Project:
The objective of the project is to enable the students to work in groups of not more than six members in each group on a project involving analytical, experimental, design or combination of these in the area of Electrical Engineering. Each project shall have a guide. The student is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem. On completion of the work, a project report should be prepared and submitted to the department. The evaluation is based on continuous internal assessment by an internal assessment committee for 75 marks. The university examination, which carries a total of 75 marks, will be a Viva Voce examination at the end of VIII Semester, conducted by a committee of one external examiner appointed by the University and one internal examiner/Guide.

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SYLLABUS OF VII & VIII SEMESTER B.E (ELECTRICAL ENGG.) (C.B.C.S.)

SEMESTER SEVENTH

7EE01 / 6EPO3 ELECTRICAL ENERGY DISTRIBUTION &UTILIZATION

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 substationequipment, 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. Introductionto High Voltage Distribution System (HVDS). Distribution Automation: Need for distribution automation, feederautomation, 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 fortrack electrification –overhead wires, conductor rail system, current collector-pantograph

Unit VI: Illumination: Street lighting**:** Principle, illumination level, mounting height of lamps, spacing, types oflamps. 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, “A First Course on Electrical Drives”, New Age International Publication
2. J.B.Gupta, “A Course in Power System”, S.Chand Publication.

Reference Books:
1. M.V.Deshpande, “Electrical Power System Design”, TMH Publishing Company Ltd
2. S.Sivanagaraju & S.Satyanarayana, “Electric Power Transmission & Distribution” Pearson Publication
3. P. S. Satnam&P.V.Gupta, “Substation design & Equipment” 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, “Modern Electric Traction” 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.

7EE02 DIGITAL SIGNAL PROCESSING

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

1. Analyze the discrete time signals in time domain.
2. Analyze the discrete time systems using DTFT and DFT.
3. Apply the concept of Bandpass sampling.
4. Design the structures of different types of digital filters.
5. Analyze the frequency response of various digital filters.
6. Apply the knowledge of multi-rate signal processing.

Unit I:
Introduction to DSP, Frequency domain description of signals &systems, Discrete time sequences systems, Linearity unit sample response, Convolution, Time invariant system, Stability criteria for discrete time systems, Solutions of linear difference equations.

Unit II:
Fourier Transform**:** Introduction to Fourier transform of Discrete Time Signal and its properties, Inverse Fourier transform, DFT and its properties, Circular convolution, Linear convolution from DFT, FFT, decimation in time and frequency algorithm.

Unit III:
Sampling of Bandpass signals, Representation of Bandpass signals, sampling of Bandpass signals, discrete time processing of continuous time signal; Analog to digital conversion-sample and hold, quantization and coding, analysis of quantization errors, oversampling of A/D converter; Digital to Analog conversion sample and hold, first order hold, linear interpolation with delay, oversampling of D/A converter.

Unit IV:
Filter categories, Direct form I, Direct form II, Cascade and parallel structure for IIR and FIR Filter, Frequency sampling structures for F.I.R. filter, Steps in Filter Design, Design by Pole Zero Placements, FIR filter design by Windowing Method, Rectangular, Triangular and Blackman window

Unit V:
Analog filter types, Butter worth, Elliptic filter, Specification and formulae to Decide to filter order, Methods to convert analog filter into IIR digital, Mapping of differential, Impulse Invariant, Bilinear, Matched Z transformation.

Unit VI:
Multirate DSP and Introduction to DSP Processor, Decimation by a factor D, interpolation by a factor I, sampling rate conversion by a rational factor I/D, Filter Design & Implementation for sampling rate conversion, Multi stage Implementation of sampling rate conversion. General Architecture of DSP, Case Study of TMS320C67XX.

Books Recommended:

Text Books:

1. J. G. Proakis and D. G. Manolakis, “Digital Signal Processing: Principles, Algorithm and Applications”, (4th Edition), Prentice Hall, 2007
2. N. J. Fliege, “Multirate Digital Signal Processing: Multirate Systems - Filter Banks – Wavelets”, (1st Edition), John Wiley and Sons Ltd, 1999.

Reference Books:

1. S. K. Mitra, “Digital Signal Processing”, 3rdEdition, TMH Edition.
2. Ifaeachor E.C, Jervis B. W., “Digital Signal Processing: A Practical Approach”, Pearson Publication
3. S. K. Mitra, “Digital Signal Processing: A Computer Based Approach”, McGraw Hill, 2011.

7EE03 ENTREPRENEURSHIP AND PROJECT MANAGEMENT

Course Outcomes:

After successful completion of this course, students will be able to:

1. Understand the concept of entrepreneurship and its role in economic development.
2. Compare the various business models and select the most suitable.
3. Identify&formulate the project report and Source of finance for a project.
4. Estimate the cost, time & resources for the project work.

Unit I:

Entrepreneurship: Introduction to Entrepreneurship, Meaning and concept of entrepreneurship, Need of Entrepreneurship, Types of Entrepreneurships-Social, For Profit, Not for Profit, the Evolution history of entrepreneurship development, role of entrepreneurship in economic development, Institutions/agencies for entrepreneurship development, future Scope of entrepreneurship, Entrepreneurial Ecosystem.

Unit II:
Entrepreneur: Entrepreneur: Who? Why? How? the Attributes, skills/traits required to be an entrepreneur; Creative and Design Thinking, types of entrepreneurs. Myths and Realities about entrepreneurs, the entrepreneurial decision process, and skill gap analysis, and Entrepreneurial models, entrepreneurial success stories, Pitching for Start-ups, Marketplace, Marketspace.

