/O, address decoding techniques. Interrupt system of 8085 (software and hardware interrupts), Data transfer schemes, serial data transfer through SOD and SID line.

Unit III: Programmable Interfacing devices: internal architecture and programming of PPI (8255), PIC (8259), and USART (8251). PIT (8253)

Unit IV: 8085 Microprocessors applications: hardware & software developments: signal conditioning & data acquisition system components. Measurement of pulse width using parallel port, SID lines, interrupts and timer and counter. Magnitude measurement techniques: rectification, sampling etc. measurement of fundamental quantities (voltage, current, frequency, speed) and derived quantities (resistance, inductance, capacitance, phase angle, power factor).

Unit V: Microprocessor 8086 General Idea of Architectural Advancements of Microprocessors: Pipelining, Cache memory, Memory Management, Virtual Memory System Features of 8086 Microprocessor
Register Organization of 8086: General Data Registers Segment Registers Pointer and Index Registers Flag Register Internal Organization of 8086 Bus Interface Unit (BUI) Execution Unit (EU) Memory Segmentation Flag register and description of all flag bits Interrupts

Unit VI: Introduction to microcontroller: 8051 architecture , 8051 Internal resources, pin diagram, I/O pins, ports and their internal logic circuits, counters, serial ports, interrupt structure, SFRs and their addressing, watch-dog timer, internal code memory, data memory, stack pointer, flags, bit addressable memory, study of instruction set of 8051.

Text Book: Microprocessor Architecture, Programming, and Applications with the 8085, Romesh Gaonkar PHI Publication - 2006

Reference Books:

1. An Introduction to Microcomputers Volume 1 Basic Concepts, Adam Osborne Osborne-McGraw Hill, Berkely California, 1980
2. Introduction to Microprocessor L. Gibson, Prentice-Hall, 2003
3. Advance Microprocessor and Peripherals, K. M. Bhurchandi & A. K. Ray, 2nd Edition, Tata McGraw Hill, 2006.
4. Microprocessor 8086 ,Sunil Mathur PHI 2010
5. The 8051 Family of Microcontrollers Richard Barnett Prentice-Hall, Inc -2000
6. The 8051 Microcontroller and Embedded Systems: Using Assembly and C,M A Mazidi,J.GMazidi and Mckinlay, 2nd Edition, Pearson.

5EX03/5EP03 ELECTRICAL MACHINES – II

Course Outcomes:

After completing this course students will be able to

1. Describe the construction, working operation & performance characteristics of three phase Induction Motor
2. Analyze the starting, braking and speed control of three phase induction motors by various methods.
3. Describe the construction, working operation & performance characteristics of single-phaseInduction Motor
4. Demonstrate the construction, working operation & performance characteristics of synchronous machine.
5. Explain the construction & working of special motors like Universal, Reluctance, PMSM & BLDC Motor

Unit I: Three phase induction motor – I:
Construction,Types (squirrel cage and slip-ring), Rotating Magnetic Fields, principles of operation, Working, Torque Slip Characteristics, Starting and Maximum Torque. Effect of parameter variation on torque slip characteristics (variation of rotor and stator resistances, stator voltage, frequency).Equivalent circuit. Phasor Diagram, Performance evaluation by direct & indirect testing, circle diagram.

Unit II: Three phase induction motor – II:
Starters for squirrel cage &slip-ring type IM, Methods of speed control, electric braking, High Torque IM, single phasing, cogging and crawling, Generator operation Self-excitation, Doubly-Fed Induction Machines.

Unit III: Single phase Induction Motor:
Double revolving field theory, Constructional features, equivalent circuit, working, Split-phase starting methods and applications of single-phase Induction motors.

Unit IV: Synchronous Generator:
Constructional details, working principle, operation, armature reaction, circuit model, determinations of parameters of the circuit model and phasor diagram, methods of determining the regulations and efficiency, Parallel operation of alternators - synchronization and load division.

Unit V: Synchronous Motor:
Construction, principle of operation, working, starting methods, torque equation - V-curve, Inverted V curve & power angle characteristics, hunting & damping, applications. Transient, sub transient & steady state reactance of synchronous machines.

Unit VI: Special Motors :
Construction, working principle, operation, characteristics and applications of Universal motor, Reluctance Motor, Permanent Magnet Synchronous Motor & BLDC Motor.

Text Books:
1. D.P.Kothari &I.J. Nagrath, ñElectrical Machinesò- 5th Edition, TMH Publication.
2. S. Langsdorf, ñAlternating current machinesò, McGraw Hill Publication.

Reference Books:
1. Stephen D. Umans, ñFitzgerald and Kingsleyôs Electric Machineryò, 7th Edition, McGraw Hill Publication, 2020.
2. M. G. Say, ñPerformance and design of AC machinesò, CBS Publishers, 2002.
3. P. S. Bimbhra, ñElectrical Machineryò, Khanna Publishers, 2011.
4. C L Dawes, ñA Course in Electrical Engineering (Volume -2)ò, McGraw Hill Publication

5EX04/ 5EP04 Professional Elective-I
1. Power System Operation And Control

Course Outcomes:
After completing this course students will be able to:
1. To impart knowledge to describe, calculate and analyze energy generation, unit commitment problem in thermal power plant, power system behavior and economics of generating costs.
2. To understand and analyze optimal dispatch with transmission losses, penalty factor and automatic load dispatch.
3. To learn s:the concept of real and reactive power flow and its control in power system.
4. To learn the automatic voltage regulator and automatic load frequency control.
5. To learn tie line interchange between interconnected utilities.
6. To illustrate various ways of interchange of power between interconnected utilities.
7. To impart knowledge about various advanced controllers such as FACTs controllers with itsevolution, principle of operation, circuit diagram and applications.

Unit I : **Economic Operation – Part I :**
Meaning of optimum scheduling, UCP and LSP; Input ï Output characteristics, Heat rate characteristic, Incremental fuel rate, Incremental fuel cost; Methods of obtaining incremental fuel costs; Conditions for incremental loading; Optimum scheduling of generation between different units (Only Two plant system without transmission loss).

Unit II : **Economic Operation – Part II:**
Transmission loss as a function of plant generation; Calculation of loss co-efficient (Two plant system); Incremental transmission loss; Optimum scheduling of generation between different plants including transmission loss; Concept and significance of penalty factor; Automatic load dispatch: Operation and Functions.

Unit III : **A. Generator Control Loops :**
Concept of real and reactive power; Effect of real and reactive power on system parameters; Basic generator control loops.

B. Automatic Voltage Regulator (AVR) :
Functions of AVR; Types of Exciter; Brushless AVR loop: Exciter modeling, Generator modeling, Transfer function block diagram representation, Static performance, dynamic response, Stability compensation, Effect of generator loading.

Unit IV : **Automatic Load Frequency Control:**
Automatic generation control (AGC); Speed governing system; Transfer function modeling: Governor, Hydraulic valve actuator, Turbine, Generator, Load; Transfer function representation of an isolated generator; Static performance of speed governor; Closing of ALFC loop.

Unit V : **Control Area:**
Meaning; Primary ALFC Loop: Static response, Dynamic response, physical interpretation of results; Secondary ALFC loop; Integral Control; Pool operation; Tie-line Modeling; Two area system ï Dynamic response; Tie-line bias control.

Unit VI : **Energy Control of Power System :**
Interchange of power between interconnected utilities, economy interchange evaluation, interchange evaluation with unit commitment, typ:es of interchange, capacity and diversity interchange, energy banking, emergency power interchange, inadvertent power exchange, power pools, Circuit diagram and applications of FACTs Technology :- SVC, TCSC, STATCOM and UPFC.

Text Books :-
1. O. L. Elgerd ñElectric Energy Systems Theory: An Introductionò 2nd edition, McGraw-Hill Book Comp. N. Y. 1987.
2. Power System Operation & Control, N.V.Ramana, PEARSON education, 2010.
3. Power System Operation by R.Miller, J.H.Malinowski, TMH, 2nd reprint 2009

Reference Books :
1. L. K. Kirchamayor ï Economic Operation of Power System- Wiley Estern Pvt. Ltd., New Delhi.
2. Hadi Saadat ï Power System Analysis ï WCB/McGraw-Hill International Edition 1999
3. I.J. Nagrath, D. P. Kothari ï Modern Power System Analysis ï Second edition, Tata Mc-Graw Hill Publishing Company, New Delhi
4. P. S. R. Murty ï Power System Operation and Control ï Tata Mc-Graw Hill Publishing Company, New Delhi.
5. Wood and Wollenberg ï Power Generation, Operation and Control ï Willey ï Inter Science Publication

5EX04 PROFESSIONAL ELECTIVE – I : ELECTRICAL ENGINEERING MATERIALS

Course Outcomes:
After completing this course students will be able to
1. understand importance of electrical engineering materials
2. understand how electric conduction takes place in conductors
3. understand importance of semiconductors and magnetic materials in electrical engineering.
4. understand importance of dielectric materials in electrical engineering.
5. Identify the need of special materials in electrical engineering.

Unit-I Introduction to Electrical Engineering Materials:
Importance of materials, Classification of electrical materials, Scope of electrical materials, Requirement of Engineering materials. Types of engineering materials, Levels of material structure.

Unit-II Conducting Materials: Review of metallic conduction on the basis of free electron theory. Variation of conductivity with temperature and composition, materials for electric resistors- General Electric properties; material for brushes of electrical machines, lamp filaments, fuses and solder.
Unit-III Semiconductors: Semiconductors: Mechanism of conduction in semiconductors, types of semiconductors. Hall effect, compound semiconductors, basic ideas of amorphous and organic semiconductors.

Unit-IV Magnetic Materials: Classification of magnetic materials- origin of permanent magnetic dipoles, magneto materials used in electrical machines, instruments and relays.
Magnetic Circuit terminology, Relation between relative permeability and magnetic susceptibility. Classification of magnetic materials, Diamagnetic, Paramagnetic, Ferromagnetic, Antiferromagnetic. Magnetization curve, Initial and maximum permeability. Hysteresis loop and loss, Eddy current loss.

Unit-V: Di-electrics & Insulating Materials: Dielectrics, Factors influencing dielectric strength. Capacitor rmaterials. Insulating materials, Insulating Materials: Inorganic materials (mica, glass, porcelain, asbestos), organic materials (paper, rubber, cotton silk fiber, wood, plastics and bakelite), resins and varnishes, liquid insulators (transformer oil) gaseous insulators (air, SF6 and nitrogen) and ageing of insulators.

Unit-VI: Materials for Special Applications: Materials for solar cells, fuel cells and battery. Materials for coatings for enhanced solar thermal energy collection and solar selective coatings, Cold mirror coatings, heat mirror coatings, antireflection coatings, sintered alloys for breaker and switch contacts.

Text & Reference Books:
1. Electrical Engineering Materials by Dekker A.J (PHI)
2. Electrical Engineering Materials by S.P.Seth (Dhanpatrai and Sons)
3. An Introduction to Electrical Engineering Materials by Dr. C. S Indulkar & Dr. S. Thiruvelgadam (S. Chand Pub.)

5EX04 PROFESSIONAL ELECTIVE – I : ANALOG COMMUNICATION SYSTEMS

Course Outcomes:
After study through lectures and assignments, students will be able to:

1. To evaluate the performance of analogue communications in the presence of noise.
2. To analyze various methods of baseband/band pass Analogue transmission and detection.
3. Analyze and allocate performance of AM, FM transmitter and receiver systems.
4. Gain the knowledge of components of analogue communication system

Unit I : Signal and Noise : - Audio signals, frequency range speech and music, sound intensity, loudness, level, frequency response, bandwidth, bandwidth requirement for different types of signals such as telegraph, telephone speech, music and video Noise: External and internal noise, noise figure, signal to noise ratio, noise figure measurement.

Unit II: Modulation Techniques : - Amplitude modulation theory, Frequency spectrum representation of AM, Modulation index side bands, power relations, current relations and voltage relation in the AM wave. Frequency modulation and phase modulation, frequency deviation, modulation index, frequency spectrum.

Unit III: AM Transmitters: - Principles of DSB-FC, DSB-SC, SSB-SC modulation and their comparison, Details of DSB-FC transmitter, Generation of DSB-SC by using balanced modulators (FET & Diodes), DSB-SC transmitter. Generation of SSB-SC by phase-shift method.

Unit IV : AM Receivers : - TRF receiver, superhetrodyne receiver, details of each block such as RF amplifier, Oscillator, IF amplifier, Diode detector, audio amplifier. Mixer: Principle, Need and type of AGC, Practical radio receiver circuit with AGC, characteristics such as selectivity, sensitivity, and fidelity communication receiver.

Unit V : FM Transmitter : - Circuits for direct FM generation using FET and varactor diode. Circuit & analysis of Indirect FM generation, Narrow band and wide band FM, their comparison, de-emphasis and pre-emphasis. FM transmitter & stereo FM transmitter.

Unit VI : FM Receivers :- Details of FM receiver, blocks such as RF amplifier, local oscillator, IF amplifier, Mixer, audio Ampl. AGC, limiter, FM discriminator, single slope and balanced slope detector, analysis of Foster seeley and ratio detectors, stereo FM receiver.

Text Book: Kennedy G.: Electronics Communication System, Tata McGraw Hill Co. New Delhi.

Reference Books :-

1. Young P.H.: Electronics Communication Techniques, A Bell and Howell Co. Indiana.
2. Martin James. : Telecommunication and the Computer, Prentice Hall Inc. New Jersey.
3. Roddey D. Coolen S.: Electronics Communication, Prentice Hall India Pvt. Ltd.
4. Beck, Robert and J.Schoen: Electronics Communication, Modulation and Transmission, A. Bell and Howell Co.

5EX06/ 5FEEP05 Open Elective – I
1. ELECTRICAL DRIVES

Course Outcomes:

After completing this course, Students will be able to:

1. Explain the basic Concept of electrical drives
2. Describe Power Electronics devices & their Applications
3. Demonstrate various starting, braking and speed control methods of D.C. Motors
4. Demonstrate various starting, braking and speed control methods of three phase Induction Motor.
5. Describe the construction, working principle and applications of single phase Induction Motor& special motors

Unit I: Concept of electric drives, classification and comparison of electrical drive system, Cooling and heating of electric motors. Types of duties: continuous, intermittent and short time. Selection of an electric drive for particular applications.

Unit II: Theory, principle, Characteristics of Power Transistor, SCR, Power MOSFET and IGBT. Introduction to single phase & three phase fully controlled bridge convertors.

Unit III: D.C. Motors: Types, characteristics, Torque equation, Starting and braking, Speed control and Applications.

Unit IV: Three phase Induction Motors: Types, construction, principle of working, characteristics and applications. Starting and braking. Speed control methods: Thyristorized stator voltage control of three phase induction motor.

Unit V: Single phase Induction Motors: Double revolving field theory, Cross field theory, types, construction, principle of working, starting methods and applications.

Unit VI: Special Motors: Construction, Principle of working, and applications of D.C. servo motors, stepper motors, Brushless D.C. motors and Universal motor.

Text Books :

1. S.K.Pillai : A First Course on Electrical Drives by New Age International Publishing Co. Ltd.
2. I.J.Nagrath & D.P.Kothari : Electric Machines by Tata Mc Graw Hill Publishing Co. Ltd.

Reference Books :

1. Vedam Subrahmanyam: Electric Drives : Concepts & Applications by Tata Mc Graw Hill Publishing Co Ltd.
2. Ion Boldea, Nasar. S A : Electric Drives by CRC Press India
3. Ashfaq Husain: Electric Machines by Dhanpat Rai & Co. Ltd
4. M.D.Singh & K.B.Khanchandani : Power Electronics by Tata Mc Graw Hill Publishing Co Ltd
5. V.K.Mehta: Principles of Electronics by S.Chand and Co Ltd ,New Delhi

5 EX06/ 5FEEP05 Open Elective – I
2. POWER PLANT ENGINEERING

Course Outcomes: -
1) Describe different Sources of Energy Generation
2) Explain the Working and layout of steam power plant & hydro power plant.
3) Discuss the working principle and basic component of Nuclear, Diesel & gas power plant
4) Illustrate various terms related to power plant economics & tariff.

Unit-I: Introduction: Energy resources and their availability, types of power plants, selection of the plants, Introduction to basic thermodynamic cycles used in power plants, Conventional and non-conventional energy sources, Indian Energy Scenario.

Unit-II: Hydro Electric Power Plant: Rainfall and run-off measurements and plotting of various curves for estimating stream flow and size of reservoir, Layout of Hydro power plant, operation of different components of hydro-electric power plant , classification of hydro Electric power plant, Pump Storage Plant, site selection, advantages & disadvantages

Unit-III: Steam Power Plants: Flow sheet and working of modern-thermal power plants, super critical pressure steam stations, Layout of Thermal power plant , Site selection, coal storage, coal handling systems, ash handling systems, working of various parts: Economizer, air preheater, condenser, cooling tower, Electrostatic Precipitator, advantages & disadvantages.

Unit-IV: Nuclear Power Plants: Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANada Deuterium-Uranium reactor (CANDU) fast breeder reactor, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

Unit-V: Diesel & Gas power plant: Layout of Diesel power plant, functions of different components of diesel plant, advantages & disadvantages, Principle of Operation of Gas Turbine Plants, Open cycle gas turbine plant, closed cycle gas power plant, combined gas and steam cycle.

Unit-VI: Power Plant Economics: Load curve, energy load curve, energy duration curve, connected load, maximum demand, demand factor, load factor, diversity factors, plant capacity and utilization factor, types of loads, operating cost, annual plant cost, Generation cost, Depreciation, Objectives of Tariff, Types of Tariff.

Text Books:
1. Generation of electrical energy by B.R.Gupta, Eurasia Publishing House, New Delhi.
2. Power Plant Engineeirng; R. K. Rajput ; Laxmi Publications

Reference Books:
1. Non conventional energy resources. By G.D.Rai, Khanna Publishers New Delhi
2. Principles of Power System by V.K.Mehta, S.Chand publication.
3. Conventional energy technology by S.B.Pandya, Tata McGraw Hill Publication.
4. Power Plant Engineering, P. K. Nag

5EX06 CONTROL SYSTEM - LAB

Student should perform minimum eight practicals based on syllabus.
Minimum eight experiments based on the syllabus content of 5 EX06 Control Systems. The intensive list of experiment is given below:

1. Study of Potentiometer
2. Study of A.C. Synchro and its characteristics
3. Determination of Transfer Function of D.C. Generator
4. Determination of Transfer Function of D.C.Servomotor and Its Characteristics
5. Performance Characteristics of a D.C. Motor Angular Position Control System
6. Determination of Frequency Response of Given R-C Network
7. Determination of Transfer Function of A.C. Tacho-Generator
8. Experimental Study of The Operating Characteristics of a Small Stepper Motor and Its Controller
9. Study Closed Loop PI Controller System and Its Time Response to Different Input.
10. Experimental Study of Position Control of DC Motor using Ardiuno
11. Experimental Study of Time Domain Analysis of Second Order Control System
12. Study AC Position Control System

5EX07 MICROPROCESSOR & MICROCONTROLLER - LAB

Student should perform minimum eight practicals based on the syllabus .

List of Experiments:
1. Write anAssembly Language Program for the Addition of two 8-bitnubers and 16-bit numbers
2. Write an Assembly Language Program for the Subtraction of two 8-bit numbers
3. Write a Program for Finding the larger and smaller one among the two 8-bit numbers
4. Write a Program for Finding the largest and smallest number from an array of ten, 8-bit numbers
5. Write a Program for Masking and setting of nibbles

6. Write a Program for Block data transfer in same and reverse order
7. Write a Program for Sorting of even and odd numbers from an array of 8-bit numbers
8. Write a Program for Multiplication of two 8-bit numbers
9. Write a Program for Square wave generation using 8255 PPI
10. Write a Program for Stepper motor control using 8255 PPI
11. Write a Program for Interfacing ADC with 8085 Microprocessor using 8255 PPI
12. Write a Program for Interfacing DAC with 8085 Microprocessor using 8255 PPI
13. Write a Program for Lamp load control using 8255 PPI
14. Write a Program for measurement of DC voltage and Current using ADC and 8255 PPI
15. Study of Architectural Difference Between Microprocessor 8085,8086 and Microcontroller 8051.

5EX08 ELECTRICAL MACHINES-II- LAB

Student should perform minimum eight practicals based on the syllabus**.**

List of Experiments:

1. Perform the load test on three phase IM & plot its performance characteristics.
2. Perform the No load test on three phase IM to separate out its no load losses.
3. Estimate the performance parameters of three phase IM from its circle diagram.
4. Plot the equivalent circuit of three phase Induction motor.
5. Study of different types of starters used for three phase IM
6. Speed control of three phase squirrel cage Induction motor by various methods like stator voltage control method, frequency control method, changing number of poles.
7. Speed control of three phase Induction motor.
8. Perform the electric braking of three phase Induction motor.
9. Perform the load test on single phase IM & plot its performance characteristics.
10. Load test on three phase alternator to determine its performance parameters.
11. Synchronize the three-phase alternator with infinite bus-bar
12. Perform the OC & SC test on synchronous generator to estimate its regulation by EMF & MMF methods
13. Estimate the regulation of three phase alternator using ZPF method.
14. Perform the load test on three phase Synchronous motor.
15. Plot the V & inverted V curves of synchronous motor.

5EX09 INFORMATION &COMMUNICATION TECHNOLOGY- LAB

Student needs to complete minimum eight assignments based on the following:

Word Processing with MS-Word:

- Basic operations- Editing and Formatting text, paragraphs and pages, Printing the documents.
- Working with tables, figures, images.
- Mail merge. Working with Charts, Equations, Symbols.

Working with workbooks /work sheets.

- Data Entry techniques & Defining data set as a Table.
- Setting, Previewing, and Printing under MS-Excel.
- Performing Calculations, using Excel Formulas, Functions and Charts.
- Sorting/ Filtering data in excel sheet.

Working with MS Power Point.

- Presentation Basics. Adding more components to the slides, Printing the slides.
- Formatting Presentations, backgrounds and layout. Applying Themes. Using Slide Master.
- Working with Graphics, Images and Clips.
- Working with Multimedia. Inserting Sound and Narration.
- Delivering Presentations. Animating Objects. Adding Action effects.
- Live Presentation. Using Custom Shows.
- Saving/Protecting the Presentation.

Working with Latex:

- Basic operations- Editing and Formatting text, paragraphs and pages, printing the documents.
- Working with tables, figure & images.

Web Page Development

- Introduction to HTML, CSS, JAVA Coding.
- Development of Web page.

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B.E. (ELECTRICAL & ELECTRONICS ENGG.) SEMESTER - VI

6EX01 POWER ELECTRONICS

Course Outcomes:

After completing this course student will be able to:

1. Explain the concepts and techniques used in power electronics
2. Apply the knowledge of series and parallel connection of SCRs in power control applications
3. Analyze various single phase and three phase power converter circuits
4. Analyze the single phase and three phase Inverter circuits
5. Explain the operation of DC/DC and AC/AC converter circuits
6. Demonstrate the applications of power electronic circuits.

Unit I: SCR, Triac, Diac ï Construction and Applications, two Transistor Analogy of SCR, SCR turn ON mechanism, different methods for turning ON SCR, turn OFF mechanism, Thyristor firing circuits, introduction to Power MOSFET and IGBT their construction and characteristics.

Unit II: Series-Parallel operation of SCRs, firing circuits for series and parallel operations, static and dynamic equalizing circuit, equalization of current in parallel connected SCRs ,string efficiency, de-rating factors, protections of SCRs against di/dt, dv/dt, over-voltage and over-current protection, Gate protections, Electro Magnetic Interference(EMI) and Shielding.

Unit III: Principle of phase control, half wavecontrolled rectifier, half controlled bridge and fully controlled bridge rectifier for R, RL and RLE load, derivation for output voltage and current, effect of freewheeling diode, effect of source inductance.
Three phase half controlled bridge and fully controlled bridge rectifier.

Unit IV: Classification of circuit for forced commutation, series inverter, improved series inverter, parallel inverter, single phase PWM inverters, principle of operation of three phase bridge inverter in 120^0 and 180^0mode,single phase transistorized bridge inverter.

Unit V: Basic principle of Chopper, Time ratio control and current limit controlled technique, Voltage commutated Chopper circuit, Jones Chopper, Step up Chopper, Step down Chopper and AC Chopper.

Unit VI: Basic principle of cycloconverter, single phase to single phase cycloconverter, Introduction, principle of operation of single-phase voltage controllers for R and R-L load.
Speed control of DC series motor using chopper, Speed control of DC shunt motor using phase controlled rectifier. Speed control of three phase Induction motor by stator voltage control method, V/f control.

Text Book: Rashid Muhammad, H., ñPower Electronics: Circuits, Devices and Applicationsò, 2nd Edition. Prentice-Hall, 1998.

Reference Books:

1. Mohan Ned, Undeland Tore, M. and Robbins William, P., ñPower Electronics: Converter, Applications and Designò, John Wiley & Sons, 1994.
2. M.D. Singh & K.B. Khanchandani, ñPower Electronics ñTata Mc-Graw Hill, New Delhi
3. Dewan, S.B. and Satrughan A., ñPower Semiconductor Circuitsò, John Wiley & Sons,
4. Dubey, G.K., Doradlla, S.R., ñThyristerised Power Controllersò, Wiley Eastern, 1987.

6EX02 POWER SYSTEMS -II

Course Outcomes:

At the end of the course, students will be able to:

1. Able to understand Power Factor improvement, Capacitor bank installation in distribution system, metering system in Industries and Residential area.
2. Able to understand Positive Sequence, Negative & zero sequence system and fault analysis.
3. Create computational models for analysis of both symmetrical and unsymmetrical conditions in power systems,
4. Analyze the system performance where there is an unbalanced fault, and also calculate the corresponding fault current.
5. To examine the need of various analysis like fault analysis, short circuit analysis stability analysis, steady state and transient analysis.

SECTION- A

Unit I : Symmetrical components:
Definition and choice, Alpha operator, transformation matrices, sequence components, power invariance, line and phase sequence quantities relations, three phase delta/star transformer bank- sequence voltages and currents relationship; power system elements ï sequence impedance and sequence networks ; Various three phase transformer connections ï zero sequence rules; Unbalanced load system - application.

Unit II : Symmetrical Fault Analysis:
Transmission line transients, three phase symmetrical short circuit at alternator terminals, Power system fault calculations, short circuit MVA, Current limiting reactors, ring system and tie bar system, Circuit breaker rating calculation.

Unit III : Unsymmetrical Fault Analysis: L-G, L-L-G and L-L faults at unloaded generator terminals, Equivalent sequence network diagram, Fault impedance, Unsymmetrical faults through impedance, Power system faults- loaded and unloaded conditions.

SECTION-B

Unit IV : Over voltages: Causes ï internal and external; Voltage surge, Basic insulation level, Protection ï earthing screen, overhead ground wire, lightning arresters.

Unit V : HVDC Transmission Basic principle: Transmission equipments, Comparison with AC links, Inverters ï reactive power requirement; Converters, DC links, Circuit breaking, ground return, Economic distance, modern developments.

Unit VI : Corona Effect : Power loss due to corona , Practical importance of corona, use of bundled conductors in E.H.V transmission lines and its advantages, Overhead line insulators ,Voltage distribution in suspension type insulator, String efficiency , Grading . Sag and stress calculation of overhead conductance, Vibration dampers .

Text Book:- Power System Analysis, N.V.Ramana, PEARSON education, 2010.

Reference Books:

1. Power System Analysis, Arthur R. Bergen, Vijay Vittal, 2nd Edition, 2009, PEARSON Education
2. I. J. Nagrath & D. P. Kothari ï ñModern Power System Analysisò, Tata- Mc-Graw Hill Publishing Company, New Delhi.
3. Electrical Power System, DEPAPRIYA DAS (D. DAS)

6EX03 COMPUTER AIDED ELECTRICAL MACHINE DESIGN

Course Outcomes:

After completing this course, student will be able to

1. Explain the Basics of Computer aided machine design & material selection.
2. Derive the design parameters of single & three phase transformer core.
3. Calculate the winding& cooling system parameters of the transformer
4. Develop the armature winding diagram for three phase Induction Motor
5. Determine the stator core dimensions of three phase Induction motor
6. Design the squirrel cage & wound type rotor for three phase Induction motor

Unit I: Introduction:

Review of transformer & Induction motor constructional features, Major considerations in electrical machine design, optimization, electrical engineering materials: Conducting, Insulating & Magnetic Materials,Limitations of traditional design, need for CAD, analysis, synthesis and hybrid methods of CAD, Introduction to FEM based machine design.

Unit II: Transformer Design –I:

Transformer Core Design - material selection, type of construction, Specific magnetic & electric loadings, output equation, core and yoke cross sections, window dimensions, overall core dimensions calculations, core loss estimation from design data. Optimum core design for Minimum cost, minimum losses, Minimum weight & Minimum volume.

Unit III: Transformer Design – II:

Transformer Winding - types, and design calculation, Layout, no-load current calculation, primary and secondary winding resistance and leakage reactance from design data, mechanical forces ï types &causes.Estimation of efficiency & regulation from design data. Cooling methods for a transformer, design of transformer tank. Calculation of cooling tubes.

Unit IV: AC winding Design:

Concentrated & distributed winding, Integral slot & fractional slot winding, Full pitch & short pitch windings, Single layer& double layer winding, distribution factor, coil pitch factor and winding factor, EMF equation, Development of winding diagrams.

Unit V: Induction motor stator design:

Specific electric and magnetic loadings selection, output equation, main dimensions (D&L) calculation, stator slot-numbers, shape and dimensions, stator teeth dimension, stator core dimensions. Air gap length calculation.

Unit VI: Induction motor rotor design:

Squirrel cage rotor design ï selecting number of rotor slots, design of rotor bars & slots, design of end rings. **Wound type rotor design** - rotor winding design, rotor slots design, and rotor core design. Bearings, shaft design. estimation of no-load current, stator and rotor winding resistances from design data, dispersion coefficient & its effect on performance of IM.

Text Books:

1. A. K. Sawhney, ñA Course in Electrical Machine Designò Dhanpat Rai & Co Ltd, 2016
2. R.K.Agrawal, ñPrinciples of Electrical Machine Designò, S.K.Kataria and Sons, Delhi.

Reference Books:

1. M.G.Say,ñThe Performance and Design of Alternating Current Machinesò, C.B.S. Pub., Delhi.
2. K.G.Upadhyay,ñDesign of Electrical Machinesò, New Age international Publishers, 1st Edition 2008
3. S.K.Sen,ñPrinciples of Electrical Machine Design with Computer Programsò, Oxford and I.B.H. Company Pvt. Ltd., New Delhi.
4. Indrajit Dasgupta, ñDesign of Transformersò, TMH 1st Edition 2002
5. Indian Standards for Transformer & Three phase IM design from BIS websites

6EX04 Professional Elective - II
1. ADVANCED CONTROL SYSTEM

Course Outcomes:

After completing this course students will be able to

1. Design compensator using time domain and frequency domain specifications
2. Represent system using state space model
3. Analyze controllability and observability for systems and design full state feedback controller.
4. Analyze digital systems using Z Transform
5. Develop the describing function for the nonlinearity to assess the stability of the system.
6. Analyze the Nonlinear system using Phase plane Analysis.

Unit I: Compensation Techniques:
Introduction, preliminary consideration of classical design. Lead compensator, Lag Compensator, Lead - Lag compensator, Feedback compensation in frequency domain.

Unit II: State Space Technique I:
State, state space and state variables ,SISO /MIMO linear systems state Variable models- differential equations, transfer functions, block diagrams And state diagrams. Transfer function decomposition ï Phase variable Forms, canonical forms and Jordan canonical forms, STM computation, L.T, Canonical transformation, and Cayley Hamilton theorem. Time Response ï SISO systems.

Unit III: State Space Technique II:
Concept-controllability and observability , SISO/ MIMO linear Systems Gilbertôs method and Kalmanôs test; SISO controllable Systems design ï state feedback.

Unit IV: Sampled Data Control Systems:
Representation,Z transform, Sampler and hold, ZOH, Open loop and closed loop SDCS, Z transfer Function, difference equation, solution, Pulse transfer function, Stability Analysis, S and Z domain relationship, Juryôs test, and bilinear Transformation. Root locus method.

Unit V: Non-Linear System Analysis I: Non linear system behaviour, types and characteristics, Describing function Stability analysis limit cycles, Limitation of Describing function.

Unit VI: **Non-Linear System Analysis II**: Linearization, Singular points, Classification and nature, Phase plane method, non linear system analysis, Phase trajectories, construction ï analytical and graphical method by isoclines, stability analysis, limit cycles, limitations ï phase plane method.

Text Books:
1. Nagrath and Gopal, òControl system Engineeringò Wiley Eastern Ltd , New Delhi
2. K.Ogata,ò Modern Control Theory ñPrentice Hall Of India Pvt Ltd , New Delhi.

Reference Books:
1. Naresh Sinha. ñControl system Engineeringò Wiley Eastern Pvt. Ltd., New Delhi.
2. B.C. Kuo. ñAutomatic Control systemò Prentice Hall Of India Pvt Ltd Delhi
3. D Roy Choudhury, ñModern Control EngineeringòPublisher: PHI Learning

6EX04 Professional Elective – II:
2. Digital Communication systems

Course Outcomes:
After Completing this course student will be able to:
1. To study basic building blocks of digital communication system.
2. To learn information theory and theoretical bounds on the data rates of digital communication.
3. To understand and analyze communication channel.
4. To study and analyze different digital modulation techniques.
5. To study baseband transmission of the signal.
6. To understand importance of channel encoding and decoding in digital communication.
7. To study multiple access schemes and spread spectrum communication

Unit-1 Introduction to Digital Communication Sstem:
Functional Blocks of Digital Communication System; Source Encoder and Decoder, Channel Encoder and Decoder, Modulator and Demodulator. Line Coding: Need for Line coding, Properties of Line Coding, Unipolar RZ and NRZ, Polar RZ and NRZ, Bipolar NRZ (AMI), Split Phase Manchester Coding, Polar Quaternary NRZ Coding, HDB3 Coding, Scrambler and Unscrambler.
Unit-2 Information Theory: Measure of Information, Entropy and Information Rate of Long Independent and Dependent Sequences. Source Encoding: Huffman Encoding, Shannonôs Encoding Algorithm, Shannon- Fano Algorithm. Discrete Communication Channel: Noiseless Channel, Deterministic Channel, Binary Symmetric Channel, Rate of Information Transfer over Discrete Channel, Capacity of Discrete Memoryless Channel.Continuous Channel: Shannon Hartley Theorem for channel capacity, Signal to Noise Ratio ï Bandwidth Tradeoff.
Unit-3 Bandpass Modulation and Demodulation techniques:
BPSK, BFSK, ASK and DPSK generation and reception, Signal space diagram, PSD and Bandwidth of BPSK and BFSK systems, QPSK. Transmitter and Receiver, Signal space diagram, PSD and Bandwidth of QPSK, Probability of Error of ASK, BPSK and BFSK systems, Comparison of Digital modulation systems. Coherent Detection: Matched Filter (Impulse response and Probability of Error).
Unit-4 Base Band Transmission: Base Band Binary PAM systems, Inter Symbol Interference, Base Band Pulse Shaping and Nyquist Criterion, Eye Diagram, Correlative Coding: Duobinary Encoder with Pre-coder, Modified Duobinary Encoder, Modified Duobinary Encoder with Pre-coder. Equaliation: Need for equalization, Transversal Equalizer (Problems Expected), Preset Equalizer, Adaptive Equalizer, Clock and Carrier Synchronization.
Unit 5: Error Control Coding: Introduction to Error Control Coding, Types of Errors, Methods of Controlling Errors, Linear Bloc Codes:Matrix Description of Linear Block codes, Hamming Distance, Hamming Weight, Minimum Hamming Distance, Hamming Codes, Encoder for Linear Block code, Syndrome Decoding, Syndrome Decoder for (n, k) Linear Block Code, Error Detection and Correction capability of Linear Block Codes (Derivation expected). Cclic Codes:Properties of Cyclic Codes, Systematic and Non-Systematic generator Matrix, Parity Check Matrices for Cyclic Codes, Encoders for Cyclic Codes, Syndrome Decoding for Cyclic Codes. Convolution Codes: Time Domain Approach and Transform domain approach for convolution code generation, Code Tree and Code Trellis for Convolution code.

Unit 6 : Multiple Access Schemes and Spread Spectrum Communication: Multiple Access schemes: Time Division Multiple Access, Frequency Division Multiple Access, Code Division Multiple Access, Space Division Multiple Access.Spread Spectrum Sstems: Notion of Spread Spectrum, PN Sequence Generation (Problems Expected), Direct Sequence Spread Spectrum (DSSS), Jamming Margin, Processing Gain, Eb/No Ratio, Frequency Hopped Spread Spectrum, Slow and Fast frequency Hopping

Text Books :

1. Shanmugam K.S. ñDigital & Analog Communication Systemsò, John Wiley & Sons, New York, 1996.
2. Lathi B. P., ñModern Digital and Communication Systemsò, Holt Rinchart and Winston Inc., New York, 1993.
3. Simon Haykin, ñDigital Communicationò, John Wiley and Sons,Pvt. Ltd., Singapore.

References:

1. Proakis J. K., ñDigital Communicationò, Mc-Graw Hill Book Co., London (Second Edition)
2. Taub, Herbert, Schilling D.L., ñPrinciples of Communication Systemsò, Mc-Graw Hill International Book Co., Tokyo.
3. W.C.Y. Lee, ñMobile Cellular Telecommunications Systemsò, Mc-Graw Hill International Editions, 1990.
4. Glover and Grant, ñDigital Communicationò, Prentice Hall Publication.

6EX04 Professional Elective – II
3. INDUSTRIAL ELECTRICAL SYSTEM

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the electrical wiring systems for residential, commercial and industrial consumers.
2. Representing the systems with standard symbols and drawings, SLD.
3. Understand various components of industrial electrical systems.
4. Analyze and select the proper size of various electrical system components.

Unit I: Electrical System Components:

LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices.

Unit II: Residential and Commercial Electrical Systems:

Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.

Unit III: Illumination Systems :

Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting.

Unit IV: Industrial Electrical Systems – I:

HT connection, industrial substation, Transformer selection, Industrial loads, motors, startingof motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction ï kVAR calculations, type of compensation, Introduction to PCC,MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

Unit V: Industrial Electrical Systems – II:

DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.

Unit VI: Industrial Electrical System Automation :

Study of basic PLC, Role of in automation, advantages of process automation, PLC basedcontrol system design, Panel Metering and Introduction to SCADA system for distribution automation.

Text Book: S. L. Uppal and G. C. Garg, ñElectrical Wiring, Estimating & Costingò, Khanna Publishers, 2008.

Reference Books:

1. K. B. Raina, ñElectrical Design, Estimating & Costingò, New age International, 2007.
2. S. Singh and R. D. Singh, ñElectrical estimating and costingò, Dhanpat Rai and Co.,
3. Web site for IS Standards.
4. H. Joshi, ñResidential Commercial and Industrial Systemsò, McGraw Hill Education, 2008.

6EX05 Open Elective – II
1. ENERGY AUDIT AND MANAGEMENT

Course Outcomes:

After completing this course student will be able to:

1. Discuss energy scenario and its management.
2. Conduct the energy audit of different systems.
3. Determine the economics of energy conservation
4. Discuss various energy Conservation methods & their case studies
5. Explain fundamentals of Harmonics.

Unit I : Energy Scenario & Management:
Indian energy scenario, Energy needs of growing economy, Energy pricing in India Energy sector reforms, various forms of energy, Primary and secondary energy, commercial and non-commercial energy, Global primary energy reserves, Energy and environment, Necessity of conserving energy, Energy strategy for the future, Electrical energy management, Concept of supply side management and demand side management, Methods of implementing Demand side management and advantages to consumer, utility and society.

Unit II: Energy Audit:
Definition, Need of energy audit, Preliminary and detailed energy audit. Procedure for carrying out energy audit, Instruments used for energy audit, Data Analysis-Energyð production relationship, specific energy consumption, Sankey diagram, CUSUM Technique, Bench marking energy performance, Recommendations for energy conservation, Action plan, Executive Summary.

Unit III: Economics of energy conservation:
Cost factors, Budgeting, Standard costing and Sources of capital, Cash flow diagram and activity chart, Simple Payback period analysis, Time value of money, Net present value method, internal rate of return method, Profitability index for benefit cost ratio

Unit IV: Energy Conservation:
Energy conservation in motive power, Illumination, Heating & cooling systems, Pumping systems, thermal power stations and Transmission & Distribution Sector. Cogeneration &Waste heat recovery systems.

Unit V: Energy Audit Case Studies:
Energy Intensive Industries, Commercial, Industrial, Municipal and Agriculture Sector, IT industries, Hospitals.

Unit VI: Fundamentals of Harmonics:
Harmonic distortion, voltage versus current distortion, Power systems quantities under non sinusoidal conditions-active reactive and apparent power, displacement and true power factor, harmonic phase sequences, triplen harmonics, harmonic indices- Total harmonic distortion (THD), Total demand distortion (TDD) , Harmonic sources from commercial and industrial load.

Text Book: Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, Book-2, Book-3, Book-4 (available online BEE website)

Reference Books:
1. S. C. Tripathy, ñUtilization of Electrical Energy and Conservationò, McGraw Hill, 1991.
2. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)
3. Energy Conservation and Audit ByThumman, Fairmont Press.
4. Energy Audit and Conservation TERI.

6EX05/ Open Elective – II
2. ELECTRICAL ESTIMATING & COSTING

Course Outcomes:
After completion of the course students will be able to:
1. Understand methods of installation and estimation of service connection
2. Decide type of wiring its estimation and costing for residential building
3. Carry out electrification of commercial complex, factory unit installations
4. Design & estimate for feeders & distributors
5. Understand contract, tendering and work execution process.

Unit I: Electrical Installation:
Classification of Electrical Installation, General requirement of Electrical Installation. Important definitions related to Installation. Service Connection: Concept of service connection, Types of service connection & their features. Methods of Installation of service connection.Estimation of service connection.

Unit II : Residential Building Electrification :

Procedures for designing the circuits and deciding the number of circuits. Selection of type of wiring and rating of wires & cables. Earthing of Residential Installation. Estimate and cost Preparation of Residential Installation.

Unit III: Electrification of commercial Installation:

Concept of commercial Installation. Differentiate between electrification of Residential and commercial Installation Deciding the size of cables, busbar and busbar chambers. Earthing of the electrical Installation Selection of type wire, wiring system.Preparation of detailed estimate and costing of commercial Installation.

Unit IV: Electrification of factory unit Installation:

Concept of Industrial load. concept of Motor wiring circuit. Important guidelines about power wiring and Motor wiring. Selection and rating of wire, cable size. Sequence to be followed to prepare estimate. Preparations of detailed estimate and costing of small factory unit/ workshop.

Unit V: Design & estimate for feeders &distributors:
Different schemes for feeders & distributors, estimates for different feeders & distributors, Distribution transformer, Deciding Size & location, Estimate for outdoor & indoor type distribution substation.

Unit VI: Contracts, Tenders and Execution:
Tender and tender notices. Procedure for submission and opening tenders. Comparative statements, criteria for selecting contractors, General conditions in order form. Principles of Execution of works administrative approval, technicalsanctions.Billing of executed work.

Text Book: Electrical Design; Estimating and costing by K.B. Raina, S.K.Bhattacharya New Age International (p) Limited, New Delhi.

