Jharkhand University of Technology

Jharkhand, Ranchi

Proposed Syllabus

For

B.Tech 5th Semester

Electrical and Electronics Engineering

1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

a) Find employment in Core Electrical and Electronics Engineering and service sectors.

b) Get elevated to technical lead position and lead the organization competitively.

c) Enter into higher studies leading to post-graduate and research degrees.

d) Become consultant and provide solutions to the practical problems of core organization.

e) Become an entrepreneur and be part of electrical and electronics product and service industries.

2. PROGRAMME OUTCOMES (POs):

After going through the four years of study, our Electrical and Electronics Engineering Graduates will exhibit ability to:

PO#	Graduate Attribute	Programme Outcome
1	Engineering knowledge	Apply knowledge of mathematics, basic science and engineering science.
2	Problem analysis	Identify, formulate and solve engineering problems.
3	Design/development of solutions	Design an electrical system or process to improve its performance, satisfying its constraints.
4	Conduct investigations of complex problems	Conduct experiments in electrical and electronics systems and interpret the data.
5	Modern tool usage	Apply various tools and techniques to improve the efficiency of the system.
6	The Engineer and society	Conduct them to uphold the professional and social obligations.
7	Environment and sustainability	Design the system with environment consciousness and sustainable development.
8	Ethics	Interacting industry, business and society in a professional and ethical manner.
9	Individual and team work	Function in a multidisciplinary team.
10	Communication	Proficiency in oral and written Communication.
11	Project management and finance	Implement cost effective and improved system.
12	Life-long learning	Continue professional development and learning as a life-long activity.

3. PROGRAM SPECIFIC OUTCOMES (PSOs):

By the completion of Electrical and Electronics Engineering program the student will have following Program specific outcomes.

1. Foundation of Electrical engineering: Ability to understand the principles and working of electrical components, circuits and systems, that are forming a part of power generation, transmission, distribution, energy saving. Students can assess the power management, auditing, crisis and saving aspects.

2. Foundations of power system development: Ability to understand the structure and development methodologies of electrical systems using knowledge on circuits, electronics for automation and control. Possess professional skills and knowledge of electrical system modelling and design of small and large systems. Familiarity and practical competence with a broad range of practice through experimentation on electrical circuits, electronic circuits and programming platforms.

3. Foundation of mathematical concepts: Ability to apply mathematical methodologies to solve computation task, model real world problem using appropriate engineering tools and suitable algorithm.

4. Applications of Computing and Research Ability: Ability to use knowledge in various domains to identify research gaps and hence to provide solution leading to new ideas and innovations.

4. PEO / PO Mapping:

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
I	✓	✓	✓	✓	✓	✓		✓	✓		✓	
II						✓	✓	✓	✓	✓	✓	
III	✓	✓	✓	✓	✓					✓	✓	✓
IV	✓	✓	✓	✓					✓	✓	✓	
V	✓		✓			✓	✓	✓		✓	✓	

SEMESTER-V (3rd YEAR)

Electrical & Electronics Engineering (B.Tech) Course Structure

Sl. No.	Category	Course Code	Course Title	Hours			Credit
				L	T	P	
Theory							
1	Professional Core Courses	EEE501	Power System-II	4	0	0	4
2	Professional Core Courses	EEE502	Control System	3	0	0	3
4	Professional Core Courses	EEE503	Electrical Machine-II	3	0	0	3
5	Professional Elective Course		Professional Elective Course -I	3	0	0	3
6	Open Elective Course		Open Elective Course-I	3	0	0	3
						Total(A)	16
Practical/Drawing/Design							
1	Professional Core Courses	EEE501P	Power System -II Lab	0	0	3	1
2	Professional Core Courses	EEE502P	Control System Lab	0	0	3	1
3	Professional Core Courses	EEE503P	Electrical Machine-II lab	0	0	3	1
3	Professional Core Courses	EEE504P	Electrical and Electronics workshop Lab	0	0	3	1
4	PPT presentation	EEE-P1	Seminar (PPT presentation)	0	0	2	2
						Total(B)	6
						Grand Total (A+B)	22
L-Lecture, T-Tutorial, P-Practical							

Professional Elective Course -I

Sl. No.	Course Code	Course Title	Hrs. /Week L: T: P	Credits	Preferred Semester
1	EEE505	Industrial Electrical Systems	03:00:00	3	V onwords
2	EEE506	Non-Conventional Energy System	03:00:00	3	V onwords
3	EEE507	Power Quality	03:00:00	3	V onwords

Open Elective Course-I

Sl. No	Code No.	Subject	Hrs./ Week L: T: P	Credits
1	OEC-CSE-501	Artificial Intelligence	03:00:00	3
2	OEC-CSE-502	Internet-of-Things	03:00:00	3
3	OEC-ECE-503	Communication and Networks	03:00:00	3

Detailed Syllabus

EEE501	POWER SYSTEMS-II	4L:0T:0P	4 Credits

Course Outcomes:

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

CO's	CO Description
CO1	**Illustrate** power system components using single line diagram and usage of per unit system.
CO2	**Calculate** symmetrical components and **Examine** different types of faults (both symmetrical and unsymmetrical).
CO3	**Formulate** nodal admittance (Y-bus) matrix, and **develop** load flow equations and **find** its solution.
CO4	**Illustrate** the concept of stability, power angle curve, and swing equation and **diagnose** steady-state and transient stability of the power system.
CO5	**Apply** different types of active, reactive and voltage control techniques.

CO's-PO's Mapping Matrix:

Enter correlation levels1, 2 or 3 as defined below-

     1. Slight (low)   2. Moderate (Medium)   3. Substantial (High)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1									
CO2	3	2	1	3	2							
CO3	3	2	1	3	2							2
CO4	3	3	1	2	2							2
CO5	3	3	1	2	2							2
Avg.	3	2.4	1	2.5	2							2

DETAILED SYLLABUS

Module I: Per Unit System and Faults   **(10 Lectures)**

Per Unit meaning and its calculation. Need and advantages of per unit system, Selection of base quantities, per unit impedance for 1-φ and 3 – φ system. Change of base value. Faults causes and consequences. Classification of faults and statistics of occurrence.

Fortescue theorem, Method of symmetrical components (positive, negative and zero sequences). Symmetrical component transformation. Sequence networks for generators, lines and transformers. Sequence network for power system. Balanced and Unbalanced faults, computation of fault currents.

Module II: Load Flow Analysis   **(10 Lectures)**

Review of the structure of power system and its components, Bus classification, formulation of Y_{bus} matrix, power flow equations. Gauss – Seidel method, algorithm, derivation of iterarative equation, modification for PV bus, Advantages and disadvantages, acceleration factor. Newton – Raphson method, algorithm, power mismatch vector, size of Jacobian matrix and its elements. Advantages and disadvantages.

Module III: Power system Stability   (12 Lectures)

Concept of power system stability and it's classification. Dynamic equation of synchronous machine. Swing equation and power angle curve. Single machine infinite bus system. Large signal stability, Equal area criteria, derivation. Critical clearing angle and effect of clearing time on stability. Methods for improvement of transient stability. Introduction to Multi – machine transient stability.

Module IV: Economic Operation of Power Systems   (6 Lectures)

Input-output characteristics of thermal and hydro plants, Optimum generator allocations without and with transmission losses, calculation of penalty factors, incremental transmission loss, transmission loss coefficients and their calculations.

Module V: Load Frequency Control: (7 Lectures)

Concept of load frequency control, load frequency control of single area system, effect of governor droop and load damping, block diagram representation of single area system, steady state frequency error, dynamic response.

Text Books

[1]. J Grainger and W.D. Stevenson, " Power System Analysis '' , McGraw Hill Education , 1994.
[2]. A.J. Wood and B.F. Wollenberg, "Power Generation, Operation and Control", John Wiley and Sons,2011.
[3]. D.P. Kothari and I.J. Nagrath, " Modern Power System Analysis '' ,McGraw Hill Education 2003
[4]. O.L. Elgerd, " Electric energy systems theory '' , McGraw Hill Education , 1995.

Reference Books

[1]. Soni Gupta & Bhatnagar , " A course in Electric Power '' , Dhanpat Rai & Sons.
[2]. A R Bergen and V Vittal , " Power system analysis '' , Pearson Education Inc, 1999.

EEE502	CONTROL SYSTEMS	3L:0T:0P	3 Credits

(This course is not offered to Electrical Engg. students)

Course Outcomes:

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

CO's	CO Description
CO1	**Analyse** electromechanical systems by mathematical modelling.
CO2	**Determine** Transient and Steady State behaviour of systems using standard test signals.
CO3	**Analyse** linear systems for steady state errors, absolute stability and relative stability using time domain and frequency domain techniques.
CO4	**Identify** and **design** a control system satisfying specified requirements.