Unit III:
Business Model & Business Organization: Types of Business Models; its importance, Business Plan: Importance, Guidelines and Contents, Specimen of a B-Plan and Feasibility Studies, pre- requisites from the perspective of investor. The importance and diversity of business model, components of an effective business model Canvas, Various form of business organization-sole proprietorship, partnership, corporations, Limited Liability Company.

Unit IV:
Project Management: Basic concepts & Planning: Life Cycle of a Project. The Steps in managing a Project.International Standards (PMI, IPMA). Different types of projects: industrial, research and more. The role of the Project Manager.Terms of the Project Contract.Project Planning.Goals and Objectives of the Project.Owners and Stakeholder. The Work Breakdown Structure (WBS) to plan a project.

Unit V:
Project identification & Evaluation: Selection - project formulation – contents of a project report - planning commission, guidelines for formulating a project - specimen of a project report. Source of finance for a project - Institutional finance supporting projects, project evaluation - objectives - types - methods.

Unit VI:
Time and Cost Management: Estimation of Time, Costs and Resources. Scheduling Project Work.Critical Path Method (CPM).Resource balancing. Defining Project Risks. Process to establish the project risk plan. Contingency Reserves. Risk Matrix Analysis. Project Control and Evaluation.

BOOKS RECOMMENDED:

Text Books:
1. S. S. Khanka, "Entrepreneurial Development", S. Chand and Company Limited, New Delhi, 2001.
2. Dr. C. B. Gupta, Dr. N.P. Srinivasan, "Entrepreneurial Development", Sultan Chand & Sons.

Reference Books:
1. S. Choudhury, "Project Management*", Tata McGraw Hill Education Private Limited, 2009.*
2. Denis Lock, "Project Management", Gower Publishing Company, USA.

7EE04 PROFESSIONAL ELECTIVE-III

(i) WIND AND SOLAR SYSTEMS

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

1. Understand the energy scenario and the consequent growth of the power generation from renewable energy sources.
2. Understand the basic physics of wind and solar power generation.
3. Understand the power electronic interfaces for wind and solar generation.
4. Understand the issues related to the grid-integration of solar and wind energy systems.

Unit I:
Physics of Wind Power: History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and power-cumulative distribution functions.

Unit II:
Wind Generator Topologies: Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent-Magnet Synchronous Generators, Power electronics converters. Generator - Converter configurations, Converter Control.

Unit III:
The Solar Resource: Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability.

Unit IV:
Solar Photovoltaic: Technologies-Amorphous, mono crystalline, polycrystalline, V-I characteristics of a PV cell, PV model, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms. Converter Control.

Unit V:
Network Integration Issues: Overview of grid code technical requirements. Fault ride-through for wind farms - real andreactive power regulation, voltage and frequency operating limits, solar PV and wind farmbehaviour during grid disturbances. Power quality issues. Power system interconnectionexperiences in the world. Hybrid and isolated operations of solar PV and wind systems.

Unit VI: Solar Thermal Power Generation:
Technologies, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, Elementary analysis.

Books Recommended:

Text Books:
1. T. Ackermann, "Wind Power in Power Systems", John Wiley and Sons Ltd., 2005.
2. S. P. Sukhatme, "Solar Energy: Principles of Thermal Collection and Storage", McGraw Hill, 1984.

References Books:
1. G. M. Masters, "Renewable and Efficient Electric Power Systems", John Wiley and Sons, 2004.
2. H. Siegfried and R. Waddington, "Grid integration of wind energy conversion systems", John Wiley and Sons Ltd., 2006.
3. G. N. Tiwari and M. K. Ghosal, "Renewable Energy Applications", Narosa Publications, 2004.
4. J. A. Duffie and W. A. Beckman, "Solar Engineering of Thermal Processes", John Wiley & Sons, 1991.

7EE04 PROFESSIONAL ELECTIVE - III
(ii) VLSI DESIGN

Course Outcomes:

1. Identify the various IC fabrication methods.
2. Express the Layout of simple MOS circuit using Lambda based design rules.
3. Apply the Lambda based design rules for subsystem design.
4. Differentiate various FPGA architectures. CO5: Design an application using Verilog HDL.
5. Concepts of modelling a digital system using Hardware Description Language

Unit-I : VLSI and Moore's Law. CMOS technology. Hierarchical design. The VLSI design process. IP-based design. Fabrication methods.Transistor structures. Characteristics of transistors and wires. Design rules. Layout design. Reliability.

Unit-II : Combinational logic. Static logic gates. Basic Gate Layout. Delay and power consumption .Alternate gate structures: switch, domino. Wire delay models. Design-for-yield. Gates as IP.

Unit III : Combinational Logic Networks: Layouts for logic networks. Delay through networks. Logic and interconnect design. Power consumption and power optimization. Switch logic networks. Combinational logic testing.

Unit-IV: Sequential Machines: Latches and flip-flops. structures and Clocking disciplines. Performance analysis. Sequential system design. Power optimization. Verification and testing of FSMs

Unit-V : Subsystems Design: Pipelines and data paths. Adders. Multipliers. Memory. PLAs.FPGAs. Image sensors. Buses and networks-on-chips. Data paths.