Reference Books:
1. Electrical Estimating and costing by Surjit Singh Dhanpat Rai and company, New Delhi
2. Electrical Estimating and costing by N. Alagappan S. Ekambaram, Tata Mc Graw Hill Publication New Delhi

6EX06 POWER ELECTRONICS - LAB

List of Experiments:
1. To verify the V-I characteristics of SCR
2. To verify forward and reverse characteristics of DIAC
3. To verify forward and reverse characteristics of TRIAC
4. To study UJT as relaxation oscillator
5. AC voltage control using triac - diac combination
6. To verify the operation of half and full controlled converter
7. To verify the operation of SCR commutation circuits
8. To design & simulate dc-dc buck converter
9. To design & simulate dc-dc boost converter
10. Construct and test the dc chopper control circuit using thyristor
11. Study of PWM based step down dc chopper using MOSFET/IGBT
12. To verify the operation of Single phase single pulse / sinusoidal PWM inverter using MOSFET/IGBT
13. To verify the operation of Single phase parallel inverter using MOSFET/IGBT
14. To verify the operation of Single phase to single phase cycloconverter
15. To verify the operation of Single phase dual converter With R - RL loads
16. To verify the operation of Single phase ac voltage controller

6EX07 POWER SYSTEMS - II LAB

List of Experiments:
1. Determination of negative sequence reactance of a synchronous generator
2. Determination of zero sequence reactance of a synchronous generator
3. To study various types of current limiting reactors
4. To study the mechanism of lightning arrester
5. Introduction to use of Simulation package (Power World Simulator) for power systems
6. To study substation layout and its components
7. To study HVDC Transmission System
8. To simulate three phase fault for a given power system using MATLAB Simulink
9. To find the direct axis synchronous reactance, X_d& quadrature axis synchronous reactance, X_q of a salient pole synchronous machine by slip test
10. To find the direct axis subtransient reactance, X_dò & quadrature axis sub ï transient reactance, X_qò of a salient pole synchronous machine by conducting static test
11. TO study of corona on EHV lines.
12. To study of faults at overhead line insulators
13. To study of sag and stress on overhead conductors

6EX08 COMPUTER AIDED ELECTRICAL MACHINE DESIGN - LAB.

Develop Minimum Eight Computer Programmes:

List of Computer Programmes:
1. Develop a computer programme for core design of a single-phase core type transformer
2. Develop a computer programme for core design of a single-phase shell type transformer
3. Develop a computer programme for core design of a three-phase core type transformer
4. Develop a computer programme for optimum core design of a three-phase core type transformer for minimum cost or maximum efficiency.
5. Develop a computer programme for Estimation of Iron losses in a three-phase core type transformer.
6. Develop a computer programme for windings design of a single-phase transformer
7. Develop a computer programme for windings design of a three-phase transformer
8. Develop a computer programme for calculating the No load current of a single-phase transformer.
9. Develop a computer programme for calculating the No load current of a three-phase transformer.
10. Develop a computer programme for tank design and calculating the number of cooling tubes required for three phase core type transformer.
11. Develop a computer programme to calculate Main dimensions (D & L) of a three phase Induction motor.
12. Develop a computer programme for stator core design of three phase induction motor.
13. Develop a computer programme for squirrel cage rotor design of three phase induction motor.
14. Develop a computer programme for wound type rotor design of three phase induction motor.
15. Develop a computer programme for estimating magnetizing current of a squirrel cage type three phase induction motor.

6EX09 COMPUTER TECHNOLOGY - LAB

Student needs to complete minimum eight assignments based on the following:

- Computer Network: Basic hardware and terminology in networks, Classifications, The Internet, The Intranet and Extranet.
- Installation of operating systems, application software in Personnel Computer or laptop.
- Develop the simulation models for various tasks in electrical engineering using simulation software.
- Develop the computer programme for various tasks in electrical engineering using software.
- Study of PLCs used for Industrial automation & develop the ladder diagram for given task in automation using PLC.
- Basics of IoT, IoT based Monitoring & Controlling of various Electrical Equipments.

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SYLLABUS BE SEM. V ELECTRICAL ENGG. (ELECTRONICS & POWER)

5EP01 POWER SYSTEM- I

Course Outcomes:

After completing this course, the students will be able to:

1. Determine the parameters of transmission lines.
2. Evaluate the performance of transmission line
3. Describe transmission lines voltage control and power factor improvement methods.
4. Explain representation of power system, Ferranti effect and corona phenomenon.
5. Demonstrate various Insulators , its string efficiency & underground cables.

Syllabus:

Unit I: Transmission line parameters: calculation of resistance, inductance and capacitance of single phase and three phase transmission lines, skin effect and proximity effect, transposition, G.M.D. & G.M.R. methods, double circuit lines, bundled conductors, effect of earth on inductance and capacitance, interference with communication lines.

Unit II: Electrical characteristics of transmission line: V-I characteristics of short, medium and long lines, A, B, C, D constants, nominal T and equivalent ´ representations.

Unit III: Voltage control and power factor improvement: methods of voltage control and power factor improvement, use of static VAR generators and synchronous condenser, automatic voltage control. Receiving end and Sending end power circle diagrams.

Unit IV: Representation of power systems: single line diagrams, per unit system and one-line impedance and reactance diagrams. Ferranti effect, corona phenomenon, Introduction to Travelling waves.

Unit V: Insulators: materials used, types, comparison of pin type and suspension type insulators, voltage distribution and string efficiency, methods of increasing string efficiency, grading rings and arcing horns. Introduction to insulator testing, line supports for LV, HV, EHV and UHV.

Unit VI: Underground cables: material used for conductor & insulation, different types of cables and their construction, parameters of underground cable, grading of cable, losses, break down and rating, selection of cables.

Text Books:

1. Modern Power System Analysis by D. P. Kothari, I. J. Nagrath TMH Publishing
2. Elements of power system analysis by William D. Stevenson, Jr, McGraw-Hill International edition

Reference Books:

1. Power System Engineering by D. P. Kothari, I. J. Nagrath TMH company ltd., New Delhi
2. Narain G. Hingorani and Lazlo Gyugyi ñUnderstanding FACTS: Concepts and Technology of Flexible AC Transmission Systems.
3. Principles of power system by V. K. Mehta, S. Chand & company ltd., New Delhi.
4. Electrical Power Systems by C. L. Wadhwa, New Age International Publishers, New Delhi
5. Electrical Power Systems by Ashfaq Husain, CBS Publishers & Distributors Pvt. Ltd., New Delhi.
6. Electrical Power system design by M. V. Deshpande, TATA McGraw-Hill Publishing Company Limited, New Delhi.

5 EP02 MICROPROCESSORS & MICROCONTROLLER

Course Outcomes:

After completing the course the students will be able to

1. Recite Fundamentals and Architecture of Microprocessor 8085, Microcontroller 8051
2. Interpret Assembly Language Programming of Microprocessor 8085, Microcontroller 8051
3. Illustrate interfacing with Microprocessor 8085, Microcontroller 8051
4. Apply knowledge of Microprocessor 8085 for measurement of Electrical quantities
5. Discusss Fundamentals and Architecture of Microprocessor 8086
6. Explain Fundamentals and Architecture of Microprocessor 8051

Unit I: 8085-architecture and Pin Diagram, Microprocessor Operations (Initiated, Internal and External) BUS organization and register structure, instruction set of 8085, addressing modes, Machine Cycles & Bus Timings.

Unit II: Assembly Language Programming of 8085, counters and time delays, stack and subroutines, Memory mapped I/O and I/O mapped I/O, address decoding techniques. Interrupt system of 8085 (software and hardware interrupts), Data transfer schemes, serial data transfer through SOD and SID line.

Unit III: Programmable Interfacing devices: Internal architecture, programming and interfacing of Programmable Peripheral Interface PPI (8255), Programmable Interrupt Controller PIC (8259), and Universal Synchronous Asynchronous Receiver Transmitter USART (8251) and Programmable Interval Timer PIT (8253)

Unit IV: Introduction to microcontroller: 8051 pin configuration and architecture, 8051 Internal resources, pin diagram, I/O pins, ports and their internal logic circuits, counters, serial ports, interrupt structure, SFRs and their addressing, watch-dog timer, internal code memory, data memory, stack pointer, flags, bit addressable memory.

Unit V: Instruction set of 8051.Addressing modes. Various groups of instructions: data transfer. Arithmetic-logical group. Interrupt, timer counter related instructions. Interfacing of 8051with external memories. Programming 8051 with interfacing examples.

Unit VI: 8085 Microprocessors / 8051 Microcontroller Applications: hardware & software developments: signal conditioning & data acquisition system components. Measurement of Pulse width and Magnitude using 8085. Measurement of fundamental quantities -voltage, current, frequency, speed using 8051 Microcontroller.

Text Book: Microprocessor Architecture, Programming, and Applications with the 8085, Romesh Gaonkar PHI Publication - 2006

Reference Books:

1. An Introduction to Microcomputers Volume 1 Basic Concepts, Adam Osborne Osborne-McGraw Hill, Berkely California, 1980
2. Introduction to Microprocessor L. Gibson, Prentice-Hall, 2003
3. Advance Microprocessor and Peripherals, K. M. Bhurchandi & A. K. Ray, 2nd Edition, Tata McGraw Hill, 2006.
4. Microprocessor 8086 ,Sunil Mathur PHI 2010
5. The 8051 Family of Microcontrollers Richard Barnett Prentice-Hall, Inc -2000
6. The 8051 Microcontroller and Embedded Systems: Using Assembly and C,M A Mazidi,J.GMazidi and Mckinlay, 2nd Edition, Pearson.

5EP03 ELECTRICAL MACHINES – II

Course Outcomes:

After completing this course students will be able to

1. Describe the construction, working operation & performance characteristics of three phase Induction Motor
2. Analyze the starting, braking and speed control of three phase induction motors by various methods.
3. Describe the construction, working operation & performance characteristics of single-phaseInduction Motor
4. Demonstrate the construction, working operation & performance characteristics of synchronous machine.
5. Explain the construction & working of special motors like Universal, Reluctance, PMSM & BLDC Motor

Unit I: Three phase induction motor – I:
Construction, Types (squirrel cage and slip-ring), Rotating Magnetic Fields, principles of operation, Working, Torque Slip Characteristics, Starting and Maximum Torque. Effect of parameter variation on torque slip characteristics (variation of rotor and stator resistances, stator voltage, frequency).Equivalent circuit. Phasor Diagram, Performance evaluation by direct & indirect testing, circle diagram.

Unit II: Three phase induction motor – II :
Starters for squirrel cage &slip-ring type IM, Methods of speed control, electric braking, High Torque IM, single phasing, cogging and crawling, Generator operation Self-excitation, Doubly-Fed Induction Machines.

Unit III: Single phase Induction Motor : Double revolving field theory, Constructional features, equivalent circuit, working, Split-phase starting methods and applications of single-phase Induction motors.

Unit IV: Synchronous Generator:
Constructional details, working principle, operation, armature reaction, circuit model, determinations of parameters of the circuit model and phasor diagram, methods of determining the regulations and efficiency, Parallel operation of alternators - synchronization and load division.

Unit V: Synchronous Motor:
Construction, principle of operation, working, starting methods, torque equation - V-curve, Inverted V curve & power angle characteristics, hunting & damping, applications. Transient, sub transient & steady state reactance of synchronous machines.

Unit VI: Special Motors:
Construction, working principle, operation, characteristics and applications of Universal motor, Reluctance Motor, Permanent Magnet Synchronous Motor & BLDC Motor.

Text Books:

1. D.P.Kothari & I.J. Nagrath, ñElectrical Machinesò- 5thEdition, TMH Publication.
2. S. Langsdorf, ñAlternating Current Machinesò, McGraw Hill Publication

Reference Books:

1. Stephen D. Umans, ñFitzgerald and Kingsleyôs Electric Machineryò, 7th Edition, McGraw Hill Publication, 2020.
2. M. G. Say, ñPerformance and design of AC machinesò, CBS Publishers, 2002.
3. P. S. Bimbhra, ñElectrical Machineryò, Khanna Publishers, 2011.
4. C L Dawes, ñA Course in Electrical Engineering (Volume -2)ò, McGraw Hill Publication.

5EP04 Professional Elective-I SIGNALS AND SYSTEMS

Course Outcomes :

After completing this course student will be able to

1. Demonstrate knowledge of continuous-time and discrete-time signals and systems.
2. Analyze the continuous-time systems using continuous Time Fourier transform.
3. Explain the concept of sampling, Sampling Theorem, aliasing and the Nyquist rate.
4. Analyze DT systems & their realization using Z-transforms.
5. Analyze the discrete time systems using DTFT and DFT

Unit I: Introduction to Signals and Systems: Classification of Signals Classification of Systems, Systems Modeling Some Ideal Signals, Energy and Power Signals Frequency Response, Discrimination of Continuous-Time Signals Topological Models, Analysis of Continuous-Time Systems Properties of Elementary Signals Linear Convolution Integral, Response of Continuous-Time Systems

Unit II: Fourier Transform Properties of Fourier Transform, Tables of Fourier Transform Pairs Fourier Transform of Periodic Signals, Ideal Low-Pass Filter Frequency-Domain Analysis of Systems Fourier analysis of Sampled Signals

Unit III: Analysis of LTI Discrete-Time Systems: Time Domain and Frequency Domain, Properties of Discrete-Time Sequences Linear Convolution, Discrete-Time System Response.

Unit IV: Sampling: Representation of continuous time signals by its samples, reconstruction of a signal from its samples, aliasing, discrete time processing of continuous time signals, sampling of discrete time signals

Unit V: Z- Transform: Z- transform, the region of convergence for the z-transform, Inverse z- transform, properties of Z transform, analysis and characterization of LTI systems using z transforms, System function algebra and block diagram representations, the unilateral z ï transform.

Unit VI: Discrete Fourier Transform and Fast Fourier Transform Representation of Discrete-Time aperiodic signals and the Discrete-Time Fourier Transform; Fourier Transform for Periodic Signals; Properties of the Discrete-Time Fourier Transform; Discrete-Time LTI Systems and Discrete-Time Fourier Transform. Fast Fourier Transform (FFT)

Text Books:

1. Alan Oppenheim &Alan Willsky ,"Signals and Systems" Prentice Hall India Learning Private Limited; 2nd edition
2. P. Ramesh Babu R. Ananda Natarajan "Signals and Systems." Scitech Publications

Reference Books:

1. Fred Taylor,Principles of Signals and Systems ñTata McGraw-Hill, 1998, New Delhi
2. Nagrath, Sharan, Ranjan Rakesh and Kumar Sukhbinderò Signals and Systemsò Tata McGraw-Hill, 1998, New Delhi.
3. S Haykin and B Van Veen, ñSignals and Systems ñJohn wiley & sons

5EP04 Professional Elective - I

2. NETWORK ANALYSIS AND SYNTHESIS

Course Outcomes :

After completing this course student will be able to

1. Analyze the transient response of series and parallel A.C. circuits
2. Demonstrate the properties of network functions.
3. Demonstrate the properties of positive Real Functions
4. Synthesize driving point functions of RL, RC and RLC
5. Synthesize two port network functions
6. Design passive filters to meet desired specifications

Unit I: Transient Analysis:

Transient response of RC, RL and RLC circuit to various excitation signals such as step, ramp, impulse and sinusoidal signals.Network solution with Laplace transformation, initial and final value theorem and convolution integral.

Unit II: **Network Functions:**

Network Functionsfor one port & two-port networks, poles and zeroes of network functions. Restrictions on poles and zeroes locations for driving point functions and transfer functions. Time domain behavior of electrical network from the pole- zeroes plot.

Unit III: Positive Real function: Driving point function, Bruneôs positive real function, properties of positive real function, testing of driving point function. An application of Maximum Modulus Theorem, properties of Hurwitz polynomial, computation of residue, even and odd functions

Unit IV: Synthesis of One Port Networks
Properties of LC, RC and RL driving point functions and their synthesis in canonical (Foster and Cauer) forms. Synthesis of RLC driving point functions which can be synthesized by partial fraction or continued fractions

Unit V: **Synthesis of Transfer Functions**
Properties of transfer functions, Zeros of Transmissions (ZOTs), synthesis of Y21 and Z21 with 1ohm termination. Synthesis of transfer functions using constant resistance single and double terminated lattice and bridge T networks. Synthesis of open circuit transfer function

Unit VI: Filter fundamentals
Classification of filters, Analysis of prototype filter section, Analysis of a prototype Low Pass Filter, High Pass Filter, Band Pass Filter, Band Stop Filter, M–Derived Filter, Low Pass Filter with RC and RL Circuits, High Pass Filter with RC and RL Circuits, Low Pass Filter with RLC Circuit. Introduction of Different Types of Active Filters

Text Books :
1. Van Valkenberg, ñNetwork Analysisò,, Prentice Hall of India (PHI)
2. Sudhakar and Shyammohan,"Circuits and Networks: Analysis and Synthesis ,McGraw-Hill Education

Reference Books:
1. Van Valkenburg ñIntroduction to Network Synthesisò, Prentice Hall of India (PHI)
2. Kelkar, Pandit, ñLinear Network Theoryò, Pratibha Publication.
3. Franklin Kuo, ñNetwork Analysis and Synthesisò, Wiley international.
4. A.Chakrabarti, ñCircuit Theoryò Dhanpat Rai & Co.
5. C.L Wadhwa, ñNetwork Analysis and Synthesisò New Age International Publishers, 2007.

5EP04 Professional Elective – I

3. **ELECTRONIC COMMUNICATION THEORY**

Course Outcomes:
After successfully completing the course, the students will be able to
1. Explain various types of signal & elements of communication system.
2. Analyze the signal using Fourier Transform
3. Apply Amplitude modulation & Frequency modulation on the communication signal
4. Compare Pulse communication & Digital communication
5. Describe microwave communication system.

Unit I: Introduction to Electronics Communication Systems:
Signals: Analog & digital, Deterministic & Non-deterministic, Periodic & non periodic,Elements of Communication Systems, Transmitter, Receiver, Need for Modulation, bandwidth requirements, Noise, External, internal noise, noise calculation, noise figure.

Unit II: Signal Analysis:
Fourier Series, Exponential Fourier Series, Fourier Transform, Properties of Fourier Transform, Dirac Delta Function, Fourier Transform of Periodic functions, Fundamental of Power Spectral Density & Energy Spectral Density.

Unit III: Amplitude Modulation:
Amplitude Modulation Theory, Generation of Amplitude Modulation, Single Side band Communication, suppression of carrier, suppression of unwanted sideband, AM receiver.

Unit IV: Frequency Modulation:
Theory of Frequency Modulation, characteristics of FM, Generation of FM, pre-emphasis, De-emphasis, wide &Narrowband FM Transmission, FM receiver.

Unit V: A. Pulse Communication:
Information Theory, Classification of pulse modulation, Sampling process, pulse amplitude modulation, PWM and PPM modulation pulse code modulation.

B. Digital Communication:
Fundamentals of data communication systems, data sets and interconnection requirements.

Unit VI: Microwave communication system
Analog microwave communication: LOS, OTH microwave system Satellite communication: Satellite orbits, frequencies, attitude, transmission path.

Text Book: Electronic Communication System by Kennedy, Davis, TMH

Reference Books:
1. Electronics Communication by K.Shoenbcle PHI, India.
2. Electronics Communication techniques, Paul Young, Willey Eastern Pub.
3. Principle of C.E TMIL Taub Schilling.
4. Electronics Communication - Robert Shrader McGraw Hill.

5FEEP05 Open Elective – I
1. ELECTRICAL DRIVES

Course Outcomes:
After completing this course, Students will be able to:

1. Explain the basic Concept of electrical drives
2. Describe Power Electronics devices & their Applications
3. Demonstrate various starting, braking and speed control methods of D.C. Motors
4. Demonstrate various starting, braking and speed control methods of three phase Induction Motor.
5. Describe the construction, working principle and applications of single phase Induction Motor& special motors.

Unit I: Concept of electric drives, classification and comparison of electrical drive system, Cooling and heating of electric motors. Types of duties: continuous, intermittent and short time. Selection of an electric drive for particular applications.

Unit II: Theory, principle, Characteristics of Power Transistor, SCR, Power MOSFET and IGBT. Introduction to single phase & three phase fully controlled bridge convertors.

Unit III: D.C. Motors: Types, characteristics, Torque equation, Starting and braking, Speed controland Applications.

Unit IV: Three phase Induction Motors: Types, construction, principle of working, characteristics and applications. Starting and braking. Speed control methods: Thyristorized stator voltage control of three phase induction motor.

Unit V: Single phase Induction Motors: Double revolving field theory, Cross field theory,types, construction, principle of working, starting methods and applications.

Unit VI: Special Motors: Construction, Principle of working, and applications of D.C. servo motors, stepper motors, Brushless D.C. motors and Universal motor.

Text Books :

1. S.K.Pillai : A First Course on Electrical Drives by New Age International Publishing Co. Ltd
2. I.J.Nagrath & D.P.Kothari : Electric Machines by Tata Mc Graw Hill Publishing Co Ltd.

Reference Books :

1. VedamSubrahmanyam: Electric Drives : Concepts & Applications by Tata Mc Graw Hill Publishing Co Ltd.
2. Ion Boldea, Nasar. S A : Electric Drives by CRC Press India
3. Ashfaq Husain: Electric Machines by Dhanpat Rai & Co. Ltd
4. M.D.Singh &K.B.Khanchandani : Power Electronics by Tata Mc Graw Hill Publishing Co Ltd
5. V.K.Mehta: Principles of Electronics by S.Chand and Co Ltd ,New Delhi

5FEEP05 Open Elective-I:
2. POWER SUPPLY SYSTEM

Course Outcomes:
After completing this course student will be able to

- Describe the Structure of Power system
- Explain construction and working of various generation plants
- Describe layout and working of Substations
- Compare various power distribution system
- Explain Electrical wiring required for various Installations

Unit I: Structure of Power System :
Generation, transmission and distribution. Power generating stations ï different types. Steam power stations: Main parts and working, Water tube boiler, Fire tube boiler and their characteristics. Main flow circuits of steam power station. Power station auxiliaries,

Unit II: Gas-turbine power stations:
Main parts, plant layout and Bryton cycle operation. Combined cycle generation & Cogeneration. Nuclear power stations- Layout of nuclear power station, types of power reactors, main parts and control of reactors, nuclear waste disposal, radioactivity and hazards.

Unit III: Hydro-electric stations:
Site selection, constituents and schematic arrangement of hydroelectric stations, principles of working, types of turbines, Layout and working of Pumped storage plant.

Unit IV: Substation:

Classification of substations, Major equipment, Selection & location of site for substation, Main Electrical connections, Symbols for various apparatus & circuit elements in substation, 66/11kV and 11kV/400V substation Key diagram, Busbar layouts. Auxillary supply, substation earthing.

Unit V: Power distribution system:
Primary and secondary distribution, types of conductors in Distribution system. Connection Scheme: radial, parallel, ring main, comparison of distribution systems

Unit VI: Electrical wiring and installation:
Domestic, commercial and industrial wiring, main, sub-main and sub-circuit wiring.Types and need of Earthing.Fuse and disconnecting devices. Electrical Safety precautions.

Text Books :
1] Principles of Power System, by V K Metha and RohitMetha, S Chand Publication
2] Generation of Electrical Energy, by B R Gupta, S Chand Publication

Reference Books :
1] A Course in Power System J B Gupta, S Chand Publication
2] Elements of Electrical Power Station Design, by M. V. Deshpande, Wheeler publications
3] Electrical Installation Estimating & Costing by J. B. Gupta
4] Transmission & Distribution by H. Cotton.

5FEEP05 Open Elective – I
3. POWER PLANT ENGINEERING

Course Outcomes: -

1) Describe different Sources of Energy Generation
2) Explain the Working and layout of steam power plant & hydro power plant.
3) Discuss the working principle and basic component of Nuclear, Diesel & gas power plant
4) Illustrate various terms related to power plant economics & tariff.

Unit-I: Introduction:
Energy resources and their availability, types of power plants, selection of the plants, Introduction to basic thermodynamic cycles used in power plants, Conventional and non-conventional energy sources, Indian Energy Scenario.

Unit-II: Hydro Electric Power Plant:

Rainfall and run-off measurements and plotting of various curves for estimating stream flow and size of reservoir, Layout of Hydro power plant, operation of different components of hydro-electric power plant , classification of hydro Electric power plant, Pump Storage Plant, site selection, advantages & disadvantages

Unit-III: Steam Power Plants:

Flow sheet and working of modern-thermal power plants, super critical pressure steam stations, Layout of Thermal power plant , Site selection, coal storage, coal handling systems, ash handling systems, working of various parts: Economizer, air preheater, condenser, cooling tower, Electrostatic Precipitator, advantages & disadvantages

Unit-IV: Nuclear Power Plants:

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANada Deuterium- Uranium reactor (CANDU) fast breeder reactor, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

Unit-V: Diesel & Gas power plant:

Layout of Diesel power plant, functions of different components of diesel plant, advantages & disadvantages, Principle of Operation of Gas Turbine Plants, Open cycle gas turbine plant, closed cycle gas power plant, Combined gas and steam cycle.

Unit-VI: Power Plant Economics:

Load curve, energy load curve, energy duration curve, connected load, maximum demand, demand factor, load factor, diversity factors, plant capacity and utilization factor, types of loads, operating cost, annual plant cost, Generation cost, Depreciation, Objectives of Tariff, Types of Tariff.

Text Books:

1. Generation of electrical energy by B.R.Gupta, Eurasia Publishing House, New Delhi.
2. Power Plant Engineeirng; R. K. Rajput ; Laxmi Publications.

Reference Books:
1. Non conventional energy resources. By G.D.Rai, Khanna Publishers New Delhi
2. Principles of Power System by V.K.Mehta, S.Chand publication.
3. Conventional energy technology by S.B.Pandya, Tata McGraw Hill Publication.
4. Power Plant Engineeirng. P. K. Nag.

5EP06 POWER SYSTEM – I LAB

Student should perform minimum eight practicals based on the syllabus

List of Experiments:

1. To study the performance of a transmission line using a nominal T model.
2. To study the performance of a transmission line using a nominal ´ model.
3. To calculate A,B,C,D parameters for a transmission line by using nominal T model
4. To calculate A,B,C,D parameters for a transmission line by using nominal ´ model.
5. To study skin effect, proximity effect and Ferranti effect in transmission line.
6. To study Corona phenomenon and corona loss and its control in transmission line.
7. To study conversion of single line diagram to impedance diagram and reactance diagram for a typical power system.
8. To draw the circle diagram for a typical power system.
9. Study of a tap changing transformer (ON load and OFF load tap changing).
10. Study of static VAR generator and synchronous condenser.
11. To study different types of insulators used in power system & their comparison.
12. To conduct a dry and wet test on a pin type insulator.
13. To conduct a flashover test on an insulator.
14. To study a horn gap.
15. To study different types of power cables.
16. To study testing of cables.
17. To draw different Tower structures

Note: Above experiments may be conducted by using models, simulation, numerical, drawing sheets or experimentation.

5EP07 MICROPROCESSOR & MICROCONTROLLER- LAB

List of Experiments:

Student should perform minimum eight practicals based on the syllabus

1. Write an Assembly Language Program for the Addition of two 8-bit/16-bit numbers
2. Writean Assembly Language Program for the Subtraction of two 8-bit numbers
3. Write a Program for Finding the larger and smaller one among the two 8- bit numbers
4. Write a Program for Finding the largest/smallest number in array of 8-bit numbers
5. Write a Program for Masking and setting of nibbles
6. Write a Program for Block data transfer in same and reverse order
7. Write a Program for Sorting of even and odd numbers from an array of 8-bit numbers
8. Write a Program for Multiplication of two 8-bit numbers
9. Write a Program for Square wave generation using 8255 PPI
10. Write a Program for Stepper motor control using 8255 PPI
11. Write a Program for Interfacing ADC with 8085/8051using 8255 PPI
12. Write a Program for Interfacing DAC with 8085/8051 using 8255 PPI
13. Write a Program for Lamp load control using 8255 PPI
14. Write a Program for measurement of DC Voltage /Current using ADC, 8255 PPI
15. Study of Architectural Differences: Microprocessor 8085, and Mcrocontroller 8051

5EP08 ELECTRICAL MACHINES-II LAB

Student should perform minimum eight practicals based on the syllabus**.**

List of Experiments:

1. Perform the load test on three phase IM & plot its performance characteristics.
2. Perform the No load test on three phase IM to separate out its no load losses.
3. Estimate the performance parameters of three phase IM from its circle diagram.
4. Plot the equivalent circuit of three phase Induction motor.
5. Study of different types of starters used for three phase IM
6. Speed control of three phase squirrel cage Induction motor by various methods like stator voltage control method, frequency control method, changing number of poles.
7. Speed control of three phase Induction motor.
8. Perform the electric braking of three phase Induction motor.
9. Perform the load test on single phase IM & plot its performance characteristics.
10. Load test on three phase alternator to determine its performance parameters.
11. Synchronize the three-phase alternator with infinite bus-bar
12. Perform the OC & SC test on synchronous generator to estimate its regulation by EMF & MMF methods
13. Estimate the regulation of three phase alternator using ZPF method.
14. Perform the load test on three phase Synchronous motor.
15. Plot the V & inverted V curves of synchronous motor.

5EP09 INFORMATION & COMMUNICATION TECHNOLOGY - LAB

Student needs to complete minimum eight assignments based on the following:

Word Processing with MS-Word:

- Basic operations- Editing and Formatting text, paragraphs and pages, printing the documents.
- Working with tables, figures, images.
- Mail merge. Working with Charts, Equations, symbols.

Working with workbooks /work sheets.

- Data Entry techniques & Defining data set as a Table.
- Setting, Previewing, and Printing under MS-Excel.
- Performing Calculations, using Excel Formulas, Functions and Charts.
- Sorting/ Filtering data in excel sheet.

Working with MS Power Point.

- Presentation Basics. Adding more components to the slides, Printing the slides.
- Formatting Presentations, backgrounds and layout. Applying Themes. Using Slide Master.
- Working with Graphics, Images and Clips.
- Working with Multimedia. Inserting Sound and Narration.
- Delivering Presentations. Animating Objects. Adding Action effects.
- Live Presentation. Using Custom Shows.
- Saving/Protecting the Presentation.

Working with Latex:

- Basic operations- Editing and Formatting text, paragraphs and pages, printing the documents.
- Working with tables, figure & images.

Web Page Development:

- Introduction to HTML, CSS, JAVA Coding.
- Development of Web page.

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6EP01 POWER ELECTRONICS

Course Outcomes:

After completing this course student will be able to

1. Explain the concepts and techniques used in power electronics
2. Apply the knowledge of series and parallel connection of SCRs in power control applications
3. Analyze various single phase and three phase power converter circuits
4. Analyze the single phase and three phase Inverter circuits
5. Explain the operation of DC/DC and AC/AC converter circuits
6. Demonstrate the applications of power electronic circuits.

Unit I: SCR, Triac, Diac ï Construction and Applications, two Transistor Analogy of SCR, SCR turn ON mechanism, different methods for turning ON SCR, turn OFF mechanism, Thyristor firing circuits, introduction to Power MOSFET and IGBT their construction and characteristics.

Unit II: Series-Parallel operation of SCRs, firing circuits for series and parallel operations, static and dynamic equalizing circuit, equalization of current in parallel connected SCRs ,string efficiency, de-rating factors, protections of SCRs against di/dt, dv/dt, over-voltage and over-current protection, Gate protections, Electro Magnetic Interference(EMI) and Shielding.

Unit III: Principle of phase control, half wavecontrolled rectifier, half controlled bridge and fully controlled bridge rectifier for R, RL and RLE load, derivation for output voltage and current, effect of freewheeling diode, effect of source inductance.

Three phase half controlled bridge and fully controlled bridge rectifier.

Unit IV: Classification of circuit for forced commutation, series inverter, improved series inverter, parallel inverter, single phase PWM inverters, principle of operation of three phase bridge inverter in 120^0 and 180^0mode,single phase transistorized bridge inverter.

Unit V: Basic principle of Chopper, Time ratio control and current limit controlled technique, Voltage commutated Chopper circuit, Jones Chopper, Step up Chopper, Step down Chopper and AC Chopper.

Unit VI: Basic principle of cycloconverter, single phase to single phase cycloconverter, Introduction, principle of operation of single-phase voltage controllers for R and R-L load

Speed control of DC series motor using chopper, Speed control of DC shunt motor using phase controlled rectifier. Speed control of three phase Induction motor by stator voltage control method, V/f control.

Text Books:

1. M.D. Singh & K.B. Khanchandani, ñPower Electronics ñTata Mc-Graw Hill, New Delhi
2. Rashid Muhammad, H., ñPower Electronics: Circuits, Devices and Applicationsò, 2nd Edition. Prentice-Hall, 1998

Reference Books:

1. Mohan Ned, Undeland Tore, M. and Robbins William, P., ñPower Electronics: Converter, Applications and Designò, John Wiley & Sons, 1994.
2. LandevCyrill, W., ñPower Electronicsò, McGraw Hills, London, 1981.
3. Dewan, S.B. and Satrughan A., ñPower Semiconductor Circuitsò, John Wiley & Sons,
4. Dubey, G.K., Doradlla, S.R., ñThyristerised Power Controllersò, Wiley Eastern, 1987.

6EP02 ELECTRICAL ENERGY DISTRIBUTION & UTILISATION

Course Outcomes:
After completing this course, Students will be able to:

1. Demonstrate the knowledge of distribution substation
2. Compare different power distribution systems
3. Describe elements of distribution Automation system
4. Select proper electrical drive for industrial applications
5. Explain the workingof electric traction system
6. Describe an illumination system & electric heating

Unit I: Substation: Selection & location of site, classification, major equipment ,graphical symbols for various apparatus & circuit elements ,key diagram for 33/11kV substation along with selection & specification of substation equipment, types of bus-bar arrangements, substation earthing. Introduction to Gas Insulated Substation (GIS).

Unit II: Power distribution system -I: Primary and secondary distribution, types of conductors in Distribution system, comparison of distribution systems radial, parallel and ring main, economics of feeder design.

Unit III: Power distribution system - II: Methods for reduction of line losses in distribution system. Introduction to High Voltage Distribution System (HVDS). Distribution Automation: Need for distribution automation, feeder automation, and communication requirements for Distribution automation, Remote terminal unit (RTU). Introduction to SCADA systems.

Unit IV: Electrical Drives: Concept, types, selection criterion for electrical drive. Types of duties, rating calculations for these duties. Heating and cooling. Industrial applications: Textile mill, Cement mill, Sugar mill.

Unit V: Traction System: Requirement, speed- time curves. General features, types, Quadrantal diagram of speed-torque characteristics of traction motors. Control of traction motors: Series-Parallel control. Different accessories for track electrification ï overhead wires, conductor rail system, current collector-pantograph

Unit VI: Illumination : Street lighting**:** Principle, illumination level, mounting height of lamps, spacing, types of lamps. Flood lighting: Flood lighting calculations, waste light factor, Depreciation factor, Utilization factor. LED: Working principle, advantages & applications.
b) **Electric Heating**:Resistance& Induction heating & its applications.

Text Books:

1. S.K.Pillai, ñA First Course on Electrical Drivesò, New Age International Publication
2. J.B.Gupta, ñA Course in Power Systemò, S.Chand Publication

Reference Books:

1. M.V.Deshpande, ñElectrical Power System Designò, TMH Publishing Company Ltd
2. S.Sivanagaraju&S.Satyanarayana, ñElectric Power Transmission & Distributionò Pearson Publication
3. P. S. Satnam&P.V.Gupta, ñSubstation design & Equipmentò Dhanpat Rai Publication.
4. J.Upadhyay&S.N.Mahendra : Electric Traction by Allied Publishers Ltd
5. J.B.Gupta :Utilization of Electric Power & Electric Traction by S.K.Kataria& Sons, New Delhi.
6. H.Pratap :Art & Science of Utilization of Electrical Energy by Dhanpat Rai & Company Ltd.
7. H Pratap, ñModern Electric Tractionò Dhanpat Rai & Sons Ltd
8. Dr.M.K.Khedkar&Dr.G.M.Dhole : A Textbook of Electrical Power Distribution Automation by University Science Press
9. S.L.Uppal: Electrical Wiring, Estimating and Costing by Khanna Publishers.

6EP03 COMPUTER AIDED ELECTRICAL MACHINE DESIGN

Course Outcomes:
After completing this course, student will be able to

1. Explain the Basics of Computer aided machine design & material selection.
2. Derive the design parameters of single & three phase transformer core.
3. Calculate the winding& cooling system parameters of the transformer
4. Develop the armature winding diagram for three phase Induction Motor
5. Determine the stator core dimensions of three phase Induction motor
6. Design the squirrel cage & wound type rotor for three phase Induction motor

Unit I: Introduction :
Review of transformer & Induction motor constructional features, Major considerations in electrical machine design, optimization, electrical engineering materials: Conducting, Insulating & Magnetic Materials,Limitations of traditional design, need for CAD, analysis, synthesis and hybrid methods of CAD, Introduction to FEM based machine design.

Unit II: Transformer Design –I:
Transformer Core Design - Material selection, type of construction, Specific magnetic & electric loadings, output equation, core and yoke cross sections, window dimensions, overall core dimensions calculations, core loss estimation from design data. Optimum core design for Minimum cost, Minimum losses, Minimum weight & Minimum volume.

Unit III:Transformer Design – II:
Transformer Winding - types, and design calculation, Layout, no-load current calculation, primary and secondary winding resistance and leakage reactance from design data, mechanical forces ï types & causes.Estimation of efficiency & regulation from design data.
Cooling methods for a transformer, design of transformer tank. Calculation of cooling tubes.

Unit IV: AC winding Design :
Concentrated & distributed winding, Integral slot & fractional slot winding, Full pitch & short pitch windings, Single layer& double layer winding, distribution factor, coil pitch factor and winding factor, EMF equation, Development of winding diagrams.

Unit V: Induction motor stator design:
Specific electric and magnetic loadings selection, output equation, main dimensions (D&L) calculation, stator slot-numbers, shape and dimensions, stator teeth dimension, stator core dimensions.Air gap length calculation.

Unit VI: Induction motor rotor design:
Squirrel cage rotor design ï selecting number of rotor slots, design of rotor bars & slots, design of end rings. **Wound type rotor design** - rotor winding design, rotor slots design, and rotor core design. Bearings, shaft design. estimation of no-load current, stator and rotor winding resistances from design data, dispersion coefficient & its effect on performance of IM.

Text Books:
1. A. K. Sawhney, ñA Course in Electrical Machine Designò Dhanpat Rai & Co Ltd, 2016
2. R.K.Agrawal, ñPrinciples of Electrical Machine Designò, S.K.Kataria and Sons, Delhi

Reference Books:
1. M.G.Say,ñThe Performance and Design of Alternating Current Machinesò, C.B.S. Pub., Delhi.
2. K.G.Upadhyay,ñDesign of Electrical Machinesò, New Age international Publishers,1st Edition 2008
3. S.K.Sen,ñPrinciples of Electrical Machine Design with Computer Programsò, Oxford and I.B.H. Company Pvt. Ltd., New Delhi
4. IndrajitDasgupta, ñDesign of Transformersò, TMH 1st Edition 2002
5. Indian Standards for Transformer & Three phase IM design from BIS websites.

6EP04 Professional Elective - II
1. ADVANCED CONTROL SYSTEMS

Course Outcome
After completing this course students will be able to
1. Design compensator using time domain and frequency domain specifications
2. Represent system using state space model
3. Analyze controllability and observability for systems and design full state feedback controller.
4. Analyze digital systems using Z Transform
5. Develop the describing function for the nonlinearity to assess the stability of the system.
6. Analyzethe Nonlinear system using Phase plane Analysis

Unit I: Compensation Techniques:
Introduction, preliminary consideration of classical design. Lead compensator, Lag Compensator, Lead-Lag compensator, Feedback compensation in frequency domain.

Unit II: State Space Technique I:
State, state space and state variables ,SISO /MIMO linear systems state Variable models- differential equations, transfer functions, block diagrams And state diagrams. Transfer function decomposition ï Phase variable Forms, canonical forms and Jordan canonical forms, STM computation, L.T, Canonical transformation, and Cayley Hamilton theorem. Time Response ï SISO systems.

Unit III: State Space Technique II:
Concept-controllability and observability , SISO/ MIMO linear Systems Gilbertôs method and Kalmanôs test; SISO controllable Systems design ï state feedback.

Unit IV: Sampled Data Control Systems:
Representation, Z transform, Sampler and hold, ZOH, Open loop and closed loop SDCS, Z transfer Function, difference equation, solution, Pulse transfer function, Stability Analysis, S and Z domain relationship, Juryôs test, and bilinear Transformation. Root locus method.

Unit V: Non-Linear System Analysis I:
Non linear system behaviour, types and characteristics, Describing function Stability analysis limit cycles, Limitation of Describing function.

Unit VI: **Non-Linear System Analysis II**:

Linearization, Singular points, Classification and nature, Phase plane method, non linear system analysis, Phase trajectories, construction ï analytical and graphical method by isoclines, stability analysis, limit cycles, limitations ï phase plane method.

Text Books:

1. Nagrath and Gopal, òControl system Engineeringò Wiley Eastern Ltd , New Delhi
2. K.Ogata,ò Modern Control Theory ñPrentice Hall Of India Pvt Ltd , New Delhi.

Reference Books:

1. Naresh Sinha. ñControl system Engineeringò Wiley Eastern Pvt. Ltd., New Delhi.
2. B.C. Kuo. ñAutomatic Control systemò Prentice Hall Of India Pvt Ltd Delhi
3. D Roy Choudhury, ñModern Control EngineeringòPublisher: PHI Learning.

6EP04 Professional Elective – II:
2. PROCESS CONTROL SYSTEMS

Course Outcomes:

After Completing this course student will be able to

1. Explain the various Electronic Instruments for measurement of electrical parameters.
2. Analyse the different signals
3. Demonstrate the signal counting, recording and working of digital readout devices.
4. Demonstrate the Various techniques of A/D and D/A conversions.
5. Apply various signal processing tools as per requirement
6. Develop ladder diagrams &programmes for PLC

Unit I : Electronics Instruments for Measurement of Electrical Parameters Advantages of Electronic Instruments, Electronic Voltmeters Electronic Multi-meter, differential volt meter, Digital voltmeter, Q meter, vector impedance meter, vector voltmeter.

Unit II: Signal Generation and Analysis Signal generators, Function generators. Wave analyzer Harmonic Distortion Analysers, Spectrum Analysis.

Unit III: Signal Counting and Recording Decade counting Assembly, Binary counter, Decimal counter, Decade counter with digital display, universal counter, Digital readout devices, storage type CRO, Servo type X-Y recorder.

Unit IV: Signal conditioning and Conversions. Frequency characteristics of various types of signals, active filters bandpass, low pass and high pass filters using opAmps. Various techniques of A/D and D/A conversions. Modulation and demodulation PCM techniques, phase locked loop.

Unit V: Signal Processing Pulse times, triggered delayed sweeps, discrete pulse delay circuits, pulse sequencing, analog multiplexers and de-multiplexers, digital multiplexing sample and hold circuits, serial and parallel digital data conversion. Signal transmission, Analog and digital telemetry techniques, MODEM and UART, keyboard and character generators, tape recorder,

Unit VI : Introduction to Processor and Processor based Techniques. Introduction to PLC, PLC architecture, programming; ladder diagram and examples, micro controller based instrumentation

Text Books:

1. H.S. Kalsi ï Electronic Instrumentation, - Tata Mc-Graw Hill Publishing Company, New Delhi.
2. Cooper, Helfrick ï Electronic Instrumentation and Measurement Techniques, A Prentice Hall of India. New Delhi.

Reference Books: -

1. B.R. Gupta-Electronics and Instrumentation ï Wheeler Publishing.
2. Rangan, Sharma & Mani ï ñInstrumentation ï devices & Systems.ò Tata Mc-Graw Hill Publishing Company, New Delhi.
3. R.P. Jain-Digital Electronics, Tata Mc-Graw Hill Publishing Company, New Delhi.
4. Microprocessors and Digital Systems, by:D.V.Hall,TMH Publishing Company, New Delhi.
5. Shoen Beck- Electronic Communication, Prentice Hall of India. Pvt. Ltd. New Delhi.
6. B. Ram- fundamental of Microprocessors, Dhanpat Rai & Sons, New Delhi.
7. A.K. Sawhney ï A Course in Electrical & Electronics Instrumentation, Dhanpat Rai & Sons, New Delhi.