CO's-PO's Mapping Matrix:

Enter correlation levels1, 2 or 3 as defined below-

1. Slight (low)   2. Moderate (Medium)   3. Substantial (High)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	3		1	1				2
CO2	3	3	2	3	3		1	1				2
CO3	3	3	2	3	3		1	1				2
CO4	3	3	3	3	3		1	1				2
Avg.	3	3	2.33	3	3		1	1				2

DETAILED SYLLABUS

Module I: **(8 Lectures)**
Concepts of system, open loop and closed loop systems, Benefits of Feedback, Mathematical modelling and representation of physical systems, analogous systems.

Transfer functions for different types of systems, block diagrams; Signal flow graphs and Mason's gain formula.

Module II   **(12 Lectures)**
Time domain performance criterion, transient response of first order, second order systems; Steady state errors: static and dynamic error constants, system types, steady state errors for unity and non-unity feedback systems, performance analysis for P, PI and PID controllers.

Concept of stability by Routh stability criterion, root-loci and root contours.

Module III   **(8 Lectures)**
Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.

Module IV: **(6 Lectures)**
Compensation - lag, lead and lag-lead networks, design of compensation networks using time response and frequency response of the system.

Module V: **(6 Lectures)**
Concepts of state, state variables, state variable representation of system, dynamic equations, merits for higher order differential equations and solution. Concept of controllability and observability and techniques to test them.

Text/References:

[1].J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009

[2].M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.

[3].B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.

[4]. K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.

EEE503	ELECTRICAL MACHINES-II	3L:0T:0P	3 Credits

Course Outcomes:

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

CO's	CO Description
CO1	**Understand** the construction and principle of operation of synchronous machines.
CO2	**Analyse** the effects of excitation and mechanical input on the operation of synchronous Machine.
CO3	**Understand** the operation principles of Reluctance motor, shaded pole, Hysteresis motor, and Universal motor, PMBLDC, tachometer, synchro and identify the suitable applications.
CO4	**Analyse** single phase induction motors and **identify** the suitable methods of starting.

CO's-PO's Mapping Matrix:

Enter correlation levels1, 2 or 3 as defined below-

     1. Slight (low)   2. Moderate (Medium)   3. Substantial (High)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2		1					2
CO2	3	3	2	2	2		1					2
CO3	3	3	2	2	2		1					2
CO4	3	3	2	2	2		1					2
Avg.	**3**	**3**	**2**	**2**	**2**		**1**					**2**

DETAILED SYLLABUS

Module I: Fundamentals of A.C. Machines   **(8 Lectures)**

Fundamental principles of A.C. machines: E.M.F equation of an elementary alternator, single & three phase, factors affecting the induced e.m.f, full pitch & fractional pitch windings, winding factors, armature reaction, concept of time phasor & space phasor.

Module-II: Synchronous Generator   **(14 Lectures)**

Various types and construction, cylindrical rotor theory, phasor diagram, open circuit & short circuit characteristics, armature reaction, synchronous reactance, SCR, load characteristics, potier reactance, voltage regulation, E.M.F. method, MMF method, ZPF method, power angle characteristics.

Theory of salient pole machine: Blondel's two reaction theory, phasor diagram, direct axis and quadrature axis synchronous reactance, power angle characteristics, slip test, parallel operation: Synchronizing method, effect of wrong synchronization, load sharing between alternators in parallel, transient & sub-transient reactances.

Module-III: Synchronous motor   **(8 Lectures)**

General physical consideration, torque & power relations in salient and non-salient pole motors, V-curves & inverted V-curves, effect of change of excitation, synchronous condenser, stating of synchronous motor, performance characteristics of synchronous motor, hunting.

Module-IV: Single phase Induction motors   (7 Lectures)
Induction type, Double revolving field theory, equivalent circuit, characteristics & starting of single phase motor, shaded pole machine, synchronous type, hysteresis motor, reluctance motor.

Module V: Single phase special type of machines   (3 Lectures)
Switched reluctance motor, PMBLDC motor, tachometer, two phase control motor, Synchro.

Text Books:
   [1]. Electric Machines by I.J.Nagrath & D.P.Kothari,Tata Mc Graw Hill, 7th Edition.2005
   [2]. Electrical machines by PS Bhimbra, Khanna Publishers.
   [3]. Electric machinery by A.E. Fitzgerald, C.Kingsley and S.Umans, Mc Graw Hill Companies, 5th edition.
   [4]. Electric Machinery Fundamentals by Stephen Chapman Mc Graw Hill Company.

   Reference Books:

   [1]. Theory of Alternating Current Machinery- by Langsdorf, Tata McGraw-Hill Companies,   2nd edition.
   [2]. Performance and Design of AC Machines by M G. Say, BPB Publishers.

EEE505	INDUSTRIAL ELECTRICAL SYSTEMS	3L:0T:0P	3 Credits

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

CO's	CO Description
CO1	**Understand** the electrical wiring systems for residential, commercial and industrial consumers, representing the systems with standard symbols and single line drawings.
CO2	**Understand** various components of industrial electrical systems.
CO3	**Analyse and select** the proper size of various electrical system components.

COs-POs Mapping Matrix:
Enter correlation levels1, 2 or 3 as defined below-
   1. Slight (low)   2. Moderate (Medium)   3. Substantial (High)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3									1
CO2	3	3	3									1
CO3	3	3	3		2							1
Avg.	**3**	**3**	**3**		**2**							**1**

DETAILED SYLLABUS

Module I: Electrical System Components   (10 Lectures)
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.

Module II: Residential and Commercial Electrical Systems   (8 Lectures)

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.

Module III: Illumination Systems   (6 Lectures)

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.

Module IV: Industrial Electrical Systems I   (8 Lectures)

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

Module V: Industrial Electrical Systems II   (8 Lectures)

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

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

Text/Reference Books:

[1]. S. L. Uppal and G. C. Garg, "Electrical Wiring, Estimating & Costing", Khanna publishers, 2008.
[2]. K. B. Raina, "Electrical Design, Estimating & Costing", New age International, 2007.
[3]. S. Singh and R. D. Singh, "Electrical estimating and costing", Dhanpat Rai and Co., 1997.
[4]. H. Joshi, "Residential Commercial and Industrial Systems", McGraw Hill Education, 2008.

EEE506	NON-CONVENTIONAL ENERGY SYSTEM	3L:0T:0P	3 Credits

Course Outcome:

After successful completion of the course students will be able to:

CO1	**Identify** different non-conventional energy system and **explain** the principle of thermo-electrical and thermionic conversions
CO2	**Analyse** the performance and limitations of the solar and wind energy conversion system
CO3	**Illustrate** the concept of geothermal energy.
CO4	**Outline** the basics of fuel cells.
CO5	**Understand** the principles behind the bio-mass, ocean thermal and wave energy conversions.

CO's-PO's Mapping Matrix:

Enter correlation levels1, 2 or 3 as defined below-
1. Slight (low)   2. Moderate (Medium)   3. Substantial (High)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1		1	1		1					1
CO2	3	2	2	2	1		1					1
CO3	1	1		1	1		1					1
CO4	2	1	1	1	1		1					1
CO5	2	1	1	1	1		1					1
Avg.	2.2	1.2	1.33	1.2	1		1					1

DETAILED SYLLABUS

Module I: Introduction   **(6 Lectures)**
Basics of energy, conventional energy sources, fossil fuels limitations, renewable energy sources, advantages and limitations, global energy scenario, energy scenario of India, new technologies (hydrogen energy, fuel cells, bio fuels).

Module II: Solar Energy   **(12 Lectures)**
Theory of solar cells, solar cell materials, I-V characteristics of solar cell, PV module, PV array, MPPT, PV systems, Stand alone and grid connected PV systems, storage, PV based water pumping, solar radiation and its measurement, flat plate collectors and their materials, applications and performance, solar thermal power plants, limitations.

Module III: Wind Energy   **(8 Lectures)**
Wind power and its sources, site selection, power in the wind, impact of tower height, classification of wind turbine and rotors, wind energy extraction, betz'z limit, wind characteristics, performance and limitations of wind energy conversion systems.

Module IV: Biomass and Geothermal energy   **(8 Lectures)**
Availability of biomass and its conversion theory, types of biomass, gasification, biogas plant, biomass cogeneration, resources of geothermal energy, thermodynamics of geo-thermal energy conversion, geothermal power generation, environmental considerations.

Module V: Emerging technologies for power generation   **(6 Lectures)**
Introduction to tidal energy, tidal characteristics, tidal power plant, tidal power development in India, introduction to wave energy, factors affecting wave energy, principles of wave energy plant, OTEC, applications of OTEC, principle of working of various types of fuel cells and their working, performance and limitations, future potential of fuel cells, Emergence of hydrogen, cost analysis of hydrogen production, hydrogen storage.