Unit-VI: Floor planning: Floor planning styles and methodology. Global routing. Clock distribution. Power distribution. Packaging and pads. Register-transfer design. Pipelining. High-level synthesis.

Text Book: Wayne Wolf: "Modern VLSI Design", Prentice-Hall.

Reference Books:

1. Vai M.M. "VLSI Design", CRC Press.
2. Weste N, Eshraghian, "Principles of CMOS VLSI Design" Pearson Education.
3. Chandrasetty V A "VLSI Design", Springer.
4. Esteban Tlelo-Cuautle and Sheldon X.-D. Tan, "VLSI Design", InTech, Croatia

7EE04 PROFESSIONAL ELECTIVE-III -
(iii) Computer Architecture & Organization

Course Outcomes:
1. Differentiate Von Neumann, Harvard, and CISC and RISC architectures. Analyze the performance of machines with different capabilities.
2. Illustrate binary format for numerical and characters. Validate efficient algorithm for arithmetic operations.
3. Construct machine level program for given expression on n-address machine. Analyze and calculate memory traffic for a program execution. Design an efficient data path for an instruction format for a given architecture.

4. Explain the importance of hierarchical memory organization. Able to construct larger memories. Analyze and suggest efficient cache mapping technique and replacement algorithms for given design requirements. Demonstrate hamming code for error detection and correction.
5. Understand the need for an interface. Compare and contrast memory mapping and IO mapping techniques. Describe and Differentiate different modes of data transfer. Appraise the synchronous and asynchronous bus for performance and arbitration.
6. Understand the structure and read write mechanisms for different storage systems. Illustrate and suggest appropriate use of RAID levels. Assess the performance of IO and external storage systems.
7. Classify parallel machine models. Illustrate typical 6-stage pipeline for overlapped execution. Analyse the hazards and solutions

Unit I: Introduction and overview of computer Architecture :
Introduction to computer systems - Overview of Organization and Architecture –Functional components of a computer -Registers and register files-Interconnection of components Organization of the von Neumann machine and Harvard architecture-Performance of processor

Unit **II: Data Representation and Computer Arithmetic:**
Fixed point representation of numbers-algorithms for arithmetic operations: multiplication (Booths, Modified Booths) - division (restoring and non-restoring) - Floating point representation with IEEE standards and algorithms for common arithmetic operations- Representation of non-numeric data (character codes).

Unit III: Fundam**entals of Computer Architecture:**
Introduction to ISA (Instruction Set Architecture)-Instruction formats- Instruction types and addressing modes-Instruction execution (Phases of instruction cycle)- Assembly language programming-Subroutine call and return mechanisms-Single cycle Data path design-Introduction to multi cycle data path-Multi cycle Instruction execution.

Unit **IV Memory System Organization and Architecture:**
Memory systems hierarchy-Main memory organization-Types of Main memory-memory interleaving and its characteristics and performance- Cache memories: performance considerations. Virtual memories, address translation, memory management requirements.

Unit: V Interfacing and Communication:
I/O fundamentals: handshaking, buffering-I/O techniques: programmed I/O, interrupt-driven I/O, DMA- Interrupt structures: vectored and prioritized-interrupt overhead- Buses.

Unit: VI Device Subsystems:
External storage systems-organization and structure of disk drives: Electronic- magnetic and optical technologies-RAID Levels- I/O Performance. Performance Enhancements -
Classification of models - Flynns taxonomy of parallel machine models (SISD, SIMD, MISD, MIMD),Computer Peripherals: Input-output devices like video displays, online storage device, graphics input devices, Printers, scanner.

Text Book(s) :
1. David A. Patterson and John L. Hennessy Computer Organization and Design-The Hardware/Software Interface 5th edition, Morgan Kaufmann, 2013.
2. Carl Hamacher, ZvonkoVranesic, SafwatZaky, Computer organization, McGraw Hill, Fifth edition, Reprint 2011.

Reference Book:
1. W. Stallings, Computer organization and architecture, Prentice-Hall, 8th edition, 2013
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

7EE05 PROFESSIONAL ELECTIVE-IV
(i) ARTIFICIAL INTELLIGENCE

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

1. To understand and communicate fundamentals of Artificial Neural Networks and Systems.
2. To understand and present various learning methods and architectures of neural network.
3. To understand and describe fuzzy logic and genetic algorithm fundamentals and be able to solve problems.
4. To apply AI techniques to solve electrical engineering problems along with inter disciplinary problems.

Unit I: Introduction: Biological Neurons and their artificial models, introduction to neural computing Components of neuron, input and output weight, threshold, weight factors, transfer Functions, concepts of supervised and unsupervised learning.

Unit II: Supervised Learning: Single Layer network, perceptron, Linear Separability, Training algorithm and limitations Multilayer Network: Architecture of feed forward network, learning rule, generalized Delta rule, learning function. Back propagation algorithm.

Unit III: Unsupervised Learning: Introduction, Counter propagation networks, Korhonen's self-organizing maps, Hopfield's networks.

Unit IV: Introduction to Fuzzy: Uncertainty in information, basic concepts of Fuzzy sets, operations on fuzzy sets, properties. Fuzzy relations: operations, properties, value assignments.

Unit V: Membership Functions: Features, fuzzification, membership value assignments, Fuzzy Rule based Systems, Graphical technique of inference. Defuzzification: Lambda-cuts for Fuzzy sets and Fuzzy relations, Defuzzification methods.