6EP04 Professional Elective – II
3. INDUSTRIAL ELECTRICAL SYSTEM

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the electrical wiring systems for residential, commercial and industrial consumers.
2. representing the systems with standard symbols and drawings, SLD.
3. Understand various components of industrial electrical systems.
4. Analyze and select the proper size of various electrical system components.

Unit I: Electrical System Components :
LT system wiring components, selection of cables, wires, switches, distribution box, meteringsystem, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse currentcharacteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator,Relays, MPCB, Electric shock and Electrical safety practices

Unit II: Residential and Commercial Electrical Systems:
Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.

Unit III: Illumination Systems:
Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting.

Unit IV: Industrial Electrical Systems – I:
HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction ï kVAR calculations, type of compensation, Introduction to PCC,MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

Unit V: Industrial Electrical Systems – II:
DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing theDG, UPS and Battery Banks, Selection of UPS and Battery Banks.

Unit VI: Industrial Electrical System Automation:
Study of basic PLC, Role of in automation, advantages of process automation, PLC basedcontrol system design, Panel Metering and Introduction to SCADA system for distribution automation.

Text Book: S. L. Uppal and G. C. Garg, ñElectrical Wiring, Estimating & Costingò, Khanna publishers, 2008.

Reference Books:

1. K. B. Raina, ñElectrical Design, Estimating & Costingò, New age International, 2007.
2. S. Singh and R. D. Singh, ñElectrical estimating and costingò, Dhanpat Rai and Co.,
3. Web site for IS Standards.
4. H. Joshi, ñResidential Commercial and Industrial Systemsò, McGraw Hill Education, 2008.

6FEEP05 Open Elective – II
(1) ENERGY AUDIT AND MANAGEMENT

Course Outcomes:
After completing this course student will be able to:

1. Discuss energy scenario and its management.
2. Conduct the energy audit of different systems.
3. Determine the economics of energy conservation
4. Discuss various energy Conservation methods & their case studies
5. Explain fundamentals of Harmonics.

Unit I : Energy Scenario & Management:
Indian energy scenario, Energy needs of growing economy, Energy pricing in India Energy sector reforms, various forms of energy, Primary and secondary energy, commercial and non-commercial energy, Global primary energy reserves, Energy and environment, Necessity of conserving energy, Energy strategy for the future, Electrical energy management, Concept of supply side management and demand side management, Methods of implementing Demand side management and advantages to consumer, utility and society.

Unit II: Energy Audit:
Definition, Need of energy audit, Preliminary and detailed energy audit. Procedure for carrying out energy audit, Instruments used for energy audit, Data Analysis-Energyð production relationship, specific energy consumption, Sankey diagram, CUSUM Technique, Bench marking energy performance, Recommendations for energy conservation, Action plan, Executive Summary.

Unit III: Economics of energy conservation:
Cost factors, Budgeting, Standard costing and Sources of capital, Cash flow diagram and activity chart, Simple Payback period analysis, Time value of money, Net present value method, internal rate of return method, Profitability index for benefit cost ratio

Unit IV: Energy Conservation:
Energy conservation in motive power, Illumination, Heating & cooling systems, Pumping systems, thermal power stations and Transmission & Distribution Sector. Cogeneration &Waste heat recovery systems.

Unit V: Energy Audit Case Studies:

Energy Intensive Industries, Commercial, Industrial, Municipal and Agriculture Sector, IT industries, Hospitals.

Unit VI: Fundamentals of Harmonics:
Harmonic distortion, voltage versus current distortion, Power systems quantities under non sinusoidal conditions- active reactive and apparent power, displacement and true power factor, harmonic phase sequences, triplen harmonics, harmonic indices- Total harmonic distortion (THD), Total demand distortion (TDD) , Harmonic sources from commercial and industrial load.

Text Book: Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, Book-2, Book-3, Book-4 (available online BEE website)

Reference Books:
1. S. C. Tripathy, ñUtilization of Electrical Energy and Conservationò, McGraw Hill, 1991.
2. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)
3. Energy Conservation and Audit ByThumman, Fairmont Press
4. Energy Audit and Conservation TERI

6FEEP05 Open Elective – II (2) ELECTRICAL ESTIMATING & COSTING

Course Outcomes:
After completion of the course students will be able to
1. Understand methods of installation and estimation of service connection
2. Decide type of wiring, its estimation and costing for residential building
3. Carry out electrification of commercial complex, factory unit installations
4. Design & estimate for feeders & distributors
5. Understand contract, tendering and work execution process.

Unit I: Electrical Installation:
Classification of Electrical Installation, General requirement of Electrical Installation. Important definitions related to Installation.
Service Connection: Concept of service connection, Types of service connection & their features. Methods of Installation of service connection. Estimation of service connection.

Unit II : Residential Building Electrification :
Procedures for designing the circuits and deciding the number of circuits. Selection of type of wiring and rating of wires & cables. Earthing of Residential Installation. Estimate and cost Preparation of Residential Installation.

Unit III: Electrification of commercial Installation:
Concept of commercial Installation. Differentiate between electrification of Residential and commercial Installation Deciding the size of cables, busbar and busbar chambers. Earthing of the electrical Installation Selection of type wire, wiring system.Preparation of detailed estimate and costing of commercial Installation.

Unit IV: Electrification of factory unit Installation:
Concept of Industrial load. concept of Motor wiring circuit.Important guidelines about power wiring and Motor wiring.Selection and rating of wire, cable size. Sequence to be followed to prepare estimate. Preparations of detailed estimate and costing of small factory unit/ workshop.

Unit V: Design & estimate for feeders &distributors:

Different schemes for feeders & distributors, estimates for different feeders & distributors, Distribution transformer, Deciding Size & location, Estimate for outdoor & indoor type distribution substation.

Unit VI: Contracts, Tenders and Execution:
Tender and tender notices. Procedure for submission and opening tenders. Comparative statements, criteria for selecting contractors, General conditions in order form. Principles of Execution of works administrative approval, technical sanctions. Billing of executed work.

Text & Reference Books:

1. Electrical Design; Estimating and costing by K.B. Raina, S.K.Bhattacharya New Age International (p) Limited, New Delhi.
2. Electrical Estimating and costing by Surjit Singh Dhanpat Rai and company, New Delhi
3. Electrical Estimating and costing by N. Alagappan S. Ekambaram, Tata Mc Graw Hill Publication New Delhi

6FEEP05 Open Elective - II
3. ELECTRICAL MATERIALS

Course outcomes:
After completing this course students will be able to
1. understand importance of electrical engineering materials
2. understand how electric conduction takes place in conductors
3. understand importance of semiconductors and magnetic materials in electrical engineering.
4. understand importance of dielectric materials in electrical engineering.
5. Identify the need of special materials in electrical engineering.

Unit-I Introduction to Electrical Engineering Materials:
Importance of materials, Classification of electrical materials, Scope of electrical materials, Requirement of Engineering materials.Types of engineering materials, Levels of material structure.

Unit-II Conducting Materials:
Review of metallic conduction on the basis of free electron theory. variation of conductivity with temperature and composition, materials for electric resistors- General Electric properties; material for brushes of electrical machines, lamp filaments,fuses and solder.

Unit-III Semiconductors:
Semiconductors: Mechanism of conduction in semiconductors, types of semiconductors. Hall effect, compound semiconductors, basic ideas of amorphous and organic semiconductors.

Unit-IV Magnetic Materials:
Classification of magnetic materials- origin of permanent magnetic dipoles, magneto materials used in electrical machines, instruments and relays.
Magnetic Circuit terminology, Relation between relative permeability and magnetic susceptibility. Classification of magnetic materials, Diamagnetic, Paramagnetic, Ferromagnetic, Antiferromagnetic. Magnetization curve, Initial and maximum permeability. Hysteresis loop and loss, Eddy current loss.

Unit-V Dielectrics & Insulating Materials:
Dielectrics, Factors influencing dielectric strength. Capacitor materials. Insulating materials, Insulating Materials: Inorganic materials (mica, glass, porcelain, asbestos), organic materials (paper, rubber, cotton silk fiber, wood, plastics and bakelite), resins and varnishes, liquid insulators(transformer oil) gaseous insulators (air, SF6 and nitrogen) and ageing of insulators.

Unit-VI Materials for Special Applications:
Materials for solar cells, fuel cells and battery. Materials for coatings for enhanced solar thermal energy collection and solar selective coatings, Cold mirror coatings, heat mirror coatings, antireflection coatings, sintered alloys for breaker and switch contacts.

Text & Reference Books:

1. Electrical Engineering Materials by Dekker A.J (PHI)
2. Electrical Engineering Materials by S.P.Seth (Dhanpatrai and Sons)
3. An Introduction to Electrical Engineering Materials by Dr. C. S Indulkar & Dr. S. Thiruvelgadam (S Chand Publication)

6EP06 POWER ELECTRONICS LAB

Perform minimum eight experiments:
List of Experiments:

1. To verify the V-I characteristics of SCR
2. To verify forward and reverse characteristics of DIAC
3. To verify forward and reverse characteristics of TRIAC
4. To study UJT as relaxation oscillator
5. AC voltage control using triac - diac combination
6. To verify the operation of half and full controlled converter
7. To verify the operation of SCR commutation circuits
8. To design & simulate dc-dc buck converter
9. To design & simulate dc-dc boost converter
10. Construct and test the dc chopper control circuit using thyristor
11. Study of PWM based step down dc chopper using MOSFET/IGBT
12. To verify the operation of Single phase single pulse / sinusoidal PWM inverter using MOSFET/IGBT
13. To verify the operation of Single phase parallel inverter using MOSFET/IGBT
14. To verify the operation of Single phase to single phase cycloconverter
15. To verify the operation of Single phase dual converter With R - RL loads
16. To verify the operation of Single phase ac voltage controller

6EP07 ELECTRICAL ENERGY DISTRIBUTION & UTILIZATION LAB

Perform minimum eight experiments
List of Experiments:
1) Study of Distribution substation equipments.
2) Study of various types of busbar arrangements.
3) Study of Power distribution system.
4) Study of Distribution Automation system.
5) Prepare a report on visit to distribution substation.
6) Simulation of various types of Electrical Distribution System (Radial, Parallel, Ring main)
7) Development of single line diagram of of 33/11 kV substation in AutoCAD Electrical
8) Determination of Efficiency by Performing Load Test on Three-Phase Induction Motor.
9) Determination of Efficiency by Performing Load Test on DC Shunt Motor.
10) Electric Braking of DC.Shunt Motor.
11) Electric Braking of Three-Phase Induction Motor.
12) Speed Control of Three-Phase Slip-Ring Induction Motor.
13) Determination of Efficiency by Performing Load Test on Single-Phase Induction Motor.

14) Study of Electric Heating.
15) Design Scheme of Illumination System.
16) Study of Electric Traction System .

6EP08 COMPUTER AIDED ELECTRICAL MACHINE DESIGN LAB

Develop Minimum Eight Computer Programme:

List of Computer Programme:

1. Develop a computer programme for core design of a single-phase core type transformer
2. Develop a computer programme for core design of a single-phase shell type transformer
3. Develop a computer programme for core design of a three-phase core type transformer
4. Develop a computer programme for optimum core design of a three-phase core type transformer for minimum cost or maximum efficiency.
5. Develop a computer programme for Estimation of Iron losses in a three-phase core type transformer.
6. Develop a computer programme for windings design of a single-phase transformer
7. Develop a computer programme for windings design of a three-phase transformer
8. Develop a computer programme for calculating the No load current of a single-phase transformer.
9. Develop a computer programme for calculating the No load current of a three-phase transformer.
10. Develop a computer programme for tank design and calculating the number of cooling tubes required for three phase core type transformer.
11. Develop a computer programme to calculate Main dimensions (D & L) of a three phase Induction motor.
12. Develop a computer programme for stator core design of three phase induction motor.
13. Develop a computer programme for squirrel cage rotor design of three phase induction motor.
14. Develop a computer programme for wound type rotor design of three phase induction motor.
15. Develop a computer programme for estimating magnetizing current of a squirrel cage type three phase induction motor.

6EP09 COMPUTER TECHNOLOGY- LAB

Student needs to complete minimum eight assignments based on the following:

- Computer Network: Basic hardware and terminology in networks, Classifications, The Internet, The Intranet and Extranet.
- Installation of operating systems, application software in Personnel Computer or laptop.
- Develop the simulation models for various tasks in electrical engineering using simulation software.
- Develop the computer programme for various tasks in electrical engineering using software.
- Study of PLCs used for Industrial automation & develop the ladder diagram for given task in automation using PLC.
- Basics of IoT, IoT based Monitoring & Controlling of various Electrical Equipments.

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B.E. COMPUTER SCIENCE & ENGINEERING SEM. V & VI

Syllabus of B.E. Sem. V (Computer Science & Engineering)

5KS01 Database Management Systems (L-4, T-0, C-4)

Course Prerequisite: Discrete Mathematics, Data Structures and Algorithm

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Database Management Systems by being able to do each of the following:

- To understand the fundamental concepts of database management system.
- To learn database query languages.
- To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.
- To understand the query processing and optimization.
- To learn basics of transaction management and concurrency control.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Model, design and normalize databases for real life applications.
2. Discuss data models, conceptualize and depict a database system using ER diagram.
3. Query Database applications using Query Languages like SQL.
4. Design & develop transaction processing approach for relational databases.
5. Understand validation framework like integrity constraints, triggers and assertions.

Unit I: Introduction to DBMS **Hours: 8**

Database System Applications, Purpose of database systems, View of Data, Database Languages Database Architecture, Database Users and Administrators, Entity- Relationship Model, Constraints, Removing redundant attributes in Entity sets, E-R diagrams, Reduction to Relational Schemas, E-R design issues, Extended E-R Features. (8)

Unit II: Relational Algebra, SQL **Hours: 8**

Relational Model: Structure of Relational Databases, Database schema, keys, schema diagram, relational query languages, relational operators, The Relational Algebra, Overview of SQL query language, SQL data definition, Basic Structure of SQL queries, Additional basic operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database Operations, Join expressions, Views.

Unit III: Relational Database Design **Hours: 8**

Integrity Constraints, SQL data types and schemas, Authorization, Triggers, Features of good relational designs,atomic domains and First Normal Form, decomposition using functional dependencies, Functional dependency theory, Algorithms for decomposition, Decomposition using multi-valued dependencies, More Normal Forms, Database Design Process.

Unit IV: Query Processing and Query Optimization **Hours: 8**

Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions, Query Optimization: Overview, Transformation of Relational Expressions ,Estimating Statistics of Expression Results, , Choice of Evaluation Plans, Materialized Views.

Unit V: Transaction Management **Hours: 8**

Transaction Concept, Simple transaction model, Storage structure, Transaction Atomicity and Durability, transaction isolation, Serializability, transaction isolation and atomicity, transaction isolation levels, Implementation of Isolation levels, Transactions as SQL statements

Unit VI: Concurrency Control and recovery system **Hours: 8**

Lock-Based Protocols, Deadlock Handling, Multiple Granularities, Timestamp- Based Protocols, Validation-Based Protocols, Multi-version schemes, Recovery system :Failure classification, Storage , Recovery & Atomicity, Recovery algorithm, buffer management, Failure with loss of nonvolatile storage , early lock release and logical undo operations, , Remote Backup Systems

Text Book: Abraham Silberschatz, Henry F. Korth, S. Sudarshan, DATABASE SYSTEM CONCEPTS, Sixth Edition, McGraw Hill

Reference Books:

1. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, McGraw-Hill
2. Shamkant B. Navathe, RamezElmasri, Database Systems, Pearson Higher Education
3. Garcia-Molina, Ullman, Widom: Database System Implementation, Pearson education.
4. S. K. Singh: Database Systems, Concepts, Design and Applications, Pearson Education.
5. G.K. Gupta: Database Management Systems, McGraw Hill.
6. Toledo and Cushman: Database Management Systems, (Schaumôs Outlines)

5KS02 COMPILER DESIGN (L-3, T-0, C-3)

Course Pre-requisite: Basic knowledge of Discrete Mathematics, Theory of Computation

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Compiler Design by being able to do each of the following:

- To learn concepts of programming language translation and phases of compiler design
- To understand the common forms of parsers.
- To study concept of syntax directed definition and translation scheme for the representation of language
- To illustrate the various optimization techniques for designing various optimizing compilers

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Describe the fundamentals of compiler and various phases of compilers.
2. Design and implement LL and LR parsers
3. Solve the various parsing techniques like SLR, CLR, LALR.
4. Examine the concept of Syntax-Directed Definition and translation.
5. Assess the concept of Intermediate-Code Generation and run-time environment
6. Explain the concept code generation and code optimization.

Unit I: Introduction to Compiler **Hours: 06**

Introduction to Compilers: Language Processor, The Structure of a Compiler. Lexical Analysis: The role of lexical analyzer, Input Buffering, Specification of tokens, Recognition of tokens, The lexical analyzer generator Lex, Finite Automata, From Regular Expressions to Finite Automata, State minimization of DFA.

Unit II: Syntax Analysis **Hours: 07**

Syntax Analysis: The role of the parser, Review of context free grammar for syntax analysis: Parse Tree and Derivation, Ambiguity in Grammar, Elimination of left recursion and left factoring. Top down parsing: recursive descent parsing, predictive parsers, Transition diagrams for predictive parsers, FIRST and FOLLOW, LL (1) Grammars, Construction of predictive parsing tables, Non recursive predictive parsing, Error recovery in predictive parsing.

Unit III: Bottom up parsing **Hours: 07**

Bottom up parsing: Handle pruning, Stack implementation of Shift Reduce Parsing, conflicts during shift reduce parsing Introduction to LR parsing: Simple LR, Items and the LR(0) Automation, The LR-Parsing algorithm, Construction of SLR parsing table, More powerful LR Parsers: canonical LR(1) Items, Constructing LR(1) sets of items and canonical LR(1) parsing tables, Constructing LALR parsing tables, The parser generator Yacc.

Unit IV: Syntax Directed Translation **Hours: 07**

Syntax Directed Translation: Syntax directed definitions, Inherited and synthesized attributes, Evaluation orders of SDDôs: Dependency Graphs, S-attributed definitions, L-attributed definition. Application of Syntax-Directed Translation: Construction of syntax trees. Syntax-directed Translation Schemes.

Unit V: Intermediate-Code Generation **Hours: 07**

Intermediate-Code Generation: Variants of Syntax Trees: Directed Acyclic Graphs(DAG), Three Address Code. Run Time Environments: Storage Organization, Static versus Dynamic Storage Organization, Stack Allocation of Space: Activation trees, Activation Records, Calling Sequences, Variable- Length data on stack. Access to Nonlocal Data on the Stack. Heap Manager: The Memory Manager. Introduction to Garbage Collection: Design Goals for Garbage Collectors.

Unit VI: Code Generation **Hours: 06**

Code Generation: Issues in Design of a Code generator, The Target Language, Address in the target code, Basic blocks and flow graphs. Optimization of Basic Blocks, Peephole Optimization and The Principal sources of Optimization.

Text Book: Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman Compilers: ñPrinciples, Techniques and Toolsò, Pearson Education Second Edition.

Reference Books:

1. D. M. Dhamdhere, Compiler Constructionð Principles and Practice, (2/e), Macmillan India.
2. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman Compilers: ñPrinciples, Techniques and Toolsò, Pearson Education (Low Price Edition).
3. Andrew Appel, Modern Compiler Implementation in C, Cambridge University press.
4. K C. Louden ñCompiler Constructionð Principles and Practiceò India Edition, CENGAGE.
5. Bennett J.P., ñIntroduction to Compiling Techniquesò, 2/e (TMH).

5KS03 COMPUTER ARCHITECTURE & ORGANIZATION (L-3, T-0, C-3)

Course Pre-requisite: Microprocessor & Assembly Language Programming

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Computer Architecture & Organization by being able to do each of the following:

- To discuss the basic concepts and structure of computers.
- To solve concepts of arithmetic operations.
- To understand addressing modes and memory organization.
- To analyze conceptualize multitasking ability of a computer and pipelining
- To explain IO communication

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Discuss basic structure of computer.
2. Understand the basic operation of CPU.
3. Compare and select various Memory and I/O devices as per requirement.
4. Solve the concepts of number representation and their operation.
5. Explain the concept of parallel processing and pipelining.

Unit I: Basic Structure of Computer **Hours: 7**

Basic Structure of Computer H/W & S/W: Functional Units, Basic Operational Concepts, Bus structures, Addressing Methods and Machine Program Sequencing: Memory Locations, Addresses, Instruction and instruction sequencing, Addressing Modes. Basic I/O Operations.

Unit II: Memory Unit **Hours: 7**

Basic Concepts, Memory Hierarchy, Semiconductor RAM Memories, Internal Organization of Memory Chips, Static Memories, Dynamic Memories, Read Only Memories, Speed, Size and Cost.

Unit III: Processing Unit **Hours: 8**

Fundamental Concepts, Execution of a Complete Instruction, Hardwired Control, Performance Consideration, Microprogrammed Control, Microinstructions, Microprogram Sequencing.

Unit IV: I/O Organization **Hours:6**

Accessing I/O Devices, Interrupts, Enabling and Disabling Inerrupts, Handling Multiple Devices, DMA,I/O Hardware, Standard I/O Interfaces:SCSI

Unit V: Arithmetic **Hours: 7**

Number Representations, Design of Fast Adders, Signed Addition and Subtraction, Multiplication of Positive Numbers ,Booth Multiplier, Fast Multiplication ,Integer Division, Floating Point Numbers and Operations.

Unit VI: Parallel Organization and Pipelining **Hours: 7**

Parallel Processing, Array Processors, The Structure of General Purpose Multiple Processors, Symmetric, Multiprocessors, Multithreading and Chip Multiprocessors, Clusters, Multicore Organization, Memory Organization in Multiprocessors. Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.

Text Book: Carl Hamacher, Zvonko Vranesic and Safwat Zaky, ñComputer Organizationò, Fifth Edition, Tata McGraw-Hill.

Reference Books:

1. William Stallings, ñComputer Organization and Architecture: Designing for Performanceò, Eighth Edition, Pearson.
   John P. Hayes, ñComputer Architecture and Organizationò, McGraw Hill Publication.
2. DA Patterson and JL Hennessy, Computer Organization and Design, Morgan Kaufmann Publisher, 2nd edition
3. A.S. Tanenbaum, "Structured Computer Organization", PHI Publication.

5KS04 COGNITIVE TECHNOLOGIES (L-3, T-0, C-3)

Course Prerequisite: Basic knowledge of Artificial Intelligence, Programming and Data Structures.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Cognitive Technologies by being able to do each of the following:

- This course intends to introduce concept of cognitive technologies and important approaches of cognitive technologies.
- Student will learn and analyze key concept of cognitive technologies.
- Students will gain an understanding of innovation concepts, terminology, current and future trends in cognitive technologies.
- Introduces students to IBM Watson platform, an artificially intelligent computer system capable of answering questions posed in natural language, developed in IBMôs Deep QA project.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Describe the Cognitive computing and principles of cognitive systems.
2. Identify role of Natural Language Processing in cognitive system.
3. Outline application of advanced analytics in cognitive computing.
4. Justify role of Cloud and Distributed Computing in Cognitive Computing.
5. Assess the process of building a Cognitive Application.
6. Identify the Emerging Areas and Future Applications of Cognitive Computing.

Unit I: Foundation of Cognitive Computing & Design Principle of Cognitive Systems Hours: 07

The Foundation of Cognitive Computing: Cognitive Computing as a New Generation, The Uses of Cognitive Systems, What Makes a System Cognitive, Gaining Insights from Data, Domains Where Cognitive Computing Is Well Suited, Artificial Intelligence as the Foundation of Cognitive Computing, Understanding Cognition, Two Systems of Judgment and Choice, Understanding Complex Relationships Between Systems, The Elements of a Cognitive System, Infrastructure and Deployment Modalities.

Design Principles for Cognitive Systems: Components of a Cognitive System, Building the Corpus, Bringing Data into the Cognitive System, Machine Learning, Hypotheses Generation and Scoring, Presentation and Visualization Services.

Unit II: NLP and Big Data in Cognitive System Hours: 07

Natural Language Processing in Support of a Cognitive System: The Role of NLP in a Cognitive System, Semantic Web, Applying Natural Language Technologies to Business Problems.

The Relationship Between Big Data and Cognitive Computing**:** Dealing with Human-Generated Data, Defining Big Data, The Architectural Foundation for Big Data, Analytical Data Warehouses, Hadoop, Data in Motion and Streaming Data, Integration of Big Data with Traditional Data.

Unit III: Knowledge Representation and Advance Analytics in Cognitive Computing Hours: 06

Representing Knowledge in Taxonomies and Ontologies: Representing Knowledge, Developing a Cognitive System, Defining Taxonomies and Ontologies, Explaining How to Represent Knowledge, Models for Knowledge Representation. Applying Advanced Analytics to Cognitive Computing: Advanced Analytics Is on a Path to Cognitive Computing, Key Capabilities in Advanced Analytics, Using Advanced Analytics to Create Value, Impact of Open Source Tools on Advanced Analytics.

Unit IV: Role of Cloud and Distributed Computing in Cognitive Computing Hours: 07

The Role of Cloud and Distributed Computing in Cognitive Computing: Leveraging Distributed Computing for Shared Resources, Why Cloud Services Are Fundamental to Cognitive Computing Systems, Characteristics of Cloud Computing, Cloud Computing Models, Delivery Models of the Cloud, Managing Workloads, Security and Governance, Data Integration and Management in the Cloud.

The Business Implications of Cognitive Computing: Preparing for Change, Advantages of New Disruptive Models, What Does Knowledge Mean to the Business?, The Difference with a Cognitive Systems Approach, Meshing Data Together Differently, Using Business Knowledge to Plan for the Future, Answering Business Questions in New Ways, Building Business Specific Solutions, Making Cognitive Computing a Reality, How a Cognitive Application Can Change a Market.

Unit V: IBM Watson and Process of Building a Cognitive Application Hours: 07

IBMôs Watson as a Cognitive System: Watson Defined, Advancing Research with a ñGrand Challengeò, Preparing Watson for Jeopardy, Preparing Watson for Commercial Applications, The Components of DeepQA Architecture.

The Process of Building a Cognitive Application: The Emerging Cognitive Platform, Defining the Objective, Defining the Domain, Understanding the Intended Users and Defining their Attributes, Defining Questions and Exploring Insights, Creating and Refining the Corpora, Training and Testing.

Building a Cognitive Healthcare Application: Foundations of Cognitive Computing for Healthcare, Constituents in the Healthcare Ecosystem, Learning from Patterns in Healthcare Data, Building on a Foundation of Big Data Analytics, Cognitive Applications across the Healthcare Ecosystem, Starting with a Cognitive Application for Healthcare, Using Cognitive Applications to Improve Health and Wellness, to Enhance the Electronic Medical Record and to Improve Clinical Teaching.

Unit VI: Emerging Areas and Future Application **Hours: 06**

Smarter Cities: Cognitive Computing in Government: How Cities Have Operated, The Characteristics of a Smart City, The Rise of the Open Data Movement Will Fuel Cognitive Cities, The Internet of Everything and Smarter Cities, Understanding the Ownership and Value of Data, Smarter Approaches to Preventative Healthcare, Building a Smarter Transportation Infrastructure, Using Analytics to Close the Workforce Skills Gap, Creating a Cognitive Community Infrastructure, The Next Phase of Cognitive Cities.

Emerging Cognitive Computing Areas: Characteristics of Ideal Markets for Cognitive, Computing Vertical Markets and Industries.

Future Applications for Cognitive Computing: Requirements for the Next Generation, Technical Advancements That Will Change the Future of Cognitive Computing, What the Future Will Look Like, Emerging Innovations.

Text Book:

Judith Hurwitz, Marcia Kaufman and Adrian Bowles, "Cognitive Computing and Big Data Analytics", publication John Wiley & Sons, Inc, 2015.

Reference Books:

1. José Luis Bermúdez, Cognitive Science: An Introduction to the Science of the Mind, publication Cambridge University Press, New York, Second Edition.
2. Jay Friedenberg and Gordon Silverman, Cognitive Science: An Introduction to the Study of Mind, Sage Publications, Inc. London, 2014.
3. Huimin Lu (Editor), Cognitive Internet of Things: Frameworks, Tools and Applications, Springer Nature Switzerland AG 2020.
4. Danish Contractor and Aaditya Telang (Editors), Applications of Cognitive Computing Systems and IBM Watson, 8th IBM Collaborative Academia Research Exchange, publication Springer Nature Singapore Pte Ltd., 2017.
5. S. Bird, E. Klein, E. Loper (2009), Natural Language Processing with Python, OôReilly Media.

5KS04 DATA SCIENCE AND STATISTICS [L-3, T-0, C-3]

Course Prerequisite: Basic knowledge of Mathematics

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Data Science and Statistics by being able to do each of the following:

- Demonstrate knowledge of statistical data analysis techniques utilized in business decision making.
- Apply principles of Data Science to the analysis of business problems.
- Apply the learned concepts for the skillful data management.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Demonstrate proficiency with statistical analysis of data.
2. Build skills in transformation and merging of data for use in analytic tools.
3. Perform linear and multiple linear regression analysis.
4. Develop the ability to build and assess data-based models.
5. Evaluate outcomes and make decisions based on data.

Unit I: Data Science and Statistical Learning **Hours: 6**

Introduction: What Is Data Science?, Statistical Inference, Exploratory Data Analysis, and the Data Science Process, Exploratory Data Analysis, Stages of a Data Science Project, The Data Science Process, Why Statistical Learning: f Estimation- Why and How, Tradeoff Between Prediction Accuracy and Model Interpretability, Supervised vs Unsupervised Learning, Regression vs Classification Problems, Accessing Model Accuracy: Measuring the Quality of Fit, The Bias Variance Trade-off, The Classification Setting.

Unit II: Linear Regression **Hours: 7**

Simple Linear Regression: Estimating the Coefficients, Assessing the Accuracy of the Coefficient Estimates, Assessing the Accuracy of the Model, Multiple Linear Regression: Estimating the Regression Coefficients, Other Considerations in the Regression Model: Qualitative Predictors, Extensions of the Linear Model, Potential Problems, The Marketing Plan, Comparison of Linear Regression with K-Nearest Neighbors.

Unit III: Classification and Cross Validation **Hours: 7**

Classification: An Overview of Classification, Why not Linear Regression?, Logical Regression: The Logistic Model, Regression Coefficients, Making Predictions, Multiple Logistic Regression, >2 Response Classes, Linear Discriminant Analysis: Using Bayesô Theorem, LDA for p = 1 and p >1, Quadratic Discriminant Analysis, Comparison of Classification Methods, Cross Validation: The Validation Set Approach, Leave-One-Out and k-Fold Cross-Validation, Bias-Variance Trade-Off for k-Fold Cross-Validation, Classification Problems, The Bootstrap

Unit IV: Linear Model Selection and Regularization **Hours: 6**

Subset Selection: Best Subset Selection, Stepwise Selection, Choosing the Optimal Model, Shrinkage Methods: Ridge Regression, The Lasso, Selecting the Tuning Parameter, Dimension Reduction Methods: Principal Components Regression, Partial Least Squares, Considerations in High Dimensions: High-Dimensional Data, What Goes Wrong in High Dimensions?, Regression in High Dimensions, Interpreting Results in High Dimensions

Unit V: Nonlinearity and Tree Based Methods **Hours: 7**

Moving Beyond Linearity: Polynomial Regression, Step Functions, Basis Functions, Regression Splines: Piecewise Polynomials, Constraints and Splines, Representation, Number and Locations of the Knots, Comparison to Polynomial Regression, Smoothing Splines: An Overview and Smoothing
Parameter ø, Local Regression, Generalized Additive Models: Regression Problems and Classification Problems, Tree-Based Methods: Decision, Regression and Classification Trees, Trees Versus Linear Models, Advantages and Disadvantages, Bagging, Random Forests, Boosting

Unit VI: SVM and Unsupervised Learning **Hours: 7**

Maximal Margin Classifier: Hyperplane and Classification, The Maximal Margin Classifier, Construction, The Non-separable Case, Support Vector Classifiers: Overview and Details, Support Vector Machines: Classification with Non-linear Decision Boundaries, SVM, Application, SVMs with More than Two Classes, Relationship to Logistic Regression, Unsupervised Learning: The Challenge of Unsupervised Learning: Principal Components Analysis, Clustering Methods: K-Means Clustering, Hierarchical Clustering, Practical Issues in Clustering.

Text Books:

1. Cathy OôNeil and Rachel Schutt: Doing Data Science, First Edition, 2014, Oôreilly Publications, ISBN: 978-1-449-35865-5
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani: An Introduction to Statistical Learning with Applications in R, First Edition, 2013, Springer-Verlag New York, ISBN: 978-1- 4614-7137-0.

Reference Book:

Nina Zumel, John Mount: Practical Data Science with R, First Edition, 2014, Manning Publications Co., ISBN: 9781617291562.

5KS04 INTERNET OF THINGS [L-3, T-0, C-3]

Course Prerequisite: Basic knowledge of Internet and Microprocessor & Assembly Language Programming

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Internet of Things by being able to do each of the following:

- To learn and understand fundamental of IoT
- To study the design methodology and different IoT platform
- To understand usefulness of IoT for society
- To design and implement application of IoT using various sensor

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Understand the basics of IoT
2. Understand design methodology and platforms involved in IoT
3. Apply the knowledge to interface various sensors with IoT development
4. Design and Implement IoT system for real time application

Unit I: **Hours: 6**

Introduction to Internet of Things, Definition & Characteristics of IoT, Physical Design of IoT Logical Design of IoT, IoT Enabled Technologies like Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels & Deployment Templates, Domain Specific IoTs: Home, Cities, Environment, Energy systems, Logistics, Agriculture, Health & Lifestyle.

Unit II: **Hours: 7**

IOT & M2M: Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT, Software defined networks, network function virtualization, IoT Systems Management, Simple Network Management Protocol (SNMP) ,Limitations of SNMP, Network Operator Requirements, NETCONF, YANG, IoT Systems Management with NETCONF-YANG, NETOPEER.

Unit III: **Hours: 7**

IoT Platforms Design Methodology, Case Study on IoT System for Weather Monitoring, Motivation for Using Python, IoT Systems - Logical Design using Python ,Installing Python, Python Data Types & Data Structures, Control Flow, Functions, Modules, Packages, File Handling l, Date/Time Operations, Classes, Python Packages of Interest for IoT

Unit IV: (**Hours: 7)** IoT Physical Devices & Endpoints, Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interfaces serial, SPI, I2C, Programming Raspberry Pi with Python, Controlling LED with Raspberry Pi, Interfacing an LED and switch with Raspberry Pi, Interfacing Light Sensor with Raspberry Pi Other IoT Devices, pcDuino, BeagleBone Black, Cubieboard.

Unit V: **Hours: 7**

IoT Physical Servers & Cloud Offerings, Introduction to Cloud Storage Models & Communication APIs , WAMP - AutoBahn for IoT , Xively Cloud for IoT , Python Web Application Framework - Django , Designing a RESTful Web API , Amazon Web Services for ,SkyNet IoT Messaging Platform.

Unit VI: **Hours: 7**

Case Studies Illustrating IoT Design, Introduction, Home Automation: Smart Lighting, Home Intrusion detection, Cities: Smart parking, Environment: Weather Monitoring System, Weather reporting Bot, Air pollution monitoring, Forest fire detection, Agriculture: Smart Irrigation, Productivity Applications: IoT printer.

Text Book: Arshdeep Bahga, Vijay Madisetti, ñInternet of Things ï A hands-on approachò, Universities Press, ISBN:0: 0996025510, 13: 978-0996025515.

Reference Books:

1. Fundamentals of Python, K.A.Lambert and B.L.Juneja, Cengage Learning, 2012.
2. David Hanes, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, ISBN-13: 978-1-58714-456-1, ISBN-10: 1-58714-456-5, 2017
3. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, ñFrom Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligenceò, 1st Edition, Academic Press, 2014

5KS04 INTRODUCTION TO CYBER SECURITY [L-3, T-0,C-3]

Course Prerequisite: Computer Programming, Data Structure, Data Communication & Networking.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Introduction to Cyber Security by being able to do each of the following:

- Understand basics of Cybercrime and Information Security.
- To familiarize various cyber threats, attacks, Cyber offenses.
- Understand Cybercrime on Mobile and Wireless devices.
- Understand tools and methods used in Cybercrime.
- Understand Access Control and Authentication.
- Understand Intrusion Detection and Prevention.

Course Outcomes (Expected Outcome): After completion of this course, the students should be able to:

1. Know fundamentals of Cybercrimes and Cyber offenses
2. Realize the Cyber threats, attacks and Vulnerabilities.
3. Explore the industry practices and tools.
4. Comprehend the Access Control and Authentication Process.
5. Implement Intrusion Detection and Prevention.

Unit I: **Hours:6**

Introduction to Cybercrime: Introduction, Cybercrime, Cybercrime and Information Security, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era.

Unit II: **Hours: 6**

Cyber offenses: Introduction, Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrime, Botnets, Attack Vector, Cloud Computing.

Unit III: **Hours: 6**

Cybercrime: Mobile and Wireless Devices Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Cards Frauds in Mobile and Wireless Computing, Security Challenges posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implementations for Organizations, Organizational Measures for Handling Mobile, Devices Related Security Issues Organizational Security Policies and Measures in Mobile Computing, Laptops.

Unit IV: **Hours: 6**

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks.

Unit V: **Hours:6**

Access Control and Authorization: Definitions, Access Rights, Access Control Systems, Authorization, Types of Authorization Systems, Authorization Principles, Authorization Granularity, Web Access and Authorization.
Authentication: Definition, Multiple Factors and Effectiveness of Authentication, Authentication Elements, Types of Authentication, Authentication Methods.

Unit VI: (**Hours: 6)** System Intrusion Detection and Prevention: Definition, Intrusion Detection, Intrusion Detection Systems (IDSs), Types of Intrusion Detection Systems, The Changing Nature of IDS Tools, Response to System Intrusion, Challenges to Intrusion Detection Systems, Implementing an Intrusion Detection System, Intrusion Prevention Systems (IPSs), Intrusion Detection Tools
Disaster Management: Introduction, Disaster Prevention, Disaster Response, Disaster Recovery, Make your Business Disaster Ready, Resources for Disaster Planning and Recovery.

Text Books:
1. Nina Godbole, Sunit Belapure, ñCyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectivesò, Wiley India Pvt Ltd, ISBN: 978-81- 265-21791,2013
2. Joseph Migga Kizza, ñA Guide to Computer Network Securityò, Springer 2009.

Reference Books:
1. V.K. Pachghare, ñCryptography and information Securityò, PHI Learning Private Limited, Delhi India.
2. Nina Godbole, ñInformation Systems Securityò, Wiley India, New Delhi
3. Kennetch J. Knapp, ñCyber Security & Global Information Assuranceò, Information Science Publishing.
4. James Graham, Richard Howard, Ryan Olson, ñCyber Security Essentialsò CRC Press.
5. Jeetendra Pande, ñIntroduction to Cyber Securityò Uttarakhand Open University, 2017

5KS05 PRINCIPLES OF MARKETING FOR ENGINEERING [L-3, T-0, C-3]

Course Pre-requisite: Basic knowledge of Computers.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Principles of Marketing for Engineering by being able to do each of the following:
- To provide students with the knowledge about business advantages of the digital marketing and its importance for marketing success;
- To develop a digital marketing plan; to make SWOT analysis;
- To define a target group; to introduced to various digital channels, their advantages and ways of integration;
- To integrate different digital media and create marketing content to manage a digital marketing performance efficiently.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Identify the importance of the digital marketing for marketing success,
2. Manage customer relationships across all digital channels and build better customer relationships,
3. Create a digital marketing plan, starting from the SWOT analysis and defining a target group,
4. Identify digital channels, their advantages and limitations, to perceiving ways of their integration taking into consideration the available budget

Unit I: Introduction to e-Marketing: **Hours: 7**
Introduction, Wired-up world, B2C, B2B, C2B and C2C Model, Objectives: Sell, Serve, Speak, Save, Sizzle, Introduction to e-strategy.

Unit II: Remix and e-Models **Hours: 7**
Introduction to Remix: Product, Price, Place, Promotion, People, Process. Introduction to e-Models, e-Marketplace, Digital Communication market, Web & Social Network Models, Customer buying models, Loyalty models

Unit III: e-Customers **Hours: 7**
Introduction to e-Customers, Motivations, Expectations, Fears & Phobias, Online Buying Process, information processing, relationship & royalty, Communities & social networks, Customer profiles

Unit IV: e-Tools & Site Design **Hours:7**
Introduction to e-Tools, Technology development & customer impact, Interactive digital TV, Digital Radio, Mobile Devices, Interactive self-service kiosks, Convergence, Integrated Campaigns, Web-site design, Integrated design, online value proposition, Dynamic & aesthetics design

Unit V: Traffic Building **Hours: 7**
Search Engine Marketing, Online PR & Partnerships, Interactive Advertising, e-mail & viral marketing, Online traffic building, Control, Resourcing

Unit VI: e-CRM & e-Business **Hours: 7**
Introduction to e-CRM, Database marketing, e-CRM, Profiling, Personalization, Introduction to e-Business, e-Business Architecture & framework, e-business security.

Text Book: E-Marketing excellence: Planning & Optimizing your Digital Marketing, Dave Chaffey & P R Smith, 3rd Edition, Butterworth-Heinemann, Elsevier.

Reference Books:
1. Marketing 4.0: Moving from Traditional to Digital, Philip Kotler, H. Kartajaya, I. Setiawan, Wiley.
2. Business Marketing and Management Principles for IT and Engineering, D. N. Chorafas, CRC Press.
3. Marketing Management, Philip Kotler, Kevin Keller, 12th Edition, Pearson Prentice Hall.
4. Marketing Insights from A to Z, Philip Kotler, John Wiley & Sons..

5KS05 Open Elect. I (i) FUNDAMENTALS OF FINANCE & ACCOUNTING [L-3, T-0, C-3]

Course Prerequisite: Basic Knowledge of Mathematics
Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Fundamentals of Finance & Accounting by being able to do each of the following:
- Know and apply accounting and finance theory
- Critically evaluate financial statement information
- Evaluate and compare different investments

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Define bookkeeping and accounting
2. Explain the general purposes and functions of accounting
3. Explain the differences between management and financial accounting
4. Describe the main elements of financial accounting information ï assets, liabilities, revenue and expenses
5. Identify the main financial statements and their purposes.

Unit I: The basics of Accounting I **Hours: 7**

The Assets, Liabilities and Balance Sheets, Procedure for creating a Balance Sheet, Different forms of Balance Sheet, Basic concepts of Accounting

Unit II: The basics of Accounting II **Hours: 7**

The Profit & Loss Account, Cash Flow Statement, Creating Profit & Loss Account, Creating Cash Flow Statement, Book Keeping Basic terminology, Debt & Credit Convention

Unit III: Interpretation of Accounts **Hours: 8**

Accounting Rules, Reports, Assets, Liabilities, ShareholdersôEquity, P&L Statement,

Unit IV: Introduction to Financial Management **Hours:6**

What is Finance, Forms of Business Organization, Stock Price & Shareholder Value, Intrinsic Value, Stock Price, Business trends and ethics, Conflicts management.

Unit V: Financial Markets and Institutions **Hours: 7**

Financial Markets, Capital Allocation, Financial Institutions, Stock Market, Market for Common Stock, Stock Market Returns, Stock Market Efficiency

Unit VI: Financial Statements & Analysis **Hours: 7**

Financial Statements & Reports, Stockholdersô Equity, Free Cash Flow, Income Taxes, Analysis of Financial Statements: Ratio Analysis, Liquidity Ratios, Asset & Debt Management Ratio, Profitability Ratio, Trend Analysis

Text Books:

1. Accounts Demystified, 5th Edition, Anthony Rice, Pearson ï Prentice Hall
2. Fundamentals of Financial Management, 6th Edition, E. F. Brigham, J.F. Houston, Cengage Learning.