Text/Reference Books:

[1]. Duffie and Beckmen, Solar Engineering of Thermal Processes, Wiley Publications, 1991.
[2]. S. P. Sukhatme, Solar Energy, TMH, India. 2008.
[3]. John Twiden and Tony Weir, Renewable Energy Resources, BSP Publications, 2006.
[4]. D. P. Kothari, Rakesh Ranjan, Renewable Energy Sources and Emerging Technologies, PHI, India, 2011.
[5]. Non Conventional Energy Resources, D.S. Chauhan, New Age International Pvt Ltd., 2006.

EEE507	POWER QUALITY	3L:0T:0P	3 Credits

Course Outcomes:

After successful completion of the course students will be able to:

COs	CO Description
CO1	To understand the various power quality issues.
CO2	Evaluate the power quality indices used in industrial power system.
CO3	Understand various mitigation techniques for compensating devices to improve the power quality.
CO4	Simulate the compensating devices to improve the power quality

CO's-PO's Mapping Matrix:

Enter correlation levels 1, 2 or 3 as defined below-
    1. Slight (low)   2. Moderate (Medium)   3. Substantial (High)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	2	1	-	1	-	2
CO2	2	-	3	2	-	2	-	-	-	-	-	-
CO3	2	3	-	2	3	2	2	-	-	-	-	-
CO4	-	3	-	3	3	2		-	2	-	-	2
Avg.	2	3	3	2.33	3	2	2	1	2	1	-	2

DETAILED SYLLABUS

Module - I: Overview of Power Quality   (10 Lectures)
Classification of power quality issues, characterization of electric power quality, power acceptability curves – power quality problems: poor load power factor, non linear and unbalanced loads, dc offset in loads, notching in load voltage, disturbance in supply voltage, flicker, transient phenomenon, voltage fluctuations, sags/swells, voltage unbalance, power quality indices, distortion index, C-message index, IT product, IEEE guides and recommended practices.

Module- II: Measurement and Analysis Methods   (8 Lectures)
Voltage, current, power and energy measurements, power factor measurement and definitions, time domain methods, Instantaneous Reactive Power Theory, Synchronous Frame Theory, Synchronous Detection Method, instantaneous symmetrical components, Instantaneous real and reactive powers

Module- III: Harmonics & Voltage Fluctuations   (8 Lectures)
Sources and effect of harmonics and inter harmonics, voltage fluctuations, flicker and impulses, flicker calculations, effect of voltage fluctuations and impulses, occurrence and causes of voltage unbalance, standardization, decomposition into symmetrical components.

Module IV: Power Quality Improvement-I   (8 Lectures)
Utility- Customer interface, harmonic filter: passive, active and hybrid filter, compensation using shunt devices-DSTATCOM, voltage regulation using DSTATCOM, principle, working and construction, algorithms for control of DSTATCOM, some case study examples.

Module V: Power Quality Improvement-II   (8 Lectures)

Series compensation, protecting sensitive loads using DVR, principle, working construction and control schemes for DVR, hybrid devices –UPQC, principle, working and construction, some case study examples.

Text /reference Books:

[1]. Power Quality Enhancement Using Custom Power Devices, Arindam Ghosh, Gerard Ledwich, Springer, 2009
[2]. Power Quality: VAR Compensation in Power Systems R. Sastry Vedam, Mulukutla S. Sarma, CRC Press, 2008
[3]. Understanding Power Quality Problems: Voltage Sags and Interruptions, Math H.J. Bollen, Wiley India Pvt Ltd, 2011.
[4]. Power Quality: Mitigation Technologies in a Distributed Environment,A Moreno Munoz, Springer India Private Limited 2007.
[5]. Power System Quality Assessment J.Arrillaga, N.R.Watson, S.Chen, Wiley India Pvt Ltd, 2011.

OEC-CSE-501	ARTIFICIAL INTELLIGENCE	3L:0T:0P	3 Credits

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

COs	CO Description
CO1	To understand the various Programming, Commands and Syntax.
CO2	Understand initial Data Analysis, Relationship between attributes: Covariance, Correlation Coefficient
CO3	Understand Data Pre-processing and Preparation.
CO4	Understand Data Quality and Transformation

CO's-PO's Mapping Matrix:

Enter correlation levels1, 2 or 3 as defined below-
    1. Slight (low)   2. Moderate (Medium)   3. Substantial (High)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	2	1	-	1	-	2
CO2	2	-	3	2	-	2	-	-	-	-	-	-
CO3	2	3	-	2	3	2	2	-	-	-	-	-
CO4	-	3	-	3	3	2		-	2	-	-	2
Avg.	2	3	3	2.33	3	2	2	1	2	1	-	2

Module I: 								**(10 Lectures)**

Data Science, AI & ML, Use Cases in Business and Scope, Scientific Method, Modeling Concepts, CRISP-DM Method.

Module II: 								**(10 Lectures)**

Programming, Commands and Syntax, Packages and Libraries, Introduction to Data Types, Data Structures in R - Vectors, Matrices, Arrays, Lists, Factors, Data Frames, Importing and Exporting Data. Control structures and Functions, Descriptive Statistics, Data exploration (histograms, bar chart, box plot, line graph, scatter plot), Qualitative and Quantitative Data, Measure of Central Tendency (Mean, Median and Mode), Measure of Positions (Quartiles, Deciles, Percentiles and Quantiles), Measure of Dispersion (Range, Median, Absolute deviation about median, Variance and Standard deviation), Anscombe's quartet Other Measures: Quartile and Percentile, Interquartile Range

Module III: (10 Lectures)

Initial Data Analysis, Relationship between attributes: Covariance, Correlation Coefficient, hi Square, Measure of Distribution (Skewness and Kurtosis), Box and Whisker Plot (Box Plot and its parts, Using Box Plots to compare distribution) and other statistical graphs Probability, Probability (Joint, marginal and conditional probabilities), Probability distributions (Continuous and Discrete), Density Functions and Cumulative functions

Module IV: (10 Lectures)

Gather information from different sources. Internal systems and External systems. Web APIs, Open Data Sources, Data APIs, Web Scrapping, Relational Database access (queries) to process/access data Data Pre-processing and Preparation, Data Munging, Wrangling Ÿ Plyr packages, Cast/Melt

Module V: (10 Lectures)

Data Quality and Transformation, Data imputation, Data Transformation (minmax, log transform, z-score transform etc.). Binning, Classing and Standardization. Outlier/Noise& Anomalies Bag-of-words, Regular Expressions, Sentence Splitting and Tokenization, Punctuations and Stop words, Incorrect spellings, Properties of words and Word cloud, Lemmatization and Term-Document TxD computation, Sentiment Analysis (Case Study)

Text Books:

1. Hawkins, J. and Blakeslee, S. On Intelligence. Times Books, 2004.
2. Dean, T., Allen, J. & Aloimonos, Y., Artificial Intelligence theory and practice. New York: Benjamin Cummings (1995).
3. Ginsberg, M., Essentials of Artificial Intelligence. Palo Alto, CA: Morgan Kaufmann (1993).
4. Luger, G. F., & Stubblefield, W. A., Artificial Intelligence - Structures and Strategies for Complex Problem Solving. New York, NY: Addison Wesley, 5th edition (2005).
5. Poole, D., Mackworth, A., and Goebel, R. Computational Intelligence - A Logical Approach. New York: Oxford University Press. (1998).
6. Nilsson, N. J. Artificial Intelligence - A Modern Synthesis. Palo Alto: Morgan Kaufmann. (1998).

OEC-CSE-502	INTERNET-OF-THINGS	3L:0T:0P	3 Credits

Course Outcomes:

After successful completion of the course students will be able to:

COs	CO Description
CO1	To understand the various Defining and Characteristics of IoT.
CO2	Understand difference between IoT and M2M.
CO3	Understand Wireless medium access issues, MAC protocol.
CO4	Understand Home automation and Industry applications.
CO5	Developing applications through IoT tools

CO's-PO's Mapping Matrix:

Enter correlation levels1, 2 or 3 as defined below-

    1. Slight (low)   2. Moderate (Medium)   3. Substantial (High)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	2	1	-	1	-	2
CO2	2	-	3	2	-	2	-	-	-	-	-	-
CO3	2	3	-	2	3	2	2	-	-	-	-	-
CO4	-	3	-	3	3	2		-	2	-	-	2
CO5	2	-	3	2	-	2	-	-	-	-	-	-
Avg.	2	3	3	2.33	3	2	2	1	2	1	-	2

Module I: **(10 Lectures)**

Introduction to IoT

Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs

IoT & M2M

Machine to Machine, Difference between IoT and M2M, Software define Network

Module II: **(8 Lectures)**

Network & Communication aspects

Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination

Module III: **(6 Lectures)**

Challenges in IoT

Design challenges, Development challenges, Security challenges, Other challenges

Module IV: **(8 Lectures)**

Domain specific applications of IoT

Home automation, Industry applications, Surveillance applications, Other IoT applications

Module V: **(8 Lectures)**

Developing IoTs

Introduction to Python, Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python

Text/Reference Books:

1. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach"
2. Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

OEC-ECE-503	COMMUNICATION ENGINEERING	3L:0T:0P	3 Credits

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

CO's	CO Description
CO1	**Analyse** and compare different Analog modulation schemes for their efficiency and bandwidth.
CO2	**Analyse** the behaviour of a communication system in presence of noise.
CO3	**Investigate** pulsed modulation system and analyse their system performance.

