परीक्षा नियंत्रण प्रकोष्ठ, जबलपुर इंजीनियरिंग महाविद्यालय, जबलपुर (म.प्र.)

क्रमांक / प.नि.प्र. / 2024 / 2682 जबलपुर, दिनांक 18 / 10 / 2024

सूचना

महाविद्यालय में अध्ध्यनरत B.Tech. (AICTE) / B.Tech. (PTDC) [AICTE] [Regular/Ex.] विद्यार्थियों को सूचित किया जाता है कि वे नवम्बर 2024 की परीक्षा एवं आगामी सत्र की परीक्षाओं में सम्मिलित होने से पूर्व अपने पेपर / विषय का Equivalence Syllabus महाविद्यालय के पोर्टल से Download कर प्राप्त कर सकते हैं अथवा महाविद्यालय के परीक्षा नियंत्रण प्रकोष्ठ में संपर्क कर सकते हैं। नवम्बर 2024 परीक्षा एवं आगामी सत्र की परीक्षा में उन्हें अपने पेपर / विषय में Equivalence Syllabus में ही सम्मिलित होना है। अतः Equivalence Syllabus की जानकारी न होने की दशा में सम्पूर्ण जिम्मेदारी स्वयं छात्र / छात्राओं की होगी।

Equivalence Syllabus हेतु निम्नानुसार Link का उपयोग कर सकते हैः–

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जबलपुर

पृ.क्रमांक / प.नि.प्र. / 2024 / जबलपुर, दिनांक / 10 / 2024

प्रतिलिपिः–

01. समस्त विभागाध्यक्ष, जबलपुर इंजीनियरिंग महाविद्यालय, जबलपुर।
02. पीटीडीसी कार्यालय, जबलपुर इंजीनियरिंग महाविद्यालय, जबलपुर।

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जबलपुर इंजीनियरिंग महाविद्यालय
जबलपुर

EQUIVALENCE OF SUBJECTS OF DIFFERENT SCHEMES
OF UNDER GRADUATE COURSES (B.Tech.) OF ELECTRICAL ENGG.

S.No.	Schemes	Subject Code & Subject Name (Semester) Having Equivalence in Syllabus	Final Subject code & subject (after equivalence)
(i)	(ii)	(iii)	(iv)
2	AICTE	EE303 Circuit theory and network analysis **B.Tech. III Sem./ B.Tech. (PTDC) I Sem.**	EE33 Circuit theory and network analysis **B.Tech. III Sem.**
	Scheme 2023	EE33 Circuit theory and network analysis **B.Tech. III Sem.**	
3	AICTE	EE304 Analog and Digital Electronics **B.Tech. III Sem./ B.Tech. (PTDC) I Sem.**	EE34 Analog and Digital Electronics **B.Tech. III Sem.**
	Scheme 2023	EE34 Analog and Digital Electronics **B.Tech. III Sem.**	
4	AICTE	EE305 Electrical Measurement and Measuring Instruments **B.Tech. III Sem./B.Tech. (PTDC) (AICTE) II Sem.**	EE35 Electrical Measurement and Measuring Instrument **B.Tech. III Sem.**
	Scheme 2023	EE35 Electrical Measurement and Measuring Instrument **B.Tech. III Sem.**	
5	AICTE	EE401 Electrical Engg. Materials **B.Tech. IV Sem./ B.Tech. (PTDC) VI Sem.**	EE41 Electrical Engg. Materials **B.Tech. IV Sem.**
	Scheme 2023	EE41 Electrical Engg. Materials **B.Tech. IV Sem.**	
6	AICTE	EE402 Electrical Machine-I **B.Tech. IV Sem./B.Tech. (PTDC) II Sem.**	EE42 Electrical Machine-I **B.Tech. IV Sem.**
	Scheme 2023	EE42 Electrical Machine-I **B.Tech. IV Sem.**	
8	AICTE	EE404 Electrical and Electronic Instrumentation **B.Tech. IV Sem./ B.Tech. (PTDC) III Sem.**	EE44 Electrical & Electronics Instruments **B.Tech. IV Sem.**
	Scheme 2023	EE44 Electrical & Electronics Instruments **B.Tech. IV Sem.**	