Reference Books:

1. Engineering Economics: Financial Decision Making for Engineering, N. M. Fraser, E. M. Jewkes, 5th Edition, Pearson Publication.
2. Financial Fundamentals for Engineers, Richard Hill & George Slot, Butterworth-Heinemann, Elsevier.
3. Financial Accounting, Jerry Weygandt, Paul Kimmel, Donald Kieso, 9th Edition, Wiley
4. Financial Accounting: Tools for Business Decision Making, Jerry Weygandt, Paul Kimmel, Donald Kieso, 6th Edition, Wiley Plus.

5KS05 ENTREPRENEURSHIP [L-3,T-0,C-3]

Course Prerequisite:

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Entrepreneurship by being able to do each of the following:

- Understand basic concepts in the area of entrepreneurship
- Understand the role and importance of entrepreneurship for economic development
- Develop personal creativity and entrepreneurial initiative,
- Adopt the key steps in the elaboration of business idea

Course Outcomes (Expected Outcome): On completion of this course, the students should be able to:

1. Analyse the business environment in order to identify business opportunities,
2. Identify the elements of success of entrepreneurial ventures,
3. Evaluate the effectiveness of different entrepreneurial strategies,
4. Specify the basic performance indicators of entrepreneurial activity,
5. Explain the importance of marketing and management in small businesses venture,
6. Interpret their own business plan.

Unit I: **Hours:6**

Introduction to Entrepreneurship: Introduction, Common Myths About Entrepreneurs, Types of Start- Up Firms, Changing Demographics of Entrepreneurs, Entrepreneurship Importance.

Recognizing Opportunities and Generating Ideas: Identifying and Recognizing Opportunities, Finding Gaps in the Marketplace, Techniques for Generating Ideas, Encouraging and Protecting New Ideas.

Unit II: H**ours:6**

Feasibility Analysis: Product/Service Feasibility Analysis, Industry/Target Market Feasibility Analysis, Organizational Feasibility Analysis and Financial Feasibility Analysis.

Writing A Business Plan: The Business Plan, Outline of the Business Plan, Presenting the Business Plan to Investors.

Unit III: **Hours:6**

Industry and Competitor Analysis: Industry Analysis, Industry Trends, The Five Competitive Forces Model, The Value of the Five Forces Model, Industry Types and the Opportunities, Competitor Analysis, Identifying Competitors, Sources of Competitive Intelligence, Completing a Competitive Analysis Grid. Developing an Effective Business Model: Business Models, Components of an Effective Business Model.

Unit IV: **Hours: 6**

Ethical and Legal Foundation: Initial Ethical and Legal issues facing a New Firm, Drafting a Founders Agreement, Avoiding Legal Disputes, Business Licenses and Permits, Choosing a Form of Business Organization.

Assessing A New Ventureôs Financial Strength and Viability: Introduction to Financial Management, Financial Statements and Forecasts, Pro forma Financial Statements.

Unit V: **Hours: 6**

New Venture Team: Creating a New-Venture Team, Rounding out the Team: The Role of Professional Advisers.

Getting Financing or Funding: The Importance of Getting Financing or Funding, Sources of Equity Funding, Sources of DEBT Financing, Creative Sources of Financing and Funding.

Unit VI: **Hours:6**

Unique Marketing Issues: Selecting a Market and Establishing a Position, Key Marketing issues for New Ventures, The 4Ps of Marketing for New Ventures.

The Importance of Intellectual Property: The Importance of Intellectual Property, Patents, Trademarks, Copyrights, Trade Secrets, Conducting an Intellectual Property Audit.

Text Book: Bruce R. Barringer, R. Duane Ireland, ñEntrepreneurship Successfully Launching New Venturesò, Pearson Education, Third Edition.

Reference Books:

1. Ram Chandran, ñEntrepreneurial Developmentò, Tata McGraw Hill, New Delhi
2. Khanka, S S. ñEntrepreneurial Developmentò, S Chand & Company Ltd. New Delhi
3. Badhai, B ñEntrepreneurship for Engineersò, Dhanpat Rai & Co. (p) Ltd.
4. Gupta and Srinivasan, ñEntrepreneurial Developmentò, S Chand & Sons, New Delhi.
5. Arya Kumar, Entrepreneurship, Pearson, Delhi
6. Poornima MCH, Entrepreneurship Development ï Small Business Enterprises, Pearson, Delhi
7. Sangeetha Sharma, Entrepreneurship Development, PHI Learning
8. Kanishka Bedi, Management and Entrepreneurship, Oxford University Press, Delhi

5KS06 DATABASE MANAGEMENT SYSTEMS LAB [P-2, C-1]

Course Prerequisite: Basic concept of programming, Basic concepts of data structures

Course Objectives:

- To study the ER model which provides a high level view of the issues in database design, to capture the semantics of realistic applications within the constraints of a data model.
- To study the primary data model (relational model) for commercial data processing applications.
- To study the standard structured query language and retrieve the information from the database in various ways.
- To study the integrity and security constraints of the database by enforcing constraints.

Course Outcomes (Expected Outcome) On completion of the course, the students will be able to

1. Design ER model for any kind of application.
2. Design and develop database.
3. Apply normalization.
4. Query the database.
5. Apply various integrity constraints
6. Build indices, views
7. Implement triggers, assertions

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

Practical 1: To Study a Database Modeling Tool.

Study of Data Modeling Tools:

Å Take a description of the enterprise, create its corresponding ER Diagram and build a database model using any modeling tool. The following basic features of the modeling should be covered while building the model:

Å Logical / Physical Modeling

Å Adding an entity / its attributes, relationships (all kinds of relationships viz., parent-child, foreign key references, one to many, many to many etc)

Å Forward / reverse engineering

Å Details of forward engineering / schema generation

Å Steps to generate the schema

Practical 2: To Study and implement DDL Commands

Implement the model created in Practical 1, in any of the DBMS like Oracle, MySQL, or Microsoft SQL Server database software.

- Creating the proper tables
- Insert the data into it.
- Study Dropping and Altering the Tables. Study the cascaded deletes.

Practical 3: To Study and implement DML Commands-I

- Å SQL queries : Write and execute different SQL queries
- Å Execute Simple queries using SELECT, FROM, WHERE clauses,
- Å In Where clause use different predicates involving OR,AND, NOT
- Å Rename operation
- Å Tuple Variables
- Å Write SQL for various String operations (%,_,*)
- Å Match beginning with
- Å Match ending with
- Å Substring
- Å Match exactly n characters
- Å Match at least n characters
- Å Sort the output of the query using Order by
- Å Write SQL using Having

Practical 4 : To Study and implement DML Commands-II Write SQL queries and perform

- Å Set membership operations
- Å In, not in
- Å Some
- Å All
- Å Exists and not exists, Test for emptyness using exists, not exists
- Å Test for absence of duplicates.
- Å Nested queries

Practical 5. Study and implement aggregation functions.

- Write different queries using following Aggregate functions
- Min (minimum 3 SQL queries)
- Max (minimum 3 SQL queries)
- Avg (minimum 3 SQL queries)
- Sum (minimum 3 SQL queries)
- Count (minimum 3 SQL queries)

Practical 6: Write SQL to create Views and Indexes.

Practical 7: Write SQL to perform the modifications to the database

Practical 8 : PL /SQL

Practical 9 : Database Access Using Cursors

Write a trigger to find the names and cities of customers who have more than xyz in any account.

Practical 10 : Triggers

- Å Write a trigger for dealing with the overdrafts (set the account balance to zero, and creating a loan in the amount of the overdraft. Keep account number as loan number in the loan table)
- Å Write a trigger for dealing with blank cities (set the city field to null when it is blank)

Practical 11: Procedures, functions

- Å Write atleast 2 functions, and demonstrate its use
- Å Write atleast 2 procedures, and demonstrate its use

Practical 12 : Web Programming with PL/SQL. (Contents beyond Syllabus)

HTTP, A Simple Example, Printing HTML Tables., Passing Parameters, Processing HTML Forms., Multi-Valued Parameters.

Practical 13: Develop a JDBC Applications, Retrieve the information by connecting to the database using a host language (JAVA, C, C++) (Contents Beyond Syllabus)

Practical 14: Web Programming with Java Servlets. (Connecting to the database) (Contents beyond Syllabus)

A Simple Servlet., HTTP Servlet API Basics.,HTML Form Processing in Servlets.

Practical 15: PHP : Develop a simple application to access the database using PHP (Contents beyond Syllabus)

Study of Open Source NoSQL Databases

Based on the concepts covered in text create a Mini Project:

Suggested Topics:

- i. Bank database (Given in Korth book)
- ii. University Database (Given in Korth book)
- iii. Airline Flight Information System.
- iv. Library Database Application.
- v. University Student Database.
- vi. Video Chain Database.
- vii. Banking Database.
- viii. BiBTeX Database.
- ix. Music Store Database.
- x. Online Auctions Database.
- xi. A Web Survey Management System.

Text Book: Korth, Sudarshan, Silberschatz, Database System Concept, Mc-Graw Hill Mysql Reference Manual (for Mysql database)

Reference Books: (may be 5 to 6)

1. Kevin Roebuck, ñStoring and Managing Big Data - NoSQL, HADOOP and Moreò, Emereopty Limited, ISBN: 1743045743, 9781743045749
2. Kristina Chodorow, Michael Dirolf, ñMangoDB: The Definitive Guideò ,O'Reilly Publications, ISBN: 978-1-449-34468-9.
3. Adam Fowler, ñNoSQL For Dummiesò, John Wiley & Sons, ISBN-1118905628
4. C J Date, ñAn Introduction to Database Systemsò, Addison-Wesley, ISBN: 0201144719.

5KS07 COMPILER DESIGN – Lab [P-2, C-1]

Course Prerequisite: Basic knowledge of C Programming, Data Structures, Theory of Computation.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Compiler Design by being able to do each of the following:

- Know the basic components of a Compiler.
- To implement Lexical Analyzer using Lex tool and Syntax Analyzer using Yaac Tool.
- To implement various parsing methods.
- To implement code optimization techniques .

Course Outcomes (Expected Outcome):

On completion of the course, the students will be able to

1. Identify the fundamentals of compiler and its phases.
2. Use the powerful compiler generation tools such as Lex and Yacc.
3. Write a lexical scanner, either from scratch or using Lex.
4. Develop program for solving parser problems.
5. Examine the various optimization techniques.

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

List of Experiments based on Syllabus: (Maximum 20)

1. Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs and new lines. It should also ignore comments. Although the syntax specification states that identifiers can be arbitrarily long, you may restrict the length to some reasonable value. Simulate the same in C language.
2. Write a C program to identify whether a given line is a comment or not.
3. Implement a C program to check parenthesis of regular expression is balanced or not.
4. Implement a C program to construct NFA from regular expression.
5. Implement a C program to simulate Deterministic Finite Automation (DFA) for a string which ending with ća, ća*b+, ćabb.
6. Write a C program to construct of DFA from NFA.
7. Implement a Lex program to verify the parenthesis of a given expression is balanced.
8. Implement a Lex program to recognize the token like Digit, Identifier & Delimiter.
9. Implement the Lexical Analyzer using JLex, flex or other lexical analyzer generating tools.
10. Implement a Lex program to a valid arithmetic expression and to recognize the identifier and operators present.
11. Implement a Lex program to count words, characters, lines, vowels and consonants from given input.
12. Implement a Lex program to check given number is positive negative or zero.
13. Implement a Lex program to generate string which is ending with zeros.
14. Implement LEX and Yacc tool to implement desk calculator.
15. Write a C program for constructing of SLR parsing.
16. Write a C program for constructing of LL (1) parsing.
17. Write a C program for constructing of LALR parsing.
18. Write a C program for constructing recursive descent parsing.
19. Write a C program to implement Program semantic rules to calculate the expression that takes an expression with digits, + and * and computes the value.
20. Write a C program for Tokenizing the file which reads a source code in C/C++ from an unformatted file and extract various types of tokens from it
21. Write functions to find FIRST and FOLLOW of all the variables / given grammar.
22. Implement a Shift Reduce Parser for the following productions.
23. E Ÿ E+E / E*E / a / b
24. Implement a symbol table containing functions create(), modify(), search(), display() and delete().
25. Implement three address Code for the input a=b*c.
26. Implement Recursive Decent Parser for the productions.

List of Experiments beyond Syllabus: (Maximum 05)

1. Convert the BNF rules into Yacc form and write code to generate Abstract Syntax Tree.
2. Write a C program to generate machine code from abstract syntax tree generated by the parser.
3. Write a Lex program to find out total number of vowels, and consonants from the given input string.
4. Implementation of Finite State machines DFA, NFAs .
5. Computation of Leading & Trailing Sets.

Text Book: Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman Compilers: ñPrinciples, Techniques and Toolsò, Pearson Education, Second Edition.

Reference Books:

1. Doug Brown, John Levine, and Tony Mason, ñLex & Yaccò, OôReilly & Associates, Inc., Second Edition.
2. Andrew Appel, ñModern Compiler Implementation in Cò, Cambridge University press.
3. K C. Louden ñCompiler Construction - Principles and Practiceò India Edition, CENGAGE.
4. Dick Grune, Kees van Reeuwijk, Henri E. Bal, Ceriel J.H. Jacobs and Koen Langendoen, ñModern Compiler Designò, Second Edition, John Wiley & Sons Publication.
5. Keith Cooper and Linda Torczon, ñEngineering: A Compilerò, Second Edition, Morgan Kaufmann Publication.

5KS09 C-Skill Lab – III [P-2, C-1]

Course Prerequisite: Basic knowledge of Web Development, HTML, CSS, JavaScript and IDE.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of C-Skill Lab - III by being able to do each of the following:

- To develop an ability to set up a local JS Library/Framework development Environment.
- To be able to install and implement different JS Libraries and Frameworks
- To be able to develop single-page/multi-page static and dynamic Web Applications.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Explain the various tools, packages and modules required for Web Development.
2. Discuss the workings of web server, cookies, routes, etc.
3. Develop a mobile application using JS Framework.
4. Design GUI using JS framework and/or Libraries.
5. Create applications using Angular, React, Node and Express.

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

List of Experiments based on Syllabus: (Maximum 20)

1. Introduction to the Node.js and its installation to print Hello World
2. To study built-in modules and implement the user defined built-in modules in the Node.js
3. To study HTTP module and implement Node.js as a web server
4. To study and implement Node.js File system module to read, write, create, update, delete and rename the file
5. To study the URL module of the Node.js and write a program that opens the requested file and returns the content of the file to the client. If anything goes wrong, throw a 404 error.
6. To convert the output "Hello World!" into upper-case letters by installing the ñupper-caseò package of NPM.
7. To study event handling in Node.js and demonstrate it using event module and EventEmitter object.
8. To study and implement the Formidable module of Node.js to upload the file on the server.
9. To study and implement the Nodemailer module of Node.js to send emails from your server.
10. To install MySQL and its driver and create connection with it using Node.js.
11. To demonstrate the creation database and table in MySQL using Node.js
12. To demonstrate the insertion of single and multiple records in the MySQL using ñINSERTò statement and Node.js
13. To demonstrate the display of records from the MySQL database using ñSELECTò statement and display it using Node.js
14. To demonstrate the display the records based on condition from the MySQL database using ñWHEREò statement using Node.js
15. To demonstrate deletion of records from database using ñDELETEò statement and Node.js
16. To demonstrate updating existing records in a table by using the "UPDATE" statement and Node.js
17. To demonstrate combining rows from two or more tables, based on a related column between them, by using a JOIN statement using Node.js

List of Experiments beyond Syllabus: (Maximum 05)

1. Create an Email sender app using Node.js
2. Create an Basic User database: Site in which User can Sign up/Login and can see other Userôs Profile Information.
3. Create a User model covering Registration, Email verification(send an email), login (with remember me, display user details and allow to save/update user details(DOB, Location, Hobbies etc or anything)
4. A random number generator web application.

Text Books:

1. Simon Holmes: Getting Mean with Mongo, Express, Angular, and Node, 2nd Edition, Manning.
2. Alex Banks and Eve Porcello: Learning React: Functional Web Development with React and Redux, OôReilly .

Reference Books:

1. ShyamSeshadri: Angular Up and Running, OôReilly
2. Akshat Paul and Abhishek Nalwaya: React Native for Mobile development, Apress.
3. Jos Dirksen: Learn Three.js, 3rd Edition, Packt Publishing.
4. Patrick Mulder and Kelsey Breseman: Node.js for Embedded Systems, OôReilly

5KS08 EMERGING TECHNOLOGY LAB I

5KS08 Emerging Technology Lab 1 is based on 5KS04 Professional Elective-I. Tentative FOSS Tools & Technology for Practicalôs are as follows:

AI : IBM Watson, Microsoft Cognitive Toolkit , TensorFlow, Apache SystemML, Caffe, OpenNN, Torch, Neuroph
DS :R, Python, Cassandra, Apache Hadoop,
IoT : Arduino, DeviceHive, Kaa, Home Assistant
Cyber Security: Kali Linux, OpenVPN, NMAP, Metasploit Framework

5KS08 DATA SCIENCE AND STATISTICS – LAB [P-2, C-1]

Course Prerequisite: Basic knowledge of Mathematics.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Data Science and Statistics by being able to do each of the following:

- Demonstrate knowledge of statistical data analysis techniques utilized in business decision making.
- Apply principles of Data Science to the analysis of business problems.
- Apply the learned concepts for the skillful data management.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Demonstrate proficiency with statistical analysis of data.
2. Build skills in transformation and merging of data for use in analytic tools.
3. Perform linear and multiple linear regression analysis.
4. Develop the ability to build and assess data-based models.
5. Evaluate outcomes and make decisions based on data.

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

List of Experiments based on Syllabus:

Introduction to R:
[1] To learn and implement the Basic Commands and Graphics in R
[2] To perform Indexing and Loading Data

Linear Regression:
[3] To learn different Libraries in R and To perform Simple Linear Regression and Multiple Linear Regression
[4] To learn Interaction Terms and to perform Non-linear Transformations of the Predictors
[5] To learn and evaluate Qualitative Predictors
[6] To learn to Write Functions

Logistic Regression, LDA, QDA, and KNN
[7] To perform Logistic Regression
[8] To perform Linear Discriminant Analysis
[9] To perform Quadratic Discriminant Analysis
[10] To implement K-Nearest Neighbors technique
[11] To use Caravan Insurance Data for LR, LDA, QDA, and KNN
Cross-Validation and the Bootstrap
[12] To learn and perform The Validation Set Approach
[13] To learn and perform Leave-One-Out Cross-Validation
[14] To learn and perform k-Fold Cross-Validation
[15] To learn and perform The Bootstrap
Subset Selection Methods
[16] To learn and perform Best Subset Selection
[17] To learn and perform Forward and Backward Stepwise Selection
[18] To learn to Choose Among Models Using the Validation Set Approach and Cross-Validation
Ridge Regression and the Lasso
[19] To learn and perform Ridge Regression
[20] To learn and perform The Lasso

PCR and PLS Regression
[21] To learn and perform Principal Components Regression
[22] To learn and perform Partial Least Squares

Non-linear Modeling
[23] To learn and perform Polynomial Regression and Step Functions
[24] To learn and perform Splines
[25] To learn and perform GAMs

Decision Trees
[26] To learn and perform Fitting Classiýcation Trees
[27] To learn and perform Fitting Regression Trees
[28] To learn and implement Bagging and Random Forests
[29] To learn and perform Boosting
Support Vector Machines
[30] To learn and perform Support Vector Classiýer
[31] To learn and perform Support Vector Machine
[32] To learn and perform ROC Curves
[33] To learn and perform SVM with Multiple Classes
[34] To use Gene Expression Data
Clustering
[35] To implement K-Means Clustering
[36] To implement Hierarchical Clustering
NCI60 Data Example
[37] To implement PCA on the NCI60 Data
To Cluster the Observations of the NCI60 Data

List of Experiments beyond Syllabus: (Maximum 05)

1. To implement the Association Rules
2. To implement the kernel method to increase data separation
3. Develop a data model and deploy it as R HTTP Services or by export
4. Develop a data model and present it to end user with proper presentations
5. Carry out your assigned task and present it to other data scientist with proper presentations

Text Books:
1. Cathy OĜNeil and Rachel Schutt: Doing Data Science, First Edition, 2014, OĜreilly Publications, ISBN: 978-1-449-35865-5
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani: An Introduction to Statistical Learning with Applications in R, First Edition, 2013, Springer-Verlag New York, ISBN: 978-1- 4614-7137-0

Reference Book:
Nina Zumel, John Mount: Practical Data Science with R, First Edition, 2014, Manning Publications Co., ISBN: 9781617291562.

B.E. (COMPUTER SCIENCE & ENGINEERING) SEM. VI

6KS01 SECURITY POLICY & GOVERNANCE [L-3, T-0, C-3]

Course Prerequisite: Data Communication and Networking,

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Security Policy & Governance by being able to do each of the following:
1. Understand the legal and regulatory environment and its relationship to Information Security.
2. Understand Information Security Concepts.
3. Understand the role of Information Security governance and planning within the organizational context.
4. Understand how to develop, implement and maintain various types of Information Security policies.
5. Understand risk management and its role in the organization.
6. Understand how to identify risk control classification categories

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. List and discuss the key characteristics of Information Security, Leadership and Management
2. Differentiate between Law and Ethics
3. Describe why ethical codes of conduct are important to Information Security
4. Discuss the importance, benefits and desired outcomes of Information Security Governance
5. Discuss the process of developing, implementing and maintaining various types of Information Security Policies.
6. Define Risk Management and its role in the organization.

Unit I: Hours:6
Introduction to the Management of Information Security: Introduction to Security, Key Concepts of Information Security: Threats and Attacks, Management and Leadership, Principles of Information Security Management.
Unit II: Hours:6
Compliance: Law and Ethics: Introduction to Law and Ethics, Ethics in information Security, Professional Organizations and Their Codes of Conduct, Information Security and Law Organizational Liability and the Management of Digital Forensics.
Unit III: Hours:6
Governance and Strategic Planning for Security: The Role of Planning, Strategic Planning, Information Security Governance, Planning for Information Security Implementation.

Unit IV: Hours:6
Information Security Policy: Policy, Enterprise Information Security Policy, Issue-Specific Security Policy, System-Specific Security Policy, Guidelines for Effective Policy Development and Implementation.
Unit V: Hours:6
Risk Management: Assessing Risk: Introduction to the Management of Risk in Information Security, The Risk Management Process.
Unit VI: Hours:6
Risk Management: Treating Risk: Introduction to Risk Treatment, Managing Risk, Alternative Risk Management Methodologies.
Text Book: Michael E. Whitman, Herbert J. Mofford, ñManagement of Information Securityò Sixth Edition, Cengage Learning, 2016.

Reference Books:
[1] Robert F Smallwood, ñInformation Governance for Business Documents and Recordsò Wiley 2014
[2] Michael E. Whitman and Herbert J. Mofford, ñPrinciples of Information Securityò Sixth Edition, Cengage Learning, 2018
[3] Krag Brotby, ñInformation Security Governance: A Practical Development and Implementation Approachò 2009 by John Wiley & Sons.
[4] Brijendra Singh, ñNetwork Security and Managementò Second Edition, PHI.
[5] Alan Calder and Steve Watkins, ñIT Governance an international guide to data security and ISO27001/ISO27002ò 2015, Kogan Page Limited.
[6] Evan Wheeler, ñSecurity Risk Management, Building an Information Security Risk Management Program from the Ground Upò 2011, Syngress publications.
[7] Mike Chapple, James Michael Stewart and Darril Gibson, ñCISSP® Certified Information Systems Security Professional Official Study Guideò Eighth Edition, 2018, John Wiley & Sons.

6KS02 DESIGN AND ANALYSIS OF ALGORITHMS [L-4, T-0, C-4]

Course Prerequisite: Any programming language, Discrete Mathematics and Data Structures.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Design and Analysis of Algorithms by being able to do each of the following:
1. To understand asymptotic analysis of algorithms.
2. To apply algorithmic strategies while solving problems.
3. Ability to analyze time and space complexity.
4. Demonstrate a familiarity with major algorithms.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Carry out the analysis of various Algorithms for mainly Time complexity.
2. Apply design principles and concepts to algorithm design.
3. Understand different algorithmic design strategies.
4. Analyze the efficiency of algorithms using time complexity.
5. Apply the standard sorting algorithms.

Unit I: Iterative Algorithm Design Issue: Hours: 8
Introduction, Use of Loops, Efficiency of Algorithms, Estimating & Specifying Execution Times, Order Notations, Algorithm Strategies, Design using Recursion
Unit II: Divide And Conquer Hours: 8
Introduction, Multiplication Algorithm and its analysis, Introduction to Triangulation, Covex Hulls, Drawbacks of D & C & Timing Analysis.
Unit III: Greedy Methods Hours: 8
Introduction, Knapsack Problem, Job sequencing with deadlines, Minimum Spanning Trees, Primôs Algorithms, Kruskalôs Algorithm, Dijkstras Shortest Path Algorithm.
Unit IV: Dynamic Programming Hours: 8
Introduction, Multistage Graphs, Traveling Salesman, Matrix multiplication, Longest Common Sub-Sequences, Optimal Polygon Triangulation, Single Source Shortest Paths.
Unit V: Backtracking Hours: 8
Combinational Search, Search & Traversal, Backtracking Strategy, Backtracking Framework, and Some typical State Spaces.
Unit VI: Efficiency of Algorithm Hours: 8
Polynomial Time & Non Polynomial Time Algorithms, Worst and Average case Behavior, Time Analysis of Algorithm, Efficiency of Recursion, Complexity, Examples of Complexity Calculation for Various Sorting algorithms. Time-Space Trade off and Time-Space Trade off in algorithm research.

Text Book: Dave and Dave: ñDesign and Analysis of Algorithmsò Pearson Education.

Reference Books:
[1] Aho,Hopcroft & Ullman ñThe Design & Analysis of Computer Algorithmsò, Addison-Wesley
[2] G. Brassard, P.Bratley: ñFundamentals of Algorithmicsò , PHI
[3] Horowitz & Sahani: ñ Fundamental Algorithmsò , Galgotia.
[4] Cormen, T.H, Lierson & Rivest: ñ Introduction to Algorithmsò, Mc Graw-Hill.

6KS03 SOFTWARE ENGINEERING [L-3, T-0, C-3]

Course Prerequisite: Fundamentals of Programming Languages.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Software Engineering by being able to do each of the following:
1. To learn and understand the principles of Software Engineering
2. To be acquainted with methods of capturing, specifying, visualizing and analyzing software requirements.
3. To apply Design and Testing principles to S/W project development.
4. To understand project management through life cycle of the project.
5. To understand software quality attributes.
6. To understand of the role of project management including planning, scheduling, risk management.

Course Outcomes (Expected Outcome): On completion of the course, student will be able toï
1. Decide on a process model for a developing a software project
2. Classify software applications and identify unique features of various domains
3. Design test cases of a software system.
4. Understand basics of Project management.
5. Plan, schedule and execute a project considering the risk management.
6. Apply quality attributes in software development life cycle.
7. Understand quality control and to ensure good quality software.

Unit I: Introduction to Software Engineering, Software Process Models Hours: 6
Evolving role of Software, Software crises & myths, Software engineering, Software process & process models, Linear sequential, prototyping ,RAD ,Evolutionary Product & Process, Project management concepts, People, Product, Process, Project W5HH principles, critical practice

Unit II: Project Management: Process, Metrics, And Estimations & Risks Hours:6
Measures, Metrics & Indicators. Metrics in process & project domains-software measurement, Metrics for software quality, small organization. Software projects Planning: Scope, resources, estimation, decomposition technique, Tools. Software risks: identification, risk projection, refinement & RMMM plan

Unit III: Project Scheduling & Quality Management Hours: 6
Project Scheduling: Concepts. Peoples Efforts. Task set, Task network. Scheduling. EV analysis, Project Plan. Software quality concepts. SQ Assurance, Software reviews, technical reviews, software reliability, ISO 900 L, SQA Plan. SCM process. Version control. SCM standard.

Unit IV: Requirement Engineering & System Engineering Hours:6
System engineering: Hierarchy, Business Process & Product engineering: Overviews. Requirement engineering, System modeling. Requirement analysis. Analysis principles. Software prototyping. Specification. Design Process. Design Principles & Concepts. Effective modular design. Design model & documentation.

Unit V: Software architecture & User interface design Hours: 6
Software architecture, Data Design, Architectural styles, Requirement mapping. Transform & Transaction mappings. User interface design: Golden Rule. UTD, Task analysis & modeling, ID activities, Tools, design evaluation. Component level design: Structure programming, Comparison of design notation.

Unit VI: Software Testing Hours: 6
Software testing fundamentals; test case design, White box testing. Basis path, control structure-, Black box-Testing, & for specialized environments. Strategic approach to S/W testing. Unit testing, integration testing, validation testing, and system testing. Debugging. Technical metrics for software.

Text Book: Pressman Roger. S: Software Engineering, A Practitionerôs Approach, TMH.

Reference Books:
[1] Somerville: Software Engineering (Addison-Wesley) (5/e)
[2] Fairly R: Software Engineering (McGraw Hill)
[3] Davis A: Principles of Software Development (McGraw Hill)
[4] Shooman, M.L: Software Engineering (McGraw-Hill)

6KS04 NATURAL LANGUAGE PROCESSING [L-3, T-0, C-3]

Course Prerequisite: Fundamentals of Artificial Intelligence.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Natural Language Processing by being able to do each of the following:
1. To learn the fundamentals of natural language processing
2. To understand the use of CFG and PCFG in NLP
3. To understand the role of semantics of sentences and pragmatics
4. To gain knowledge in Information Extraction.

Course Outcomes (Expected Outcome): On completion of the course, student will be able toï
1. Understand how to tag a given text with basic Language features
2. Design an innovative application using NLP components
3. Implement a rule-based system to tackle morphology/syntax of a language
4. Design a tag set to be used for statistical processing for real-time applications
5. Compare and contrast the use of different statistical approaches for different types of NLP applications.

Unit I: Overview and Morphology Hours: 6
Introduction, Models and Algorithms, Regular Expressions Basic Regular Expression Patterns, Finite State Automata, Morphology, Inflectional Morphology, Derivational Morphology, Finite-State Morphological Parsing

Unit II: Word Level Analysis Hours: 6
Role of language models. Simple N-gram models. Estimating parameters and smoothing. Evaluating language models. Part Of Speech Tagging and Sequence Labeling Lexical syntax. Hidden Markov Models. Maximum Entropy models.

Unit III: Syntactic Analysis Hours: 6
Context-Free Grammars, Grammar rules for English, Treebanks, and Normal Forms for grammar, Dependency Grammar, Syntactic Parsing, Ambiguity, Probabilistic CFG, and Probabilistic Lexicalized CFGs.

Unit IV: Semantic Analysis Hours: 6
Representing Meaning, Meaning Structure of Languages, First Order Predicate Calculus, Syntax-Driven Semantic Analysis, Semantic Attachments, Syntax-Driven Analyzer, Robust Analysis, Relations among Lexemes and their Senses, Word Sense Disambiguation

Unit V: Learning to Classify Text: Hours: 6
Supervised classification, further examples of supervised classification, Evaluation, Decision Trees, Naïve Bayes classifiers, Modelling Linguistic Patterns.

Unit VI: Extraction Information from Text: Hours: 6
Information Extraction, Chunking, Developing and Evaluating Chunks, Recursion in Linguistic Structure, Named Entity Recognition, Relation Extraction.

Text Books:
[1] Daniel Jurafsky, James H. Martin - Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
[2] Steven Bird, Ewan Klein and Edward Loper - Natural Language Processing with Python, First Edition, OReilly Media, 2009.
[3] Christopher D.Manning and Hinrich Schuetze - Foundations of Statistical Natural Language Processing, MIT press, 1999.

Reference Books:
[1] Breck Baldwin, Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
[2] Richard M Reese, Natural Language Processing with Java, OReilly Media, 2015.
[3] Nitin Indurkhya and Fred J. Damerau, Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
[4] Roland R.Hausser - Foundations of Computational Linguistics: Human Computer Communication in Natural Language, Paperback, MIT press,2011
[5] Tanveer Siddiqui, U.S. Tiwary, Natural Language Processing and Information Retrieval, Oxford University Press, 2008
[6] Daniel Jurafsky and James H. Martin - Speech and Language Processing, 2nd
[7] Edition , Prentice Hall,2008.
[8] Charu C.Aggarwal - Machine Learning for Text, Springer,2018 edition

6KS04 BIG DATA ANALYTICS [L-3, T-0, C-3]

Course Prerequisite: Knowledge of basic computer science principles and skills, Basic knowledge of Linear Algebra and Probability Theory, Basic knowledge of Data Base Management Systems

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Big Data Analytics by being able to do each of the following:
1. To know the fundamental concepts of big data and analytics.
2. To explore tools and practices for working with big data.
3. To know about the research that requires the integration of large amounts of data.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Work with big data tools and its analysis techniques.
2. Analyze data by utilizing clustering and classification algorithms.
3. Learn and apply different algorithms and recommendation systems for large volumes of data.
4. Perform analytics on data streams.
5. Learn NoSQL databases and management.

Unit I: Big Data Analytics and Lifecycle Hours: 6
Big Data Analytics: Big Data Overview, State of the Practice in Analytics, Key Roles for the New Big Data Ecosystem, Examples of Big Data Analytics, Data Analytics Lifecycle: Overview, Phase 1: Discovery, Phase 2: Data Preparation, Phase 3: Model Planning, Phase 4: Model Building, Phase 5: Communicate Results, Phase 6: Operationalize, Case Study: Global Innovation Network and Analysis (GINA).

Unit II: Review of Basic Data Analytics Methods, Clustering and Association Rules Hours: 7
Exploratory Data Analysis, Statistical Methods for Evaluation: Hypothesis Testing, Difference of Means, Wilcoxon Rank-Sum Test, Type I and II Errors, ANOVA, Overview of Clustering, K-means: Use Cases, Overview, Number of Clusters, Diagnostics, Additional Algorithms, Overview, Apriori Algorithm, Evaluation of Candidate Rules, Applications of Association Rules, An Example: Transactions in a Grocery Store, The Groceries Dataset, Frequent Itemset Generation, Rule Generation and Visualization, Validation and Testing, Diagnostics.

Unit III: Regression and Classification Hours: 7
Linear Regression: Use Cases, Model Description, Diagnostics, Logistic Regression: Use Cases, Model Description, Diagnostics, Reasons to Choose and Cautions, Additional Regression Models, Decision Trees: Overview of a Decision Tree, The General Algorithm, Decision Tree Algorithms, Evaluating a Decision Tree, Decision Trees, Naïve Bayes: Bayesô Theorem, Naïve Bayes Classifier, Smoothing, Diagnostics, Naïve Bayes, Diagnostics of Classifiers, Additional Classification Methods.

Unit IV: Time Series Analysis and Text Analysis Hours: 6
Overview of Time Series Analysis: Box-Jenkins Methodology, ARIMA Model: Autocorrelation Function (ACF), Autoregressive Models, Moving Average Models, ARMA and ARIMA Models, Building and Evaluating an ARIMA Model, Reasons to Choose and Cautions, Additional Methods, Text Analysis Steps, A Text Analysis Example, Collecting Raw Text, Representing Text, Term Frequencyð Inverse Document Frequency (TFIDF), Categorizing Documents by Topics, Determining Sentiments, Gaining Insights.

Unit V: Tool and Techniques: MapReduce & Hadoop Hours: 7
Big Data Tool and Techniques: Big Data Storage, High-Performance Architecture, HDFS, MapReduce and YARN, Big Data Application Ecosystem, Zookeeper, HBase, Hive, Pig, Mahout, Developing Big Data Applications: Parallelism, Myth, Application Development Framework, MapReduce Programming Model, Simple Example, More on MapReduce, Other Frameworks, The Execution Model, Analytics for Unstructured Data: Use Cases, MapReduce, Apache Hadoop, The Hadoop Ecosystem: Pig, Hive, HBase, Mahout, NoSQL.

Unit VI: Database Analytics, NoSQL and Graph Analytics Hours: 7
SQL Essentials, In-Database Text Analysis, Advanced SQL, NoSQL Data Management: What is NoSQL, Schema-less Models, Key-Value Stores, Document Stores, Tabular Stores, Object Data Stores, Graph Database, Communicating and Operationalizing an Analytics Project, Creating the Final Deliverables, Graph Analytics: Model, Triples, Graphs and Network Organization, Graph Analytics and Use Cases, Graph Analysis Algorithms, Technical Complexity, Features of Graph Analytic Platform, Data Visualization Basics.

Text Books:
[1] EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", 2015, John Wiley & Sons, Inc., ISBN: 978-1-118-87613-8.
[2] David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", First Edition, 2013, Morgan Kaufmann/Elsevier Publishers, ISBN: 978-0-12-417319-4.

Reference Books:
[1] Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", First Edition, 2014, Wiley Publishers, ISBN: 978-1-118-89271-8.
[2] Mohammad Guller, ñBig Data Analytics with Spark A Practitionerôs Guide to Using Spark for Large-Scale Data Processing, Machine Learning, and Graph Analytics, and High-Velocity Data Stream Processingò, First Edition, 2015, Apress Publisher, ISBN-13 (pbk): 978-1-4842-0965-3.
[3] Arshdeep Bahga & Vijay Madisetti, ñBig Data Science & Analytics: A Hands-On Approachò, First Edition, 2019, ISBN: 978-1-949978-00-1.

6KS04 SENSORS AND ACTUATORS [L-3, T-0, C-3]

Course Prerequisite: Internet of Things, Micro-technology

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Sensors and Actuators by being able to do each of the following:
1. To understand the fundamentals of sensors and actuators
2. An exposure to sensors and its importance in the real world
3. To understand functional safety in machinery and emergency stop applications

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Fabricate some of those sensors
2. Simulate sensors and characterize before fabricating it
3. Design application with sensors and actuators for real world

Unit I: Hours: 7
Introduction: Sensors and Actuators, Technologies related to Sensors: Data Logger, Metal Detector, Photoelectric Sensor, Global Positioning System, Wireless Sensor Network, Sonar, Echo Sounding, Level Sensor, Biosensor, Blood Glucose Monitoring, Load Cell

Unit II: Hours: 7
Application of Sensors: On-board Automobile Sensors, Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing, Medical Diagnostic Sensors, Sensors for Environmental Monitoring

Unit III: Hours: 7
Varied Types of Actuators: Pneumatic Actuator, Hydraulic Cylinder, Linear Actuator, Plasma Actuator, Rotary Actuator

Unit IV: Hours: 7
Actuators: Technologies and Devices- Pneumatic Motor, Pneumatic Cylinder, Hydraulic Press, Jackscrew, Hoist (Device), Electroactive Polymers, Roller Screw, MEMS Magnetic Actuator.

Unit V: Hours: 7
Remote Sensing: An Overview- Water Remote Sensing, Remote Sensing, Lidar, ERDAS Imagine, TerrSet, Remote Sensing (Archaeology)

Unit VI: Hours: 7
Rader and its application: Radar, Radar Imaging, Radar Navigation

Text Books:

[1] Princeton Brown, ñSensors and Actuators: Technology and Applicationsò, Library Press, 2017.
[2] D. Patranabis, ñSENSORS AND TRANSDUCERSò, Second Edition, PHI Learning Private Limited, 2003.

Reference Books:

[1] D.A. Hall and C.E.Millar, ñSensors and Actuatorsò, CRC Press, 1999.
[2] Nathan Ida, ñSensors, Actuators, and their Interfaces: A multidisciplinary introduction (Materials, Circuits and Devices)ò, Large Print, 2011.

6KSO4 CRYPTOGRAPHY [L-3,T-0,C-3]

Course Prerequisite: Discrete Structure & Graph Theory, Data Communication and Networking, Introduction to Cyber security

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Cryptography by being able to do each of the following:
1. Understand Security Concepts.
2. Know about various encryption techniques.
3. Understand the concept of public key cryptography.
4. Study about message authentication and hash functions.
5. Impart knowledge on Network security, Internet Security Protocols.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Classify the symmetric encryption techniques
2. Illustrate various public key cryptographic techniques
3. Evaluate the authentication and hash algorithms.
4. Discuss authentication applications
5. Summarize the intrusion detection and its solutions to overcome the attacks.
6. Understand basic concepts of system level security

Unit I: Hours: 6
Attacks on Computers and Computer Security: Introduction, Need for Security, Security Approaches, Principles of Security, Types of Attacks. Cryptography: Concepts and Techniques Introduction, Plain Text and Cipher Text, Substitution and Transposition Techniques, Encryption and Decryption, Symmetric and Asymmetric Key Cryptography, Stenography, Key Range and Key Size, Possible Types of Attacks

Unit II: Hours: 6
Symmetric Key Algorithms and AES: Introduction, Algorithm Types and Modes, An Overview of Symmetric Key Cryptography, Data Encryption Standard(DES), International Data Encryption Algorithm(IDEA), RC4, RC5, Blowfish, Advanced Encryption Standard(AES).

Unit III: Hours:6
Asymmetric Key Algorithms, Digital Signatures and RSA: Introduction, History and Overview of Asymmetric Key Cryptography, The RSA Algorithm, Symmetric and Asymmetric Cryptography, Digital Signatures, Knapsack and other Algorithms.

Unit IV: Hours:6

Digital Certificates and Public Key Infrastructure (PKI): Introduction, Digital Certificates, Private Key Management, The PKIX Model, Public Key Cryptography Standards (PKCS), XML,PKI and Security, Creating Digital Certificate.

Unit V: Hours:6

Internet Security Protocols: Introduction, Concepts, Secure Socket Layer(SSL), Transport Layer Security(TLS), Secure Hypertext Transport Protocol(SHTTP), Time Stamping Protocol(TSP), Secure Electronic Transaction(SET), SSL Versus SET, 3-D Secure Protocol, Electronic Money, Email Security, Wireless Application Protocol(WAP)Security, Security in GSM, Security in 3G.

Unit VI: Hours:6

User Authentication and Kerberos: Introduction, Authentication Basics, Passwords, Authentication Tokens, Certificate-based-Authentication, Biometric Authentication, Kerberos, Key Distribution Center(KDC), Security Handshake Pitfalls, Single Sign On (SSO) Approaches.

Text Book:

[1] Atul Kahate, ñ Cryptography and Network Securityò, McGraw Hill, Second Edition.

Reference Books:

[1] William Stallings, ñCryptography and Network Security, Principles and Practiceò, PHI Fourth Edition.
[2] Behrouz A. Forouzan and Debdeep Mukhopadhyay, ñCryptography and Network Securityò, McGraw Hill, Second Edition.
[3] Matt Bishop, ñComputer Security Arts and Scienceò, Pearson Education.
[4] Douglas R Stinson, ñCryptography, Theory and Practiceò CRC Press.
[5] Keith M Martin, ñEveryday Cryptography, Fundamental Principles and Applicationsò, Oxford University Press, Second Edition.

6KSO5 COMPUTATIONAL BIOLOGY [L-3, T-0, C-3]

Course Pre-requisite:

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Computational Biology by being able to do each of the following:
1. To familiarize the students with most basic and useful algorithms for sequence analysis
2. To aware the students with basic file formats
3. To transform the basic molecular data for interpreting their patterns for various analysis
4. To compare genomes of different species, gene finding, and gene regulation

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Understand what types of biological questions can be investigated using computers, and what limitations computational methods impose on the understanding of biology.
2. Describe the properties of DNA, RNA, and proteins, the relationships among these molecules.
3. Analyze how to convert a biological question into a computational problem that can be solved using computers.
4. Explain general approaches for solving computational problems, and will be able to apply these approaches to new problems you encounter.
5. Understand how implement the algorithms by writing computer programs.

Unit I: Cellular and Molecular Biology Fundamentals Hours: 6

The structure of DNA & RNA, Gene Structure and control, Tree of Life and evolution, Primary & Secondary Structure of Protein, Implications for Bioinformatics Protein fold to form compact structures. Dealing with Databases: Structure of databases, Types of databases, Data Quality.