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CO's-PO's Mapping Matrix:
Enter correlation levels1, 2 or 3 as defined below-
         1. Slight (low)   2. Moderate (Medium)   3. Substantial (High)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1								2
CO2	3	2	3	1								2
CO3	3	3	3	2								2
Avg.	3	2.66	3	2	1		1					2

Module – I:
Review of Fourier transform and Fourier series.
Amplitude modulation: **(8 Lectures)**
Frequency domain representation of signals, Need of Modulation, normal AM, modulation index, Generation and demodulation- envelop and synchronous detector, DSB-SC: Generation and demodulation, SSB: Generation and Demodulation, Concept of VSB modulation, Frequency Division multiplexing.

Module – II: Angle Modulation   **(7 Lectures)**

Representation of FM and PM signals, Spectral characteristics of angle modulated signals, frequency deviation and modulation index, Narrowband FM, Generation of wideband FM-Armstrong method, Direct method, Demodulation of WBFM using PLL.

Module - III: Noise   **(6 Lectures)**

Review of probability and random process, Type of Noise, Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and De-emphasis, Threshold effect in angle modulation.

Module– IV: Pulse modulation: **(9 Lectures)**

Sampling Theorem, Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM), Pulse Position Modulation (PPM) - their generation and detection, Time Division Multiplexing.

Digital communication:

Pulse code modulation (PCM), Differential pulse code modulation (DPCM), Delta modulation, Noise considerations in PCM, Digital Modulation – ASK, BPSK, BFSK.

Mod – V: Optical communication: **(10 Lectures)**

Types of optical fibers - step index and graded index, multimode and single mode; Attenuation and Dispersion in fibers; Optical transmitters – LEDs and Laser Diode; Optical Receivers- PIN and APDs, Fiber optic links.

Microwave communication:

Transmitter and Receiver antennas, Line of Sight Systems, Satellite Link-G/T Ratio of earth station, VSATS and GPSS, TDMA, FDMA, CDMA.

Text/Reference Books:

1. Haykin S., "Communications Systems", John Wiley and Sons, 2001.

2. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.

3. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill, 2001.

4. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering'',John Wiley, 1965.

5. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication'', Kluwer Academic Publishers, 2004.

6. Proakis J.G., ``Digital Communications'', 4th Edition, McGraw Hill, 2000.

7. Keiser Gerd, " Optical Fiber Communication", 2nd Edition, McGraw Hill, 1991.

8. Liao, "Microwave Devices and circuits", prentice Hall of India.

EEE501P	**POWER SYSTEMS-II Lab**	**0L:0T:3P**	**1 Credits**

(Any 10)

1. To obtain the DC Transmission line characteristics in different load resistance.
2. To obtain the correct phase sequence of three phase system.
3. To improvement of power factor control mechanism using APFC-relay kit.
4. Determination of positive, negative and zero-sequence reactance of 3-phase transformer using sequence current excitation fault calculation.

5. To study three different transmission line models.
6. Study of different types of insulators.
7. To measurement of Earth Resistance using Earth Tester.
8. Study of different types of Earthing.
9. Study on (i) on load Time Delay Relay (ii) off load Time Delay Relay.
10. Polarity, Ratio and Magnetisation Characteristics Test of CT & PT.
11. Testing on (i) Under Voltage Relay and (ii) Earth Fault Relay.
12. Study on D C Load Flow.
13. Study of A C Load Flow Using Gauss – Seidel Method.
14. Study of A C Load Flow Using Newton Raphson Method.
15. Study on Economic Load Dispatch.
16. Study of Generator Protection by Simulation.

NOTE : At least ten experiments are to be performed, minimum seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

EEE502P	CONTROL SYSTEM LAB	0L:0T:3P	1 Credits

(Any 10)

1. To study and perform the synchro transmitter and receiver system as an indicating instrument.
2. To study the performance of stepper motor in
    (a) Wave drive mode
    (b) Full wave mode
    (c) Half wave mode
3. Demonstration of Pneumatic trainer kit.
4. Demonstration of Single and Double Acting Cylinder using Pneumatic Trainer Kit.
5. To study the "Proportional- Integral-Derivative (PID)" control for a temperature process controller using process control software.
6. To study the DC Servo Motor position control system.
7. To study the operation of a Proportional, Proportional-Integral (PI) Proportional-Derivative (PD) and Proportional- Integral-Derivative (PID) control systems.
8. To study the "Proportional-Integral-Derivative (PID)" control action for a using Matlab Simulink Software.
9. Study the effect of PI & PD controller on system performance.
10. VFD based Speed Control of Three Phase Induction Motor Using PLC.
11. Study of a DC Speed control system and determination of transfer function of a permanent magnet dc motor.
12. Study of a two-phase AC servomotor and its transfer function parameters.
13. Find the frequency response of a Lag and Lead compensator.
14. To observe the time response of a second order process with P, P+I, P+I+D control and apply PID control to a DC servomotor.
15. To study the characteristic of a relay and analyse the relay control system (Phase Plane).
16. Study of a DC position control system

NOTE : At least ten experiments are to be performed, minimum seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

EEE503P	ELECTRICAL MACHINE-II LAB	0L:0T:3P	1 Credits

(Any 10)

1. To plot the 'V' and 'inverted ∧' curves of Synchronous motor.
2. To conduct the direct load test on the given three phase induction motor to determine and plot its performance characteristics.
3. To determine the equivalent circuit parameters of a single phase induction motor by performing the no- load and blocked rotor tests.
4. To conduct the direct load test on the given single phase induction motor and to determine and plot its performance characteristics.
5. To Study The Synchronization Of Alternator With Infinite Bus By Bright Lamp Method.
6. To study about the various types of AC starters.
7. Brake Test on Slip Ring Induction Motor.
8. No-load and block rotor tests on squirrel cage induction motor.
9. Equivalent circuit of single phase induction motor.
10. Regulation of alternator by synchronous impedance method and MMF method.
11. Regulation of alternator by Zero Power Factor method.
12. Determination of X_d and X_q of a salient pole synchronous machine from slip test.
13. Determination of sub-transient reactance of Salient Pole Synchronous Machine.
14. Determination of sequence impedances of Salient Pole Synchronous Machine.
15. Rotor resistance starter for slip ring induction motor.
16. Parallel operation of Alternators.

NOTE : At least ten experiments are to be performed, minimum seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

EEE504P	ELECTRICAL AND ELECTRONICS WORKSHOP LAB	0L:0T:3P	1 Credits

(Any 10)

1. To understand & draw the symbols of various electronic devices and to identify resistors, capacitors using different codes.
2. Verification of truth tables of logic gates (NAND, NOR, EX-OR, AND, OR, NOT).
3. To study cathode ray oscilloscope and perform measurements.
4. To study digital multi-meter and perform testing of various components.
5. To study function generator & power supply and perform measurements.
6. To study soldering- de-soldering techniques.

7. To study wiring diagram of ceiling fan.
8. How fluorescent lights work.
9. To study about stair case wiring two way switch.
10. To study half – wave rectifier.
11. To study stair case wiring and circuit of SMPS.
12. To study house wiring i.e, BATTEN, CLEAT, CASING-CAPING AND CONDUIT WIRINGS.
13. To study moving iron, moving coil, electro-dynamic and induction type meter.
14. To study circuit and working of UPS
15. To study circuit and working of home inverter
16. To study fuses MCBS and importance of earthing.