Unit VI: Genetic Algorithm (GA): Introduction to genetic algorithm, workingprinciple, coding of variables, Fitness function. GA operators, similarities & differences between GAs and Traditional methods; Unconstrained and constrained optimization using Genetic Algorithm, real coded GA, Advanced GA, global optimization using GA.

Books Recommended:

Text Books:

1. J.M. Zurada, "Introduction to Artificial Neural Network", Jaico Publishing House.
2. T J Ross, "Fuzzy Logic with Engineering Application", Wiley Publication.

Reference Books:

1. G. J. Khir and T. A. Folger, "Fuzzy sets, Uncertainty and Information", PHI Publication.
2. Koska Bart, "Neural Network & Fuzzy systems", Prentice Hall of India Pvt Ltd, New Delhi.
3. MeherotraKishan, Mohan C. K., Ranka Sanjay, "Elements of Artificial Neural Networks", Penram International Publishing (India) Pvt. Ltd.
4. D. E. Goldberg, "Genetic Algorithm in Search Optimization and Machine Learning", Addison-Wesley Longman Publishing Co., US.
5. Kalyanmoy Deb, "Optimization for Engineering Design Algorithms and Examples", Prentice Hall of India, New Delhi.

7EE05 PROFESSIONAL ELECTIVE-IV
(ii) ELECTRICAL DRIVES & CONTROL

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

1. Explain the basic Concept of electrical drives
2. Demonstrate various modern speed, torque control techniques of DC drives
3. Demonstrate various modern speed, torque control techniques of AC drives.

Unit I: Introduction to Electrical Drives: Overview of electrical drive, comparison of DC & AC drive, components of load torque. Stability of an electrical drive.Introduction to frame of references (synchronous and rotating), Park and Clark transformation.

Unit II: DC Drive Control: Introduction to Four quadrant operation of dc drive, reviewof principle of operation of the chopper, four quadrant chopper circuit operation. Steady state analysis of chopper-controlled DC motor drive: continuous and discontinuous current conduction. Closed loop speed controlled separately excited dc motor drive.

Unit III: AC Drive Control: Review of basic principle of operation, speed control of induction motor: Impact of rotor resistance of the induction motor torque--speed curve. Review of slip energy recovery scheme. Closed loop control of slip energy recovery-controlled induction motor drive. Power electronic based rotor side control of slip ring Induction motor.

Unit IV: Scalar Control of Induction Motor: overview of three-phase voltage source inverter, generation of three-phase PWM signals, sinusoidal modulation, space vector theory, conventional space vector modulation, voltage fed inverter control: open loop v/f control, close loop speed control with v/f control and slip regulation.

Unit V: Vector Controlled Drive: Review of DC drive analogy, equivalent circuit and phasor diagram, principles of vector control, direct or feedback vector control, flux vector estimation, indirect or feed forward vector control, vector control of line side PWM rectifier, statorflux-oriented vector control, vector control of current Fed inverter drive.

Unit VI: Direct Torque & Flux Control (DTC): Torque expression with stator & rotor fluxes, control strategy of DTC, Adaptive control: self-tuning control, Model Referencing adaptive control (MRAC), sliding mode control: Control Principle, sliding trajectory control of vector drive.

Books Recommended:

Text Books:

1. Bimal K. Bose, "Modern Power Electronics and AC Drive",Pearson Education.
2. VedamSubrahmanyam, "Electric Drives: Concepts & Applications", Tata McGraw Hill Publishing Co Ltd.
3. Austin Hughes and Bill Drury, "Electric Motor and Drives: Fundamentals, Types and Applications", Newnes, Oxford.

Reference Books:

1. S. K. Pillai, "A First Course on Electrical Drives", New Age International Publishing Co. Ltd.
2. Gopal. K. Dubey, "Fundamentals of Electrical Drives", CRC Press
3. R. Krishnan, "Electric Motor Drives: Modeling, Analysis & Control", Prentice Hall of India Pvt Ltd.
4. M. D. Singh & K. B. Khanchandani, "Power Electronics", Tata McGraw Hill Publishing Co Ltd.
5. G. K. Dubey, "Power Semiconductor Controlled Drives", Prentice Hall.
6. Dr. P. S. Bimbhra, "Generalized theory of Electrical Machine", Khanna Publishers

7EE05 PROFESSIONAL ELECTIVE – IV:
(iii) DIGITAL CONTROL SYSTEMS

Course Outcomes:

1. Discretize the continuous system
2. Analyze the response of the system.
3. Analyze the stability of the system.
4. controllability/ observability of a system
5. Discretize the analog controller/ compensator
6. Design the state feedback control law.
7. Design the estimator for the given system.
8. Design a component or a product applying all the relevant standards with realistic constraints

Unit:I Introduction: Overview of design approaches, continuous versus digital control, sampling process, Sample and hold device, A/D, D/A conversion.Calculus of difference equations.Z-transform. Pulse transfer function

Unit:II Stability Analysis of discrete systems: location of poles, Jury's stability criterion, stability analysis through bilinear transforms. State variable analysis: State equations of discrete data systems – State transition equations – Relationship between state equation and transfer functions - Characteristic equations – Eigen value – Eigen vector.

Unit: III: State Space Representation: Diagonalization of Matrix – Jordan canonical form – Methods of computing state transition matrix – State diagram – Decomposition of discrete data transfer function. Controllability and observability of linier time invariant discrete data systems.