Unit II: Sequence Alignments Hours: 6

Principles of sequence alignments, scoring alignments, substitution matrices, Inserting gaps, Types of Alignments, Searching Databases, Searching with Nucleic Acid or protein sequences, Protein Sequences Motifs or Patterns, Searching using Motifs and patterns, Patterns & protein function.

Unit III: Pairwise Sequence Alignments & Database Searching Hours:6

Substitution Matrices and scoring, Dynamic Programming Algorithms, Indexing Techniques & Algorithmic approximations, Alignments score significance, aligning complete genome sequences

Unit IV: Patterns Profiles and Multiple Alignments Hours:6

Profile & sequence logos, Profile Hidden Markov Models, Aligning Profiles, Multiple Sequence Alignment by Gradual Sequence Addition, Sequence Pattern Discovery.

Unit V: Revealing Genome Features Hours:6

Preliminary examination of Genome Sequence, Gene Predictions, Splice site Detection, Prediction of Promoter Regions, Confirming Predictions, Genome Annotation, Large Genome Comparisons.

Unit VI: Gene Detection and Genome Annotation Hours:6

Detection of Functional RNA Molecules using Decision Trees, Algorithms for Gene Detection in Prokaryotes, Features used in Eukaryotic Gene Detection, Predicting Eukaryotic Gene Signals, Predicting Exon/Intron Structure, Beyond the Prediction of Individual Genes.

Text Books:

[1] Understanding Bioinformatics , Marketa Zvelbil and Jeremy O. Baum, Garland Sceincem Taylor & Francis Group, LLC
[2] Bioinformatics: Principles and Applications, Bal, H. P. (2005), Tata McGraw-Hill.

Reference Books:

[1] Bioinformatics Algorithms ï Design and Implementation in Python, Miguel Rocha & Pedro Ferreira, Academic Press, Elsevier Inc.
[2] Bioinformatics Algorithms: An Active Learning Approach, Edition 2, Volume 1. Phillip Compeau & Pavel Pevzner.
[3] Bioinformatics computing, Bergeron, B. P. (2003), Prentice Hall Professional.
[4] Bioinformatics Technologies, Chen, Y. P. P. (Ed.). (2005). Springer.
[5] Bioinformatics for dummies, Claverie, J. M., & Notredame, C. (2011), John Wiley & Sons.
[6] Fundamental Concepts of Bioinformatics, Dan. E. Krane, & Raymer, M. L. (2003), Pearson Education International.

6KSO5 CYBER LAWS & ETHICS [L-3,T-0,C-3]

Course Prerequisite: Basic Knowledge of Internet

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Cyber Laws & Ethics by being able to do each of the following:

1. Understand Cyber Space, Cyber Crime, Cyber Laws, Information Technology, Internet, Internet Services
2. Know Legal Aspects of Regulation concerned with Cyber Space, Technology and Forms of Cyber Crimes
3. Understand Computer Crimes and Cyber Crimes, Cyber Crime in Global and Indian Response.
4. Understand Criminal Liability, Cyber Crime implications and challenges.
5. Learn Precaution & Prevention of Cyber Crimes, Human Rights perspective of Cyber Crime

Course Outcomes (Expected Outcome): On completion of this course, the students should be able to:

1. Understand Cyber Space, Cyber Crime, Information Technology, Internet & Services.
2. List and discuss various forms of Cyber Crimes
3. Explain Computer and Cyber Crimes
4. Understand Cyber Crime at Global and Indian Perspective.
5. Describe the ways of precaution and prevention of Cyber Crime as well as Human Rights.

Unit I: Hours:6

Information Technology & Cyber Crimes: Introduction, Glimpses, Definition and Scope, Nature and Extent, Know no Boundaries, Rapid Transmission and Accuracy, Diversity and Span of Victimization, Cyber World, Inadequacy of Law, Influence of Teenagers Information Technology: Definition & Perspective, Growth & Future, Various Facets & Dimensions. Regulatory Perspective on Technology: Impact of Information and Technology, Regulation of Cyber Space, Legal Aspects of Regulation.

Unit II: Hours:6

Technology & Forms of Cyber Crimes: Influence of Technology on Criminality, Forms of Cyber Crimes.
Computer Crimes & Cyber Crimes: A Criminological Analysis Computer Crimes and Cyber Crimes: Terminological Aspects, Opportunities to Cyber Criminals, Motives of Offenders, Problems Affecting Prosecution, Cyber Crimes: Challenges of Prevention and Control, Need and Prospects (~f Criminological Research.

Unit III: Hours:6

Cyber Crimes 'and Global Response: Global Perspective, Country wise Legal Response, Country wise Analysis. Cyber Crimes and Indian Response: Introduction, The Indian Information Technology Act 2000,
Preamble & Coverage, Nature of Offences and Penalties, Miscellaneous and Subsidiary Provisions Certain Shortcomings, Future Prospects and Needs.

Unit IV: Hours:6

Mens Rea & Criminal Liability: Introduction, Historical Perspectives, Mens Rea in Indian Criminal Law, Mens Rea in English Criminal Law, Abetment of Offence, Criminal Liability and Role of Mens Rea in Indian Information Technology Act, 2000 Investigation in Cyber Crimes: Implications and Challenges: : Introduction, Procedural Aspects, Issues, Complications and Challenges Concerning Cyber Crimes, Problems and Precautionary measures for Investigation.

Unit V: Hours:7

Cyber Crimes : Discovery and Appreciation of Evidences: Introduction, Law of Evidence, Evidences in Cyber Crimes : Challenges and Implications, Computer Generated Evidence and their Admissibility, Judicial Interpretation of Computer related Evidence Prevention of Cyber Crimes :National and International Endeavours: Introduction, International Services on Discovery and Recovery of Electronic and Internet Evidence, International Organisation on Computer Evidence (IOCE), OECD Initiatives, Efforts of G-7 and G-8 Groups, Endeavours of Council of Europe, Measures of United Nations, Efforts of WTO, Measures of World Intellectual Property Organisation (WIPO),Interpol and its Measures, Efforts in India, Need of International Assistance and Appropriate Amendments, U.S. Laws on Cyber Crimes, U.S. Case-law on Cyber Evidences and Related Issues

Unit VI: Hours:7

Human Rights Perspectives Cyber Crimes: Introduction, Ideological Aspects, Fundamental Rights and Civil Liberties, Various Issues and Challenges. Cyber Crimes : Precaution and Prevention: Introduction, Awareness and Law Reforms, Improving Criminal Justice Administration, Increasing International Cooperation, Curricular Endeavours and Checking Kids' Net Addiction, Role of Guardians, Mobile Pornography: No Nearer Solution in Sight, Self-regulation in Cyber Space.

Text Book:

[1] Dr Pramod Kr.Singh, ñLaws on Cyber Crimes [Along with IT Act and Relevant Rules]ò Book Enclave Jaipur India.

Reference Books:

[1] Craig B, ñCyber Law: The Law of the Internet and Information Technologyò. Pearson Education.
[2] Pawan Duggal, ñCyber Lawsò Universal Law Publishing.
[3] K.Kumar,ò Cyber Laws: Intellectual property & E Commerce, Securityò, First Edition, Dominant Publisher, 2011.
[4] Rodney D. Ryder, ñGuide to Cyber Lawsò, Second Edition, Wadhwa And Company, New Delhi, 2007.
[5] Vakul Sharma, "Handbook of Cyber Laws" Macmillan India Ltd, Second Edition, PHI, 2003.
[6] Justice Yatindra Singh, "Cyber Laws", Universal Law Publishing, First Edition, New Delhi, 2003.
[7] Sharma, S.R., ñDimensions of Cyber Crimeò, Annual Publications Pvt. Ltd., First Edition, 2004.
[8] Augastine, Paul T., ñCyber Crimes and Legal Issuesò, Crecent Publishing Corporation, 2007.

6KS05 INTELLECTUAL PROPERTY RIGHTS [L-3,T-0,C-3]

Course Prerequisite: Basic knowledge of Communication skills, Soft skills, Presentation and Ethics.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Intellectual Property Rights in the following:

1. This course is intended to impart awareness on Intellectual Property Rights (IPR) and various regulatory issues related to IPR
2. To make familiarizing students with the shades of Intellectual Property Rights (IPR) so as to help them integrate the IPR process in their project and research activities.
3. To make the students familiar with basics of IPR and their implications in Project research, development and commercialization.
4. To impart awareness on intellectual property rights and various regulatory issues related to IPR.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Demonstrate a breadth of knowledge in Intellectual property.
2. Assess fundamental aspects of Intellectual Property Rights.
3. Discuss Patents, Searching, filling and drafting of Patents
4. Discuss the basic principles of geographical indication, industrial designs, and copyright.
5. Explain of Trade Mark and Trade Secret.
6. Investigate current trends in IPR and Government initiatives in fostering IPR.

Unit I: Overview of Intellectual Property Rights Hours: 06

Discovery, Invention, Creativity, Innovation, History & Significance of Intellectual Property Rights (IPR), Overview of IPR - Patent, Copyright, Trade Mark, Trade Secret, Geographical Indication, Industrial Design & Integrated Circuit, Non-patentable criteria.

Unit II: Patents Hours: 08

Patents: Patents- Patentability Criteria, Types of Patents-Process, Product & Utility Models, Software Patenting and protection, Overview of Patent Search-Types of Searching, Public & Private Searching Databases, Basics of Patent Filing & Drafting, Indian Patents Law Patents - Elements of Patentability: Novelty, Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and license , Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board.

Unit III: Copyrights Hours: 06

Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties ï Related Rights - Distinction between related rights and copyrights.

Unit IV: Trademarks Hours: 07

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board.

Unit V: Design & Geographical Indication Hours: 07

Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection. Geographical indication: meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection.

Unit VI: IPR: Current Contour Hours: 06

India`s New National IP Policy, 2016 ï Govt. of India step towards promoting IPR ï Govt. Schemes in IPR ï Career Opportunities in IP - IPR in current scenario with case studies.

Text Books:

[1] K. V. Nithyananda (2019), ñIntellectual Property Rights: Protection and Managementò, IN: Cengage Learning India Private Limited.
[2] P. Neeraj and D. Khusdeep (2014), ñIntellectual Property Rightsò, PHI learning Private Limited.

Reference Books:

[1] Deborah E. Bouchoux, ñIntellectual Property for Paralegals ï The law of Trademarks, Copyrights, Patents & Trade secretsò, 4th Edition, Cengage learning, 2012.
[2] N. S. Gopalakrishnan and T. G. Agitha, ñPrinciples of Intellectual Propertyò, Eastern Book Company, Lucknow, 2009.
[3] M. M. S. Karki, ñIntellectual Property Rights: Basic Conceptsò, Atlantic Publishers, 2009.
[4] Ganguli Prabuddha, ñIntellectual Property Rights--Unleashing the Knowledge Economyò, Tata McGrawHill, 2001.
[5] V. K. Ahuja, ñLaw relating to Intellectual Property Rightsò. India, IN: Lexis Nexis, 2017.
[6] P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.
[7] Ajit Parulekar and Sarita Dô Souza, Indian Patents Law ï Legal & Business Implications; Macmillan India ltd, 2006.
[8] B. L. Wadehra. Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000.
[9] Ganguli Prabuddha, ñGearing up for Patentsé The Indian Scenarioò, Universities Press, 1998.

6KS06 DESIGN AND ANALYSIS OF ALGORITHMS – LAB [P-2, C-1]

Course Prerequisite: Any programming language, Discrete Mathematics and Data Structures

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Design and Analysis of Algorithms by being able to do each of the following:
1. To understand asymptotic analysis of algorithms.
2. To apply algorithmic strategies while solving problems.
3. Ability to analyze time and space complexity.
4. Demonstrate a familiarity with major algorithms.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Carry out the analysis of various Algorithms for mainly Time complexity.
2. Apply design principles and concepts to algorithm design.
3. Understand different algorithmic design strategies.
4. Analyze the efficiency of algorithms using time complexity.
5. Apply the standard sorting algorithms.

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

List of Experiments based on Syllabus: (Maximum 20)

[1] Implement C programs to perform recursive calls using the following searching algorithms.
   1. Linear Search when the list is given.
   2. Binary Search when the given list is not sorted.

[2] Study and analyze to sort an array of integers using merge sort.
[3] Implement and analyze to sort an array of integers using quicksort.
[4] Write a program to implement the Closest Pair of Points problem using the divide and conquer strategy.
[5] Study and Implement the Divide and Conquer strategy using the Merge sort Algorithm and determine the complexity of an algorithm. DATA- {23, 12, 3, 5, 89, 1, 24}
[6] Write a C program for Implementing (n X n) matrix multiplication using the Strassen matrix multiplication algorithm.
[7] Explain the knapsack algorithm to find an optimal solution of getting maximum profit and implement using the program.
[8] Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm and implement using C.
[9] Implement programs to find minimum cost spanning trees from a given graph using Primôs algorithm.
[10]Implement Primôs algorithm to find the Minimum Cost Spanning Tree of an undirected graph using the program.
[11] Develop a program to implement Floyd's algorithm which will produce the shortest distance between all vertex pairs of a weighted graph.

[12] Implement programs to find the shortest path in a given graph using Dijkstraõs algorithm.
[13] Implement programs factorial knapsack problem.
[14] Develop a program to implement Strassenõs matrix multiplication algorithm.
[15] Implement programs to implement LCS problems using Dynamic Programming.
[16] Develop a program to implement matrix chain multiplication problems using dynamic programming.
[17] Explain Breadth-First Search and Implement BFS to print all the nodes reachable from a given starting node in a digraph.
[18] Develop a program to Print all the nodes reachable from a given starting node in a digraph using Depth First Search.
[19] Study an algorithm Tower of Hanoi where the aim is to move the entire stack to another rod for n=3 and understand the concept of recursion.
[20] Implement C programs N Queen's problem using Back Tracking.

List of Experiments beyond Syllabus: (Maximum 05)

[1] Implement the Work Function Algorithm and the Greedy Algorithm for the k-Server problem on graph metrics.
[2] Design and Implement Boyer Moore Algorithm for Pattern Searching.
[3] Design and Implement Topological Sort of a graph using departure time of vertex.
[4] Implement programs to find an s-t cut of minimum capacity. Minimum Cut Problem s 2 3 4 5 6 7 t 15 5 30 15 10 8 15 9 6 10 15 4 4 A Capacity = 10 + 8 + 10 = 28
[5] Implement programs to s-t flow of maximum value. Maximum Flow Problem 10 9 9 14 4 10 4 8 9 1 0 0 0 14 capacity flow s 2 3 4 5 6 7 t 15 5 30 15 10 8 15 9 6 10 15 4 4 0 Value = 28

Text Books:
[1] Dave and Dave: ñDesign and Analysis of Algorithmsò Pearson Education.

Reference Books:
[1] Aho,Hopcroft & Ullman ñThe Design & Analysis of Computer Algorithmsò, Addison-Wesley
[2] G. Brassard, P.Bratley: ñFundamentals of Algorithmicsò , PHI
[3] Horowitz & Sahani: ñ Fundamental Algorithmsò , Galgotia.
[4] Cormen, T.H, Lierson & Rivest: ñ Introduction to Algorithmsò, Mc Graw-Hill.

6KS07 SOFTWARE ENGINEERING LAB.

Course Prerequisite: A Scripting Language, IDEs (Integrated Development Environment), Databases, Software Development Life Cycle (SDLC)

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Software Engineering by being able to do each of the following:
1. Impart state-of-the-art knowledge on Software Engineering and UML in an interactive manner
2. Present case studies to demonstrate the practical applications of different concepts
3. Provide a scope to the students where they can solve small, real-life problems
4. All the while it is intended to present Software Engineering as an interesting subject to the students where learning and fun can go alongside.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Understand basic Software engineering methods and practices, and their appropriate application.
2. Describe software process models such as the waterfall and evolutionary models.
3. Discuss role of project management including planning, scheduling and, risk management.
4. Explain data models, object models, context models and behavioral models.
5. Understand of different software architectural styles and Process frame work.

List of experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

[1] Identifying the Requirements from Problem Statements
Requirements, Characteristics of Requirements, Categorization of Requirements, Functional Requirements, Identifying Functional Requirements
[2] Estimation of Project Metrics
Project Estimation Techniques, COCOMO, Basic COCOMO Model, Intermediate COCOMO Model, Complete COCOMO Model, Advantages of COCOMO, Drawbacks of COCOMO, Halstead's Complexity Metrics
[3] Modeling UML Use Case Diagrams and Capturing Use Case Scenarios
Use case diagrams |,Actor , Use Case , Subject , Graphical Representation , Association between Actors and Use Cases , Use Case Relationships , Include Relationship , Extend Relationship , Generalization Relationship ,Identifying Actors , Identifying Use cases , Guidelines for drawing Use Case diagrams
[4] E-R Modeling from the Problem Statements
Entity Relationship Model , Entity Set and Relationship Set , Attributes of Entity , Keys , Weak Entity , Entity Generalization and Specialization ,Mapping Cardinalities , ER Diagram , Graphical Notations for ER Diagram , Importance of ER modeling
[5] Identifying Domain Classes from the Problem Statements
Domain Class , Traditional Techniques for Identification of Classes ,Grammatical Approach Using Nouns , Advantages , Disadvantages ,Using Generalization ,Using Subclasses , Steps to Identify Domain Classes from Problem Statement , Advanced Concepts

[6] State chart and Activity Modeling
State chart Diagrams , Building Blocks of a State chart Diagram , State , Transition , Action , Guidelines for drawing State chart Diagrams , Activity Diagrams , Components of an Activity Diagram, Activity , Flow , Decision , Merge , Fork ,Join , Note , Partition ,A Simple Example , Guidelines for drawing an Activity Diagram
[7] Modeling UML Class Diagrams and Sequence diagrams
Structural and Behavioral aspects , Class diagram , Elements in class diagram , Class , Relationships , Sequence diagram , Elements in sequence diagram , Object , Life-line bar , Messages
[8] Modeling Data Flow Diagrams
Data Flow Diagram, Graphical notations for Data Flow Diagram, Explanation of Symbols used in DFD , Context diagram and leveling DFD
[9] Estimation of Test Coverage Metrics and Structural Complexity
Control Flow Graph, Terminologies, McCabe's Cyclomatic Complexity, Computing Cyclomatic Complexity, Optimum Value of Cyclomatic Complexity, Merits , Demerits
[10] Designing Test Suites
Software Testing , Standards for Software Test Documentation , Testing Frameworks , Need for Software Testing , Test Cases and Test Suite , Types of Software Testing , Unit Testing , Integration Testing , System Testing , Example , Some Remarks.

Software Requirements: StarUML

Text Book: Pressman Roger. S: Software Engineering, A Practitionerôs Approach, TMH.

Reference Books:

[1] Somerville: Software Engineering (Addison-Wesley) (5/e)
[2] Fairly R: Software Engineering (McGraw Hill)
[3] Davis A: Principles of Software Development (McGraw Hill)
[4] Shooman, M.L: Software Engineering (McGraw-Hill).

6KS09 C SKILL LAB IV– LAB (DevOps) [P-2, C-1]

Course Prerequisite: Basic knowledge on SDLC and STLC

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of DevOps learning by being able to do each of the following:
1. Learn what Jenkins, continuous integration is and where does Jenkins fits into SDLC (Software Development Life Cycle)
2. Learn how to setup Jenkins and use Jenkins on their systems, create and configure jobs in Jenkins
3. Learn how to use and manage plugins, how to create and manage users in Jenkins
4. Learn how to deploy application on server, how to work with multiple nodes
5. Learn how to create pipelines

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Install and setup of Jenkins on your systems
2. Create and run jobs in Jenkins
3. Add and manage plugins. Use plugins in jobs
4. Create and run pipelines in Jenkins
5. Setup, configure, and deploy jobs

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)
List of Experiments based on Syllabus: (Maximum 20)

1. Study and implement Linux commands
2. Study practical on installation of java, Tomcat Server
3. Study practical on software development life cycle
4. Study practical on DevOps life cycle & stages
5. Study practical on DevOps Tools (Docker, Jenkins, Git, Jira, copado)
6. Learn about DevOps Pipeline (CI /CD) using any tool
7. Study Practical on AWS for DevOps
8. Study Practical on Microsoft Azur for DevOps
9. Study Practical on Google Cloud for DevOps
10. Study Practical on Salesforce with Copado for DevOps
11. To setup and configure of Jenkins
12. To create Job and manage it using Jenkins
13. To experiment plugin management with jenkins
14. To study and demonstrate User role creation and management using Jenkins
15. To study and demonstrate Integration with Git using Jenkins
16. To study and demonstrate Automated deployments using Jenkins
17. To study and demonstrate Build and delivery pipelines using Jenkins
18. To study and demonstrate Job Parameterization using Jenkins
19. To study and demonstrate Command line executions using Jenkins
20. To study and demonstrate Jenkins node management

List of Experiments beyond Syllabus: (Maximum 05)

1. Learn how to setup Jenkins on docker
2. Learn how to do Jenkins maintenance
3. Learn how to work with Git and Jenkins

Text Book: John Ferguson Smart: Jenkins: The Definitive Guide, O'Reilly Media, Inc.

Reference Books:

[1] Gene Kim, Jez Humble, Patrick Debois, and John Willis,: The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations
[2] Gene Kim, Kevin Behr, and George Spafford,: The Phoenix Project: A Novel About IT, DevOps, and Helping Your Business Win,
[3] Andrew Davis, : Mastering Salesforce DevOps: A Practical Guide to Building Trust While Delivering Innovation, Apress

6KS08 EMERGING TECHNOLOGY LAB II

6KS08 Emerging Technology Lab II is based on 6KS04 Professional Elective-II. Tentative FOSS Tools & Technology for Practicalôs are as follows:

AI : Natural Language Toolkit (NLTK),SpaCy, PyTorch-NLP, Natural, Retext, TextBlob

DS : KNIME, Spark, Neo4J, MongoDB, Hive, Storm,

IoT : Devicehub, Zetta, Node-RED, Flutter, M2MLabs Mainspring

Cyber Security : VeraCrypt, ModSecurity, AdBlocker, CheckShortURL, SPAMfighter, SpamBully

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B.E. COMPUTER ENGINEERING (SEM. V& VI)

SYLLABUS OF B.E. SEM. V (COMPUTER ENGINEERING)

5KE01 DATABASES [L-4, T-0, C-4]

Course Prerequisite: Discrete Mathematics, Data Structures and Algorithm.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Databases by being able to do each of the following:

1. To understand the fundamental concepts of database management system.
2. To learn database query languages.
3. To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.
4. To understand the query processing and optimization.
5. To learn basics of transaction management and concurrency control.

Course Outcomes (Expected Outcome):

On completion of the course, the students will be able to

1. Model, design and normalize databases for real life applications.
2. Discuss data models, conceptualize and depict a database system using ER diagram.
3. Query Database applications using Query Languages like SQL.
4. Design & develop transaction processing approach for relational databases.
5. Understand validation framework like integrity constraints, triggers and assertions.

Unit I: Introduction to DBMS **Hours: 8**

Database System Applications, Purpose of database systems, View of Data, Database Languages Database Architecture, Database Users and Administrators, Entity- Relationship Model, Constraints, Removing redundant attributes in Entity sets, E-R diagrams, Reduction to Relational Schemas, E-R design issues, Extended E-R Features

Unit II: Relational Algebra, SQL **Hours: 8**

Relational Model: Structure of Relational Databases, Database schema, keys, schema diagram, relational query languages, relational operators, The Relational Algebra,Overview of SQL query language, SQL data definition, Basic Structure of SQL queries, Additional basic operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the DatabaseOperations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database,Join expressions, Views

Unit III: Relational Database Design **Hours: 8**

Integrity Constraints, SQL data types and schemas, Authorization, Triggers, Features of good relational designs,atomic domains and First Normal Form, decomposition using functional dependencies, Functional dependency theory, Algorithms for decomposition, Decomposition using multivalued dependencies, More Normal Forms, Database Design Process.

Unit IV: Query Processing and Query Optimization **Hours: 8**
Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions, Query Optimization: Overview, Transformation of Relational Expressions, Estimating Statistics of Expression Results, Choice of Evaluation Plans, Materialized Views.

Unit V: Transaction Management **Hours:8**
Transaction Concept, Simple transaction model, Storage structure, Transaction Atomicity and Durability, transaction isolation, Serializability, transaction isolation and atomicity, transaction isolation levels, Implementation of Isolation levels, Transactions as SQL statements

Unit VI: Concurrency Control and recovery system **Hours:8**
Lock-Based Protocols, Deadlock Handling, Multiple Granularities, Timestamp- Based Protocols, Validation-Based Protocols, Multiversion schemes, Recovery system :Failure classification, Storage , Recovery & Atomicity, Recovery algorithm, buffer management, Failure with loss of nonvolatile storage, early lock release and logical undo operations, , Remote Backup Systems

Text Book: Abraham Silberschatz, Henry F. Korth, S. Sudarshan, DATABASE SYSTEM CONCEPTS, Sixth Edition, McGraw Hill.

Reference Books:
1. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, McGraw-Hill
2. Shamkant B. Navathe, RamezElmasri, Database Systems, Pearson Higher Education
3. Garcia-Molina, Ullman, Widom: Database System Implementation, Pearson education.
4. S. K. Singh: Database Systems, Concepts, Design and Applications, Pearson Education.
5. G.K. Gupta: Database Management Systems, McGraw Hill.
6. Toledo and Cushman: Database Management Systems, (Schaumôs Outlines)

5KE02 COMPILERS [L-3, T-0, C-3]

Course Prerequisite: Basic knowledge of Discrete Mathematics, Theory of Computation

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Compilers by being able to do each of the following:
1. To learn concepts of programming language translation and phases of compiler design
2. To understand the common forms of parsers.
3. To study concept of syntax directed definition and translation scheme for the representation of language
4. To illustrate the various optimization techniques for designing various optimizing compilers.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Describe the fundamentals of compiler and various phases of compilers.
2. Design and implement LL and LR parsers
3. Solve the various parsing techniques like SLR, CLR, LALR.
4. Examine the concept of Syntax-Directed Definition and translation.
5. Assess the concept of Intermediate-Code Generation and run-time environment
6. Explain the concept code generation and code optimization.

Unit I: Introduction to Compiler **Hours: 06**
Introduction to Compilers: Language Processor, The Structure of a Compiler. Lexical Analysis: The role of lexical analyzer, Input Buffering, Specification of tokens, Recognition of tokens, The lexical analyzer generator Lex, Finite Automata, From Regular Expressions to Finite Automata, State minimization of DFA.

Unit II: Syntax Analysis **Hours: 07**
Syntax Analysis: The role of the parser, Review of context free grammar for syntax analysis: Parse Tree and Derivation, Ambiguity in Grammar, Elimination of left recursion and left factoring. Top down parsing: recursive descent parsing, predictive parsers, Transition diagrams for predictive parsers, FIRST and FOLLOW, LL (1) Grammars, Construction of predictive parsing tables, Non recursive predictive parsing, Error recovery in predictive parsing.

Unit III: Bottom up parsing **Hours: 07**
Bottom up parsing: Handle pruning, Stack implementation of Shift Reduce Parsing, conflicts during shift reduce parsing Introduction to LR parsing: Simple LR, Items and the LR(0) Automation, The LR-Parsing algorithm, Construction of SLR parsing table, More powerful LR Parsers: canonical LR(1) Items, Constructing LR(1) sets of items and canonical LR(1) parsing tables, Constructing LALR parsing tables, The parser generator Yacc.

Unit IV: Syntax Directed Translation **Hours: 07**
Syntax Directed Translation: Syntax directed definitions, Inherited and synthesized attributes, Evaluation orders of SDDôs: Dependency Graphs, S-attributed definitions, L-attributed definition. Application of Syntax-Directed Translation: Construction of syntax trees. Syntax-directed Translation Schemes.

Unit V: Intermediate-Code Generation **Hours: 07**

Intermediate-Code Generation: Variants of Syntax Trees: Directed Acyclic Graphs(DAG), Three Address Code. Run Time Environments: Storage Organization, Static versus Dynamic Storage Organization, Stack Allocation of Space: Activation trees, Activation Records, Calling Sequences, Variable- Length data on stack. Access to Nonlocal Data on the Stack. Heap Manager: The Memory Manager. Introduction to Garbage Collection: Design Goals for Garbage Collectors.

Unit VI: Code Generation **Hours:06**

Code Generation: Issues in Design of a Code generator, The Target Language, Address in the target code, Basic blocks and flow graphs. Optimization of Basic Blocks, Peephole Optimization and The Principal sources of Optimization.

Text Book: Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman Compilers: ñPrinciples, Techniques and Toolsò, Pearson Education Second Edition.

Reference Books:

1. D. M. Dhamdhere, Compiler Constructionð Principles and Practice, (2/e), Macmillan India.
2. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman Compilers: ñPrinciples, Techniques and Toolsò, Pearson Education (Low Price Edition).
3. Andrew Appel, Modern Compiler Implementation in C, Cambridge University press
4. K C. Louden ñCompiler Constructionð Principles and Practiceò India Edition, CENGAGE.
5. Bennett J.P., ñIntroduction to Compiling Techniquesò, 2/e (TMH).

5KE03 COMPUTER ORGANIZATION & ARCHITECTURE [L-3, T-0, C-3]

Course Pre-requisite:
Microprocessor & Assembly Language Programming.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Computer Organization & Architecture by being able to do each of the following:

1. To discuss the basic concepts and structure of computers.
2. To solve concepts of arithmetic operations.
3. To understand addressing modes and memory organization.
4. To analyze conceptualize multitasking ability of a computer and pipelining
5. To explain IO communication.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Discuss basic structure of computer.
2. Understand the basic operation of CPU.
3. Compare and select various Memory and I/O devices as per requirement.
4. Solve the concepts of number representation and their operation.
5. Explain the concept of parallel processing and pipelining.

Unit I: Basic Structure of Computer **Hours: 7**

Basic Structure of Computer H/W & S/W: Functional Units, Basic Operational Concepts, Bus structures, Addressing Methods and Machine Program Sequencing: Memory Locations, Addresses, Instruction and instruction sequencing, Addressing Modes. Basic I/O Operations.

Unit II: Memory Unit **Hours: 7**

Basic Concepts, Memory Hierarchy, Semiconductor RAM Memories, Internal Organization of Memory Chips, Static Memories, Dynamic Memories, Read Only Memories, Speed, Size and Cost.

Unit III: Processing Unit **Hours: 8**

Fundamental Concepts, Execution of a Complete Instruction, Hardwired Control, Performance Consideration, Microprogrammed Control, Microinstructions, Microprogram Sequencing.

Unit IV: I/O Organization **Hours:6**

Accessing I/O Devices, Interrupts, Enabling and Disabling Inerrupts, Handling Multiple Devices, DMA,I/O Hardware, Standard I/O Interfaces:SCSI.

Unit V: Arithmetic **Hours: 7**

Number Representations, Design of Fast Adders, Signed Addition and Subtraction, Multiplication of Positive Numbers ,Booth Multiplier, Fast Multiplication ,Integer Division, Floating Point Numbers and Operations.

Unit VI:Parallel Organization and Pipelining **Hours: 7**

Parallel Processing, Array Processors, The Structure of General Purpose Multiple Processors, Symmetric, Multiprocessors, Multithreading and Chip Multiprocessors, Clusters, Multicore Organization, Memory Organization in Multiprocessors. Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards

Text Book: Carl Hamacher, Zvonko Vranesic and Safwat Zaky, ñComputer Organizationò, Fifth Edition, Tata McGraw-Hill.

Reference Books:

1. William Stallings, ñComputer Organization and Architecture: Designing for Performanceò, Eighth Edition, Pearson.
2. John P. Hayes, ñComputer Architecture and Organizationò, McGraw Hill Publication.
3. DA Patterson and JL Hennessy, Computer Organization and Design, Morgan Kaufmann Publisher, 2nd edition
4. A.S. Tanenbaum, "Structured Computer Organization", PHI Publication.

5KE04 COGNITIVE TECHNOLOGIES [L-3, T-0, C-3]

Course Prerequisite: Basic knowledge of Artificial Intelligence, Programming and Data Structures

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Cognitive Technologies by being able to do each of the following:

1. This course intends to introduce concept of cognitive technologies and important approaches of cognitive technologies.
2. Student will learn and analyze key concept of cognitive technologies.
3. Students will gain an understanding of innovation concepts, terminology, current and future trends in cognitive technologies.
4. Introduces students to IBM Watson platform, an artificially intelligent computer system capable of answering questions posed in natural language, developed in IBMôs Deep QA project.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Describe the Cognitive computing and principles of cognitive systems.
2. Identify role of Natural Language Processing in cognitive system.
3. Outline application of advanced analytics in cognitive computing.
4. Justify role of Cloud and Distributed Computing in Cognitive Computing.
5. Assess the process of building a Cognitive Application.
6. Identify the Emerging Areas and Future Applications of Cognitive Computing.

Unit I: Foundation of Cognitive Computing & Design Principle of Cognitive Systems Hours: 07

The Foundation of Cognitive Computing: Cognitive Computing as a New Generation, The Uses of Cognitive Systems, What Makes a System Cognitive, Gaining Insights from Data, Domains Where Cognitive Computing Is Well Suited, Artificial Intelligence as the Foundation of Cognitive Computing, Understanding Cognition, Two Systems of Judgment and Choice, Understanding Complex Relationships Between Systems, The Elements of a Cognitive System, Infrastructure and Deployment Modalities.Design Principles for Cognitive Systems: Components of a Cognitive System, Building the Corpus, Bringing Data into the Cognitive System, Machine Learning, Hypotheses Generation and Scoring, Presentation and Visualization Services.

Unit II: NLP and Big Data in Cognitive System Hours: 07

Natural Language Processing in Support of a Cognitive System: The Role of NLP in a Cognitive System, Semantic Web, Applying Natural Language Technologies to Business Problems. The Relationship between Big Data and Cognitive Computing: Dealing with Human-Generated Data, Defining Big Data, the Architectural Foundation for Big Data, Analytical Data Warehouses, Hadoop, Data in Motion and Streaming Data, Integration of Big Data with Traditional Data.

Unit III: Knowledge Representation and Advance Analytics in Cognitive Computing Hours: 06

Representing Knowledge in Taxonomies and Ontologies: Representing Knowledge, Developing a Cognitive System, Defining Taxonomies and Ontologies, Explaining How to Represent Knowledge, Models for Knowledge Representation. Applying Advanced Analytics to Cognitive Computing: Advanced Analytics Is on a Path to Cognitive Computing, Key Capabilities in Advanced Analytics, Using Advanced Analytics to Create Value, Impact of Open Source Tools on Advanced Analytics.

Unit IV: Role of Cloud and Distributed Computing in Cognitive Computing Hours: 07

The Role of Cloud and Distributed Computing in Cognitive Computing: Leveraging Distributed Computing for Shared Resources, Why Cloud Services Are Fundamental to Cognitive Computing Systems, Characteristics of Cloud Computing, Cloud Computing Models, Delivery Models of the Cloud, Managing Workloads, Security and Governance, Data Integration and Management in the Cloud. The Business Implications of Cognitive Computing: Preparing for Change, Advantages of New Disruptive Models, What Does Knowledge Mean to the Business?, The Difference with a Cognitive Systems Approach, Meshing Data Together Differently, Using Business Knowledge to Plan for the Future, Answering Business Questions in New Ways, Building Business Specific Solutions, Making Cognitive Computing a Reality, How a Cognitive Application Can Change a Market.

Unit V: Cognitive System: IBM Watson and Process of Building a Cognitive Application Hours: 07
IBMôs Watson as a Cognitive System: Watson Defined, Advancing Research with a ñGrand Challengeò, Preparing Watson for Jeopardy, Preparing Watson for Commercial Applications, The Components of DeepQA Architecture. The Process of Building a Cognitive Application: The Emerging Cognitive Platform, Defining the Objective, Defining the Domain, Understanding the Intended Users and Defining their Attributes, Defining Questions and Exploring Insights, Creating and Refining the Corpora, Training and Testing. Building a Cognitive Healthcare Application: Foundations of Cognitive Computing for Healthcare, Constituents in the Healthcare Ecosystem, Learning from Patterns in Healthcare Data, Building on a Foundation of Big Data Analytics, Cognitive Applications across the Healthcare Ecosystem, Starting with a Cognitive Application for Healthcare, Using Cognitive Applications to Improve Health and Wellness, to Enhance the Electronic Medical Record and to Improve Clinical Teaching.

Unit VI:Emerging Areas and Future Application Hours: 06
Smarter Cities: Cognitive Computing in Government: How Cities Have Operated, The Characteristics of a Smart City, The Rise of the Open Data Movement Will Fuel Cognitive Cities, The Internet of Everything and Smarter Cities, Understanding the Ownership and Value of Data, Smarter Approaches to Preventative Healthcare, Building a Smarter Transportation Infrastructure, Using Analytics to Close the Workforce Skills Gap, Creating a Cognitive Community Infrastructure, The Next Phase of Cognitive Cities. Emerging Cognitive Computing Areas: Characteristics of Ideal Markets for Cognitive, Computing Vertical Markets and Industries. Future Applications for Cognitive Computing: Requirements for the Next Generation, Technical Advancements That Will Change the Future of Cognitive Computing, What the Future Will Look Like, Emerging Innovations.

Text Book: Judith Hurwitz, Marcia Kaufman and Adrian Bowles, "Cognitive Computing and Big Data Analytics", publication John Wiley & Sons, Inc, 2015.

Reference Books:
[1] José Luis Bermúdez, Cognitive Science: An Introduction to the Science of the Mind, publication Cambridge University Press, New York, Second Edition.
[2] Jay Friedenberg and Gordon Silverman, Cognitive Science: An Introduction to the Study of Mind, Sage Publications, Inc. London, 2014.
[3] Huimin Lu (Editor), Cognitive Internet of Things: Frameworks, Tools and Applications, Springer Nature Switzerland AG 2020.
[4] Danish Contractor and Aaditya Telang (Editors), Applications of Cognitive Computing Systems and IBM Watson, 8th IBM Collaborative Academia Research Exchange, publication Springer Nature Singapore Pte Ltd., 2017.
[5] S. Bird, E. Klein, E. Loper (2009), Natural Language Processing with Python, OôReilly Media.

5KE04 ADVANCE COMPUTER ARCHITECTURE [L-3, T-0, C-3]

Course Prerequisite: Basic knowledge of Computer Organization

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Advance Computer Architecture by being able to do each of the following:

1. Understand the concept of Parallel Processing
2. To impart the concepts and principles of parallel and advanced computer architectures
3. To develop the design techniques of Scalable and multithreaded Architectures.
4. To apply the concepts and techniques of parallel and advanced computer architectures to design modern computer systems.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Describe Computational models and Computer Architectures.
2. Discuss Concepts of parallel computer models
3. Explain Scalable Architectures, Pipelining, Superscalar processors, multiprocessors
4. Distinguish the performance of pipelining and non-pipelining environment in a processor.

Unit I: Parallel Computing Models Hours: 6
Theory of Parallelism, Parallel computer models, The State of Computing, Multiprocessors and Multicomputer, Multivector and SIMD Computers, PRAM and VLSI models, Architectural development tracks, Program and network properties, Conditions of parallelism, Program partitioning and Scheduling, Program flow Mechanisms, System interconnect Architectures.

Unit II: Principals of Scalable performance Hours: 6
Performance metrics and measures, Parallel Processing applications, Speed up performance laws, Scalability Analysis and Approaches.

Unit III: Hardware Technologies Hours: 6

Processes and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology, Bus Cache and Shared memory, Backplane bus systems, Cache Memory organizations, Shared Memory Organizations, Sequential and weak consistency models.

Unit IV: Pipelining **Hours: 6**

Pipelining and superscalar techniques, Linear Pipeline Processors, Non-Linear Pipeline Processors,Instruction Pipeline design, Arithmetic pipeline design, superscalar pipeline design.

Unit V: Parallel and Scalable Architectures **Hours: 6**

Multiprocessors and Multicomputers, Multiprocessor system interconnects, cache coherence and synchronization mechanism, Three Generations of Multicomputers, Message-passing Mechanisms, Multivetor and SIMD computers, Vector Processing Principals, Multivector Multiprocessors, Compound Vector processing, SIMD computer Organization, CM-2 Architecture.

Unit VI: Scalable, Multithreaded and Dataflow Architectures **Hours: 6**

Latency-hiding techniques, Principals of Multithreading, Fine-Grain Multicomputers, Scalable and multithreaded Architectures, Dataflow and hybrid Architectures

Text Book: Advanced Computer Architecture Second Edition, Kai Hwang, Tata McGraw Hill Publishers.

Reference Books:

1. Computer Architecture, Fourth edition, J. L. Hennessy and D.A. Patterson. ELSEVIER
2. Advanced Computer Architecture, D. Sima, T. Fountain, P. Kacsuk, Pearson education
3. Computer System Architecture, Morris M. Mano, 3rd edition, Pearson/Prentice Hall India.
4. Advanced Computer Architectures, S.G. Shiva, Special Indian edition, CRC, Taylor & Francis.

5KE04 INTERNET OF THINGS [L-3, T-0, C-3]

Course Pre-requisite: Basic knowledge of Internet and Microprocessor & Assembly Language Programming

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Internet of Things by being able to do each of the following:

1. To learn and understand fundamental of IoT
2. To study the design methodology and different IoT platform
3. To understand usefulness of IoT for society
4. To design and implement application of IoT using various sensor

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Understand the basics of IoT
2. Understand design methodology and platforms involved in IoT
3. Apply the knowledge to interface various sensors with IoT development
4. Design and Implement IoT system for real time application.

Unit I: **Hours: 6**

Introduction to Internet of Things, Definition & Characteristics of IoT, Physical Design of IoT Logical Design of IoT, IoT Enabled Technologies like Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels & Deployment Templates, Domain Specific IoTs: Home, Cities, Environment, Energy systems, Logistics, Agriculture, Health & Lifestyle .

Unit II: **Hours: 7**

IOT & M2M: Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT, Software defined networks, network function virtualization, IoT Systems Management, Simple Network Management Protocol (SNMP) ,Limitations of SNMP, Network Operator Requirements, NETCONF, YANG, IoT Systems Management with NETCONF-YANG, NETOPEER.

Unit III: **Hours: 7**

IoT Platforms Design Methodology, Case Study on IoT System for Weather Monitoring, Motivation for Using Python, IoT Systems - Logical Design using Python ,Installing Python, Python Data Types & Data Structures, Control Flow, Functions, Modules, Packages, File Handling l, Date/Time Operations, Classes, Python Packages of Interest for IoT.

Unit IV: **Hours: 7**

IoT Physical Devices & Endpoints, Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interfaces serial, SPI, I2C, Programming Raspberry Pi with Python, Controlling LED with Raspberry Pi, Interfacing an LED and switch with Raspberry Pi, Interfacing Light Sensor with Raspberry Pi Other IoT Devices, pcDuino, BeagleBone Black, Cubieboard.

Unit V: **Hours: 7**

IoT Physical Servers & Cloud Offerings, Introduction to Cloud Storage Models & Communication APIs , WAMP - AutoBahn for IoT , Xively Cloud for IoT , Python Web Application Framework - Django , Designing a RESTful Web API , Amazon Web Services for ,SkyNet IoT Messaging Platform.

Unit VI: **Hours: 7**

Case Studies Illustrating IoT Design, Introduction, Home Automation: Smart Lighting, Home Intrusion detection, Cities: Smart parking, Environment: Weather Monitoring System, Weather reporting Bot, Air pollution monitoring, Forest fire detection, Agriculture: Smart Irrigation, Productivity Applications: IoT printer.

Text Book: Arshdeep Bahga, Vijay Madisetti, ñInternet of Things ï A hands-on approachò, Universities Press, ISBN:0: 0996025510, 13: 978-0996025515.