NOTE : At least ten experiments are to be performed, minimum seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

Jharkhand University of Technology

Jharkhand, Ranchi

Proposed Syllabus

For

B.Tech 6th Semester

Electrical and Electronics Engineering

SEMESTER-VI (3rd YEAR)

Electrical & Electronics Engineering (B.Tech) Course Structure

Sl. No.	Category	Course Code	Course Title	Hours			Credit
				L	T	P	
Theory							
1	Professional Core Courses	EEE601	Power Electronics	4	0	0	4
2	Professional Core Courses	EEE602	Signals and Systems	3	0	0	3
4	Professional Core Courses	EEE603	Microprocessors and Microcontroller	3	0	0	3
3	Professional Elective Course		Professional Elective Course -II	3	0	0	3
5	Open Elective Course		Open Elective Course - II	3	0	0	3
						Total(A)	16
Practical/Drawing/Design							
1	Professional Core Courses	EEE601P	Power Electronics Lab	0	0	3	1
2	Professional Core Courses	EEE602P	Signals and Systems Lab	0	0	3	1
2	Professional Core Courses	EEE603P	Microprocessors and Microcontroller Lab	0	0	3	1
2	Professional Core Courses	EEE604P	Electrical Simulation Lab	0	0	3	1
3	Project Work	IN601	Internship/Tour and Training/Industrial Training	0	0	2	2
						Total(B)	6
			Grand Total (A+B)				22
L-Lecture, T-Tutorial, P-Practical							

Professional Elective Course -II

Sl. No.	Course Code	Course Title	Hrs. /Week L: T: P	Credits	Preferred Semester
1	EEE605	High Voltage Engineering	03:00:00	3	VI onwords
2	EEE606	Advanced Control Systems	03:00:00	3	VI onwords
3	EEE607	Digital Control Systems	03:00:00	3	VI onwords

Open Elective Course -II

Sl. No	Code No.	Subject	Hrs./ Week L: T: P	Credits
1	OEC-CSE-601	Soft Computing Techniques	03:00:00	3
2	OEC-EEE-602	Power Plant Engineering	03:00:00	3
3	OEC-CSE-603	Image Processing	03:00:00	3

EEE601	**POWER ELECTRONICS**	**4L:0T:0P**	**4 Credits**

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

CO's	CO Description
CO1	To **understand** different power semiconductor devices and their switching characteristics.
CO2	To **understand** the operation, characteristics and performance parameters of AC to DC Converters.
CO3	To **study** the operation, switching techniques and basic topologies of DC-DC Converters
CO4	To learn the different modulation techniques of PWM inverters and to **understand** commutation techniques.
CO5	To **study** the operation of AC voltage controller and various configurations.

CO's-PO's Mapping Matrix:
Enter correlation levels1, 2 or 3 as defined below-

      1. Slight (low)   2. Moderate (Medium)   3. Substantial (High)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	1		1					1
CO2	2	2	3	3	2		1					1
CO3	2	2	3	2	1	1	1					1
CO4	2	3	2	2	2	1	1					1
CO5	2	3	3	2	1	1	1					1
Avg.	**2.2**	**2.4**	**2.6**	**2.2**	**1.4**	**1**	**1**					**1**

DETAILED SYLLABUS

Module I: Power Semiconductor Devices   **(9 Lectures)**
Diode, Thyristor, MOSFET, IGBT, GTO: constructional features, I-V Characteristics; Firing circuit for thyristor; protection of thyristor and gate drive circuit, Turn on techniques, Voltage and current commutation of a thyristor.

Module II: AC-DC Converters   **(9 Lectures)**
Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R, R-L and R-L-E load; effect of source inductance, Three-phase full-bridge thyristor rectifier with R, R-L and R-L-E load; freewheeling effect, power factor improvement.

Module III: DC-DC Buck and Boost Converter   **(9 Lectures)**
Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage, power circuit of a buck converter, analysis and waveforms at steady state, duty ratio control of output voltage.

Power circuit of a boost converter, analysis and waveforms at steady state, relation between duty ratio and average output voltage.

Module IV: Single-Phase Voltage Source Inverter   (9 Lectures)

Power circuit of single-phase voltage source inverter, switch states and instantaneous output voltage, square wave operation of the inverter, concept of average voltage over a switching cycle, sinusoidal pulse width modulation, modulation index and output voltage.

Module V: Three-Phase Voltage Source Inverter   (9 Lectures)

Power circuit of a three-phase voltage source inverter, switch states, instantaneous output voltages, average output voltages over a sub-cycle, 120- degree conduction, 180-degree conduction, three-phase sinusoidal pulse width modulation

Text/References Books:

[1]. M. H. Rashid, "Power electronics: circuits, devices, and applications", Pearson Education India, 2009.

[2]. N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design",

John Wiley & Sons, 2007.

[3]. R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science

&Business Media, 2007.

[4]. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.

EEE602	SIGNALS AND SYSTEMS	3L:0T:0P	3 Credits

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

CO's	CO Description
CO1	**Understand** the concepts of continuous time and discrete time systems.
CO2	**Analyze** systems in complex frequency domain.
CO3	**Understand** sampling theorem and its implications

.

CO's-PO's Mapping Matrix:
Enter correlation levels1, 2 or 3 as defined below-

         1. Slight (low)   2. Moderate (Medium)   3. Substantial (High)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1								2
CO2	3	2	3	1								2
CO3	3	3	3	2								2
Avg.	3	2.66	3	2								2

DETAILED SYLLABUS

Module-I   Introduction and Classification of signals   (8 Lectures)

signals: Definition, Continuous time and discrete time signals, Elementary Continuous time signals and Disccrete time signals or sequences:, step, ramp, impulse, exponential, sine, , rectangular, triangular, signum, Sinc functions. Classification of signals as even and odd, periodic and aperiodic, deterministic and non-deterministic, energy and power. Operations on signals: time reversal,   time shifting, Amplitude scaling, time scaling ,addition, multiplication, etc. and. Systems: Definition, Classification: Continuous time and discrete time systems ,linear and nonlinear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable.

Module-II Continuous and discrete time LTI systems :   (8 Lectures)

Impulse response and step response , Convolution, input- output behavior with aperiodic convergent inputs, cascade interconnections , characterizations of causality and stability of LTI systems, System representation through differential equations and difference equations . State- space representation of systems . state space analysis , multi input , multi output representation.State transition matrix and its role .

Module-III Fourier analysis of Continuous time & Discrete time signals and systems

(8 Lectures)

Fourier series , Fourier transform and its properties, Parseval's Theorem , Frequency response of LTI systems, Discrete time Fourier transform and its properties, Frequency response of Discrete time LTI systems. Sampling theorem, Sampling of Continuous time signals, sampling by impulse functions, Signal reconstructions.

 Module-IV Laplace Transform   (8 Lectures)

Laplace transform and inverse Laplace transform , Properties of Laplace-transform, existence conditions , Region of convergence (ROC) and its properties, Application of Laplace transform for the analysis of Continuous time LTI system, significance of poles and zeros.

Module-V Z-Transforms: (8 Lectures)

z-transform and its inverse , Properties of z-transform, existence conditions , Region of convergence (ROC), Application of Z- transform for the analysis of Discrete time LTI systems, Significance of Poles and Zeros.. inverse z-transform using Contour integration - Residue Theorem, Power Series expansion and Partial fraction expansion, Relationship between z-transform and Fourier transform.

Text/References Books :

 [1].Haykin. S., Venn B. V. Signals and Systems
 [2].Oppenheim A.V., Willsky A.S. &Nawab S.H., Signals and Systems, Tata McGraw Hill
 [3].Taylor F.H, Principles of Signals and Systems, McGraw Hill
 [4].Bracewell R.N., Fourier Transform & Its Applications, McGraw Hill
 [5].Haykin S., Communication Systems, John Wiley
 [6].Lathi B.P., Modern Digital& Analog Communication Systems, Oxford University Press
 [7].Papoulis A., Fourier Integral & Its Applications, McGraw Hill

EEE603	MICROPROCESSORS AND MICROCONTROLLER	3L:0T:0P	3 Credits

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

CO's	CO Description
CO1	**Understand** the concepts of addressing modes & instruction set of 8085 & 8051.
CO2	**Develop** skills in simple program writing in assembly languages.
CO3	**Understand** commonly used peripheral/ interfacing ICs.
CO4	**Understand** typical applications of micro-processors and micro-controllers.

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CO's-PO's Mapping Matrix:
Enter correlation levels1, 2 or 3 as defined below-
        1. Slight (low)   2. Moderate (Medium)   3. Substantial (High)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1								2
CO2	3	2	3	1								2
CO3	3	3	3	2								2
CO4	3	2	2	2	1		1					1
Avg.	3	2.66	3	2	1		1					2

Module I: Fundamentals of Microprocessors: **(11 Lectures)**
Fundamentals of 8 bit Microprocessor: Architecture, pin description, Timing diagram, Instruction set, ,Overview of 8085 Microprocessor, Data Transfer Scheme, Memory Basics of Memory and I/O Interfacing, Data Transfer Scheme (Serial & parallel data transfer scheme, Programmed & interrupt driven data transfer, Direct memory access, Programmable peripheral devices), Programmable interval timer, Analog input-output using AD & DA converter.

Module II: Fundamentals of Microcontrollers   **(5 Lectures)**
8-bit Microcontroller architecture, Comparison of Microprocessor and Microcontrollers, Comparison of 8-bit microcontrollers, 16-bit and 32-bit microcontrollers. Definition of embedded system and its characteristics, Role of microcontrollers in embedded Systems.

Module III:The 8051 Architecture   **(8 Lectures)**
Architecture of 8051, Internal Block Diagram, CPU, ALU, address, data and control bus, Pin description, I/O configuration, interrupts; Interrupt structure and interrupt priorities, Port structure and operation, Accessing internal & external memories and different mode of operations, Memory organization, Timing diagrams and Execution Cycles, Data and Program Memory,

Module IV: Instruction Set and Programming   **(8 Lectures)**
Addressing modes: Introduction, Instruction syntax, Data types, Subroutines Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing,

Indexed addressing, Bit inherent addressing, bit direct addressing. 8051 Instruction set, Instruction timings. Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. Assembly language programs, Assemblers and compilers. Programming and debugging tools.