Unit: IV Design of Digital Control Systems: Classical Method: Digital PID controllers and frequency domain compensation design.

Unit: V: State Feedback Design: State variable methods - Pole placement design, Observer design and the discrete linear regulator problem.

Unit:VI: Microprocessor Based Digital Control
-Selection of processors ,Mechanization of control algorithms. Iterative computation via parallel, direct, canonical, cascade realization. Case studies.

Text Books:

1. K. Ogata, "Discrete-time control systems", Pearson, 2015.
2. G. F. Franklin, J. D. Powell and M Workman, 'Digital Control of Dynamic Systems' PHI (Pearson), 2008.

7EE06 ELECTRICAL ENERGY DISTRIBUTION & UTILIZATION - LAB

- Student should perform minimum eight practical based on syllabus.

7EE07 DIGITAL SIGNAL PROCESSING – LAB.

- Student should perform minimum eight practical based on syllabus.

7EE08 ENTREPRNEUURSHIP & PROJECT MANAGEMENT - LAB.

Student will carry out minimum eight assignments based on syllabus. List of assignments is given below for reference.

List of Assignments:

1. Undertake SWOT analysis to arrive at your business idea (Product / services).
2. Undertake self-assessment test to discover your Entrepreneurial traits.
3. Undertake the market survey to identify the need of market.
4. Identify Business opportunity for you.
5. Carry out the survey of industries of your stream and prepare the report.

6. Arrange the Visit to industries/firms of your product/service stream to study their business model.
7. Visit the banks and other financial Institutions to enquire about various funding scheme for set up the new business.
8. Compile the information of government agencies and financial agencies which provide loan/financial support to establish the business.
9. Prepare a report of technological and financial feasibility of chosen product/service.
10. Prepare a marketing strategy for chosen product/service.
11. Prepare a short term & long-term goal of your business.
12. Prepare a business plan for your chosen product/services.
13. Arrange a discussion session with successful entrepreneur to discuss on your business plan.
14. Study the stories of successful entrepreneur.
15. Prepare a DPR (Detail Project Report) of chosen product /services.

7EE09 PROJECT & SEMINAR

Seminar:
Each one of the students will be assigned a Seminar Topic in the current and frontier areas. The student has to conduct a detailed study/survey on the assigned topic and prepare a report. The student will make an oral presentation followed by a brief question and answer session. The Seminar (presentation and report) will be evaluated by an internal assessment committee for 50 marks.

Project:
The objective of the project is to enable the students to work in groups of not more than six members in each group on a project involving analytical, experimental, design or combination of these in the area of Electrical Engineering. Each project shall have a guide. The student is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem. On completion of the work, a project report should be prepared and submitted to the department. The evaluation is based on continuous internal assessment by an internal assessment committee for 75 marks. The university examination, which carries a total of 75 marks, will be a Viva Voce examination at the end of VIII Semester, conducted by a committee of one external examiner appointed by the University and one internal examiner/Guide.

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EIGHTH SEMESTER

8EE01 EMBEDED SYSTEMS

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

6. Acquire a basic knowledge about fundamentals of microcontrollers
7. Acquire a basic knowledge about programming and system control to perform a specific task.
8. Acquire knowledge about devices and buses used in embedded networking.
9. Develop programming skills in embedded systems for various applications.
10. Acquire knowledge about Life cycle of embedded design and its testing.

Unit-I : Introduction: Embedded systems design, embedded system architecture, embedded systems model, An Overview of Programming Languages and Examples of Their Standards, Standards and Networking, Multiple Standards-Based Device Example: Digital Television (DTV).

Unit-II: Embedded Hardware Building Blocks and the Embedded Board:
Powering the hardware, Instruction Set Architecture (ISA) architecture model, internal processor design and its performance.

Unit-III: Memory: ROM, RAM and auxiliary memory, Memory Management of External Memory, Performance of memory .I/ O: Managing Data: Serial vs. Parallel I/O, Interfacing the I/O Components, I/O performance.Buses: arbitration, timing and performance.

Unit-IV: Device Drivers: Device Drivers for Interrupt-Handling, Memory Device Drivers, On-board Bus Device Drivers, Board I/O Driver. Embedded OS: Multitasking and Process Management, Memory Management.

Unit-V: Embedded OS: I/O and File System Management, OS Standards: POSIX, OS Performance Guidelines. Middleware: meaning and examples. Application layer software: meanings and examples.

Unit-VI: Embedded system design & implementation:
Defining the System-Creating the Architecture and Documenting the Design, Stages in creating an Embedded System Architecture. Implementing the Design. Quality Assurance and Testing of the Design.

Text Book: Tammy Noergaard “Embedded Systems Architecture” Elsevier Newnes Publication.
Reference Books:
1. Rajkamal , “Embedded Systems, Architecture, Programming & Design” TMH.
2. Jane W. S. Liu ‘Real Time Systems”, Pearson Education
3. Vahid&Givargis “Embedded System Design” John Wiley & Sons P Ltd.
4. Peter Marwedel “Embedded Systems Design” Springer, Netherland.

8EE02 POWER SYSTEM PROTECTION

Course Outcomes:
After successful completion of this course, the students will be able to:

1. Explain the need, desirable features & main components of protection system.
2. Design the various protection scheme for transmission line
3. Develop the protection scheme for Alternator, Transformer, Motors &Busbar
4. Demonstrate the knowledge of static relays & Numerical relays
5. Select the proper type & rating of circuit breaker and fuses for various applications.