Reference Books:

1. Fundamentals of Python, K.A.Lambert and B.L.Juneja, Cengage Learning, 2012.
2. David Hanes, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, ISBN-13: 978-1-58714-456-1, ISBN-10: 1-58714-456-5, 2017
3. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, ñFrom Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligenceò, 1st Edition, Academic Press, 2014

5KE04 GRAPHICS & VISUALIZATION [L-3, T-0, C-3]

Course Prerequisite: Basic knowledge of Multimedia

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Graphics & Visualization by being able to do each of the following:

1. Explain hardware, software and OpenGL Graphics Primitives.
2. Illustrate interactive computer graphic using the OpenGL.
3. Design and implementation of algorithms for 2D graphics Primitives and attributes.
4. Demonstrate Geometric transformations, viewing on both 2D and 3D objects.
5. Infer the representation of curves, surfaces, Color and Illumination models.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Explain fundamental concepts within computer graphics
2. Understand the ideas in some fundamental algorithms for computer graphics and to some extent be able to compare and evaluate them
3. Apply fundamental principles within interaction programming
4. Understand fundamental concepts within information visualization and scientific visualization

Unit I: Introduction **Hours: 06**

Brief History, Applications, Concepts, Graphics Pipeline, Image Buffers , Graphics Hardware , Conventions

Unit II: Rasterization Algorithms **Hours: 07**

Introduction ,Mathematical Curves and Finite Differences, Line Rasterization, Circle Rasterization, Point-in-Polygon Tests , Polygon Rasterization , Perspective Correction ,Spatial Antialiasing , Two-Dimensional Clipping Algorithms

Unit III: 2D and 3D Coordinate Systems and Transformations **Hours: 07**

Introduction , Affine Transformations , 2D Affine Transformations , Composite Transformations, 2D Homogeneous Affine Transformations ,2D Transformation Examples, 3D Homogeneous Affine Transformations , 3D Transformation Examples , Quaternions, Geometric Properties

Unit IV: Projections and Viewing Transformations **Hours: 07**

Introduction, Projections, Projection Examples, Viewing Transformation, Extended Viewing Transformation, Frustum Culling and the Viewing Transformation, The Viewport Transformation.

Unit V: Subdivision for Graphics and Visualization **Hours: 07**

Introduction, Notation , Subdivision Curves , Subdivision Surfaces , Manipulation of Subdivision Surfaces , Analysis of Subdivision Surfaces, Subdivision Finite Elements

Unit VI: Visualization Principles **Hours: 06**

Introduction, Methods of Scientific Exploration, Data Aspects and Transformations, Time-Tested Principles for Good Visual Plots, Tone Mapping, Matters of Perception, Visualizing Multidimensional Data.

Text Book: T. Theoharis G. Papaioannou N. Platis N. Patrikalakis Graphics and Visualization: Principles & Algorithms.

Reference Books:

1. Edward Angel, Interactive Computer Graphics, A Top-Down Approach Using OpenGL Pearson 2008 fifth Edition
2. Donald Hearn and Pauline Baker and F. S. Hill Jr. and S. M. Kelley ,Computer Graphics with OpenGL Prentice Hall 2003 & 2006,third edition

5KE05 PRINCIPLES OF MARKETING FOR ENGINEERING

L-3, T-0, C-3

Course Prerequisite: Basic knowledge of Computers

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Principles of Marketing for Engineering by being able to do each of the following:

1. To provide students with the knowledge about business advantages of the digital marketing and its importance for marketing success;
2. To develop a digital marketing plan; to make SWOT analysis;
3. To define a target group; to introduced to various digital channels, their advantages and ways of integration;
4. To integrate different digital media and create marketing content to manage a digital marketing performance efficiently.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Identify the importance of the digital marketing for marketing success,
2. Manage customer relationships across all digital channels and build better customer relationships,
3. Create a digital marketing plan, starting from the SWOT analysis and defining a target group,
4. Identify digital channels, their advantages and limitations, to perceiving ways of their integration taking into consideration the available budget

Unit I: Introduction to e-Marketing: **Hours: 7**

Introduction, Wired-up world, B2C, B2B, C2B and C2C Model, Objectives: Sell, Serve, Speak, Save, Sizzle, Introduction to e-strategy

Unit II: Remix and e-Models **Hours: 7**

Introduction to Remix: Product, Price, Place, Promotion, People, Process. Introduction to e-Models, e-Marketplace, Digital Communication market, Web & Social Network Models, Customer buying models, Loyalty models

Unit III: e-Customers **Hours: 7**

Introduction to e-Customers, Motivations, Expectations, Fears & Phobias, Online Buying Process, information processing, relationship & royalty, Communities & social networks, Customer profiles

Unit IV: e-Tools & Site Design **Hours:7**

Introduction to e-Tools, Technology development & customer impact, Interactive digital TV, Digital Radio, Mobile Devices, Interactive self-service kiosks, Convergence, Integrated Campaigns, Web-site design, Integrated design, online value proposition, Dynamic & aesthetics design

Unit V: Traffic Building **Hours: 7**

Search Engine Marketing, Online PR & Partnerships, Interactive Advertising, e-mail & viral marketing, Online traffic building, Control, Resourcing

Unit VI: e-CRM & e-Business **Hours: 7**

Introduction to e-CRM, Database marketing, e-CRM, Profiling, Personalization, Introduction to e-Business, e-Business Architecture & framework, e-business security.

Text Book: E-Marketing excellence: Planning & Optimizing your Digital Marketing, Dave Chaffey & P R Smith, 3rd Edition, Butterworth-Heinemann, Elsevier.

Reference Books:

1. Marketing 4.0: Moving from Traditional to Digital, Philip Kotler, H. Kartajaya, I. Setiawan, Wiley.
2. Business Marketing and Management Principles for IT and Engineering, D. N. Chorafas, CRC Press.
3. Marketing Management, Philip Kotler, Kevin Keller, 12th Edition, Pearson Prentice Hall.
4. Marketing Insights from A to Z, Philip Kotler, John Wiley & Sons..

5KE05 FUNDAMENTALS OF FINANCE & ACCOUNTING

(L-3, T-0, C-3)

Course Prerequisite: Basic Knowledge of Mathematics

Objectives: Throughout the course, students will be expected to demonstrate their understanding of Fundamentals of Finance & Accounting by being able to do each of the following:

1. Know and apply accounting and finance theory
2. Critically evaluate financial statement information
3. Evaluate and compare different investments.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Define bookkeeping and accounting
2. Explain the general purposes and functions of accounting
3. Explain the differences between management and financial accounting
4. Describe the main elements of financial accounting information ï assets, liabilities, revenue and expenses
5. Identify the main financial statements and their purposes.

Unit I: The basics of Accounting I **Hours: 7**

The Assets, Liabilities and Balance Sheets, Procedure for creating a Balance Sheet, Different forms of Balance Sheet, Basic concepts of Accounting

Unit II: The basics of Accounting II **Hours: 7**

The Profit & Loss Account, Cash Flow Statement, Creating Profit & Loss Account, Creating Cash Flow Statement, Book Keeping Basic terminology, Debt & Credit Convention

Unit III: Interpretation of Accounts **Hours: 8**

Accounting Rules, Reports, Assets, Liabilities, ShareholdersôEquity, P&L Statement,

Unit IV: Introduction to Financial Management **Hours: 6**

What is Finance, Forms of Business Organization, Stock Price & Shareholder Value, Intrinsic Value, Stock Price, Business trends and ethics, Conflicts management.

Unit V: Financial Markets and Institutions **Hours: 7**

Financial Markets, Capital Allocation, Financial Institutions, Stock Market, Market for Common Stock, Stock Market Returns, Stock Market Efficiency

Unit VI: Financial Statements & Analysis **Hours: 7**

Financial Statements & Reports, Stockholdersô Equity, Free Cash Flow, Income Taxes, Analysis of Financial Statements: Ratio Analysis, Liquidity Ratios, Asset & Debt Management Ratio, Profitability Ratio, Trend Analysis.

Text Books:

1. Accounts Demystified, 5th Edition, Anthony Rice, Pearson ï Prentice Hall
2. Fundamentals of Financial Management, 6th Edition, E. F. Brigham, J.F. Houston, Cengage Learning.

Reference Books:

1. Engineering Economics: Financial Decision Making for Engineering, N. M. Fraser, E. M. Jewkes, 5th Edition, Pearson Publication.
2. Financial Fundamentals for Engineers, Richard Hill & George Slot, Butterworth-Heinemann, Elsevier.
3. Financial Accounting, Jerry Weygandt, Paul Kimmel, Donald Kieso, 9th Edition, Wiley
4. Financial Accounting: Tools for Business Decision Making, Jerry Weygandt, Paul Kimmel, Donald Kieso, 6th Edition, Wiley Plus.

5KE05 ENTREPRENEURSHIP

L-3,T-0,C-3

Course Prerequisite: Basic Knowledge of Business, Management Techniques.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Entrepreneurship by being able to do each of the following:

1. Understand basic concepts in the area of entrepreneurship
2. Understand the role and importance of entrepreneurship for economic development
3. Develop personal creativity and entrepreneurial initiative,
4. Adopt the key steps in the elaboration of business idea.

Course Outcomes (Expected Outcome): On completion of this course, the students should be able to:

1. Analyze the business environment in order to identify business opportunities,
2. Identify the elements of success of entrepreneurial ventures,
3. Evaluate the effectiveness of different entrepreneurial strategies,
4. Specify the basic performance indicators of entrepreneurial activity,
5. Explain the importance of marketing and management in small businesses venture,
6. Interpret their own business plan.

Unit I: **Hours: 6**

Introduction to Entrepreneurship: Introduction, Common Myths About Entrepreneurs, Types of Start- Up Firms, Changing Demographics of Entrepreneurs, Entrepreneurship Importance. Recognizing Opportunities and Generating Ideas: Identifying and Recognizing Opportunities, Finding Gaps in the Marketplace, Techniques for Generating Ideas, Encouraging and Protecting New Ideas.

Unit II: **Hours: 6**

Feasibility Analysis: Product/Service Feasibility Analysis, Industry/Target Market Feasibility Analysis, Organizational Feasibility Analysis and Financial Feasibility Analysis. Writing A Business Plan: The Business Plan, Outline of the Business Plan, Presenting the Business Plan to Investors.

Unit III: **Hours: 6**

Industry and Competitor Analysis: Industry Analysis, Industry Trends, The Five Competitive Forces Model, The Value of the Five Forces Model, Industry Types and the Opportunities, Competitor Analysis, Identifying Competitors, Sources of Competitive Intelligence, Completing a Competitive Analysis Grid. Developing an Effective Business Model: Business Models, Components of an Effective Business Model.

Unit IV: **Hours: 6**

Ethical and Legal Foundation: Initial Ethical and Legal issues facing a New Firm, Drafting a Founders Agreement, Avoiding Legal Disputes, Business Licenses and Permits, Choosing a Form of Business Organization. Assessing A New Ventureôs Financial Strength and Viability: Introduction to Financial Management, Financial Statements and Forecasts, Pro forma Financial Statements.

Unit V: **Hours: 6**

New Venture Team: Creating a New-Venture Team, Rounding out the Team: The Role of Professional Advisers. Getting Financing or Funding: The Importance of Getting Financing or Funding, Sources of Equity Funding, Sources of DEBT Financing, Creative Sources of Financing and Funding.

Unit VI **Hours: 6**

Unique Marketing Issues: Selecting a Market and Establishing a Position, Key Marketing issues for New Ventures, The 4Ps of Marketing for New Ventures. The Importance of Intellectual Property: The Importance of Intellectual Property, Patents, Trademarks, Copyrights, Trade Secrets, Conducting an Intellectual Property Audit.

Text Book: Bruce R. Barringer, R. Duane Ireland, ñEntrepreneurship Successfully Launching New Venturesò, Pearson Education, Third Edition.

Reference Books:

1. Ram Chandran, ñEntrepreneurial Developmentò, Tata McGraw Hill, New Delhi
2. Khanka, S S. ñEntrepreneurial Developmentò, S Chand & Company Ltd. New Delhi
3. Badhai, B ñEntrepreneurship for Engineersò, Dhanpat Rai & Co. (p) Ltd.
4. Gupta and Srinivasan, ñEntrepreneurial Developmentò, S Chand & Sons, New Delhi.
5. Arya Kumar, Entrepreneurship, Pearson, Delhi
6. Poornima MCH, Entrepreneurship Development ï Small Business Enterprises, Pearson, Delhi
7. Sangeetha Sharma, Entrepreneurship Development, PHI Learning
8. Kanishka Bedi, Management and Entrepreneurship, Oxford University Press, Delhi

5KE06 DATABASES - LAB

P-2, C-1

Course Prerequisite: Basic concept of programming, basic concepts of data structures.

Course Objectives:

1. To study the ER model which provides a high level view of the issues in database design, to capture the semantics of realistic applications within the constraints of a data model.
2. To study the primary data model (relational model) for commercial data processing applications.
3. To study the standard structured query language and retrieve the information from the database in various ways.
4. To study the integrity and security constraints of the database by enforcing constraints.

Course Outcomes (Expected Outcome) : On completion of the course, the students will be able to

1. Design ER model for any kind of application.
2. Design and develop database.
3. Apply normalization.
4. Query the database.
5. Apply various integrity constraints
6. Build indices, views
7. Implement triggers, assertions.

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

Practical 1: To Study a Database Modeling Tool.

Study of Data Modeling Tools

- Take a description of the enterprise, create its corresponding ER Diagram and build a database model using any modeling tool. The following basic features of the modeling should be covered while building the model:
- Logical / Physical Modeling
- Adding an entity / its attributes , relationships (all kinds of relationships viz., parent-child, foreign key references, one to many, many to many etc)
- Forward / reverse engineering
- Details of forward engineering / schema generation
- Steps to generate the schema

Practical 2: To Study and implement DDL Commands

Implement the model created in Practical 1, in any of the DBMS like Oracle, MySQL, or Microsoft SQL Server database software.

- Creating the proper tables
- Insert the data into it.
- Study Dropping and Altering the Tables. Study the cascaded deletes.

Practical 3: To Study and implement DML Commands-I

- SQL queries : Write and execute different SQL queries
- Execute Simple queries using SELECT, FROM, WHERE clauses,
- In Where clause use different predicates involving OR,AND, NOT
- Rename operation
- Tuple Variables
- Write SQL for various String operations (%,_,*)
- Match beginning with
- Match ending with
- Substring
- Match exactly n characters
- Match at least n characters
- Sort the output of the query using Order by
- Write SQL using Having

Practical 4 : To Study and implement DML Commands-II
Write SQL queries and perform

- Set membership operations
- In, not in
- Some
- All
- Exists and not exists, Test for emptyness using exists, not exists
- Test for absence of duplicates.
- Nested queries

Practical 5: Study and implement aggregation functions.
Write different queries using following Aggregate functions

- Min (minimum 3 SQL queries)
- Max (minimum 3 SQL queries)
- Avg (minimum 3 SQL queries)
- Sum (minimum 3 SQL queries)
- Count (minimum 3 SQL queries)

Practical 6: Write SQL to create Views and Indexes.

Practical 7: Write SQL to perform the modifications to the database

Practical 8 : PL /SQL

Practical 9 : Database Access Using Cursors

Write a trigger to find the names and cities of customers who have more than xyz in any account.

Practical 10 : Triggers

- Write a trigger for dealing with the overdrafts (set the account balance to zero, and creating a loan in the amount of the overdraft. Keep account number as loan number in the loan table)
- Write a trigger for dealing with blank cities (set the city field to null when it is blank)
- 11. Practical 11: Procedures, functions
- Write atleast 2 functions, and demonstrate its use
- Write atleast 2 procedures, and demonstrate its use

Practical 12 : Web Programming with PL/SQL. (Contents beyond Syllabus)
HTTP, A Simple Example., Printing HTML Tables., Passing Parameters., Processing HTML Forms., Multi-Valued Parameters.

Practical 13: Develop a JDBC Applications, Retrieve the information by connecting to the database using a host language (JAVA, C, C++) (Contents Beyond Syllabus)

Practical 14: Web Programming with Java Servlets. (Connecting to the database) (Contents Beyond Syllabus) A Simple Servlet., HTTP Servlet API Basics.,HTML Form Processing in Servlets.

Practical 15: PHP : Develop a simple application to access the database using PHP (Contents Beyond Syllabus)

Practical 16: Study of Open Source NoSQL Databases

Practical 16: Based on the concepts covered in text create a Mini Project:

Suggested Topics :

1. Bank database (Given in Korth book)
2. University Database (Given in Korth book)
3. Airline Flight Information System.
4. Library Database Application.
5. University Student Database.
6. Video Chain Database.
7. Banking Database.
8. BiBTeX Database.
9. Music Store Database.
10. Online Auctions Database.
11. A Web Survey Management System.

Text Book: Korth, Sudarshan, Silberschatz, Database System Concept, Mc-Graw Hill Mysql Reference Manual (for Mysql database)

Reference Books: (may be 5 to 6)

1. Kevin Roebuck, ñStoring and Managing Big Data - NoSQL, HADOOP and Moreò, Emereopty Limited, ISBN: 1743045743, 9781743045749
2. Kristina Chodorow, Michael Dirolf, ñMangoDB: The Definitive Guideò, O'Reilly Publications, ISBN: 978-1-449-34468-9.
3. Adam Fowler, ñNoSQL For Dummiesò, John Wiley & Sons, ISBN-1118905628
4. C J Date, ñAn Introduction to Database Systemsò, Addison-Wesley, ISBN: 0201144719

5KE07 COMPILERS - LAB

P-2, C-1

Course Prerequisite: Basic knowledge of C Programming, Data Structures, Theory of Computation.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Compiler Design by being able to do each of the following:
Know the basic components of a Compiler.

1. To implement Lexical Analyzer using Lex tool and Syntax Analyzer using Yaac Tool.
2. To implement various parsing methods.
3. To implement code optimization techniques.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Identify the fundamentals of compiler and its phases.
2. Use the powerful compiler generation tools such as Lex and Yacc.
3. Write a lexical scanner, either from scratch or using Lex.
4. Develop program for solving parser problems.
5. Examine the various optimization techniques.

List of Experiments:
This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

List of Experiments based on Syllabus: (Maximum 20)

1. Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs and new lines. It should also ignore comments. Although the syntax specification states that identifiers can be arbitrarily long, you may restrict the length to some reasonable value. Simulate the same in C language.
2. Write a C program to identify whether a given line is a comment or not.
3. Implement a C program to check parenthesis of regular expression is balanced or not.
4. Implement a C program to construct NFA from regular expression.
5. Implement a C program to simulate Deterministic Finite Automation (DFA) for a string which ending with ća, ća*b+a, ćabba
6. Write a C program to construct of DFA from NFA.
7. Implement a Lex program to verify the parenthesis of a given expression is balanced.
8. Implement a Lex program to recognize the token like Digit, Identifier & Delimiter.
9. Implement the Lexical Analyzer using JLex, flex or other lexical analyzer generating tools.
10. Implement a Lex program to a valid arithmetic expression and to recognize the identifier and operators present.
11. Implement a Lex program to count words, characters, lines, vowels and consonants from given input.
12. Implement a Lex program to check given number is positive negative or zero.
13. Implement a Lex program to generate string which is ending with zeros.
14. Implement LEX and Yacc tool to implement desk calculator.
15. Write a C program for constructing of SLR parsing.
16. Write a C program for constructing of LL (1) parsing.
17. Write a C program for constructing of LALR parsing.
18. Write a C program for constructing recursive descent parsing.
19. Write a C program to implement Program semantic rules to calculate the expression that takes an expression with digits, + and * and computes the value.
20. Write a C program for Tokenizing the file which reads a source code in C/C++ from an unformatted file and extract various types of tokens from it
21. Write functions to find FIRST and FOLLOW of all the variables / given grammar.
22. Implement a Shift Reduce Parser for the following productions.
23. E Ÿ E+E / E*E / a / b
24. Implement a symbol table containing functions create(), modify(), search(), display() and delete().
25. Implement three address Code for the input a=b*c.
26. Implement Recursive Decent Parser for the productions.

List of Experiments beyond Syllabus: (Maximum 05)

1. Convert the BNF rules into Yacc form and write code to generate Abstract Syntax Tree.
2. Write a C program to generate machine code from abstract syntax tree generated by the parser.
3. Write a Lex program to find out total number of vowels, and consonants from the given input string.
4. Implementation of Finite State machines DFA, NFAs.
5. Computation of Leading & Trailing Sets.

Text Book: Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman Compilers: ñPrinciples, Techniques and Toolsò, Pearson Education, Second Edition.

Reference Books:

1. Doug Brown, John Levine, and Tony Mason, ñLex & Yaccò, OôReilly & Associates, Inc., Second Edition.
2. Andrew Appel, ñModern Compiler Implementation in Cò, Cambridge University press.
3. K C. Louden ñCompiler Construction - Principles and Practiceò India Edition, CENGAGE.
4. Dick Grune, Kees van Reeuwijk, Henri E. Bal, Ceriel J.H. Jacobs and Koen Langendoen, ñModern Compiler Designò, Second Edition, John Wiley & Sons Publication.
5. Keith Cooper and Linda Torczon, ñEngineering: A Compilerò, Second Edition, Morgan Kaufmann .Publication.

5KE09 C-SKILL LAB – III [P-2, C-1]

Course Prerequisite: Basic knowledge of Web Development, HTML, CSS, JavaScript and IDE.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of C-Skill Lab - III by being able to do each of the following:

1. To develop an ability to set up a local JS Library/Framework development Environment.
2. To be able to install and implement different JS Libraries and Frameworks
3. To be able to develop single-page/multi-page static and dynamic Web Applications.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Explain the various tools, packages and modules required for Web Development.
2. Discuss the workings of web server, cookies, routes, etc.
3. Develop a mobile application using JS Framework.
4. Design GUI using JS framework and/or Libraries.
5. Create applications using Angular, React, Node and Express.

List of Experiments:

This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

List of Experiments based on Syllabus: (Maximum 20)

1. Introduction to the Node.js and its installation to print Hello World
2. To study built-in modules and implement the user defined built-in modules in the Node.js
3. To study HTTP module and implement Node.js as a web server
4. To study and implement Node.js File system module to read, write, create, update, delete and rename the file
5. To study the URL module of the Node.js and write a program that opens the requested file and returns the content of the file to the client. If anything goes wrong, throw a 404 error.
6. To convert the output "Hello World!" into upper-case letters by installing the ñupper-caseò package of NPM.
7. EventEmitter object.
8. To study and implement the Formidable module of Node.js to upload the file on the server.
9. To study and implement the Nodemailer module of Node.js to send emails from your server.
10. To install MySQL and its driver and create connection with it using Node.js.
11. To demonstrate the creation database and table in MySQL using Node.js
12. To demonstrate the insertion of single and multiple records in the MySQL using ñINSERTò statement and Node.js
13. To demonstrate the display of records from the MySQL database using ñSELECTò statement and display it using Node.js
14. To demonstrate the display the records based on condition from the MySQL database using ñWHEREò statement using Node.js
15. To demonstrate deletion of records from database using ñDELETEò statement and Node.js
16. To demonstrate updating existing records in a table by using the "UPDATE" statement and Node.js
17. To demonstrate combining rows from two or more tables, based on a related column between them, by using a JOIN statement using Node.js

List of Experiments beyond Syllabus: (Maximum 05)

1. Create an Email sender app using Node.js
2. Create an Basic User database: Site in which User can Sign up/Login and can see other Userôs Profile Information.
3. Create a User model covering Registration, Email verification(send an email), login (with remember me, display user details and allow to save/update user details(DOB, Location, Hobbies etc or anything)
4. A random number generator web application.

Text Books:

1. Simon Holmes: Getting Mean with Mongo, Express, Angular, and Node, 2nd Edition, Manning.
2. Alex Banks and Eve Porcello: Learning React: Functional Web Development with React and Redux, OôReilly.

Reference Books:

1. ShyamSeshadri: Angular Up and Running, OôReilly
2. Akshat Paul and Abhishek Nalwaya: React Native for Mobile development, Apress.
3. Jos Dirksen: Learn Three.js, 3rd Edition, Packt Publishing.
4. Patrick Mulder and Kelsey Breseman: Node.js for Embedded Systems, OôReilly

5KE08 DEPARTMENT PROFESSIONAL ELECTIVE-I LAB

5KE08 Department Professional Elective-I Lab is based on 5KE04 Professional Elective-I. Tentative FOSS Tools & Technology for Practicalôs are as follows:
AI: IBM Watson, Microsoft Cognitive Toolkit , TensorFlow, Apache SystemML, Caffe, OpenNN, Torch, Neuroph
Cloud: Stackato, Docker, Salt Stack, OpenQRM-Openshift
IoT: Arduino, DeviceHive, Kaa, Home Assistant
Multimedia: LibreOffice Draw, Lumen5, Openshot

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B.E. (COMPUTER ENGINEERING) SEMESTER – VI

Syllabus of B.E. Sem. VI (Computer Engineering)

6KE01 SOFTWARE ENGINEERING

L-3, T-0, C-3

Course Prerequisite: Fundamentals of Programming Languages
Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Software Engineering by being able to do each of the following:
1. To learn and understand the principles of Software Engineering
2. To be acquainted with methods of capturing, specifying, visualizing and analyzing software requirements.
3. To apply Design and Testing principles to S/W project development.
4. To understand project management through life cycle of the project.
5. To understand software quality attributes.
6. To understand of the role of project management including planning, scheduling, risk management.

Course Outcomes (Expected Outcome):
On completion of the course, student will be able toï
1. Decide on a process model for a developing a software project
2. Classify software applications and identify unique features of various domains
3. Design test cases of a software system.
4. Understand basics of Project management.
5. Plan, schedule and execute a project considering the risk management.
6. Apply quality attributes in software development life cycle.
7. Understand quality control and to ensure good quality software.

Unit I: Introduction to Software Engineering **Hours: 6**

Software Process Models Evolving role of Software, Software crises & myths, Software engineering, Software process & process models, Linear sequential, prototyping ,RAD ,Evolutionary Product & Process, Project management concepts, People, Product, Process, Project W5HH principles, critical practice .

Unit II: Project Management: **Hours: 6**
Process, Metrics, Estimations & Risks **,**Measures, Metrics & Indicators. Metrics in process & project domains-software measurement, Metrics for software quality, small organization. Software projects Planning: Scope, resources, estimation, decomposition technique, Tools. Software risks : identification, risk projection, refinement & RMMM plan.

Unit III: Project Scheduling & Quality Management **Hours: 06**
Project Scheduling: Concepts. Peoples Efforts. Task set, Task network. Scheduling. EV analysis, Project Plan. Software quality concepts. SQ Assurance, Software reviews, technical reviews, software reliability, ISO 900 L, SQA Plan. SCM process. Version control. SCM standard.

Unit IV: Requirement Engineering & System Engineering **Hours:06**
System engineering: Hierarchy, Business Process & Product engineering: Overviews. Requirement engineering, System modeling. Requirement analysis. Analysis principles. Software prototyping. Specification. Design Process. Design Principles & Concepts. Effective modular design. Design model & documentation.

Unit V: Software architecture & User interface design **Hours: 06**
Software architecture, Data Design, Architectural styles, Requirement mapping. Transform & Transaction mappings. User interface design: Golden Rule. UTD, Task analysis & modeling, ID activities, Tools, design evaluation. Component level design: Structure programming, Comparison of design notation.

Unit VI: Software Testing **Hours: 06**
Software testing fundamentals; test case design, Whitebox testing. Basis path, control structure-, Blackbox-Testing, & for specialized environments. Strategic approach to S/W testing. Unit testing, integration testing, validation testing, system testing. Debugging. Technical metrics for software.

Text Book: Pressman Roger. S: Software Engineering, A Practitionerôs Approach, TMH.

Reference Books:
1. Somerville: Software Engineering (Addison-Wesley) (5/e)
2. Fairly R: Software Engineering (McGraw Hill)
3. Davis A: Principles of Software Development (McGraw Hill)
4. Shooman, M.L: Software Engineering (McGraw-Hill)

6KE02 ALGORITHMIC

[L-4, T-0, C-4]

Course Prerequisite: Any programming language, Discrete Mathematics and Data Structures

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Algorithmics by being able to do each of the following:

1. To understand asymptotic analysis of algorithms.
2. To apply algorithmic strategies while solving problems.
3. Ability to analyze time and space complexity.
4. Demonstrate a familiarity with major algorithms.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Carry out the analysis of various Algorithms for mainly Time complexity.
2. Apply design principles and concepts to algorithm design.
3. Understand different algorithmic design strategies.
4. Analyze the efficiency of algorithms using time complexity.
5. Apply the standard sorting algorithms.

Unit I: Iterative Algorithm Design Issue **Hours: 8**
Introduction, Use of Loops, Efficiency of Algorithms, Estimating & Specifying Execution Times, Order Notations, Algorithm Strategies, Design using Recursion

Unit II: Divide And Conquer **Hours: 8**
Introduction, Multiplication Algorithm and its analysis, Introduction to Triangulation, Covex Hulls, Drawbacks of D & C & Timing Analysis.

Unit III: Greedy Methods **Hours: 8**
Introduction, Knapsack Problem, Job sequencing with deadlines, Minimum Spanning Trees, Primôs Algorithms, Kruskalôs Algorithm, Dijkstras Shortest Path Algorithm.

Unit IV: Dynamic Programming **Hours: 8**
Introduction, Multistage Graphs, Traveling Salesman, Matrix multiplication, Longest Common Sub-Sequences, Optimal Polygon Triangulation, Single Source Shortest Paths.

Unit V: Backtracking **Hours: 8**
Combinational Search, Search & Traversal, Backtracking Strategy, Backtracking Framework, and Some typical State Spaces.

Unit VI: Efficiency of Algorithm **Hours: 8**
Polynomial Time & Non Polynomial Time Algorithms, Worst and Average case Behavior, Time Analysis of Algorithm, Efficiency of Recursion, Complexity, Examples of Complexity Calculation for Various Sorting algorithms. Time-Space Trade off and Time-Space Trade off in algorithm research.

Text Book: Dave and Dave: ñDesign and Analysis of Algorithmsò Pearson Education .

Reference Books:
[1] Aho,Hopcroft & Ullman ñThe Design & Analysis of Computer Algorithmsò, Addison-Wesley
[2] G. Brassard, P.Bratley: ñFundamentals of Algorithmicsò , PHI
[3] Horowitz & Sahani: ñ Fundamental Algorithmsò , Galgotia.
[4] Cormen, T.H, Lierson & Rivest: ñ Introduction to Algorithmsò, Mc Graw-Hill.

6KE03 SIGNALS AND SYSTEMS

[L-3, T-0, C-3]

Course Prerequisite: Communication Engineering

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Signal and System by being able to do each of the following:
1. To understand the basic properties of signal and systems
2. To know the methods of characterization of LTI systems in time domain
3. To analyze continuous time signals and system in the Fourier and Laplace domain
4. To analyze discrete time signals and system in the Fourier and Z transform domain

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Represent and Classify signal and systems.
2. Obtain the response of a continuous, linear, time-invariant, causal system by using convolution.
3. Utilize the Laplace transform method to solve continuous, linear, time-invariant systems and to obtain transfer functions.
4. Analyse continuous, linear time-invariant systems using state variable formulation and solve the resulting state equations.
5. Convert a continuous-time signal to the discrete-time domain and reconstruct it using the sampling theorem.

Unit I: **Hours: 7**
Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids_ Classification of signals ï Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals.

Unit II: **Hours: 7**
Classification of systems- CT systems and DT systems- ï Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.

Unit III: **Hours: 7**
Fourier series for periodic signals ï Fourier Transform ï properties- Laplace Transforms and properties.

Unit IV: **Hours: 7**
Impulse response ï convolution integrals- Differential Equation- Fourier and Laplace transforms in Analysis of CT systems ï Systems connected in series / parallel.

Unit V: **Hours: 7**
Baseband signal Sampling ï Fourier Transform of discrete time signals (DTFT) ï Properties of DTFT ï Z Transform & Properties.

Unit VI: **Hours: 7**
Impulse response ï Difference equations-Convolution sum- Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems-DT systems connected in series and parallel.

Text Book: Allan V.Oppenheim, S.Wilsky and S.H.Nawab, Signals and Systems, Pearson, 2015.

Reference Books:
1. B. P. Lathi, Principles of Linear Systems and Signals, Second Edition, Oxford, 2009.
2. R.E.Zeimer, W.H.Tranter and R.D.Fannin, Signals and Systems ï Continuous and Discrete, Pearson, 2007.
3. John Alan Stuller, An Introduction to Signals and Systems, Thomson, 2007.

6KE04 NATURAL LANGUAGE PROCESSING [L-3, T-0, C-3]

Course Prerequisite: Fundamentals of Artificial Intelligence.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Natural Language Processing by being able to do each of the following:
1. To learn the fundamentals of natural language processing
2. To understand the use of CFG and PCFG in NLP
3. To understand the role of semantics of sentences and pragmatics
4. To gain knowledge in Information Extraction.

Course Outcomes (Expected Outcome): On completion of the course, student will be able toï
1. Understand how to tag a given text with basic Language features
2. Design an innovative application using NLP components
3. Implement a rule-based system to tackle morphology/syntax of a language
4. Design a tag set to be used for statistical processing for real-time applications
5. Compare and contrast the use of different statistical approaches for different types of NLP applications.

Unit I: Overview and Morphology **Hours: 06**
Introduction, Models and Algorithms, Regular Expressions Basic Regular Expression Patterns, Finite State Automata, Morphology, Inflectional Morphology, Derivational Morphology, Finite-State Morphological Parsing.

Unit II: Word Level Analysis **Hours:06**
Role of language models. Simple N-gram models. Estimating parameters and smoothing. Evaluating language models. Part Of Speech Tagging and Sequence Labeling Lexical syntax. Hidden Markov Models. Maximum Entropy models.

Unit III: Syntactic Analysis **Hours: 06**
Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar, Dependency Grammar, Syntactic Parsing, Ambiguity, Probabilistic CFG, Probabilistic Lexicalized CFGs.

Unit IV: Semantic Analysis **Hours:06**
Representing Meaning, Meaning Structure of Languages, First Order Predicate Calculus, Syntax-Driven Semantic Analysis, Semantic Attachments, Syntax-Driven Analyzer, Robust Analysis, Relations among Lexemes and their Senses, Word Sense Disambiguation.

Unit V: Learning to Classify Text **Hours: 06**
Supervised classification, Further examples of Supervised classification, Evaluation, Decision Trees, Naïve Bayes classifiers, Modelling Linguistic Patterns.

Unit VI: Extraction Information from Text **Hours: 06**
Information Extraction, Chunking, Developing and Evaluating Chunks, Recursion in Linguistic Structure, Named Entity Recognition, Relation Extraction.

Text Books:
1. Daniel Jurafsky, James H. Martin - Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper - Natural Language Processing with Python, First Edition, OReilly Media, 2009.
3. Christopher D.Manning and Hinrich Schuetze - Foundations of Statistical Natural Language Processing, MIT press, 1999.

Reference Books:
1.Breck Baldwin, Language Processing with Java and Ling Pipe Cookbook, Atlantic Publisher, 2015.
2. Richard M Reese, Natural Language Processing with Java, OReilly Media, 2015.
3. Nitin Indurkhya and Fred J. Damerau, Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
4. Roland R.Hausser - Foundations of Computational Linguistics: Human Computer Communication in Natural Language, Paperback, MIT press, 2011
5. Tanveer Siddiqui, U.S. Tiwary, Natural Language Processing and Information Retrieval, Oxford University Press, 2008
6. Daniel Jurafsky and James H. Martin - Speech and Language Processing, 2nd Edition , Prentice Hall,2008.
7. Charu C.Aggarwal ï ñMachine Learning for Textò, Springer, 2018 Edition.

6KE04 PARALLEL COMPUTING [L-3, T-0, C-3]

Course Prerequisite: Basic knowledge of computer architecture.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Parallel Computing by being able to do each of the following:
1. To familiarize students with fundamental concepts, techniques and tools of parallel computing.
2. To explain models and issues in parallel computing
3. To study shared memory paradigm with Pthreads.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Acquire knowledge on large scale parallel system
2. Implement parallel programs for large-scale parallel systems
3. Understand, appreciate and apply parallel and distributed algorithms in problem Solving.
4. Design efficient parallel algorithms and applications
5. Measure the performance of parallel and distributed programs.

Unit I: Introduction to Parallel Computing **Hours: 6**
Motivating Parallelism, Scope of parallel computing, Parallel programming platforms, Implicit Parallelism, Limitations of Memory System Performance, Dichotomy of Parallel computing platforms, Physical organization of parallel platforms, Communication costs in parallel machines, Routing mechanisms for inter connection networks.

Unit II: Principles of Parallel Algorithm Design **Hours: 6**
Preliminaries, Decomposition techniques, characteristics of tasks and interactions, mapping techniques for load balancing, methods for containing interaction overheads, parallel algorithm models.

Unit III: Basic Communication Operations **Hours: 6**
One to all broadcast and all to one reduction, all to all broadcast and reduction, scatter and gather, Circular Shift, sources of overhead in parallel programs, performance metrics for parallel systems, the effect of granularity on performance.

Unit IV: Programming Using Message Passing Paradigm **Hours: 6**
Principles of message-passing programming, Building blocks, Message passing interface (MPI) Topologies and embedding, Overlapping computation with communication, Collective communication and computation operation.

Unit V: Programming Shared Address Space Platforms **Hours: 6**
Thread basics, Why threads?, POSIX thread, Thread basics, Synchronization primitives in Pthreads, controlling thread and synchronization attributes, Composite synchronization constructs.

Unit VI: Sorting **Hours: 6**
Issues in Sorting on Parallel Computers, Sorting Networks, Bubble Sort, Quick Sort, Bucket Sort, Sample Sort, Enumeration Sort and Radix Sort. Graph Algorithm: Definitions and representation, Primôs Algorithm, Single-Source: Dijkstraôs Algorithm, All-Pairs Shortest Paths: Dijkstraôs Algorithm, Floydôs Algorithm, Connected components: A Depth-First Search Based Algorithm.

Text Books:
[1] Ananth Grama, Vipin Kumar, òIntroduction to parallel computingò, Second edition, 2007.
[2] Cameron Hughes, Tracey Hughes, òParallel and Distributed Programming using C++.Pearson education, 2005

Reference Books:

[1] Quinn, M. J., Parallel Computing: Theory and Practice (McGraw-Hill Inc.)
[2] R. Buyya (ed.) High Performance Cluster Computing: Programming and Applications, Prentice Hall, 1999.
[3] Bary Wilkinson and Michael Allen: Parallel Programming Techniques using Networked of workstations and Parallel Computers, Prentice Hall, 1999.

6KE04 SENSORS AND ACTUATORS [L-3, T-0, C-3]

Course Prerequisite: Internet of Things, Micro-technology

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Sensors and Actuators by being able to do each of the following:
1. To understand the fundamentals of sensors and actuators
2. An exposure to sensors and its importance in the real world
3. To understand functional safety in machinery and emergency stop applications.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Fabricate some of those sensors
2. Simulate sensors and characterize before fabricating it
3. Design application with sensors and actuators for real world

Unit I: **Hours: 7**
Introduction: Sensors and Actuators, Technologies related to Sensors: Data Logger, Metal Detector, Photoelectric Sensor, Global Positioning System, Wireless Sensor Network, Sonar, Echo Sounding, Level Sensor, Biosensor, Blood Glucose Monitoring, Load Cell

Unit II: **Hours: 7**
Application of Sensors: On-board Automobile Sensors, Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing, Medical Diagnostic Sensors, Sensors for Environmental Monitoring.

Unit III: **Hours: 7**
Varied Types of Actuators: Pneumatic Actuator, Hydraulic Cylinder, Linear Actuator, Plasma Actuator, Rotary Actuator

Unit IV: **Hours: 7**
Actuators: Technologies and Devices- Pneumatic Motor, Pneumatic Cylinder, Hydraulic Press, Jackscrew, Hoist (Device), Electroactive Polymers, Roller Screw, MEMS Magnetic Actuator.

Unit V: **Hours: 7**
Remote Sensing: An Overview- Water Remote Sensing, Remote Sensing, Lidar, ERDAS Imagine, TerrSet, Remote Sensing (Archaeology)

Unit VI:
Rader and its application: Radar, Radar Imaging, Radar Navigation. **[Hours: 7]**

Text Books:
1. Princeton Brown, ñSensors and Actuators: Technology and Applicationsò, Library Press, 2017.
2. D. Patranabis, ñSENSORS AND TRANSDUCERSò, Second Edition, PHI Learning Private Limited, 2003.

Reference Books:
1. D.A. Hall and C.E.Millar, ñSensors and Actuatorsò, CRC Press, 1999.
2. Nathan Ida, ñSensors, Actuators, and their Interfaces: A multidisciplinary introduction (Materials, Circuits and Devices)ò, Large Print, 2011.

6KE04 DIGITAL MEDIA PROCESSING L-3, T-0, C-3

Course Pre-requisite: Basic Knowledge of Multimedia, Graphics & Visualization.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Digital Media Processing by being able to do each of the following:
1. Understand media objects
2. Draw on a rigorous combination of theory, analysis and hands-on digital work in development of original ideas in digital media
3. Understand the process of working with users in bringing ideas from concept to production

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Describe Multimedia components and representation.
2. Discuss color in Image and Video and explore fundamentals concepts in video
3. Compare and contrast different compression algorithms.
4. Apply Audio and Video compression techniques to media to improve efficiency.

Unit I: Hours: 06
Multimedia Authoring and Data Representations: Introduction. Components of Multimedia. Hypermedia and Multimedia. Overview of Multimedia Software Tools, Multimedia Authoring, VRM. Graphics and Image Data Representations: 1- Bit Images, 8-Bit Gray-Level Images, 24- Bit Color Images, 8-Bit Color Images, Color Lookup Tables, Popular Image File Formats.

Unit II: Hours: 07
Color in Image and Video Color Science, Color Models in Images, Color Models in Video. Fundamental Concepts in Video: Types of Video Signals, Component Video, Composite Video, S-Video, Analog Video, NTSC Video, PAL Video, SECAM Video, Digital Video.

Unit III: Hours: 07
Basics of Digital Audio: Digitization of Sound, Digitization, Nyquist Theorem, Signal-to-Noise Ratio (SNR), Signal-toQuantization-Noise Ratio (SQNR), MIDI: Musical Instrument Digital Interface. Hardware Aspects of MIDI, Structure of MIDI Messages, General MIDI, MIDI-to-WAV Conversion.

Unit IV: Hours: 07
Multimedia Data Compression: Lossless Compression Algorithms: Basics of Information Theory, Run-Length Coding, Variable-Length Coding , Dictionary-Based Coding, Arithmetic Coding, Lossy Compression Algorithms: Introduction, Distortion Measures, Quantization, Uniform Scalar Quantization, No uniform Scalar Quantization, Image Compression Standard: The JPEG Standard.

Unit V: Hours: 07
Basic Video Compression Techniques: Introduction, Video Compression Based on Motion Compensation, Search for Motion Vectors, H.261 Encoder and Decoder, MPEG-1, Motion Compression in MPEG-1, MPEG-2, Supporting Interlaced Video, MPEG-2 Scalabilities, Other Major Differences from MPEG-1.

Unit VI: Hours:06
Basic Audio Compression Techniques: ADPCM in Speech Coding, Vocoders, Phase Insensitivity, Channel Vocoder, Format Vocoder, Linear Predictive Coding. Audio Compression: Psychoacoustics, Equal-Loudness Relations, Frequency Masking, Temporal Masking, MPEG Audio, MPEG Layers, MPEG Audio Strategy, MPEG Audio Compression Algorithm.

Text Book: Ze-Nian, Li, Mark S. Drew ñFundamentals of Multimediaò (Pearson Education)

Reference Books:
1. Rajan Parekh ñPrinciples of Multimedia ñ (Tata McGraw-Hill)
2. S.J. Gobbs & D.C. Tsichritzis ñMultimedia Programmingò. Addison Wesley 1995
3. P.W. Agnew & A.S. Kellerman ñDistributed Multimediaò. , Addison Wesley 1996
4. F. Fluckiger,ò Understanding Networked Multimediaò. Prentice-Hall 1995

6KEO5 COMPUTATIONAL BIOLOGY [L-3, T-0,C-3]

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Computational Biology by being able to do each of the following:
1. To familiarize the students with most basic and useful algorithms for sequence analysis
2. To aware the students with basic file formats
3. To transform the basic molecular data for interpreting their patterns for various analysis
4. To compare genomes of different species, gene finding, and gene regulation.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Understand what types of biological questions can be investigated using computers, and what limitations computational methods impose on the understanding of biology.