Module V: Memory and I/O Interfacing   **(12 Lectures)**

Memory and I/O expansion buses, control signals, memory wait states. Interfacing of peripheral devices such as General Purpose I/O, ADC, DAC, timers, counters, memory devices.

External Communication Interface

Asynchronous Communication. RS232, SPI, I2C. Introduction and interfacing to protocols like Blue-tooth and Zig-bee. Module6: Applications (06 Hours) LED, LCD and keyboard interfacing. Stepper motor interfacing, DC Motor interfacing, sensor interfacing.

Text/References Books :

[1]. 0000 to 8085 – Introduction to Microprocessor for Scientists & Engineers by Ghosh & Sridhar, PHI publication (for Module I to Module – III)
[2]. Advanced Microprocessor and Peripherals (Architecture, Programming & Interfacing) by A.K. Roy & K.M. Bhurchandi – TMH Publication (For Module-V to Module- VII)
[3]. The 8051 Microcontroller & Embedded Systems by Mazidi & Mazidi – Pearson / PHI publication (For Module-IV)
[4]. Microcontrollers [theory and applications] TMH publication by Ajay V. Deshmukh. (Chapter – 2 to Chapter – 6)
[5]. Microprocessors and programmed logic (2nd Edition), Pearson Education by Kenneth L. Short

EEE605	HIGH VOLTAGE ENGINEERING	3L:0T:0P	3 Credits

Course Outcomes:

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

CO's	CO Description
CO1	**Read** the terms and numerical methods used in High Voltage engineering.
CO2	**Discuss** the different breakdown mechanisms in dielectrics and liquids.
CO3	**Analyse** the concept of Generation of High Voltages, High Currents, Impulse voltages and currents.
CO4	**Outline** the techniques employed in High Voltage Measurements.
CO5	**Generalize** with non-distractive test techniques in High Voltage Engineering.

CO's-PO's Mapping Matrix:

Enter correlation levels1, 2 or 3 as defined below

1. Slight (low)   2. Moderate (Medium)   3. Substantial (High)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	2	2		1								
CO3		2	3		2							
CO4	1		3		2							

CO5	2	2	2		2							
Average	**2**	**2**	**2.7**	**1**	**2**							

DETAILED SYLLABUS

Module I: Introduction   **(6 Lectures)**
Introduction to High voltage Engineering, its scope, Latest Trends, HVDC Transmission. Introduction, breakdown in gases, Townsend's criterion for breakdown, numerical. Streamers theory, Paschen's law, time lag for break down, breaks down under ac voltage, impulse voltage. Break down in electro negative gases, vacuum break down.

Module II: Generation of high voltage   **(10 Lectures)**
Generation of HVAC: Different methods for generation of HVAC in lab, comparison between power and testing transformer, Cascaded transformer method, Resonant transformers, numericals. Generation of HVDC: Rectifier circuits, electrostatic generator, Cockroft Walton voltage multiplier circuit, numericals. Generation of Impulse voltage: Impulse wave and its characteristics, different forms of impulse wave, Different types of impulse generator circuits and their analysis. Multi stage impulse generator, its construction, layout, triggering and synchronization, numericals.

Module III: High Voltage Measurement   **(6 Lectures)**
Purpose of HV testing in lab, sphere gap its construction, working. Use of sphere gaps in HV measurement, factors affecting measurement by sphere gap. CRO- their types, principle and working, recurrent surge oscillograph, measurement using CRO.

Module IV: Over Voltages   **(12 Lectures)**
Origin and characteristics of over voltages on transmission lines, wave propagation, use of modal theory in wave propagation. Reflection and refraction of voltage and current waves over the line, Lattice diagram, Ferro resonance, numerical. External over voltages- Lightning over voltages, theories about lightning, development of lightning stroke, direct and indirect stroke, line model for lightning. Protection against over voltages, use of ground wire, tower footing resistance, lightning arrestors, etc. Insulation co ordination.

Module V: Testing of Insulators   **(6 Lectures)**
Definitions of various terms used in testing, testing of insulators, power transformers, cables. Non destructive Testing- Use of Schering Bridge, Partial discharge technique for testing of insulation.

Text/Reference Books:

[1]. Khalifa **, "High Voltage Engineering",** Marcel Dekker; 1st Printing edition,1990.
[2]. Kuffel, **"High Voltage Engineering",** Newnes,2000.
[3]. R.D. Begamudre, "EHV AC Transmission Engineering", New Age International,2011
[4]. Kamraju and Naidu, **"High Voltage Engineering",** Tata McGraw-Hill Education,2004.
[5]. C.L.Wadhwa, **"High Voltage Engineering",** New Age International,2007.

EEE606	ADVANCED CONTROL SYSTEMS	3L:0T:0P	3 Credits

Prerequisite: Control Systems

Course Outcomes:

After successful completion of the course, students should be able to:

CO's	CO Description
CO1	**Evaluate** the output of a digital system for a given input.
CO2	**Describe** the dynamics of a Linear, Time Invariant systems through difference equations.
CO3	**Analyse** digital systems using the Z-transformation, state space methods.
CO4	**Design** digital controllers for physical systems.

CO's-PO's Mapping Matrix:

Enter correlation levels1, 2 or 3 as defined below-
   1. Slight (low)   2. Moderate (Medium)   3. Substantial (High)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2		1	1	1	1					1
CO2	3	1	3	2	2							
CO3	3	2		2	2							
CO4	3	3	3	3	3		1					2
Avg.	3	2	3	2	2	1	1					1.5

Module –I   **(10 hours)**
Mathematical modelling of dynamic systems in state space, State space representation of Mechanical and electrical systems, State space representation of transfer functions, relations between state equation and transfer functions, Characteristics equation, egenvalue and eigenvector of state matrix, Solution of time-invariant state equation, determination of State Transition Matrix, Use of Cayley –Hamilton Theorem, Minimal Polynomial, Sylvester's interpolations, Controllability, Observability.

Module –II   **(8 hours)**
Introduction to design of control systems in state space, design of phase lead and phase lag controllers in time and frequency domain, Pole placement design, State observers.

Module –III   **(4 hours)**
Sampling and signal reconstruction: Definition and Evaluation of Z-Transform, Properties of Z-Transform, Inverse Z-Transform, Mapping between S-plane and Z-plane, System descriptions by difference equations.

Module –III   **(10 hours)**
Sampled Data Control Systems: Transfer Function f discrete data systems, Pulse and Z-transform Functions, Transfer Function of discrete data systems with Cascade elements, Transfer Function of Zero- Order and 1st – Order Holds, Transfer Function of Closed Loop discrete data systems, State equations of discrete data systems, Solutions of discrete state equations, discrete state transition equations, Z-Transform solutions of discrete equations,

Transfer Function Matrix and the Characteristic equation, Stability Tests of discrete state equations, Bilinear Transformation Method, Direct Stability Tests.

Module – IV   **(10 hours)**

Nonlinear Systems: Common Physical nonlinearities, The Phase-Plane Method, Basic concepts, singular Points, Stability of nonlinear systems, Construction of Phase trajectories, Construction by analytical and graphical methods, System analysis by Phase Plane Method, The Describing function Method: Basic concepts, derivation of describing functions for common nonlinearities, Stability analysis by Describing Function approach, jump resonance, Lyapunov Stability Criterion, Popov's Stability Criterion.

Text Books
1. Modern Control Engineering, K. Ogata (PHI)
2. Automatic Control System, B.C. Kuo (PHI)
3. Digital Control of Dynamic Systems, G. Franklin, J.D Powell, M. Workman (Pearson)

EEE607	DIGITAL CONTROL SYSTEMS	3L:0T:0P	3 Credits

Prerequisite: Control Systems

Course Outcomes:

After successful completion of the course, students should be able to:

CO's	CO Description
CO1	**Evaluate** the output of a digital system for a given input.
CO2	**Describe** the dynamics of a Linear, Time Invariant systems through difference equations.
CO3	**Analyse** digital systems using the Z-transformation, state space methods.
CO4	**Design** digital controllers for physical systems.

CO's-PO's Mapping Matrix:

Enter correlation levels1, 2 or 3 as defined below-
    1. Slight (low)   2. Moderate (Medium)   3. Substantial (High)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2		1	1	1	1					1
CO2	3	1	3	2	2							
CO3	3	2		2	2							
CO4	3	3	3	3	3		1					2
Avg.	3	2	3	2	2	1	1					1.5

DETAILED SYLLABUS

Module I: Sampling and Reconstruction   **(8 Lectures)**

Introduction, Examples of Data control systems, Sampler, Sampling Theorem, Signal Reconstruction-Digital to Analog conversion and Analog to Digital conversion, sample and hold operations.