Unit I: Circuit Interruption, Circuit breaker control circuit, Fault clearing process, Autoreclosure, Arc phenomenon-maintenance, properties and interruption theories; AC circuit breakers- current interruption, transient recovery voltage (TRV), rate of rise of TRV, factors affecting TRV, ratings; Inductive and Capacitive current interruptions, current chopping.

Unit II: A. Fuses Types, Constructional features, operation, Characteristics and Applications B. Circuit Breaker (Part – I) Air break, Air blast, Bulk oil and minimum oil-types, constructional features, operation and application.

Unit III: Circuit Breaker (Part – II) SF6,Vacuum, Miniature, Earth leakage and Moulded Case – types, Constructional features, operation and application; Testing, Installation and Maintenance.

Unit IV: A. Relaying Principle Components, Essential features, Characteristics, Terminology, CT's and PT's, Relay classification. B. Electromagnetic Relays, Overcurrent, Directional, Distance and Differential – types, constructional features, operation, characteristics and application.

Unit V: Protection of Transmission Lines Relaying schemes – overcurrent, earth fault, directional, distance and differential; Parallel feeders and ring mains protection, three stepped protection ,Carrier current relaying, Overload and Power swing.

Unit VI: A. Other Power System Elements Protection Transformers, Motors, Generators and Buses.
B. Static Relaying Basic concepts, equipment's, comparators, Characteristics realization – overcurrent, directional, differential and distance relay. Microprocessor based relay introduction.

Text Book: Sunil S. Rao – "Switchgear and Protection" Khanna Publications New Delhi.

Reference Books:

1. R. T. Lythall – "Switchgear Handbook" J and P Newness Butterworth, London.
2. C. R. Mason – "The Art and Science of Protective Relaying"
3. A. R. Van and C Warringtan – "Protective Relaying ,Vol 1 and 2," Chapman Hall, London.
4. Geosonoviz – "High Voltage Circuit Breakers"
5. V. A. Slabikov – "Generation Protection and Switchgear" CIT, Coimbatore.
6. Badri Ram and B. N. Vishwkarma – "Power System Protection and Switchgear" Tata Mc-Graw Hill Publishing Company Limited, New Delhi.
7. B. Ravindranath and M Chander – "Power System Protection and Switchgear" Wiley Eastern Ltd, New Delhi.

8EE03 PROFESSIONAL ELECTIVE - V
(i) BIOMEDICAL ELECTRONICS

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

1. Understand the electronic devices and theory of operation in the medical area.
2. Learn to design, test, and analyze electronic circuits using oscilloscopes and other electronic test equipment.
3. Apply knowledge of engineering and science to interpret data.
4. Apply knowledge of engineering and science to understand the principle of biomedical electronic circuits.
5. Understand how to apply, measure circuit performance, and solve problems in the areas of biomedical signals.

UNIT-I: introduction to biomedical engineering:

Physiological system of heart, Man instrument system, Sources of bioelectric potentials, Different bioelectric signals like ECG, EMG and EEG, Bio-potential Electrode theory, Basic electrode, Electrodes for EEG, ECG, EMG, Biochemical electrodes. Skin contact Theory : skin contact impedance measurement of skin con tact impedance, motion artefacts, nearest equation Nearest Equation.

UNIT-II: Biomedical Recorder And Measurement:
Biomedical recorders for EEG, ECG, EMG, Blood pressure variation as a function of time, relationship of heart soundsto a function of the cardio vascular system, Measurement of Blood Pressure (Direct & Indirect), Blood flow, Heart sound.

UNIT-III: Medical Imaging System:
Instrumentation for diagnostics X-ray , X- ray basics properties , X-ray machine , Special imaging technique. Ultrasonic imaging system : Physics of Ultrasound, Biological effect of ultrasound. Ultrasonic A-scan, M-scan, B-scan, Real-time ultrasonic imaging systems.

UNIT-IV: Therapeutic Equipments:
Need of Physiological and electro therapy equipment. Cardiac pacemaker machine, Cardiac Defibrillators, Nerve and Muscle stimulators. Diathermy : short wave, microwave, ultrasonic.

UNIT-V: Patient Care and Monitoring and Safety:
System concepts, Bedside patient monitors, central monitors, Average reading heart monitor, Intensive care monitoring, Ambulatory monitoring. Biotelemetry: Single channel and Multichannel biotelemetry, telephonic data transmission. PATIENT SAFETY : Electric shock hazards, leakage current. Types of Leakage current, measurement of leakage current, methods of reducing leakage current, precautions to minimize electric shock hazards. Telemedicine.

UNIT-VI: Computers In Biomedical Engineering:
Computerized Axial Tomography (CAT), Computerized Aided ECG analysis, Computerized patient monitoring system. Computerized Catheterization.

Text Books:
1. Khandpur R.S. : "Handbook of Biomedical Instrumentation", TMH, New Delhi.
2. Cromwell L. &Weibell F.J.: "Biomedical Instrumentation and Measurement", Prentice Hall of India.

Reference Books:
1. Dr.Lele R.D. : "Computer Applications of Medicine", Tata Mc-Graw Hill, New Delhi.
2. Webstar J.G. : "Medical Instrumentation", IIIed., John Wiley & Sons.
3. Carr and Brown : Biomedical Equipment Technology.