2. Describe the properties of DNA, RNA, and proteins, the relationships among these molecules.
3. Analyze how to convert a biological question into a computational problem that can be solved using computers.
4. Explain general approaches for solving computational problems, and will be able to apply these approaches to new problems you encounter.
5. Understand how implement the algorithms by writing computer programs.

Unit I: Cellular and Molecular Biology Fundamentals Hours: 6
The structure of DNA & RNA, Gene Structure and control, Tree of Life and evolution, Primary & Secondary Structure of Protein, Implications for Bioinformatics Protein fold to form compact structures. Dealing with Databases: Structure of databases, Types of databases, Data Quality.

Unit II: Sequence Alignments Hours: 6
Principles of sequence alignments, scoring alignments, substitution matrices, Inserting gaps, Types of Alignments, Searching Databases, Searching with Nucleic Acid or protein sequences, Protein Sequeces Motifs or Patterns, Searching using Motifs and patterns, Patterns & protein function.

Unit III: Pair wise Sequence Alignments & Database Searching Hours: 6
Substitution Matrices and scoring, Dynamic Programming Algorithms, Indexing Techniques & Algorithmic approximations, Alignments score significance, Aligning complete genome sequences.

Unit IV: Patterns Profiles and Multiple Alignments Hours: 6
Profile & sequence logos, Profile Hidden Markov Models, Aligning Profiles, Multiple Sequence Alignment by Gradual Sequence Addition, Sequence Pattern Discovery.

Unit V: Revealing Genome Features Hours: 6
Preliminary examination of Genome Sequence, Gene Predictions, Splice site Detection, Prediction of Promoter Regions, Confirming Predictions, Genome Annotation, Large Genome Comparisons.

Unit VI: Gene Detection and Genome Annotation Hours: 6
Detection of Functional RNA Molecules using Decision Trees, Algorithms for Gene Detection in Prokaryotes, Features used in Eukaryotic Gene Detection, Predicting Eukaryotic Gene Signals, Predicting Exon/Intron Structure, Beyond the Prediction of Individual Genes.

Text Books:
1. Understanding Bioinformatics, Marketa Zvelbil and Jeremy O. Baum, Garland Sceincem Taylor & Francis Group, LLC
2. Bioinformatics: Principles and Applications, Bal, H. P. (2005), Tata McGraw-Hill.

Reference Books:
1. Bioinformatics Algorithms ï Design and Implementation in Python, Miguel Rocha & Pedro Ferreira, Academic Press, Elsevier Inc.
2. Bioinformatics Algorithms: An Active Learning Approach, Edition 2, Volume 1. Phillip Compeau & Pavel Pevzner.
3. Bioinformatics computing, Bergeron, B. P. (2003), Prentice Hall Professional.
4. Bioinformatics Technologies, Chen, Y. P. P. (Ed.). (2005). Springer.
5. Bioinformatics for dummies, Claverie, J. M., & Notredame, C. (2011), John Wiley & Sons.
6. Fundamental Concepts of Bioinformatics, Dan. E. Krane, & Raymer, M. L. (2003), Pearson Education International.

6KSO5 CYBER LAWS & ETHICS L-3,T-0,C-3]

Course Prerequisite: Basic Knowledge of Internet.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Cyber Laws & Ethics by being able to do each of the following:
1. Understand Cyber Space, Cyber Crime, Cyber Laws, Information Technology, Internet, Internet Services
2. Know Legal Aspects of Regulation concerned with Cyber Space, Technology and Forms of Cyber Crimes
3. Understand Computer Crimes and Cyber Crimes, Cyber Crime in Global and Indian Response.
4. Understand Criminal Liability, Cyber Crime implications and challenges.
5. Learn Precaution & Prevention of Cyber Crimes, Human Rights perspective of Cyber Crime.

Course Outcomes (Expected Outcome): On completion of this course, the students should be able to:
1. Understand Cyber Space, Cyber Crime, Information Technology, Internet & Services.
2. List and discuss various forms of Cyber Crimes
3. Explain Computer and Cyber Crimes
4. Understand Cyber Crime at Global and Indian Perspective.
5. Describe the ways of precaution and prevention of Cyber Crime as well as Human Rights.

Unit I: Hours: 6
Information Technology & Cyber Crimes: Introduction, Glimpses, Definition and Scope, Nature and Extent, Know no Boundaries, Rapid Transmission and Accuracy, Diversity and Span of Victimization, Cyber World, Inadequacy of Law, Influence of Teenagers Information Technology: Definition & Perspective, Growth & Future, Various Facets & Dimensions. Regulatory Perspective on Technology: Impact of Information and Technology, Regulation of Cyber Space, Legal Aspects of Regulation.

Unit II: **Hours: 6**

Technology & Forms of Cyber Crimes: Influence of Technology on Criminality, Forms of Cyber Crimes. Computer Crimes & Cyber Crimes: A Criminological Analysis Computer Crimes and Cyber Crimes: Terminological Aspects, Opportunities to Cyber Criminals, Motives of Offenders, Problems Affecting Prosecution, Cyber Crimes: Challenges of Prevention and Control, Need and Prospects (~f Criminological Research.

Unit III: **Hours: 6**

Cyber Crimes 'and Global Response: Global Perspective, Country wise Legal Response, Country wise Analysis. Cyber Crimes and Indian Response: Introduction, The Indian Information Technology Act 2000, Preamble & Coverage, Nature of Offences and Penalties, Miscellaneous and Subsidiary Provisions Certain Shortcomings, Future Prospects and Needs.

Unit IV: **Hours: 6**

Mens Rea & Criminal Liability: Introduction, Historical Perspectives, Mens Rea in Indian Criminal Law, Mens Rea in English Criminal Law, Abetment of Offence, Criminal Liability and Role of Mens Rea in Indian Information Technology Act, 2000 Investigation in Cyber Crimes: Implications and Challenges: : Introduction, Procedural Aspects, Issues, Complications and Challenges Concerning Cyber Crimes, Problems and Precautionary measures for Investigation.

Unit V: **Hours: 7**

Cyber Crimes : Discovery and Appreciation of Evidences: Introduction, Law of Evidence, Evidences in Cyber Crimes : Challenges and Implications, Computer Generated Evidence and their Admissibility, Judicial Interpretation of Computer related Evidence Prevention of Cyber Crimes :National and International Endeavours: Introduction, International Services on Discovery and Recovery of Electronic and Internet Evidence, International Organisation on Computer Evidence (IOCE), OECD Initiatives, Efforts of G-7 and G-8 Groups, Endeavours of Council of Europe, Measures of United Nations, Efforts of WTO, Measures of World Intellectual Property Organisation (WIPO),Interpol and its Measures, Efforts in India, Need of International Assistance and Appropriate Amendments, U.S. Laws on Cyber Crimes, U.S. Case-law on Cyber Evidences and Related Issues.

Unit VI: **Hours:7**

Human Rights Perspectives Cyber Crimes: Introduction, Ideological Aspects, Fundamental Rights and Civil Liberties, Various Issues and Challenges.

Cyber Crimes : Precaution and Prevention: Introduction, Awareness and Law Reforms, Improving Criminal Justice Administration, Increasing International Cooperation, Curricular Endeavours and Checking Kids' Net Addiction, Role of Guardians, Mobile Pornography: No Nearer Solution in Sight, Self-regulation in Cyber Space.

Text Book: Dr Pramod Kr.Singh, ñLaws on Cyber Crimes [Along with IT Act and Relevant Rules]ò Book Enclave Jaipur India.

Reference Books:

1. Craig B, ñCyber Law: The Law of the Internet and Information Technologyò. Pearson Education.
2. Pawan Duggal, ñCyber Lawsò Universal Law Publishing.
3. K.Kumar,ò Cyber Laws: Intellectual property & E Commerce, Securityò, 1st Edition, Dominant Publisher, 2011.
4. Rodney D. Ryder, ñGuide to Cyber Lawsò, Second Edition, Wadhwa And Company, New Delhi, 2007.
5. Vakul Sharma, "Handbook of Cyber Laws" Macmillan India Ltd, Second Edition, PHI, 2003.
6. Justice Yatindra Singh, "Cyber Laws", Universal Law Publishing, First Edition, New Delhi, 2003.
7. Sharma, S.R., ñDimensions of Cyber Crimeò, Annual Publications Pvt. Ltd., First Edition, 2004.
8. Augastine, Paul T., ñCyber Crimes and Legal Issuesò, Crecent Publishing Corporation, 2007.

6KE05 INTELLECTUAL PROPERTY RIGHTS [L-3,T-0,C-3]

Course Prerequisite: Basic knowledge of Communication skills, Soft skills, Presentation and Ethics.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Intellectual Property Rights in the following:

1. This course is intended to impart awareness on Intellectual Property Rights (IPR) and various regulatory issues related to IPR
2. To make familiarizing students with the shades of Intellectual Property Rights (IPR) so as to help them integrate the IPR process in their project and research activities.
3. To make the students familiar with basics of IPR and their implications in Project research, development and commercialization.
4. To impart awareness on intellectual property rights and various regulatory issues related to IPR.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Demonstrate a breadth of knowledge in Intellectual property.
2. Assess fundamental aspects of Intellectual Property Rights.
3. Discuss Patents, Searching, filling and drafting of Patents
4. Discuss the basic principles of geographical indication, industrial designs, and copyright.
5. Explain of Trade Mark and Trade Secret.
6. Investigate current trends in IPR and Government initiatives in fostering IPR.

Unit I: Overview of Intellectual Property Rights **Hours: 06**

Discovery, Invention, Creativity, Innovation, History & Significance of Intellectual Property Rights (IPR), Overview of IPR - Patent, Copyright, Trade Mark, Trade Secret, Geographical Indication, Industrial Design & Integrated Circuit, Non-patentable criteria.

Unit II: Patents **Hours: 08**

Patents: Patents- Patentability Criteria, Types of Patents-Process, Product & Utility Models, Software Patenting and protection, Overview of Patent Search-Types of Searching, Public & Private Searching Databases, Basics of Patent Filing & Drafting, Indian Patents Law Patents - Elements of Patentability: Novelty, Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and license , Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board.

Unit III: Copyrights **Hours: 06**

Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties ï Related Rights - Distinction between related rights and copyrights.

Unit IV: Trademarks **Hours: 07**

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board.

Unit V: Design & Geographical Indication **Hours: 07**

Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection. Geographical indication: meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection.

Unit VI: IPR: Current Contour **Hours: 06**

India`s New National IP Policy, 2016 ï Govt. of India step towards promoting IPR ï Govt. Schemes in IPR ï Career Opportunities in IP - IPR in current scenario with case studies.

Text Books:

1. K. V. Nithyananda (2019), ñIntellectual Property Rights: Protection and Managementò, IN: Cengage Learning India Private Limited.
2. P. Neeraj and D. Khusdeep (2014), ñIntellectual Property Rightsò, PHI learning Private Limited.

Reference Books:

1. Deborah E. Bouchoux, ñIntellectual Property for Paralegals ï The law of Trademarks, Copyrights, Patents & Trade secretsò, 4th Edition, Cengage learning, 2012.
2. N. S. Gopalakrishnan and T. G. Agitha, ñPrinciples of Intellectual Propertyò, Eastern Book Company, Lucknow, 2009.
3. M. M. S. Karki, ñIntellectual Property Rights: Basic Conceptsò, Atlantic Publishers, 2009.
4. Ganguli Prabuddha, ñIntellectual Property Rights--Unleashing the Knowledge Economyò, Tata McGrawHill, 2001.
5. V. K. Ahuja, ñLaw relating to Intellectual Property Rightsò. India, IN: Lexis Nexis, 2017.
6. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.
7. Ajit Parulekar and Sarita Dô Souza, Indian Patents Law ï Legal & Business Implications; Macmillan India ltd, 2006.
8. B. L. Wadehra. Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000.
9. Ganguli Prabuddha, ñGearing up for Patentsé The Indian Scenarioò, Universities Press, 1998.

6KE06 SOFTWARE ENGINEERING - LAB [P-2, C-1]

Course Prerequisite: A Scripting Language, IDEs (Integrated Development Environment), Databases, Software Development Life Cycle (SDLC)

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Software Engineering by being able to do each of the following:

1. Impart state-of-the-art knowledge on Software Engineering and UML in an interactive manner
2. Present case studies to demonstrate the practical applications of different concepts
3. Provide a scope to the students where they can solve small, real-life problems
4. All the while it is intended to present Software Engineering as an interesting subject to the students where learning and fun can go alongside.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Understand basic Software engineering methods and practices, and their appropriate application.
2. Describe software process models such as the waterfall and evolutionary models.
3. Discuss role of project management including planning, scheduling and, risk management.
4. Explain data models, object models, context models and behavioral models.
5. Understand of different software architectural styles and Process frame work.

List of experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

[1] Identifying the Requirements from Problem Statements Requirements, Characteristics of Requirements, Categorization of Requirements, Functional Requirements, Identifying Functional Requirements
[2] Estimation of Project Metrics Project Estimation Techniques, COCOMO, Basic COCOMO Model, Intermediate COCOMO Model, Complete COCOMO Model, Advantages of COCOMO, Drawbacks of COCOMO, Halstead's Complexity Metrics
[3] Modeling UML Use Case Diagrams and Capturing Use Case Scenarios
Use case diagrams |,Actor , Use Case , Subject , Graphical Representation , Association between Actors and Use Cases , Use Case Relationships , Include Relationship , Extend Relationship, Generalization Relationship , Identifying Actors , Identifying Use cases , Guidelines for drawing Use Case diagrams

[4]E-R Modeling from the Problem Statements
Entity Relationship Model , Entity Set and Relationship Set , Attributes of Entity , Keys , Weak Entity , Entity Generalization and Specialization ,Mapping Cardinalities , ER Diagram , Graphical Notations for ER Diagram , Importance of ER modeling
[5] Identifying Domain Classes from the Problem Statements
Domain Class , Traditional Techniques for Identification of Classes ,Grammatical Approach Using Nouns , Advantages , Disadvantages ,Using Generalization ,Using Subclasses , Steps to Identify Domain Classes from Problem Statement , Advanced Concepts
[6] State chart and Activity Modeling State chart Diagrams , Building Blocks of a Statechart Diagram , State , Transition , Action , Guidelines for drawing Statechart Diagrams , Activity Diagrams , Components of an Activity Diagram, Activity , Flow , Decision , Merge , Fork ,Join , Note , Partition ,A Simple Example , Guidelines for drawing an Activity Diagram
[7] Modeling UML Class Diagrams and Sequence diagramsStructural and Behavioral aspects , Class diagram , Elements in class diagram , Class , Relationships , Sequence diagram , Elements in sequence diagram , Object , Life-line bar , Messages
[8] Modeling Data Flow Diagrams Data Flow Diagram, Graphical notations for Data Flow Diagram, Explanation of Symbols used in DFD , Context diagram and leveling DFD
[9] Estimation of Test Coverage Metrics and Structural Complexity Control Flow Graph, Terminologies , McCabe's Cyclomatic Complexity, Computing Cyclomatic Complexity , Optimum Value of Cyclomatic Complexity , Merits , Demerits
[10] Designing Test Suites Software Testing , Standards for Software Test Documentation , Testing Frameworks , Need for Software Testing , Test Cases and Test Suite , Types of Software Testing , Unit Testing , Integration Testing , System Testing , Example , Some Remarks. Software Requirements: Star UML

Text Book: Pressman Roger. S: Software Engineering, A Practitionerôs Approach, TMH.

Reference Books:
1. Somerville: Software Engineering (Addison-Wesley) (5/e)
2. Fairly R: Software Engineering (McGraw Hill)
3. Davis A: Principles of Software Development (McGraw Hill)
4. Shooman, M.L: Software Engineering (McGraw-Hill)

6KE07 ALGORITHMICS – LAB [P-2, C-1]

Course Pre-requisite: Any programming language, Discrete Mathematics and Data Structures.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Design and Analysis of Algorithms by being able to do each of the following:
1. To understand asymptotic analysis of algorithms.
2. To apply algorithmic strategies while solving problems.
3. Ability to analyze time and space complexity.
4. Demonstrate a familiarity with major algorithms.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Carry out the analysis of various Algorithms for mainly Time complexity.
2. Apply design principles and concepts to algorithm design.
3. Understand different algorithmic design strategies.
4. Analyze the efficiency of algorithms using time complexity.
5. Apply the standard sorting algorithms.

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

List of Experiments based on Syllabus: (Maximum 20)
1. Implement C programs to perform recursive calls using the following searching algorithms.
2. Linear Search when the list is given.
3. Binary Search when the given list is not sorted.
[4] Study and analyze to sort an array of integers using merge sort.
[5] Implement and analyze to sort an array of integers using quick sort.
[6]Write a program to Implement the Closest Pair of Points problem using the divide and conquer strategy.

[7]Study and Implement the Divide and Conquer strategy using the Merge sort Algorithm and determine the complexity of an algorithm. DATA- {23,12,3,5,89,1,24}
[8] Write a C program for Implementing (n X n) matrix multiplication using the Strassen matrix multiplication algorithm.
[9] Explain the knapsack algorithm to find an optimal solution of getting maximum profit and implement using the program.
[10] Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm and implement using C.
[9] Implement programs to find minimum cost spanning trees from a given graph using Primôs algorithm.
[10]Implement Primôs algorithm to find the Minimum Cost Spanning Tree of an undirected graph using the program.
[11] Develop a program to implement Floyd's algorithm which will produce the shortest distance between all vertex pairs of a weighted graph.
[12] Implement programs to find the shortest path in a given graph using Dijkstraôs algorithm.
[13] Implement programs factorial knapsack problem.
[14] Develop a program to implement Strassenôs matrix multiplication algorithm.
[15] Implement programs to implement LCS problems using Dynamic Programming.
[16] Develop a program to implement matrix chain multiplication problems using dynamic programming.
[17] Explain Breadth-First Search and Implement BFS to print all the nodes reachable from a given starting node in a digraph.
[18] Develop a program to Print all the nodes reachable from a given starting node in a digraph using Depth First Search.
[19] Study an algorithm Tower of Hanoi where the aim is to move the entire stack to another rod for n=3 and understand the concept of recursion.
[20] Implement C programs N Queen's problem using Back Tracking.

List of Experiments beyond Syllabus: (Maximum 05)

[1] Implement the Work Function Algorithm and the Greedy Algorithm for the k-Server problem on graph metrics.
[2] Design and Implement Boyer Moore Algorithm for Pattern Searching.
[3]Design and Implement Topological Sort of a graph using departure time of vertex.
[4] Implement programs to find an s-t cut of minimum capacity. Minimum Cut Problem s 2 3 4 5 6 7 t 15 5 30 15 10 8 15 9 6 10 15 4 4 A Capacity = 10 + 8 + 10 = 28
[5]Implement programs to s-t flow of maximum value. Maximum Flow Problem 10 9 9 14 4 10 4 8 9 1 0 0 0 14 capacity flow s 2 3 4 5 6 7 t 15 5 30 15 10 8 15 9 6 10 15 4 4 0 Value = 28

Text Book: Dave and Dave: ñDesign and Analysis of Algorithmsò Pearson Education .

Reference Books:
[1] Aho,Hopcroft & Ullman ñThe Design & Analysis of Computer Algorithmsò, Addison-Wesley
[2] G. Brassard, P.Bratley: ñFundamentals of Algorithmicsò , PHI
[3] Horowitz & Sahani: ñ Fundamental Algorithmsò , Galgotia.
[4] Cormen, T.H, Lierson & Rivest: ñ Introduction to Algorithmsò, Mc Graw-Hill.

6KE09 C Skill Lab IV– LAB (DevOps) [P-2, C-1]

Course Pre-requisite: Basic knowledge on SDLC and STLC.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of DevOps learning by being able to do each of the following:

1. Learn what is Jenkins, continuous integration and where does Jenkins fits into SDLC (Software Development Life Cycle)
2. Learn how to setup Jenkins and use Jenkins on their systems, create and configure jobs in Jenkins
3. Learn how to use and manage plugins, how to create and manage users in Jenkins
4. Learn how to deploy application on server, how to work with multiple nodes
5. Learn how to create pipelines

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Install and setup of Jenkins on your systems
2. Create and run jobs in Jenkins
3. Add and manage plugins. Use plugins in jobs
4. Create and run pipelines in Jenkins
5. Setup, configure, deploy jobs

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

List of Experiments based on Syllabus: (Maximum 20)
1. Study and implement Linux commands
2. Study practical on installation of java, Tomcat Server
3. Study practical on software development life cycle

4. Study practical on DevOps life cycle & stages
5. Study practical on DevOps Tools (Docker, Jenkins, Git, Jira, copado)
6. Learn about DevOps Pipeline (CI /CD) using any tool
7. Study Practical on AWS for DevOps
8. Study Practical on Microsoft Azur for DevOps
9. Study Practical on Google Cloud for DevOps
10. Study Practical on Salesforce with Copado for DevOps
11. To setup and configure of Jenkins
12. To create Job and manage it using Jenkins
13. To experiment plugin management with jenkins
14. To study and demonstrate User role creation and management using Jenkins
15. To study and demonstrate Integration with Git using Jenkins
16. To study and demonstrate Automated deployments using Jenkins
17. To study and demonstrate Build and delivery pipelines using Jenkins
18. To study and demonstrate Job Parameterization using Jenkins
19. To study and demonstrate Command line executions using Jenkins
20. To study and demonstrate Jenkins node management

List of Experiments beyond Syllabus: (Maximum 05)

[1] Learn how to setup Jenkins on docker
[2] Learn how to do Jenkins maintenance
[3] Learn how to work with Git and Jenkins

Text Book: John Ferguson Smart: Jenkins: The Definitive Guide, O'Reilly Media, Inc.

Reference Books:
[1] Gene Kim, Jez Humble, Patrick Debois, and John Willis,: The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations
[2] Gene Kim, Kevin Behr, and George Spafford,: The Phoenix Project: A Novel About IT, DevOps, and Helping Your Business Win,
[3] Andrew Davis, : Mastering Salesforce DevOps: A Practical Guide to Building Trust While Delivering Innovation, Apress.

6KE08 EMERGING TECHNOLOGY - LAB II

6KE08 Department Professional Elective Lab II is based on 6KE04 Professional Elective-II. Tentative FOSS Tools & Technology for Practicalôs are as follows:

AI : Natural Language Toolkit (NLTK),SpaCy, PyTorch-NLP, Natural, Retext, TextBlob
Cloud : Stack, FOSS cloud Eucalyptus
IoT : Devicehub, Zetta, Node-RED, Flutter, M2MLabs Mainspring
Multimedia : Inkscape, GIMP, Krita, Scribus, RawTherapee.

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SYLLABUS PRESCRIBED FOR B.E. (INFORMATION TECHNOLOGY) SEM. V

5IT01 DATABASE MANGEMENT SYSTEMS

Course Objectives:

1. Identify role of database system, find out its applications and learn about database file systems.
2. Understand concept of designing database schema and its mapping to relational table.
3. Apply the concepts of database integrity and security, encryption, authorization and Normalization.
4. Evaluate query expression, query cost, query optimization and different operation.
5. Understand the concept of transaction management and its properties.
6. Understand concept of concurrency control and various type of protocol.

Course Outcomes:

1. To understand concept of database system.
2. To understand and apply the concept related with data model
3. Apply concepts of database querying, integrity and security using SQL.
4. To understand query processing and query optimization.
5. To understand concept of transaction management and its properties.
6. To understand the concept of Concurrency control and study of various database protocols.

Unit I: **Introduction:** Database, types of databases, DBMS, Purpose of DBMS & its Applications, RDBMS, File System, DBMS Architecture & its types, DBMS: SQL, MYSQL, ORACLE, PostgreSQL, DB2, SQL Server, Database Users and Administrator **Data Models:** Types of data Models: network, relational, object based data model; Data model schema, Data dependence, types of database languages, ACID properties. E-R Model Concepts, E-R diagram Notations, Mapping Constraints, DBMS Keys, E-R diagram to Table conversion.

Unit-II: **Relational Data Model:** Concepts, Relational algebra, Join operation, Integrity constraint nd its type, relational calculus, Normalization: functional dependencies, Decomposition, Domain & data dependency, types of Normal forms: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF; **Transaction processing:** Operations on transaction**,** Properties: Atomicity, Consistency, Isolation and Durability, States, schedule, deadlock in DBMS.

Unit-III: **SQL Introduction:**

SQL: Characteristic, advantages, data types, operators, wildcard operators, expressions, **Database commands:** create, drop, select and show database, Create table, drop table, Query with Select statements, Insert statement, Update statement, Delete statement with use of where, and, or clauses, Use of like and top clause, Alter command, Distinct Command, View in SQL, Create view using one or multiple table, delete view, Index creation & Drop, Null Values, SQL sub queries rules, sub queries using select, insert, update, delete statements, **SQL clauses:** having, group by, order by, join, **SQL Aggregate functions:** Count, sum average, max, min; Date function, **SQL Join:** inner, left, right, full, **SQL Set Operations**, Cursors, triggers

Unit-IV: **Concurrency Control:** Lock based protocol, Timestamp based schedulers,Validation based protocol, Serializability of scheduling, multiple granularity, and Concurrency Control schemes.

Unit-V: **Database Security:** Authentication, Authorization and access control, DAC, Mandatory Access Control and Role-Based Access Control models, Intrusion detection, SQL injection.

Unit-VI: **Advanced topics:** Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

Text Book: Korth, Sudarshan : Database System Concept , Mc Graw Hill, 6th Edition

Reference Books:

1. Raghu Ramkrishnan : Database system
2. C.J.Date : Database System, 7th ed.
3. Connolly &Begg : Database System, Low Price Ed.

5IT02: THEORY OF COMPUTATION

Course Prerequisite: Discrete Mathematics, Data Structures.

Course Objectives:

1. To understand different automata theory and its operation.
2. To understand mathematical expressions for the formal languages
3. To study computing machines and comparing different types of computational models
4. To understand the fundamentals of problem decidability and Un-Decidability.

Course Outcomes:

On completion of the course, the students will be able to

1. To construct finite state machines to solve problems in computing.
2. To write regular expressions for the formal languages.
3. To construct and apply well defined rules for parsing techniques in compiler
4. To construct and analyze Push Down, Turing Machine for formal languages
5. To express the understanding of the Chomsky Hierarchy.
6. To express the understanding of the decidability and un-decidability problems.

Unit I: Finite State Machines :

Alphabet, String, Formal and Natural Language, Operations, Definition and Design DFA (Deterministic Finite Automata), NFA (Non Deterministic Finite Automata), Equivalence of NFA and DFA: Conversion of NFA into DFA, Conversion of NFA with epsilon moves to NFA, Minimization Of DFA, Definition and Construction of Moore and Mealy Machines, Inter-conversion between Moore and Mealy Machines. Minimization of Finite Automata. (Construction of Minimum Automaton)

Unit II: Regular Expression and Regular Grammar :

Definition and Identities of Regular Expressions, Construction of Regular Expression of the given Language, Construction of Language from the RE, Conversion of FA to RE using Ardenʼs Theorem, Inter-conversion RE to FA, Pumping Lemma for RL, Closure properties of RLs (proofs not required), Regular grammar, Equivalence of RG (RLG and LLG) and FA.

Unit III: Context Free Grammar and Languages:

Introduction, Formal Definition of Grammar, Notations, Derivation Process: Leftmost Derivation, Rightmost Derivation, Derivation Trees, Construction of Context-Free Grammars and Languages, Pumping Lemma for CFL, Simplification of CFG, Normal Forms (CNF and GNF), Chomsky Hierarchy.

Unit IV: Pushdown Automata:
Introduction and Definition of PDA, Construction of PDA, Acceptance of CFL, Equivalence of CFL and PDA: Inter-conversion , Introduction of DCFL and DPDA, Enumeration of properties of CFL, Context Sensitive Language, Linear Bounded Automata.

Unit V: Turing Machines:
Formal definition of a Turing Machine, Design of TM, Computable Functions, Churchs hypothesis, Counter machine, Variants of Turing Machines: Multi-tape Turing machines, Universal Turing Machine.

Unit VI: Decidability and Un-Decidability:
Decidability of Problems, Halting Problem of TM, Un-Decidability: Recursive enumerable language, Properties of recursive & non-recursive enumerable languages, Post Correspondence Problem, Introduction to Recursive Function Theory.

Text Books:
1. Hopcraft H.E. & Ullman J: Introduction to Automata Theory, Languages and Computation
2. Peter Linz: An Introduction to Formal Languages and Automata .

Reference Books:
1. Rajesh K. Shukla: Theory of Computation, CENGAGE Learning, 2009.
2. K V N Sunitha and N Kalyani: Formal Languages and Automata Theory, McGraw Hill, 2010
3. Lewis H.P. and Papadimition C.H.: Elements of Theory of Computation
4. Mishra &Chandrashekharan: Theory of Computation
5. C.K.Nagpal: Formal Languages and Automata Theory, Oxford University Press, 2011.
6. Vivek Kulkarni: Theory of Computation, OUP India, 2013.

5IT03 SOFTWARE ENGINEERING

Course Objectives:
1. To understand the nature of software complexity in various application domains, disciplined way of software development and software lifecycle process models.
2. To know methods of capturing, specifying, visualizing and analyzing software requirements.
3. To learn about project planning, execution, tracking, audit and closure of project.
4. To introduce principles of agile software development, the SCRUM process and agile practices.
5. To understand project management through life cycle of the project.
6. To understand current and future trends and practices in the IT industry.

Course Outcomes:
1. To identify unique features of various software application domains and classify software applications.
2. To analyze software requirements by applying various modeling techniques.
3. To choose and apply appropriate lifecycle model of software development.
4. To describe principles of agile development, discuss the SCRUM process and distinguish agile process model from other process models.
5. To understand IT project management through life cycle of the project and future trends in IT Project Management.

Unit I: Evolving role of Software. Software crises & myths. Software engineering. Software process & process models: Linear sequential, prototyping, RAD, Evolutionary Product & Process. Project management concepts: People, Product, Process, Project. W5HH principles, critical practice.

Unit II: Measures, Metrics & Indicators. Metrics in process & project domains-software measurement, Metrics for software quality, small organization. Software projects Planning: Scope, resources, estimation, decomposition technique, Tools. Software risks : identification, risk projection, refinement & RMMM plan.

Unit III: Project Scheduling: Concepts. Peoples Efforts. Task set, Task network. Scheduling. EV analysis, Project Plan. Software quality concepts. SQ Assurance, Software reviews, technical reviews, software reliability, ISO 900 L, SQA Plan. SCM process. Version control. SCM standard.

Unit IV: System Engineering: Hierarchy, Business Process & Product engineering: Overviews. Requirement engineering, System modeling. Requirement analysis. Analysis principles. Software prototyping. Specification. Design Process. Design Principles & Concepts. Effective modular design. Design model & documentation.

Unit V: Software architecture, Data Design, Architectural styles, Requirement mapping. Transform & Transaction mappings. User interface design : Golden Rule. UTD, Task analysis & modeling, ID activities, Tools, design evaluation. Component level design : Structure programming, Comparison of design notation.

Unit VI: Software testing fundamentals; test case design, Whitebox testing. Basis path, control structure-, Blackbox-Testing, & for specialized environments. Strategic approach to S/W testing. Unit testing, integration testing, validation testing, system testing. Debugging. Technical metrics for software.

Text Book: Pressman Roger. S: Software Engineering, A Practitionerôs Approach, TMH. (5/e)

Reference Books:

1. Fairly R: Software Engineering (McGraw Hill)
2. Davis A: Principles of Software Development (McGraw Hill)
3. Shooman, M.L: Software Engineering (McGraw-Hill)

5IT04 PROFESSIONAL ELECTIVE - I (i) INFORMATION SECURITY SYSTEM

Course Objectives:

1. Understand the basics of Information Security
2. Know the legal, ethical and professional issues in Information Security
3. Know the aspects of risk management
4. Become aware of various standards in this area
5. Know the technological aspects of Information Security

Course Outcomes:

The learning outcomes are:

1. Study the foundational theory behind information security.
2. Discuss the basic information security.
3. Illustrate the legal, ethical and professional issues.
4. Discuss the aspects of risk management.
5. Summarize various standards for information security.
6. Explain the security techniques.

Course Contents:

UNIT I: Introduction to Information Security: History, What is Information Security?, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC

UNIT II : Security Investigation: Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues.

UNIT III : Legal, Ethical, and Professional Issues in Information Security: Law and Ethics in Information Security, International Laws and Legal Bodies, Ethics and Information Security.

UNIT IV : Security Analysis: An Overview of Risk Management, Risk Identification, Risk Assessment, Risk Control Strategies.

UNIT V : Planning for Security: Information Security Planning and Governance. Information Security Policy, Standards, and Practices, the Information Security Blueprint, Security Education, Training, and Awareness Program. Continuity Strategies .

UNIT VI : Cryptography: Foundations of Cryptology, Cipher Methods, Cryptographic Algorithms, Cryptographic Tools, Protocols for Secure Communications, Attacks on Cryptosystems.

TEXT BOOK : Michael E Whitman and Herbert J Mattord, ñPrinciples of Information Securityò, Vikas Publishing House, New Delhi, 2003.

REFERENCE BOOKS:

1. Micki Krause, Harold F. Tipton, ñ Handbook of Information Security Managementò, Vol 1-3 CRC Press LLC, 2004.111
2. William Stallings ,"Cryptography and Network Security: Principles and Practice", 6th Edition, Prentice Hall
3. M. Stamp, ñInformation Security: Principles and Practice,ò 2nd Edition, Wiley, ISBN: 0470626399, 2011.
4. Nina Godbole, ñ Information Systems Securityò, Wiley India Pvt. Ltd, ISBN -978-81-265-1692-6
5. Mark Merkow, ñ Information Security-Principles and Practicesò, Pearson Ed. 978-81-317-1288- 7.

5IT04 PROFESSIONAL ELECTIVE - I (ii) DATA SCIENCE & STATISTICS

Course Objectives:

Throughout the course, students will be expected to demonstrate their understanding of Data Science & Statistics by being able to do each of the following:

1. Organize, manage and present data.
2. Understand basic theoretical and applied principles of statistics.
3. Analyze statistical data using measures of central tendency, dispersion and location.
4. Introduce students to the basic concepts and techniques of Data Science.
5. Acquire knowledge of regression methods and classification methods.

Course Outcomes:

On completion of the course, the students will be able to:

1. Gain knowledge about basic concepts of Data Science & Statistics.
2. Demonstrate proficiency with statistical analysis of data.
3. Analyze statistical data graphically using frequency distributions and cumulative frequency distributions.
4. Develop the ability to build and assess data-based models.
5. Evaluate models generated from data

UNIT I Python for Data Science :

Mean, Median, Mode, Variance, Standard Deviation Numpy: The Basics of NumPy Arrays, Universal Functions, Aggregators, Broadcasting, Fancy Indexing; Pandas: Introducing Pandas Objects, Operating on Data in Pandas, Handling Missing Data, Hierarchical Indexing, Combining Datasets: Concat, Append, merge and join, aggregation and grouping , pivot Tables.

UNIT II Exploratory Data Analysis and Statistics:

EDA: Matplotlib and Seaborn: Simple Line Plots, Simple Scatter Plots, Density and Contour Plots, Histograms, Binnings, and Density ,Random Sampling, Distributions: Uniform Distribution, Normal Distribution, Poissonôs Distribution, Binomial Distribution.

UNIT III Statistical Experiments and Significance Testing:
Hypothesis Test: The Null Hypothesis, Alternative Hypothesis, One way, Two way Hypothesis Test; Statistical Significance and P-Values: P-value, alpha, type 1 error , type 2 error; t-Tests, Degrees of Freedom, ANOVA: F statistics, Two-way Anova; Chi-Square Test: A Resampling Approach.

UNIT IV Regression Techniques:
Introduction to Machine Learning, Hyper parameter and Model Validation, Feature engineering, Assumptions in Regression, Simple Linear Regression, Multiple Linear Regression.

UNIT V Classification: Logistic regression:
Logistic Response Function and Logit, Predicted Values from Logistic Regression, Interpreting the Coefficients and Odds Ratios; Evaluating Classification Models: Confusion Matrix, Precision, Recall, and Specificity, ROC Curve, AUC

UNIT VI Decision Tree and Radom Forest:
A Simple Example, The Recursive Partitioning Algorithm, Measuring Homogeneity or Impurity, Stopping the Tree from Growing, Predicting a Continuous Value; Random Forest

Text Books:

[1] Practical Statistics for Data Scientists By Peter Bruce, Andrew Bruce, O'Reilly Media, Inc.

[2] Python Data Science Handbook By Jake VanderPlas O'Reilly Media, Inc

Reference Books:

[1] Introduction to Machine Learning with Python By Andreas C. Müller, Sarah Guido, O'Reilly Media, Inc.

[2] Think Stats By Allen B. Downey O'Reilly Media, Inc.

5IT04 PROFESSIONAL ELECTIVE - I (III) INTERNET OF THINGS

Course Objectives:

The educational objectives of this course are:

To explore various components of Internet of things
To Recognize various devices, sensors and applications
To build a couple of applications that will communicate with IoT hardware and software.
To understand the IoT Reference Architecture and Real World Design Constraints.

Course Outcomes:

At the end of this course, the student would be able:

- To design small scale as well as sophisticated embedded system.
- To implement standalone application and GUI based application for real life projects.
- To recognize the role of professional societies in providing solution for real world problem.

Unit I: Introduction to IoT:
Sensing, Actuation, Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, IoT Definition, Characteristics. IoT Functional Blocks, Physical design of IoT, Logical design of IoT, Communication models & APIs.

Unit II: M2M to IoT:
From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics. Definitions, M2M Value Chains, IoT Value Chains.

Unit III: M2M vs IoT An Architectural Overview:
Main design principles and needed capabilities, An IoT architecture outline, standards considerations. Reference Architecture and Reference Model of IoT.

Unit IV: IoT Reference Architecture:
Getting Familiar with IoT Architecture, Various architectural views of IoT such as Functional, Information, Operational and Deployment, Constraints affecting design in IoT world- Introduction, Technical design Constraints.

Unit V: Developing IoT solutions:
Introduction to Python, Introduction to different IoT tools, Introduction to Arduino and Raspberry Pi. Implementation of IoT with Arduino and Raspberry, Cloud Computing, Fog Computing, Connected Vehicles, Data Aggregation for the IoT in Smart Cities

Unit VI: Security, Privacy & Trust:
IoT security challenge, Spectrum of security considerations, Unique security challenges of IoT devices, Internet of things privacy background, Unique privacy aspects of internet of things, Trust for IoT.

Text Books:

[1] Vijay Madisetti and Arshdeep Bahga, ñInternet of Things (A Hands-on-Approach)ò, 1 st Edition, VPT, 2014
[2] Peter Waher, ñLearning Internet of Thingsò, PACKT publishing, BIRMINGHAM ï MUMBAI

Reference Books:

[1] ñInternet of Things: Converging Technologies for Smart Environments and Integrated Ecosystemsò, Ovidiu Vermesan, Peter Friess, River Publishers.

[2] Bernd ScholzReiter, Florian Michahelles, ñArchitecting the Internet of Thingsò, ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer.

5IT05 OPEN ELECTIVE - I (I) SOFT SKILLS & INTERPERSONAL COMMUNICATIONS

Course objectives:

1. Explain and elaborate fundamentals of communication
2. Apply knowledge of verbal and nonverbal communication in business cases
3. Elaborate the barriers of communication and apply it improve communication

Course outcomes:
Student will be able to

1. Use and apply interaction skills
2. Use and apply leadership skills
3. Use and apply negations skills.

Unit I: Introduction, Need for Communication, Process of Communication, Written and Verbal Communication, Visual communication, Signs, Signals and Symbols, Silence as a Mode of Communication, Inter-cultural, Intra-cultural, Cross-cultural and International communication, Communications skills, Communication through Questionnaires, Business Letter Writing, Electronic Communication.

Unit II: Business Cases and Presentations, Letters within the Organizations, Letters from Top Management, Circulars and Memos, Business Presentations to Customers and other stakeholders, Presenting a Positive Image through Verbal and Non-verbal Cues, Preparing and Delivering the Presentations, Use of Audio-visual Aids, Report Writing.

Unit III: Barriers to Communication, Improving Communication Skills, Preparation of Promotional Material, Non-verbal communication, Body language Postures and gestures, Value of time , Organizational body language, Importance of Listening, Emotional Intelligence.

Unit IV: Individual Interaction and skills, Basic Interaction Skills ï Within family, Society, Personal and interpersonal intrapersonal skills, Types of skills; conceptual, supervisory, technical, managerial and decision making skills. Problem Solving, Lateral Thinking, Self Awareness and Self Esteem, Group Influence on Interaction Skills, Human relations examples through role ï play and cases.

Unit V: Leadership Skills, Working individually and in a team, Leadership skills, Leadership Lessons through Literature, Team work & Team building, Interpersonal skills ï Conversation, Feedback, Feed forward, Interpersonal skills ï Delegation, Humor, Trust, Expectations, Values, Status, Compatibility and their role in building team ï work Conflict Management ï Types of conflicts, how to cope with them, Small cases including role ï plays will be used as teaching methodology.

Unit VI : Negotiation Skills (To be Taught through Role Plays and Cases) ,Types of Negotiation ,Negotiation Strategies, Selling skills ï Selling to customers, Selling to Superiors, Selling to peer groups, team mates & subordinates, Conceptual selling, Strategic selling, Selling skills ï Body language,

Books Recommended:

1. Peggy Klaus, The Hard Truth about Soft Skills.
2. Nitin Bhatnagar. Effective Communication and Soft Skills. Pearson Education India.
3. Eric Garner. Team Building. 4. Wendy Palmer and Janet Crawford. Leadership Embodiment.

5IT05 OPEN ELECTIVE - I (II) COMPUTATIONAL BIOLOGY

Unit I: Introduction: Molecular Biology Introduction, Cell, Nucleus, Genes, DNA, RNA, Proteins, And Chemical structure of DNA, RNA, Transcription and Translation Process. Protein Structure and Functions, Nature of Chemical Bonds Molecular Biology tools, Polymerase chain reaction

Unit II: Sequence Alignment: Simple alignments, Gaps, Scoring Matrices, Global and Local Alignments, Smith-Waterman Algorithm, Multiple sequence Alignments, Gene Prediction, Statistical Approaches to Gene Prediction

Unit III: Genome Algorithms: Genome Rearrangements, Sorting by Reversals, Block Alignment and the Four-Russians Speedup, Constructing Alignments in Sub-quadratic Time, Protein Sequencing and Identification, the Peptide Sequencing Problem, Introduction to Nature Inspired Algorithms.

Unit IV: Microarray Data Analysis: Microarray technology for genome expression study, Image analysis for data extraction, Data analysis for pattern discovery, gene regulatory network analysis

Unit V: Phylogenetic: Neighborôs relation method, Neighbor-joining method, Maximum likelihood Approaches, Multiple Sequence Methods Structural Biology, Sequence, organisms, 3D structures, complexes, Assemblies, Case Studies, examples

Unit VI: Drug Discovery &Next Gen Sequencing: Similarities/differences between drugs and receptors, protein-ligand docking, Massively Parallel Signature Sequencing (MPSS), SOLiD sequencing, Single molecule real time (SMRT) sequencing .

Text Books:

1) Dan E. Krane, Michael L. Raymer, ñFundamental Concepts of Bioinformatics,ò, Pearson Education, Inc. Fourth Edition, 9780805346336.

2) Harshawardhan P. Bal, ñBioinformatics Principles and Applicationsò, Tata McGraw-Hill, seventh reprint, 9780195692303.