Module II: The Z – Transforms   **(8 Lectures)**

Introduction, Linear difference equations, pulse response, Z – transforms, Theorems of Z – Transforms, inverse Z-transforms, Z-Transform method for solving difference equations; Pulse transforms function

Module III: State Space Analysis   **(12 Lectures)**

State variables, State model for linear continuous-time system. Types of state models, Eigen value and Eigen vectors, Solution of state equation, State transition matrix and it's Properties, Methods for Computation of State Transition Matrix, State Space Representation of discrete time systems, Matrix solving discrete time state space equations, Discretization of continuous time state – space equations

Module IV: Controllability, Observability & Stability   **(8 Lectures)**

Concepts of Controllability and Observability, Tests for controllability and Observability Duality between Controllability and Observability, Transfer matrix. Analysis of closed loop systems in the Z-Plane. Jury stability test – Stability Analysis by use of the Bilinear Transformation.

Module V: State Feedback Controller   **(4 Lectures)**

Design of state feedback controller through pole placement – Necessary and sufficient conditions.

Text Books:

[1]. Discrete-Time Control systems – K. Ogata, Pearson Education/PHI, 2nd Edition
[2]. B. C Kuo, Digital Control Systems, 2nd Edition, Oxford University Press, Inc., 1992.

Reference Books:

[1]. F. Franklin, J.D. Powell, and M.L. Workman, Digital control of Dynamic Systems, Addison-Wesley Longman, Inc., Menlo Park, CA , 1998.
[2]. Digital Control and State Variable Methods by M.Gopal, TMH.

OEC-CSE-601	SOFT COMPUTING TECHNIQUES	3L:0T:0P	3 Credits

Course Outcomes:

After successful completion of the course students will be able to:

CO1	**Distinguish** the concept between the hard and soft computing techniques.
CO2	**Understand** the basic concept of the Artificial Neural Network (ANN).
CO3	**Understand** the basic concept of the fuzzy logic system
CO4	**Explain** the concept of Genetic Algorithm (GA) and its limitation.
CO5	**Choose** the different kind of evolutionary programming for multi objective optimization problem based on their application.

CO's-PO's Mapping Matrix:
Enter correlation levels1, 2 or 3 as defined below-
    1. Slight (low)   2. Moderate (Medium)   3. Substantial (High)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	2							2
CO2	3	3	3	2	2							2
CO3	3	3	3	2	2							2
CO4	3	3	3	3	2							2
CO5	3	3	3	2	2							2
Avg.	**3**	**3**	**3**	**2**	**2**							**2**

DETAILED SYLLABUS

Module I: Fundamentals of Soft Computing Techniques   **(8 Lectures)**
Conventional and Modern Control System, Intelligence, Soft and Hard Computing, Artificial Intelligence.

Module-II: Artificial Neural Network   **(10 Lectures)**
Introduction to Artificial neural networks-biological neurons, Basic models of artificial neural networks- Connections, Learning, Activation Functions, McCulloch and Pitts Neuron.
 Learning rule- Hebbian Learning, Perceptron Learning, Delta Learning- Training and Testing algorithm, Adaptive Linear Neuron, Back Propagation Network – Architecture, Training algorithm.

Module-III: Fuzzy Logic System-I   **(8 Lectures)**
Fuzzy Logic- Fuzzy sets- Properties- Operation on fuzzy sets, fuzzy relations- operations on fuzzy relations.
Fuzzy membership functions, fuzzification, Methods of membership value assignments- intuition- inference- rank ordering, Lambda- cuts for fuzzy sets, Defuzzification methods.

Module –IV: Fuzzy Logic System-II   **(8 Lectures)**
Truth values and Tables in Fuzzy Logic, Fuzzy propositions, Formation of fuzzy rules – Decomposition of rules- Aggregation of rules, Fuzzy Inference Systems- Mamdani and Sugeno types, Neuro-fuzzy hybrid systems – characteristics- classification

Module-V: **(6 Lectures)**
Introduction to genetic algorithm, operators in genetic algorithm – coding – selection – cross over – mutation, Stopping condition for genetic algorithm flow, Generational Cycle, Applications. Evolutionary Programming, Multi-objective Optimization Problem Solving and its applications, Genetic- neuro hybrid systems, Genetic-Fuzzy rule based system.

Text Books:
    [1].N.P Padhy, Artificial Intelligence and Intelligent Systems- Oxford University Press.

[2]. S. N. Sivanandam and S. N. Deepa, Principles of Soft Computing- Wiley India.

[3]. Timothy J. Ross, Fuzzy Logic with engineering applications – Wiley India.

[4]. M.E. E1- Hawary , Artificial Intelligence application in Power Systems, IEEE Press,2009

[5]. Jan Jantzen, Foundations of Fuzzy Control, A practical approach, Wiley,2013

[6]. M Gopal, Digital Control and State Variable Methods, conventional and neural-fuzzy control system, Published by Tata McGraw Hill Education Private Ltd,2012

[7]. David E Goldberg, Genetic Algorithms, published by Pearson 2008

Reference Books:

[1]. Satish Kumar, Neural Networks- Prentice Hall of India.

[2]. N. K. Sinha and M.M. Gupta, Soft Computing and Intelligent Systems: Theory & Applications- Academic Press/ Elsevier, 2009.

[3]. Simon Haykin, Neural Network- A comprehensive Foundation- PHI, Inc.

[4]. Eberhart and Y. Shi, Computational Intelligence: Concepts to Implementation, Morgan Kaufman/ Elsevier, 2007.

OEC-EEE-602	POWER PLANT ENGINEERING	3L:0T:0P	3 Credits

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

CO's	CO Descriptions
CO1	**Describe** and **analyse** different types of sources and mathematical expressions related to thermodynamics and various terms and factors involved with power plant operation.
CO2	**Analyse** the working and layout of thermal power plants and the different systems comprising the plant and **discuss** about its economic and safety impacts
CO3	To **define** the working principle of diesel power plant, its layout, safety principles and compare it with plants of other types.
CO4	**Discuss** and **analyse** the mathematical and working principles of different electrical equipment involved in the generation of power and to **understand** co-generation.
CO5	Discuss and analyze the mathematical and working principles of different electrical equipment involved in the generation of power and to understand co-generation.

CO's-PO's Mappings Matrix:

Enter correlation levels1, 2 or 3 as defined below-
1. Slight (low)   2. Moderate (Medium)   3. Substantial (High)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	3	1		2					1

CO2	2	2	3	1	2		1					1
CO3	2		2	1		1	2					1
CO4	2		2	1		1	2					1
CO5	2	2	1	2	1	2	1					1
Avg.	**2**	**2.33**	**2**	**2.67**	**1.33**	**1.33**	**1.66**					**1**

DETAILED SYLLABUS

Module I: Introduction   **(10 Lectures)**

Conventional & Non-Conventional Sources of Energy and their availability in India, Different Types of Power Plants, Layout of Steam , Hydel , Diesel , MHD, Nuclear and Gas turbine power plants, Combined Power cycles – comparison and selection , Load duration Curves, Steam boilers and cycles – High pressure and Super Critical Boilers – Fluidized Bed Boilers.

Module II: Thermal Power Plants   **(10 Lectures)**
Basic thermodynamic cycles, various components of steam power plant-layout-pulverized coal burners-Fluidized bed combustion-coal handling systems-ash handling systems- Forced draft and induced draft fans- Boilers-feed pumps super heater- regenerator-condenser- de-aerators, cooling towers, electrostatic precipitators.

Module III: Hydel Power Plant   **(8 Lectures)**
Principle of working, Classification, Site selection; Different components & their functions; Types of Dams;Types, Characteristics & Selection of Hydro-Turbines; Mini & Micro Hydro Power Plants, Pumped Storage Power Plants.

Module IV: Diesel And Gas Turbine Power Plant   **(8 Lectures)**
Types of diesel plants, components, Selection of Engine type, applications. Gas turbine power plant- Fuels- Gas turbine material, open and closed cycles, reheating, Regeneration and inter cooling, combines cycle.

Module V: Co-Generation   **(6 Lectures)**
Concept; Schemes; Brief Description; Benefits & Limitations; Applications. Non-Conventional Energy Sources, Types, Brief Description, Advantages & Limitations.

Text/Reference Books:

[1]. P.K.Nag, "Power Plant Engineering", Tata McGraw Hill Publications.2007
[2]. EI-Wakil M.M, "Power Plant Technology," Tata McGraw-Hill 1984
[3]. Power Plant Engineering, Gautam S, Vikas Publishing House. 2012
[4]. Power station Engineering and Economy by Bernhardt
[5]. G.A.Skrotzki and William A. Vopat- Tata McGraw Hill Publishing Company Ltd.2002
[6]. "Modern Power Station Practice", Volume B, British Electricity International Ltd., Central Electricity Generating Board,Pergamon Press, Oxford.1991
[7]. 'Power Plant Familiarization – Vol. II', NPTI Publication.