8EE03/6EP04 PROFESSIONAL ELECTIVE-V
(ii) 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 HarmonicDistortion 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 op Amps. 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, pulses 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– Electronic Instrumentation, - Tata Mc-Graw Hill Publishing Company, New Delhi.
2. Cooper, Helfrick– Electronic Instrumentation and Measurement Techniques, A Prentice Hall of India, New Delhi.

Reference Books: -
1. B.R.Gupta -Electronics and Instrumentation – Wheeler Publishing.
2. Rangan, Sharma & Mani – "Instrumentation – devices & Systems" 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– A Course in Electrical & Electronics Instrumentation, Dhanpat Rai& Sons, New Delhi

8EE03 PROFESSIONAL ELECTIVE-V
(iii) DIGITAL IMAGE PROCESSING

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

1. Review the fundamental concepts of a digital image processing system.
2. Analyze images in the frequency domain using various transforms.
3. Evaluate the techniques for image enhancement and image restoration.
4. Categorize various compression techniques.
5. Interpret Image compression standards.
6. Interpret image segmentation and representation techniques.

UNIT-I : Introduction to digital image processing :
Digital Image Fundamental, Elements of Visual Perception, Simple Image Model, Sampling and Quantization, Basic Relationships between Pixel Imaging Geometry, Gray scale image representation.

UNIT-II: Image Transforms:
Introduction to the Fourier Transform, DFT, Properties of Two Dimensional Fourier Transform, FFT, Hadamard, Harr DCT, Slant Transform.

UNIT-III: Image Enhancement:
Basic Techniques, Enhancement by point processing, Spatial Filtering, Enhancement in Frequency domain, histogram based processing, homo-morphic filtering.

UNIT-IV: Image Restoration:
Degradation model, Diagonalisation concept, Algebraic approach to Restoration. Inverse filtering, Weiner (CNS) filtering Restoration in Spatial domain, Basic morphological concept, morphological principles, binary morphology, Basic concepts of erosion and dilation.

UNIT-V: Image Compression:
Fundamentals, Image compression models, Elements of Information theory, Lossy and predictive methods, vectorquantization, runlength coding, Hauff coding, and lossless compression, compression standards.

UNIT-VI: Image Segmentation:
Detection of discontinuities, Edge Linking and boundary detection, Thresholding, Regional oriented Segmentation.

Text Books :
1) Gonzaler and Woods: “Digital Image Processing”, Addison / Wesley.
2) Milan Sonka, Vaclav Hlavac, Roger Boyle: “Image processing Analysis and Machine Vision” , Book / Cole 2nd Edition.

Reference Books:
1) A. K. Jain: “Digital Image Processing”, PHI
2) William K. Pratt : “Digital Image Processing”, 3rd ed. , John Wiley and Sons Publi.

8EE04 PROFESSIONAL ELECTIVE-VI
(i) ROBOTICS

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

1. Learn about knowledge for the design of robotics.
2. Understand robot kinematics and robot programming.
3. Understand application of Robots.
4. Learn about force and torque sensing.

UNIT I: Introduction:
Brief History, Types of robots, Degrees of freedom of robots, Robot configurations and concept of workspace, End effectors and Different types of grippers, vacuum and other methods of gripping. Pneumatic, hydraulic and electrical actuators, applications of robots, specifications of different industrial robots.

UNIT II: Rigid Motion and Homogeneous transformation:
Position definitions. Coordinate frames. Different orientation descriptions.Free vectors. Translations rotations and relative motion, Composition of rotation, rotation with respect to fixed frame and current frame, parameterisation of rotation, Euler Angele, roll, pitch, yaw, axis/angle representation, Homogeneous transformation

UNIT III: Forward Kinematics:
Link coordinate frames, Denavit-Hartenberg convention. Assignment, of coordinate frame, Joint and end effector Cartesian space. Calculation of DH parameters and forward kinematic equation of different configuration of manipulator, Planner elbow manipulator, Cylindrical three link, SCARA, Spherical Wrist and other configuration.

UNIT IV: Velocity Kinematics:
Forward kinematics transformations of position Translational and rotational velocities.Velocity Transformations. Singularity, The Manipulator Jacobian.

UNIT V: Robot Dynamics:
Lagrangian formulation, general expression for kinetic and potential energy of n-link manipulator, Newton-Euler equations of motion. Derivation of equations of motion for simple cases: two-link.

UNITVI: Trajectory Planning& Programming: Trajectory planning and avoidance of obstacles. Trajectory for point to point motion, Cubic polynomial trajectory, Quintic polynomial, LSPB(Linear segment with parabolic blend)Minimum time trajectory, Trajectories for Paths Specified by Via Points. Robot languages, computer control and Robot software.

Text Books:

1. M.W. Spong, S. Hutchinson, and M. Vidyasagar, Robot Modeling and Control, Wiley, .2nd revise edition, 2012
2. J.J. Craig, Introduction to Robotics: Mechanics and Control, Pearson Education, 4th Edition, 2017
3. M.P. Groover, et.al., Industrial Robots: Technology, Programming and applications, McGraw Hill, 2nd Indian edition, 2012.

Reference Books:
1. Robot Manipulators: Modeling, Performance Analysis and Control. by Etienne Dombre; Wisama Khalil, Somerset : Wiley, 2013.
2. M O Tokhi, A K M Azad, Flexible robot manipulator :modelling, simulation and control 2nd edition, 2017.
3. Ashitava Ghosal. 'Robotic fundamental Concept and Analysis', Oxford University Press, 11th impression 2015.