Reference Books:

1) Teresa Attwood, David Parry-Smith, ñIntroduction to Bioinformaticsò, Pearson Education Series, 9788180301971

2) R. Durbin, S. Eddy, A. Krogh, G. Mitchison., ñBiological Sequence Analysis: Probabilistic Models of proteins and nucleic acidsò, Cambridge University Press, 9780521629713.

5IT05 OPEN ELECTIVE - I (III) CYBER LAW & ETHICS

Course Objectives:

1. To identify and describe the major types of cyber crime.
2. To identify cyber crime vulnerabilities and exploitations of the Internet.
3. To understand the law with regards to the investigation and prosecution of cyber criminals.
4. To identify appropriate law enforcement strategies to both prevent and control cyber crime.
5. Explain jurisdictional challenges that nations face when responding to cybercrime

Course outcomes:

1. Understand Cyber laws
2. Describe Information Technology act and Related Legislation
3. Demonstrate Electronic business and legal issues.
4. Interpret Cyber Ethics.

Unit I: Introduction to Cyber law: Evolution of computer Technology, emergence of cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, CyberspaceWeb space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access.

Unit II Information Technology Act: Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.

Unit III : Cyber law and Related Legislation: Patent Law, Trademark Law, Copyright, Software ï Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution, Online Dispute Resolution (ODR).

Unit IV : Electronic Business and legal issues: Evolution and development in E-commerce, paper vs paper less contracts E-Commerce models- B2B, B2C, E security. Business, taxation, electronic payments, supply chain, EDI, E-markets, Emerging Trends.

Unit V: Cyber Ethics: The Importance of Cyber Law, Significance of cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block chain Ethics.

Unit VI : Case Study On Cyber Crimes: Harassment Via E-Mails, Email Spoofing (Online A Method Of Sending E-Mail Using A False Name Or E-Mail Address To Make It Appear That The E-Mail Comes From Somebody Other Than The True Sender, Cyber Pornography (Exm.MMS),Cyber-Stalking.

Reference Books:

1. Cyber Laws: Intellectual property & E Commerce, Security- Kumar K, dominant Publisher
2. Cyber Ethics 4.0, Christoph Stuckelberger, Pavan Duggal, by Globethic
3. Information Security policy & Implementation Issues, NIIT, PHI
4. Computers, Internet and New Technology Laws, Karnika Seth, Lexis Nexis Butterworths Wadhwa Nagpur.
5. Legal Dimensions of Cyber Space, Verma S, K, Mittal Raman, Indian Law Institute, New Delhi,
6. Cyber Law, Jonthan Rosenoer, Springer, New York, (1997).
7. The Information Technology Act, 2005: A Handbook, OUP Sudhir Naib,, New York, (2011) .

5IT06 DATABASE MANGEMENT SYSTEMS - LAB

1. **Practical 1**: To Study a Database Modeling Tool. Study of Data Modeling Tools
   - Take a description of the enterprise, create its corresponding ER Diagram and build a database model using any modeling tool. The following basic features of the modeling should be covered while building the model:
     - Logical / Physical Modeling
     - Adding an entity / its attributes , relationships (all kinds of relationships viz., parent-child, foreign key references, one to many, many to many etc)
     - Forward / reverse engineering
     - Details of forward engineering / schema generation
     - Steps to generate the schema

2. **Practical 2**: To Study and implement DDL Commands
   Implement the model created in Practical 1, in any of the DBMS like Oracle, MySQL, or Microsoft SQL Server database software.
     - Creating the proper tables
     - Insert the data into it.
     - Study Dropping and Altering the Tables. Study the cascaded deletes.

3. **Practical 3**: To Study and implement DML Commands-I
   - SQL queries : Write and execute different SQL queries
   - Execute Simple queries using SELECT, FROM, WHERE clauses,
   - In Where clause use different predicates involving OR,AND, NOT
   - Rename operation
   - Tuple Variables
   - Write SQL for various String operations (%,_,*)
     - Match beginning with
     - Match ending with
     - Substring
     - Match exactly n characters
     - Match at least n characters
   - Sort the output of the query using **Order by**
   - Write SQL using **Having**

4. **Practical 4** : To Study and implement DML Commands-II
   Write SQL queries and perform
     - Set membership operations
     - In, not in
     - Some
     - All
     - Exists and not exists, Test for emptyness using exists, not exists
     - Test for absence of duplicates.
     - Nested queries

5. **Practical 5**. Study and implement aggregation functions.
   Write different queries using following Aggregate functions
     a. Min (minimum 3 SQL queries)
     b. Max (minimum 3 SQL queries)
     c. Avg (minimum 3 SQL queries)
     d. Sum (minimum 3 SQL queries)
     e. Count (minimum 3 SQL queries)

6. **Practical 6:** Write SQL to create Views and Indexes.
7. **Practical 7**: Write SQL to perform the modifications to the database
8. **Practical 8** : PL /SQL
9. **Practical 9** : Database Access Using Cursors
   Write a trigger to find the names and cities of customers who have more than xyz in any account.
10. **Practical 10** : Triggers
    - Write a trigger for dealing with the overdrafts (set the account balance to zero, and creating a loan in the amount of the overdraft. Keep account number as loan number in the loan table)
    - Write a trigger for dealing with blank cities (set the city field to null when it is blank)

11. **Practical 11**: Procedures, functions
    - Write atleast 2 functions, and demonstrate its use
    - Write atleast 2 procedures, and demonstrate its use
12. **Practical 12** : Web Programming with PL/SQL. **(Contents Beyond Syllabus)**
    HTTP, A Simple Example., Printing HTML Tables., Passing Parameters., Processing HTML Forms., Multi-Valued Parameters.
13. **Practical 13**: Develop a JDBC Applications, Retrieve the information by connecting to the database using a host language (JAVA, C, C++) **(Contents Beyond Syllabus)**
14. **Practical 14**: Web Programming with Java Servlets. **(Connecting to the database) (Contents Beyond Syllabus)**
    A Simple Servlet., HTTP Servlet API Basics.,HTML Form Processing in Servlets.
15. **Practical 15**: PHP : Develop a simple application to access the database using PHP **(Contents Beyond Syllabus)**
16. Study of Open Source NoSQL Databases
17. Based on the concepts covered in text create a Mini Project:

Suggested Topics:

i. Bank database (Given in Korth book)
ii. University Database (Given in Korth book)
iii. Airline Flight Information System.
iv. Library Database Application.
v. University Student Database.
vi. Video Chain Database.
vii. Banking Database.
viii. BiBTeX Database.
ix. Music Store Database.
x. Online Auctions Database.
xi. A Web Survey Management System.

5IT07 SOFTWARE ENGINEERING LAB.

Minimum eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units and **a mini project based on the syllabus using case studies.**

LIST OF EXPERIMENTS:

1. Preparing Software Requirements Specifications
2. Identifying Domain Classes from the Problem Statements
3. Modeling UML Class Diagrams and Sequence diagrams
4. Modeling UML Use Case Diagrams and Capturing Use Case Scenarios
5. E-R Modeling
6. State chart and Activity Modeling
7. Modeling Data Flow Diagrams
8. Estimation of Project Metrics
9. Estimation of Test Coverage Metrics and Structural Complexity
10. Designing Test Suites
11. Preparing Final Project Report

5IT08 PROFESSIONAL ELECTIVE – I (I) INFORMATION SECURITY SYSTEM LAB .

Minimum eight experiments/programming assignments must be completed based on the syllabus uniformly covering each of the units.

5IT08 PROFESSIONAL ELECTIVE - I (II) DATA SCIENCE & STATISTICS

Minimum eight experiments/programming assignments must be completed based on the syllabus uniformly covering each of the units

List of Experiments:

Experiment No.	EXPERIMENT DESCRIPTION
01	Study of setting up the Python environment of and how it is useful for data science.
02	Study of Pandas, NumPy, SciPy and Matplotlib Libraries in Python and their importance in data science and statistics.
03	Write a python program to plot a sine wave using Matplotlib library.
04	Write a python program to understand the tokenization of string data.
05	Write a python program to handle the data in series and Data Frame format using NumPy Library.
06	Write a python program to read a csv file and display data from specific rows and specific columns from it.
07	Write a python program to print a 3D plot using matplotlib library.
08	Write a python program to understand the linear regression of data and display it.
09	Write a python program to read a time series data from a csv file and display it in a graph.
10	Write a python program to understand and implement the Naïve Bayes Algorithm.

5IT08 PROFESSIONAL ELECTIVE - I (III) INTERNET OF THINGS

Minimum eight experiments must be completed based on the syllabus uniformly covering each of the units.

LIST OF EXPERIMENTS:

1. To Interface **PRI Motion Sensor** with Raspberry Pi and write a program to control LED.
2. To Interface **Optical Sensor** with Raspberry Pi and write a program to control LED.
3. To Interface **Rain Drop Sensor** with Raspberry Pi and write a program to sound an alarm.
4. To Interface **Moisture Sensor** with Raspberry Pi and write a program to display value.
5. To Interface **Touch Sensor** with Raspberry Pi and write a program to detect and record physical touch.
6. To Interface **Gas Sensor** with Raspberry Pi and write a program to sounds an alarm.
7. To Interface **Pressure Sensor** with Raspberry Pi and write a program to display value.
8. To Interface **Ultrasonic Sensor** with Raspberry Pi and write a program to measure the distance between any two objects.

5IT 09 COMPUTER SKILL LAB - III

Minimum eight experiments/programming assignments must be completed based on the syllabus uniformly covering each of the units.

LIST OF EXPERIMENTS:

Sr. No.	Title for Experiment
1	Understanding and use of HTML & CSS Programming
2	Understanding and use of Java Script
3	Understanding and use of Type Script
4	Introduction to Angular
5	Angular Environment Set up
6	Creating Angular Project and basic introduction about project structure / directory.
7	Understanding Components and how to create components in Angular
8	Understanding of data binding in Angular component and view files.
9	Understanding and use of different types of Angular directives
10	Understanding of modules and routing in angular.
11	Understanding of services and component ós life cycle method
12	Understanding of package. json file in Angular Project.
13	Understanding of how to fetch data from the API using services.

Pre-requisites -Before proceeding with this Angular tutorial course, students should have a basic understanding of HTML, CSS, and JavaScript, basic oops concept.https://dotnettutorials.net/lesson/creating-angular-project/
Angular Tutorials Links:
https://angular.io/
https://www.javatpoint.com/angular-7-tutorial
https://www.tutorialsteacher.com/angular
https://www.tutorialspoint.com/angular7/index.htm

Reference Books:

1. ñAngular in Action **"by Jeremy Wilken: Manning Publications**
2. ñAngular: Up and Running: Learning Angular, Step by Stepò by Shyam eshadri: Shroff/O'Reilly PUBLICATIONS
3. ñ Beginning Angular with Typescriptò By : Greg Lim
4. ñLearning Angularò By **Aristeidis Bampakos and** Pablo Deeleman **Packt Publishing Limited.**

B.E. SEMESTER VI [INFORMATION TECHNOLOGY]

6IT01 COMPILER DESIGN

Course Objectives:
Throughout the course, students will be expected to demonstrate their understanding of Compiler Design by being able to do each of the following:

1. To learn concepts of programming language translation and phases of compiler design
2. To understand the common forms of parsers.
3.To study concept of syntax directed definition and translation scheme for the representation of language
4. To illustrate the various optimization techniques for designing various optimizing compilers.

Course Outcomes:
On completion of the course, the students will be able to:

1. Describe the fundamentals of compiler and various phases of compilers.
2. Design and implement LL and LR parsers
3. Solve the various parsing techniques like SLR, CLR, LALR.
4. Examine the concept of Syntax-Directed Definition and translation.
5. Assess the concept of Intermediate Code Generation and run-time environment
6. Explain the concept code generation and code optimization.

Unit I: Introduction to Compiling: Definition of Compiler, Phases of a Compiler, Grouping of Phases, Compiler Construction Tools.
Lexical Analysis: The role of lexical analyzer, input buffering, specification of tokens, recognition of tokens, language for specifying lexical analysis, lex and yacc tools, finite automata, from regular expressions to finite automata and state minimization of DFA.

Unit II: Syntax Analysis: The role of the parser, Review of context free grammar for syntax analysis.
Top down parsing: recursive descent parsing, predictive parsers, Transition diagrams for predictive parsers, Non recursive predictive parsing, FIRST and FOLLOW, Construction of predictive parsing tables, LL (1) grammars. Non recursive predictive parsing, Error recovery in predictive parsing.

Unit III: Bottom up parsing: Handle pruning, Stack implementation of Shift Reduce Parsing, conflicts during shift reduce parsing, LR parsers: LR parsing algorithm, Construction of SLR parsing table, canonical LR parsing tables and canonical LALR parsing tables. Error recovery in LR parsing, The parser generator Yacc.

Unit IV: Syntax Directed Translation: Syntax directed definitions, synthesized and inherited attributes, dependency graphs, Evaluation orders. Construction of syntax trees. Syntax directed definition for constructing syntax trees, directed acyclic graphs for expressions. Bottom up evaluation of s-attributed definitions, L-attributed definition. Top down translation, Design of a predictive translator.

Unit V: Run Time Environments: Source language issues: Activation trees, control stacks, storage organization, scope of a declaration, Storage Organization, Storage allocation strategies, static allocation, stack allocation, dangling references, heap allocation. Access to non-local names, Parameter passing, Symbol table: Entries, Storage allocation, Hash tables, Scope information.

Unit VI: Intermediate Code Generation: Intermediate languages, Translation of Declarations & Assignments statements. Design issues of a Code generator, Target machine, Runtime storage management, Basic blocks and flow graphs. Introduction to Code Optimization, Principal Sources of Optimization.

Text Book: Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman Compilers: ñPrinciples, Techniques and Toolsò, Pearson Education (Low Price Edition).
Reference Books:

[1] D. M. Dhamdhere, Compiler Constructionð Principles and Practice, (2/e), Macmillan India.
[2] Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman Compilers: ñPrinciples, Techniques and Toolsò, Pearson Education Second Edition
[3] Andrew Appel, Modern Compiler Implementation in C, Cambridge University press
[4] K C. Louden ñCompiler Constructionð Principles and Practiceò India Edition, CENGAGE
[5] Bennett J.P., ñIntroduction to Compiling Techniquesò, 2/e (TMH).

6IT02 DESIGN & ANALYSIS OF ALGORITHM

Course Objectives:

1. To teach paradigms and approaches used to analyze and design algorithms and to appreciate the impact of algorithm design in practice.
2. To make students understand how the worst-case time complexity of an algorithm is defined, how asymptotic notation is used to provide a rough classification of algorithms.
3. To explain different computational models (e.g., divide-and- conquer), order notation and various complexity measures.
4. Study of various advanced design and analysis techniques such as greedy algorithms, dynamic programming
5.Synthesize efficient algorithms in Common Engineering situations.

Course Outcomes:

- Analyze worst-case running times of algorithms using asymptotic analysis.
- Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it.
- Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it.
- Describe the greedy paradigm and explain when an algorithmic design situation calls for it.
- Able to understand the concept of Backtracking, Polynomial Time & Non Polynomial Time Algorithms.

Unit I: Top-Down Design: Structured Programming, Control Constructs, Procedures & Functions, Recursion. Iterative Algorithm Design Issue: Introduction, Use of Loops, Efficiency of Algorithms, Estimating & Specifying Execution Times, Order Notations, Algorithm Strategies, Design using Recursion.

Unit II: Divide and Conquer: Multiplication Algorithm and its analysis, Application to Graphics Algorithms: Introduction to Triangulation, Covex Hulls.

Unit III: Greedy Methods: Introduction, Knapsack Problem, Job sequencing with deadlines, Minimum Spanning Trees, Primôs Algorithms, Kruskalôs Algorithm, Dijkstras Shortest Path Algorithm.

Unit IV: Dynamic Programming: Introduction, Multistage Graphs, Traveling Salesman, Matrix multiplication, Longest Common Sub-Sequences, Optimal Polygon Triangulation. Single Source Shortest Paths

Unit V: Backtracking: Combinational Search, Search & Traversal, Backtracking Strategy, Backtracking Framework-8-Queenôs problem, graph coloring , Some Typical State Spaces, Branch-and-Bound Algorithms.

Unit VI: Polynomial Time & Non Polynomial Time Algorithms, Worst and Average case Behavior, Time Analysis of Algorithm, Efficiency of Recursion, Complexity, Examples of Complexity Calculation for Various Sorting algorithms. Time-Space Trade off and Time-Space Trade off in algorithm research.

Text Book: Dave and Dave: ñDesign and Analysis of Algorithmsò Pearson Education

Reference Books:

1. Aho,Hopcroft & Ullman ñThe Design & Analysis of Computer Algorithmsò, Addison-Wesley
2. G. Brassard, P.Bratley: ñFundamentals of Algorithmicsò , PHI
3. Horowitz & Sahani: ñ Fundamental Algorithmsò , Galgotia.
4. Cormen, T.H, Lierson & Rivest: ñ Introduction to Algorithmsò, Mc Graw-Hill .

6IT03 ARTIFICIAL INTELLIGENCE

Course Objectives:

1. Familiarity with basic principles of AI
2. Capable of using heuristic searches
3. Aware of knowledge based systems
4. Able to use fuzzy logic
5. Learn various applications domains AI.

Course Outcomes: Students will be able to

1. Define Artificial Intelligence and identify problems for which solution by AI methods can be devised.
2. Evaluate of different uninformed search algorithms on well formulate problems along with stating valid conclusions that the evaluation supports.
3. Design and Analysis of informed search algorithms on well formulated problems.
4. Formulate and solve given problem using Propositional and First order logic.
5. Apply reasoning for non-monotonic AI problems.
6. have a basic understanding of some of the more advanced topics of AI such as learning, Understanding, Natural Language Processing.

Unit-I: Introduction to Artificial Intelligence: The AI Problems, The Underlying Assumption, What is an AI Technique; Tic-Tac-Toe**, Problems, Problem Spaces, and Search,** Production Systems, Problem Characteristics , Production System Characteristics, Issues in the Design of Search Programs.

Unit-II: Basic Problem Solving methods: Reasoning, Problem trees and graphs, Knowledge Representation, **Uninformed Search Strategies:** Breadth First Search, Depth First Search, Depth Limited Search, Iterative Deepening Depth First Search, Bidirectional Search.

Unit–III: Informed Search Strategies Generate-and-Test, Hill Climbing, Best-first Search, A* Algorithm, Problem Reduction, AND-OR Graphs, The AO* Algorithm, Constraint Satisfaction, Means ends Analysis.

Unit –IV: Knowledge Representation Issues: Representations and Mappings, Approaches to Knowledge Representation, Issues in Knowledge Representation, **Predicate Logic:** Representing Simple Facts in Logic, Representing Instance and *ISA* Relationships, Computable Functions and Predicates, Resolution, Natural Deduction **Representing Knowledge Using Rules,** Procedural Versus Declarative Knowledge, Logic Programming Forward Versus Backward Reasoning.

Unit-V: Symbolic Reasoning Under Uncertainty Introduction to Non Monotonic Reasoning, Logics for Non Monotonic Reasoning, Semantic Nets, Statistical Reasoning, Fuzzy logic: fuzzy set definition and types, membership function. Probability and Bayesô theorem, Bayesian Networks.

Unit-VI: Understanding What is Understanding?, Understanding as Constraint Satisfaction, **Natural Language Processing,** Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing, Statistical Natural Language Processing, Spell Checking, **Common Sense** Qualitative Physics.

TEXT BOOK: Artificial Intelligence ï Elaine Rich, Kevin Knight, Nair (Third Edition) [Mc Graw Hill]

REFERENCE BOOKS:

1. Introduction to Artificial Intelligence and expert system ï Dan W. Patterson
2. Introduction to Artificial Intelligence ï Rajendra Akerkar
3. Nils Nilson: ñ Principles of Artificial Intelligenceò.(Addison-Wesley)
4. R. J. Winston: ñ Artificial Intelligenceò.(Wiley)
5. Patterwson ñIntroduction to Artificial Intelligence and Expert Systemsò (PHI).
6. Rolston ñPrinciples of Artificial Intelligence and Expert Systemsò, McGraw Hill.

6IT04 PROFESSIONAL ELECTIVE – II (I) CRYPTOGRAPHY AND NETWORK SECURITY

Course Objectives:
Throughout the course, students will be expected to demonstrate their understanding of Cryptography & Network Security by being able to do each of the following:

ÅTo understand the fundamental concepts of Cryptography & Network Security.
ÅTo familiarize the students with basic taxonomy and terminology of Cryptography & Network Security.
ÅTo understand various protocols for network security to protect against the threat in the network.
ÅTo understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.

Course Outcomes:
On completion of the course learner will be able to

- Understand the principles and fundamental concept of Cryptography & Network Security.
- To learn Encryption and Decryption Techniques.
- Evaluate various Key Encryption Algorithms.
- Understand IP Security system and protocols.
- Identify and understand Network Security controls.
- Explore web and system security and its applications to digital world.

Unit I: Introduction : OSI Security Architecture, Security Attacks: Threats, Vulnerability and Controls, Security Services: Confidentiality, Integrity, Availability, Introduction to Cryptography, Conventional Encryption: Conventional encryption model - classical encryption techniques.

Unit II: Encryption and Decryption: Characteristics of Good Encryption Technique: Properties of Trustworthy Encryption Systems; Types of Encryption Systems: Based on Key, Based on Block; Confusion and Diffusion; Cryptanalysis.

Unit III: Symmetric Key Encryption and Public Key Encryption: Data Encryption Standard (DES) Algorithm: Double and Triple DES, Security of the DES; Advanced Encryption Standard (AES) Algorithm, DES and AES Comparison, RSA Technique, Digital Signature.

Unit IV IP Security: Overview of IP Security (IPSec); IP Security Architecture; Modes of Operation; Security Associations, Security Parameter Index (SPI), SA Management, Security Policy: Authentication Header (AH); Encapsulating Security Payload (ESP); Internet Key Exchange.

Unit V Network Security: Network Concepts; Threats in Networks, Threats in Transit: Eavesdropping and Wiretapping, Protocol Flaws, Impersonation; Network Security Controls: Architecture, Encryption, Virtual Private Networks, Public Key Infrastructure (PKI) and Certificates.

Unit VI Web and System Security: Web Security: Secure socket layer and transport layer security, Secure Electronic transaction, System Security: Intruders, Viruses and related threads; Network Security Controls: Architecture, Public Key Infrastructure (PKI) and Certificates, Security Features of Trusted Operating Systems.

Text Book: William Stallings, ñCryptography and Network security Principles and Practicesò, Pearson/PHI.

Reference Books:
1. W. Mao, ñModern Cryptography ï Theory and Practiceò, Pearson Education.
2. Wade Trappe, Lawrence C Washington, ñIntroduction to Cryptography with coding theoryò, Pearson.
3. Charles P. Pfleeger, Shari Lawrence Pfleeger ñSecurity in computingò, Prentice Hall of Ind

6IT04 PROFESSIONAL ELECTIVE – II (II) BIG DATA ANALYTICS

Course Objectives:

1. To make the students aware about the basics concepts of big data analytics.
2. To introduce the tools required to manage and analyze big data like Hadoop and NoSql
3. To discuss the basic concepts and operations of map-Reduce
4. To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
5. To introduce several new algorithms for big data mining like classification, clustering and finding frequent patterns
6. To introduce to the students several types of big data like social media, web graphs and data streams and help them to solve real world problems in for decision support.

Course Outcomes:

On completion of the course the student(s) will be able to

1. Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.
2. Acquire fundamental enabling techniques like Hadoop, and NO SQL in big data analytics.
3. Achieve basic knowledge and operations of Map-Reduce
4. Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.

5. Implement algorithms for Clustering, Classifying and finding associations in Big Data 6. Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications.

UNIT I: Introduction to Big Data:

Introduction to Big Data, Big Data characteristics, types of Big Data, Traditional vs. Big Data business approach, Case Study of Big Data Solutions.

UNIT II: Introduction to big data frameworks: Hadoop and NoSQL:

Introduction to Hadoop, Hadoop Components; Hadoop Ecosystem; Overview of : Apache Spark, Pig, Hive, Hbase, Sqoop ,Introduction to NoSQL, NoSQL data architecture patterns: Key-value stores, Graph stores, Column family (Bigtable) stores, Document stores, Mongo DB.

UNIT III: MapReduce Paradigm:

MapReduce: The Map Tasks, Grouping by Key, The Reduce Tasks, Combiners, Details of MapReduce Execution, Coping With Node Failures. Algorithms Using MapReduce: Matrix-Vector Multiplication by MapReduce , Relational-Algebra Operations, Computing Selections by MapReduce, Computing Projections by MapReduce, Union, Intersection, and Difference by MapReduce, Computing Natural Join by MapReduce, Grouping and Aggregation by MapReduce, Matrix Multiplication, Matrix Multiplication with One MapReduce.

UNIT IV: Mining Big Data Stream:

The Stream Data Model: A DataStream-Management System, Examples of Stream Sources, Stream Queries, Issues in Stream Processing. Sampling Data in a Stream : Sampling Techniques. Filtering Streams: The Bloom Filter. Counting Distinct Elements in a Stream : The Count-Distinct Problem, The Flajolet-Martin Algorithm, Combining Estimates, Space Requirements . Counting Ones in a Window: The Cost of Exact Counts, The Datar-Gionis-IndykMotwani Algorithm, Query Answering in the DGIM Algorithm.

UNIT V: Big Data Mining Algorithms:

Frequent Pattern Mining : Handling Larger Datasets in Main Memory Basic Algorithm of Park, Chen, and Yu. The SON Algorithm and MapReduce. Clustering Algorithms: CURE Algorithm. Canopy Clustering, Clustering with MapReduce. Classification Algorithms: Parallel Decision trees, Overview SVM classifiers, Parallel SVM, K-Nearest Neighbor classifications for Big Data, One Nearest Neighbour.

UNIT VI: Big Data Analytics Applications

Link Analysis : PageRank Definition, Structure of the web, dead ends, Using Page rank in a search engine, Efficient computation of Page Rank, PageRank Iteration Using MapReduce, Topic sensitive Page Rank, link Spam, Hubs and Authorities, HITS Algorithm, Mining Social- Network Graphs : Social Networks as Graphs, Types , Clustering of Social Network Graphs, Direct Discovery of Communities, Counting triangles using Map-Reduce. Recommendation Engines: Content based Recommendation, Collabrative Filtering.

Text Books:

1. Radha Shankarmani, M Vijayalakshmi, òBig Data Analyticsò, Wiley Publications
2. Anand Rajaraman and Jeff Ullman ñMining of Massive Datasetsò, Cambridge University Press.

Reference Books:

1. Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Bart Baesens , WILEY Big Data Series.
2. Alex Holmes ñHadoop in Practiceò, Manning Press, Dreamtech Press.
3. Professional NoSQL Paperback, by Shashank Tiwari, Dreamtech Press
4. MongoDB: The Definitive Guide Paperback, Kristina Chodorow (Author), Michael Dirolf,O'Reilly Publications
5. Big Data Analytics with R and Hadoop by Vignesh Prajapati Paperback, Packt Publishing Limited Hadoop: The Definitive Guide by Tom White, O'Reilly Publications.

6IT04 PROFESSIONAL ELECTIVE – II (III) SENSORS & ACTUATORS

Course Learning Objectives:

- To learn concept behind working of various types of Sensors.
- To understand available sensor to measure each physical parameters used in Industry and normal measurement applications.
- To interface real sensors for meaningful output in Electrical form.

Course Outcomes:

- Concept behind working of measurement systems and different types of sensors and actuators.
- Understanding of electric and magnetic sensors and actuators and their applications.
- Understanding of optical sensors and other sensors and their applications.
- Understanding of smart sensors and their uses.

UNIT I: Introduction:
Definitions, Classification of Sensors and Actuators, General Requirements for Interfacing, Measuring Units. Performance Characteristics of Sensors and Actuators, Input and Output characteristics.

UNIT II: TEMPERATURE SENSORS AND THERMAL ACTUATORS:

Introduction, Thermosensitive Sensors: Thermistors, Resistance Temperature Sensors
and Silicon Resistive Sensors, Thermoelectric Sensors, P-N junction Sensors. Optical and Acoustical Sensors, Thermomechanical Sensors and Actuators.

UNIT III: OPTICAL SENSORS AND ACTUATORS:

Introduction, Optical Units, Materials, Effects of Optical Radiation, Quantum Based Optical Sensors, Photoelectric Sensors, Coupled Charge (CCD) Sensors and Detectors, Thermal-Based Optical Sensors, Optical Actuators.

UNIT IV: ELECTRIC AND MAGNETIC SENSORS AND ACTUATORS:

Introduction, Units, The Electric Field: Capacitive Sensors and Actuators, Magnetic Fields: Inductive Sensors and Hall Effect Sensors, MHD Sensors and Actuators, Magnetic Actuators, Voltage and Current Sensors.

Unit V: MECHANICAL / ACOUSTIC SENSORS AND ACTUATORS :

Introduction, Definitions/Units, Force Sensors, Accelerometers, Velocity Sensing.
Microphones, Acoustic Actuators, Ultrasonic Sensors and Actuators. Piezoelectric Actuators, Resonators and SAW Devices.

Unit VI: MEMS AND SMART SENSORS:
Introduction, MEMS Sensors and Actuators with Applications, Smart Sensors/Actuators Issues. Wireless Sensors and Actuators, Modulation/Demodulation, Encoding/Decoding Sensor Networks.

Text Book: Nathan Ida, ñSensors, Actuators, and their Interfaces: A Multidisciplinary Introductionò, SciTech Publishing.

Reference Books:

1. Patrick F Dunn, ñFundamentals Of Sensors For Engineering And Scienceò CRC Press, Taylor & Francis Group, 2014
2. Patranabis D., "Sensors and Transducers", Prentice-Hall India, 2nd Ed., 2004.
3. Shawhney A. K., "Electrical and Electronics Measurements and Instrumentation", Dhanpat Rai & Sons, 1994.
4. J. Fraden, Handbook of Modern Sensors: Physical, Designs, and Applications, AIP Press,

6IT05 OPEN ELECTIVE II (I) ECONOMIC POLICY IN INDIA

Course Objectives:

1. Student will be able explain and elaborate fundaments Indian economy
2. Student will be able to explain, elaborate and identify the role of agriculture in Indian economy
3. Student will be able to explain elaborate and identify the role of industrial sector in Indian economy.

Course Outcomes:

1. Student will be able to explain, elaborate and indentify the impact of external sector on Indian economy
2. Student will be able to explain, elaborate and indentify the impact monetary and fiscal policies in India
3. Student will be able to explain ,elaborate and analyze the issues of Indian economy.

UNIT - I : Indian Economy and Development Basic characteristics of the Indian economy - Major issues of development - The determinants of economic development - sustainable development - Demographic features of Indian population - Rural Urban Migration - poverty and Inequality.

UNIT - II : The Agricultural Sector The Role of Agriculture in Economic development - Place of Agriculture in the Economy of India - Land Reforms in India - Inter dependency of Agriculture and Industry - Agricultural Finance - Agricultural prices, polices and Food problem - Agricultural development.

UNIT - III : The Industrial Sector A review on Industrial Policy - Role of large scale and small scale Industries in development. Private Sector and public sector - Industrial sickness - Industrial Finance - Industrial monopoly and Multinational corporations - Role of Information Technology in Industrial development.

UNIT - IV : External Sector Structure and Direction of Foreign trade, Balance of Trade & Balance of payments - composition of Trade - Important of Foreign trade for developing economy - Exchange rate - Foreign capital and MNCs in India - Globalisation and its impact on Indian economy - WTO and its impact on the different sectors of the economy.

UNIT V: Monetary and Fiscal Policies in India, Credit and Monetary Policy, Capital Market and its Regulation, Public Finance and Fiscal Policy, Fiscal Federalism in India.

UNIT VI: Some Issues of Indian Economy: National Institution for Transforming India (NITI Aayog), National Development Council (NDC); Developing Grass-Root Organizations for Development: Panchayatiraj; Role of Non Government Organizations (NGOs) and Pressure Groups in Indiaגs Economy. Public Private Partnership (PPP).

Text Books:

1. Ahluwalia, IJ and IMD Little (Eds) (1999), Indian Economic Reforms and Development. (Essays in Honour of Manmohansingh) Oxford University, Press, New Delhi.
2. Bardhan, P.K (9th edition) (1999), The political economy of development in India, Oxford University, Press, New Delhi.

Reference Books:

1. Bawa, R.S and P.S.Raikhy (Ed) (1997) structural changes in Indian economy, Guru Nanak Dev University Press, Amritsar.
2 Brahmananda, P.R. and V.R Panchmukhi (Eds) (2001) Development Experience in the Indian economy: Interstate Perspectives, Bookwel Delhi.
3. Chakravartym .S (1987), Development Planning : The Indian Experience, Oxford University, Press, New Delhi.
4. Government of India, Econimic Survey (Animal) Ministry of Finance, New Delhi.
6. Jaban. B,(1992) The Indian Economy ð problems and prospects, Viking New Delhi.
7. Parikh.K.S (1999) India Development Report ð 1999 ð 2000 Oxford University, Press, NeW Delhi.
8. Reserve Bank of India, Report on currency and finance (Annual) 10. Sri R.K. and B. Chatterjee (2001) Essays in Honour of Prof.P.R.Brahmanandha), Deep & Deep Publications, New Delhi.

6IT05 OPEN ELECTIVE II (II) HUMAN RESOURCE DEVELOPMENT & ORGANIZATION BEHAVIOR

Course Objective:

The objective of the course is to familiarise the students about the different aspects of managing people in the organisations from the stage of acquisition to development and retention.

Course Outcome:

1. To have an understanding of the basic concepts, functions and processes of human resource management
2. To be aware of the role, functions and functioning of human resource department of the organizations.
3. To Design and formulate variours HRM processes such as Recruitment, Selection, Training, Development, Performance appraisals and r Reward Systems, Compensarion Plans and Ethical Behaviour.
4. Develop ways in which human resources management might diagnose a business strategy and then facilitate the internal change necessary to accomplish the strategy.
5. Evaluate the developing role of human resources in the global arena.

UNIT I: Introduction: Conceptual foundations; Human aspect of management, Human Relations; Human Resource Management- Concept, Scope and Importance; Competencies of HR Manager: Employer branding and Competency mapping; Changing role of HRM- Workforce diversity, Technological change, Restructuring and rightsizing, Empowerment; TQM, Managing ethical issues.

UNIT II: Human Resource Planning, Job Analysis, and Job Design: Assessing Human Resource requirements; Human resource forecasting; Work load analysis ; Job analysis; Job description and specifications; Job design; Job characteristic approach to job design

UNIT III: Recruitment, Selection, Training, and Development: Factors affecting recruitment; Sources of recruitment (internal and external); Basic selection model; Psychological tests for selection; Interviewing; Placement and Induction; Job Changes- Transfers, Promotions, and Separations; An overview of Training and Development; Emerging trends in Recruitment, Selection, and development.

UNIT IV: Understanding Organisation: Significance of Scientific Study of Human Behaviour, Hawthorn Studies itגs importance & implication, Approaches-Cognitive, Behaviourstic & Social learning framework Human Need, theory, Maslow & Herzberg Motivation Process.

UNIT V: Perspectives of Organisation: Perception & Impression, Personality & Attitudes, Learning Values. Group Dynamics, Group formation, Group interaction, Conflict Management, Team Management ñMoraleò

UNIT VI: Leadership: Managerial styles Managerial effectiveness, Indian Manager & His effectiveness, Delegation, Decision Making.

Text Books:

1) D'Cenzo, David A., Stephen P. Robbins, and Susan L. Verhulst, *Human Resource Management,* JohnWiley and Sons, NewDelhi.

2) Keith Devis Human Behaviour at Work.

3) Kundson&Fleeror Management of Organizational Behaviour.

Reference Books:

1. Gomez-Mejia, Luis R., D. B. Balkin, and R. L. Cardy, Managing Human Resources, Prentice Hall NewJersey.
2. Ian, Beardwell, and Len Holden, Human Resource Management, Prentice Hall.
3. Dessler, Garry, Human Resource Management, Prentice Hall of India.
4. Saiyadain, Mirza S., Human Resource Management, Tata McGraw-Hill Pub. Co. Ltd., New Delhi.
5. 6. Noe, Raymond A., John R. Hollenbeck, BarryGerhart and Patrick M. Wright , Human Resource Management, Tata McGraw Hill.
6. Korman A.K. Organizational Behaviour.
7. Prasad Organization Theory & Behaviour.

6IT05 OPEN ELECTIVE II (III) INTELLECTUAL PROPERTY RIGHT

Course Objectives:

Throughout the course, students will be expected to demonstrate their understanding of Intellectual Property Rights in the following:

1. This course is intended to impart awareness on Intellectual Property Rights (IPR) and various regulatory issues related to IPR
2. To make familiarizing students with the shades of Intellectual Property Rights (IPR) so as to help them integrate the IPR process in their project and research activities.
3. To make the students familiar with basics of IPR and their implications in Project research, development and commercialization.
4. To impart awareness on intellectual property rights and various regulatory issues related to IPR.

Course Outcomes:

On completion of the course, the students will be able to

1. Demonstrate a breadth of knowledge in Intellectual property.
2. Assess fundamental aspects of Intellectual Property Rights.
3. Discuss Patents, Searching, filling and drafting of Patents
4. Discuss the basic principles of geographical indication, industrial designs, and copyright.
5. Explain of Trade Mark and Trade Secret,
6. Investigate current trends in IPR and Government initiatives in fostering IPR.

UNIT I: Overview of Intellectual Property Rights:

Discovery, Invention, Creativity, Innovation, History & Significance of Intellectual Property Rights (IPR), Overview of IPR - Patent, Copyright, Trade Mark, Trade Secret, Geographical Indication, Industrial Design & Integrated Circuit, Non-patentable criteria.

UNIT II: Patents:

Patents: Patents- Patentability Criteria, Types of Patents-Process, Product & Utility Models, Software Patenting and protection, Overview of Patent Search-Types of Searching, Public & Private Searching Databases, Basics of Patent Filing & Drafting, Indian Patents Law

Patents - Elements of Patentability: Novelty, Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and license , Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board.

UNIT III: Copyrights:

Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties ï Related Rights - Distinction between related rights and copyrights.

UNIT IV: Trademarks:

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board.

UNIT V: Design & Geographical Indication:
Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection.
Geographical indication: meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection.

UNIT VI: IPR: Current Contour: India`s New National IP Policy, 2016 ï Govt. of India step towards promoting IPR ï Govt. Schemes in IPR ï Career Opportunities in IP - IPR in current scenario with case studies.

Text Books:
1. K. V. Nithyananda (2019), ñIntellectual Property Rights: Protection and Managementò, IN: Cengage Learning India Private Limited.
2. P. Neeraj and D. Khusdeep (2014), ñIntellectual Property Rightsò, PHI learning Private Limited.

Reference Books:
[1] Deborah E. Bouchoux, ñIntellectual Property for Paralegals ï The law of Trademarks, Copyrights, Patents & Trade secretsò, 4th Edition, Cengage learning, 2012.
[2] N. S. Gopalakrishnan and T. G. Agitha, ñPrinciples of Intellectual Propertyò, Eastern Book Company, Lucknow, 2009.
[3] M. M. S. Karki, ñIntellectual Property Rights: Basic Conceptsò, Atlantic Publishers, 2009.
[4] Ganguli Prabuddha, ñIntellectual Property Rights--Unleashing the Knowledge Economyò, Tata McGrawHill, 2001.
[5] V. K. Ahuja, ñLaw relating to Intellectual Property Rightsò. India, IN: Lexis Nexis, 2017.
[6] P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.
[7] Ajit Parulekar and Sarita Dô Souza, Indian Patents Law ï Legal & Business Implications; Macmillan India ltd, 2006.
[8] B. L. Wadehra. Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000.
[9] Ganguli Prabuddha, ñGearing up for Patentsé The Indian Scenarioò, Universities Press,1998.

6IT06 COMPILER DESIGN LAB

Suggested List of Experiments:

Experiment No.	*EXPERIMENT DESCRIPTION*
01	Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs and new lines.
02	Write a C program to identify whether a given line is a comment or not.
03	Write a C program to recognize strings under 'a*', 'a*b+', 'abb'.
04	Write a C program to test whether a given identifier is valid or not.
05	Write a C program to simulate lexical analyzer for validating operators.
06	Implement the lexical analyzer using JLex, flex or other lexical analyzer generating tools.
07	Write a LEX Program to scan reserved word and Identifiers of C Language.
08	Design Predictive Parser for the given language.
09	Implement SLR(1) Parsing algorithm.
10	Design a LALR bottom up parser for the given language.
11	Write a C program to generate three address codes.
12	Write a LEX Program to convert the substring abc to ABC from the given input string.
13	Write a lex program to find out total number of vowels, and consonants from the given input sting.

6IT07 DESIGN & ANALYSIS OF ALGORITHM LAB

Suggested List of Experiments:

1. To study various algorithm designing strategies.
2. Implement Multiplication algorithm using divide and conquer technique and analyze time complexity.
3. Implement Knapsack problem using greedy method
4. Implement Dijkstras Shortest Path Algorithm.
5. Implement Primôs algorithm using greedy method.
6. Implement travelling salesman problem using dynamic programming.
7. Implement search and traversal using backtracking approach.
8. To study polynomial time and non-polynomial time algorithms.

6IT08 PROFESSIONAL ELECTIVE – II (I) CRYPTOGRAPHY & NETWORK SECURITY- LAB.

Concerned faculty member should suitably frame at least 8 laboratory assignments from the following list or can design suitably 1 or 2 practical from each unit. Study practical are highly discouraged instead of that you can add comparison between different algorithms.

Suggested List of Experiments:

1. To download various security tools which are available on Internet.
2. WAP to demonstrate any substitution stream cipher algorithm.
3. WAP to demonstrate any transposition stream cipher algorithm.
4. WAP to implement Fesital Cipher Algorithm for 8 bit data, for single round.(Assume that the session Key is 1100 & complex function õFö be simple õXORö.
5. WAP to demonstrate authentication using password.
6. Activation of Firewall on the system & their setting.
7. How to detect Trojans by using ï Netstat,fPort,TCPview
8. Steganography using tools: Merge Streams, image hide,Stealth Files
9. Scanning for vulnerabilities using(Angry IP,HPing2,IPSacnner)
10. Braking Mono-alphabetic Substation cipher.

6IT08 PROFESSIONAL ELECTIVE – II (II) BIG DATA ANALYTICS LAB

List of Experiments :

1. Installation of Hadoop & R
2. Building Hadoop MapReduce Application for counting frequency of words/phrase in simple text file.
3. Study of R: Declaring Variable, Expression, Function and Executing R script.
4. Creating List in R ï merging two lists, adding matrices in lists, adding vectors in list.
5. Manipulating & Processing Data in R ï merging data sets, sorting data, plotting data, managing data using matrices & data frames 4. Implementation of K-Means Clustering with R
6. Text Analysis using R: analyzing minimum three different data sets
7. Twitter Data Analysis with R
8. Sentiment Analysis of Whatsapp data with R

6IT08 PROFESSIONAL ELECTIVE – II (III) SENSORS & ACTUATORS LAB

Concerned faculty member should suitably frame at least 8 laboratory assignments from the entire syllabus or can design suitably 1 or 2 practical from each unit. Study practical are highly discouraged.

6IT09 - COMPUTER SKILL LAB IV #

(# C Skill Lab IV - Mini project based on Software Engineering to be decided by Individual Dept. of respective College)

While designing a Mini Project student should follow the following steps;

1. Identifying the Requirements from Problem Statements
2. Estimation of Project Metrics
3. Modeling UML Use Case Diagrams and Capturing Use Case Scenarios
4. E-R Modeling from the Problem Statements
5. Identifying Domain Classes from the Problem Statements
6. Statechart and Activity Modeling
7. Modeling UML Class Diagrams and Sequence diagrams
8. Modeling Data Flow Diagrams
9. Estimation of Test Coverage Metrics and Structural Complexity
10. Designing Test Suites

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