OEC-CSE-603	IMAGE PROCESSING	3L:0T:0P	3 Credits

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

COs	CO Description
CO1	To understand and be able to describe how digital images are represented, manipulated, encoded and processed.
CO2	Analyse algorithm design, implementation and performance evaluation.
CO3	Knowledge of Hardware and Software tools for Image Analysis.
CO4	Design and Analysis of Various Techniques and Process to Understand Image.
CO5	Application of Mathematics for Image Understanding and Analysis.

CO's-PO's Mapping Matrix:

Enter correlation levels1, 2 or 3 as defined below-
   1. Slight (low)   2. Moderate (Medium)   3. Substantial (High)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	2	1	-	1	-	2
CO2	2	-	3	2	-	2	-	-	-	-	-	-
CO3	2	3	-	2	3	2	2	-	-	-	-	-
CO4	-	3	-	3	3	2		-	2	-	-	2
CO5	2	-	3	2	-	2	-	-	-	-	-	-
Avg.	2	3	3	2.33	3	2	2	1	2	1	-	2

Module I: **(6 Lectures)**
For the complete syllabus, results, class timetable and more kindly download iStudy. It's a lightweight, easy to use, no images, no pdfs platform to make student's life easier.

Module II: **(8 Lectures)**
IMAGE ENHANCEMENT : Spatial Domain: Gray level transformations-Histogram processing-Basics of Spatial FilteringSmoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform-Smoothing and Sharpening frequency domain filters-Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

Module III: **(8 Lectures)**
IMAGE RESTORATION : Image Restoration-degradation model, Properties, Noise models-Mean Filters-Order Statistics-Adaptive filters-Band reject Filters-Band pass Filters-Notch Filters-Optimum Notch Filtering-Inverse Filtering-Wiener filtering

Module IV: **(8 Lectures)**
For the complete syllabus, results, class timetable and more kindly download iStudy. It's a lightweight, easy to use, no images, no pdfs platform to make student's life easier.

Module V: **(10 Lectures)**
IMAGE COMPRESSION AND RECOGNITION: Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation,

Boundary description, Fourier Descriptor, Regional Descriptors-Topological feature, Texture-Patterns and Pattern classes-Recognition based on matching.

Text/Reference Books:
1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing Pearson, Third Edition, 2010
2. Anil K. Jain, Fundamentals of Digital Image Processing Pearson, 2002.
3. Kenneth R. Castleman, Digital Image Processing Pearson, 2006.
4. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Digital Image Processing using MATLAB Pearson Education, Inc., 2011.
5. D,E. Dudgeon and RM. Mersereau, Multidimensional Digital Signal Processing Prentice Hall Professional Technical Reference, 1990.
6. William K. Pratt, Digital Image Processing John Wiley, New York, 2002
7. Milan Sonka et al Image processing, analysis and machine vision Brookes/Cole, Vikas Publishing House, 2nd edition, 1999

EEE601P	POWER ELECTRONICS LAB	0L:0T:3P	1 Credits

(Any 10)

1. Study of V-I characteristics of DIODE, ZENER, SCR, DIAC, and TRIAC
2. Study of V-I characteristics of UJT, MOSFET, BJT.
3. Different methods of triggering of SCR

   (a) Phase controlled method

   (b) UJT triggering method

   (c) Cosine controlled triggering method

4. Study of TRIAC and full wave voltage control method of it.
5. 1 phase half wave and full wave full controlled converter with R, R-L and D.C motor load with / without freewheel diode
6. 3-phase half and full wave full controlled converter with R, R-L and D.C motor load with/ without freewheeling diodes
7. Study of characteristics curves of a 3 phase diode bridge.
8. Study of DC chopper with PWM controller
9. Study of SCR communication

(a) Forced communication

(b) Load communication

10. Study of single phase series inverter
11. Three phases IGBT based four quadrant chopper drive for D.C motor
12. Study of 1 phase cyclo converter
13. Speed control of a 1 phase Induction motor.
14. AC Voltage control by using TRIAC & DIAC.
15. Oscillation Chopper Circuit.
16. DC Supply using Diode (Hardware).

NOTE : At least ten experiments are to be performed, minimum seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

EEE604P	**Electrical Simulation Lab**	**0L:0T:3P**	**1 Credits**

(Any 10)

1. Introduction to MATLAB and its basic commands.
2. Y bus formation for systems, without mutual coupling, by singular transformation.
3. Formation of Z-bus, using Z-bus build Algorithm without mutual
4. To find load flow solution of the given power system using Gauss-Seidel method theoretically for one iteration and obtain full solution using MATLAB.
5. To obtain original phasor from following symmetrical components of voltage in a 3phase system. The symmetrical components are as follows $V_{ao}=3.282 \angle 23.960$, $V_{a1}=14.842 \angle 43.020$, $V_{a2}=5.766 \angle -108.720$
6. The fuel cost functions for three thermal plants in $/h are given by
   $C_1 = 500 + 5.3 P_1 + 0.004 P_1^2$; P_1 in MW
   $C_2 = 400 + 5.5 P_2 + 0.006 P_2^2$; P_2 in MW
   $C_3 = 200 + 5.8 P_3 + 0.009 P_3^2$; P_3 in MW
   The total load , PD is 800MW.Neglecting line losses and generator limits, find the optimal dispatch and the total cost in $/h by analytical method. Verify the result using MATLAB program.
7. Find optimum loading of generators with penalty factor.
8. Determination of bus currents, bus power & line flows for a specified system voltage (bus) profile.
9. Simulink model for evaluating transient Stability of single machine connected to Infinite bus.
10. To find dynamic response of the given single area load frequency control problem theoretically and to plot and verify the results in SIMULINK.
11. To find dynamic response of the given two - area load frequency control problem theoretically and to plot and verify the results in SIMULINK.
12. Determination of step & impulse response for a Type '0', Type '1', Type '2' systems.
13. Determination of step & impulse response for the first order and second order unity feedback system using Matlab Software.
14. To obtain following using Matlab Software
    a) Pole, zero, gain values from a given transfer function
    b) Transfer function model from pole, zero, gain values
    c) Pole, zero plot of a transfer function
15. Determination of Bode plot, Root Locus and Nyquist plot using Matlab control system toolbox for 2nd order system & obtain controller specification parameters using Matlab Software.
16. Study the effect of addition of poles and zeros to the forward path transfer function of a closed loop system.

NOTE : At least ten experiments are to be performed, minimum seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

EEE601P	SIGNALS AND SYSTEMS LAB	0L:0T:3P	1 Credits

(Any 10)

1. Generations and capturing various continuous time signals and plot them.

2. Generation and capturing of discrete time signals and plot them.

3. Discretization using different sampling rate and observing aliasing effect.

4. Simulation of continuous time LTI system.

5. Simulation of discrete time LTI systems.

6. Obtaining impulse response of the systems.

7. To study LPF & HPF, band pass and reject filters using RC circuits.

8. To study convolution theorem in time and frequency.

9. To compare Fourier and Laplace transformations of a signal.

10. Domain Computing FT and DTFT of the CT signals and DT sequences.

11. To study Z- transform of: a) Sinusoidal signals b) Step functions.

12. Study of Analog Filters Using Matlab

13. Experiment 10 : DFT & FFT algorithms using Matlab

14. Advanced Matlab Problems related to signals & systems

NOTE : At least ten experiments are to be performed, minimum seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

EEE601P	MICROPROCESSORS	0L:0T:3P	1 Credits

	AND MICROCONTROLLER LAB		

(Any 10)

1. Simple arithmetic operations: 8 and 16 bit addition / subtraction / multiplication
2. Programming with control instructions:
   (i) Ascending / Descending order, Maximum / Minimum of numbers
   (ii) Programs using Rotate instructions
   (iii) Hex / ASCII / BCD code conversions.
3. Interface Experiments: with 8085
   (i) A/D Interfacing. & D/A Interfacing.
4. Traffic light controller.
5. Programming Practices with Simulators/Emulators/open source
6. Read a key , interface display
7. Demonstration of basic instructions with 8051 Micro controller execution, including:
   (i) Conditional jumps, looping (ii) Calling subroutines.
8. Programming I/O Port 8051
   (i) study on interface with A/D & D/A (ii) study on interface with DC & AC motor.
9. Interfacing matrix or keyboard to 8051.
10. Interfacing ADC and DAC to 8086
11. Parallel communication between two microprocessors using 8255.
12. Serial communication between two microprocessor kits using 8251.
13. Data transfer from peripheral to memory through DMA controller 8237/8257.
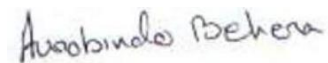14. Mini project development with processors.

The syllabus for the 5th and 6th semester students of Electrical and Electronics Engineering has been prepared with strict accordance to All India Council for Technical Education (AICTE) and the Jharkhand University of Technology (JUT) letter no: JUT-21/2018. The subjects and the topics included in the subjects are designed so as to enhance the knowledge of the students in a progressive manner and prepare them well for the upcoming subjects and competitive exams. Finally, it should be stated that the syllabus also considers the previously studied subjects in preceding semesters.

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