8EE04/8EP04 PROFESSIONAL ELECTIVE – VI

(ii) ELECTRICAL ENERGY CONSERVATION AND AUDITING

Course Outcomes:

After successful completion of this course, students will be able to:

1. Summarize Indian and global energy scenario.
2. Explain types of energy Audit and its procedure.
3. Discuss economics of energy conservation
4. Elaborate the concepts of energy conservation and management.
5. Choose Appropriate energy efficient techniques for energy conservation
6. Apply the understanding of energy conservation and management for industrial applications.

Unit I: Energy Scenario: Various forms of energy: Primary and secondary energy, commercial and non-commercial energy, renewable and non-renewable. Indian and global energy scenario, energy needs of growing economy, energy pricing, electricity billing and tariff. Energy sector reforms: In coal, oil, natural gas and electricity. Functions and Responsibilities of CERC& SERC. Energy Conservation Act-2001, Indian electricity Act 2003 and its features.Electricity (Amendment) Bill, 2020 – Key Highlights. Energy and environmental Impacts.

Unit II: Energy Audit: Definition, energy audit, need, types of energy audit: Preliminary and detailed energy audit. Energy audit instruments. Procedure for carrying out energy audit.Data Analysis-Energy production relationship, specific energy consumption, Sankey (energy flow) diagram, CUSUM Technique, Bench marking, energy performance.

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, and internal rate of return method. Profitability index for benefit cost ratio.

Unit IV: Energy Conservation & Management: Definition and necessity of energy conservation. Review of electric motors, types, losses, motor efficiency, factors affecting motor Performance, transformer types & its losses. Rewinding and motor replacement issues. Definition and Objective of Energy Management, concept of Supply Side Management (SSM) and Demand Side Management (DSM), methods of implementing demand side management and advantages to consumer, utility and society. Energy strategy for the future.

Unit V: Energy Efficient Techniques in Electrical Systems: Review of power factor improvement and its benefit, selection and location of capacitors. Power factor penalties and incentives in tariff for demand control. Recommendations for energy conservation: Maximum demand controllers, automatic power factor controllers, Variable Speed Drives, Energy efficient transformers. Soft starting of motors.

Unit VI: Energy Conservation in Industrial Applications: Energy conservation opportunities in motive power (Motors and drive system)- Energy efficient motors, Heating Ventilation and Air Conditioning (HVAC), Illumination system, Pumps and Pumping systems, thermal power stations, Utility Industries: Transmission & Distribution Sector. Cogeneration & Waste heat recovery systems. Energy Audit Case Study of energy intensive industry.

BOOKS RECOMMENDED:

Text Books:

1. "Energy Audit and Conservation", TERI.
2. S. C. Tripathy, "Utilization of Electrical Energy and Conservation", Mc. Graw Hill, 1991.

Reference Books:

1. "Success stories of Energy Conservation", BEE, New Delhi. (www.beeindia.gov.in)
2. Thumman, "Energy Conservation and Audit", Fairmont Press.
3. Sonal Desai, "Handbook of Energy Audit", Mc. Graw Hill.
4. Guide books for National Certification Examination for Energy Manager/Energy.
5. Auditors Books, General Aspects (available online).

8EE04/8EP04 PROFESSIONAL ELECTIVE – VI
(iii) ELECTRIC AND HYBRID VEHICLES

Course Outcomes:

After successful completion of this course, students will be able to:

1. Understand the models to describe hybrid vehicles and their performance.
2. Understand the different possible ways of energy storage.
3. Understand the different strategies related to energy storage systems.

Unit I: Introduction: Conventional Vehicles: Basics of vehicle performance, vehicle power sourceCharacterization, transmission characteristics, mathematical models to describe vehicle performance.

Unit II: Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

Unit III: **Hybrid Electric Drive**: Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

Unit IV: Electric Trains: Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

Unit V: Energy Storage: Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems.

Unit VI: Energy Management Strategies: Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison ofdifferent energy management strategies, implementation issues of energy managementstrategies. Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

BOOKS RECOMMENDED:

Text Books:

1. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.
2. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, 2015.

Reference Books:

1. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.
2. T. Denton, "Electric and Hybrid Vehicles", Routledge, 2016.

8EE05 EMBEDDED SYSTEMS LAB

- Student should perform minimum eight practical based on syllabus.

8EE06 POWER SYSTEM PROTECTION LAB

- Student should perform minimum eight practical based on syllabus.

8EE07 PROJECT & SEMINAR

Seminar:

Each one of the students will be assigned a Seminar Topic in the current and frontier areas. The student has to conduct a detailed study/survey on the assigned topic and prepare a report. The student will make an oral presentation followed by a brief question and answer session. The Seminar (presentation and report) will be evaluated by an internal assessment committee for 50 marks.

Project:

The objective of the project is to enable the students to work in groups of not more than six members in each group on a project involving analytical, experimental, design or combination of these in the area of Electrical Engineering. Each project shall have a guide. The student is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem. On completion of the work, a project report should be prepared and submitted to the department. The evaluation is based on continuous internal assessment by an internal assessment committee for 75 marks. The university examination, which carries a total of 75 marks, will be a Viva Voce examination at the end of VIII Semester, conducted by a committee of one external examiner appointed by the University and one internal examiner/Guide.

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