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S.No.	Schemes	Subject Code & Subject Name (Semester) Having Equivalence in Syllabus	Final Subject code & subject (after equivalence)
10	AICTE	EE601B Wind & Solar Energy Systems **B.Tech. VI Sem./** EE704B Wind & Solar Energy System **B.Tech. (PTDC) V Sem.**	EE51A Wind & Solar Energy System **B.Tech. V Sem.**
	Scheme 2023	EE51A Wind & Solar Energy System **B.Tech. V Sem.**	
12	AICTE	EE505 Control System **B.Tech. V Sem./B.Tech. (PTDC) VI Sem.**	EE52 Control System **B.Tech. V Sem.**
	Scheme 2023	EE52 Control System **B.Tech. V Sem.**	
13	AICTE	EE503 Electrical Machine-II **B.Tech. V Sem./B.Tech. (PTDC) IV Sem.**	EE53 Electrical Machine-II B.Tech. V Sem.
	Scheme 2023	EE53 Electrical Machine-II **B.Tech. V Sem.**	
16	AICTE	BT521 Engineering Economics and Management **B.Tech. V Sem./ B.Tech. (PTDC) IV Sem.**	EE62A Engineering Economics and Management **B.Tech. VI Sem.**
	Scheme 2023	EE62A Engineering Economics and Management **B.Tech. VI Sem.**	
17	AICTE	EE804A Digital Image Processing **B.Tech. VIII Sem./ B.Tech. (PTDC) VIII Sem.**	EE62B Digital Image Processing **B.Tech. VI Sem.**
	Scheme 2023	EE62B Digital Image Processing **B.Tech. VI Sem.**	
18	AICTE	EE603 Microprocessor & Microcontroller **B.Tech. VI Sem./ B.Tech. (PTDC) V Sem.**	EE63 Microprocessor & Microcontroller **B.Tech. VI Sem.**
	Scheme 2023	EE63 Microprocessor & Microcontroller **B.Tech. VI Sem.**	
19	AICTE	EE804B Power Quality **B.Tech. VIII Sem./B.Tech. (PTDC) VIII Sem.**	EE71A Power Quality **B.Tech. VII Sem.**
	Scheme 2024	EE802M B Power Quality **B.Tech. VIII Sem.**	
	Scheme 2023	EE71A Power Quality **B.Tech. VII Sem.**	

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S.No.	Schemes	Subject Code & Subject Name (Semester) Having Equivalence in Syllabus	Final Subject code & subject (after equivalence)
20	AICTE	EE705B Digital Control System **B.Tech. VII Sem./ B.Tech. (PTDC) VI Sem.**	EE71B Digital Control System **B.Tech. VII Sem.**
	Scheme 2024	EE705M B Digital Control System **B.Tech. VII Sem.**	
	Scheme 2023	EE71B Digital Control System **B.Tech. VII Sem.**	
21	AICTE	EE704C Advanced Digital Communication **B.Tech. VII Sem./ B.Tech. (PTDC) V Sem.**	EE72A Advance Digital Communication **B.Tech. VII Sem.**
	Scheme 2024	EE704M C Advanced Digital Communication **B.Tech. VII Sem.**	
	Scheme 2023	EE72A Advance Digital Communication **B.Tech. VII Sem.**	
23	AICTE	EE702 Electrical Drives **B.Tech. VII Sem./B.Tech. (PTDC) VII Sem.**	EE74 Electrical Drives **B.Tech. VII Sem.**
	Scheme 2024	EE702M Electrical Drives **B.Tech. VII Sem.**	
	Scheme 2023	EE74 Electrical Drives **B.Tech. VII Sem.**	
24	AICTE	EE604 Switchgear & Protection **B.Tech. VI Sem./B.Tech. (PTDC) V Sem.**	EE75 Switchgear & Protection **B.Tech. VII Sem.**
	Scheme 2023	EE75 Switchgear & Protection **B.Tech. VII Sem.**	
26	AICTE	EE803B SCADA System & Application **B.Tech. VIII Sem./ B.Tech. (PTDC) VII Sem.**	EE81B SCADA System & Applications **B.Tech. VIII Sem.**
	Scheme 2024	EE801M B SCADA System & Applications **B.Tech. VIII Sem.**	
	Scheme 2023	EE81B SCADA System & Applications **B.Tech. VIII Sem.**	
27	AICTE	EE803C Renewable & Non Conventional Energy Sources **B.Tech. VIII Sem./ B.Tech. (PTDC) VII Sem.**	EE81C Renewable & Non Conventional Energy Sources **B.Tech. VIII Sem.**
	Scheme 2024	EE801M C Renewable & Non Conventional Energy Sources **B.Tech. VIII Sem.**	
	Scheme 2023	EE81C Renewable & Non Conventional Energy Sources **B.Tech. VIII Sem.**	

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S.No.	Schemes	Subject Code & Subject Name (Semester) Having Equivalence in Syllabus	Final Subject code & subject (after equivalence)
28	AICTE	EE804C Computer Networks **B.Tech. VIII Sem./ B.Tech.(PTDC) VIII Sem.**	EE82C Computer Networks **B.Tech. VIII Sem.**
	Scheme 2024	EE802M C Computer Networks **B.Tech. VIII Sem.**	
	Scheme 2023	EE82C Computer Networks **B.Tech. VIII Sem.**	
29	AICTE	EE704A Power System Planning & Reliability **B.Tech. VII Sem./ B.Tech. (PTDC) V Sem.**	EE704M A Power System Planning & Reliability **B.Tech. VII Sem.**
	Scheme 2024	EE704M A Power System Planning & Reliability **B.Tech. VII Sem.**	
30	AICTE	EE704B Soft Computing Techniques **B.Tech. VII Sem./ B.Tech. (PTDC) IV Sem.**	EE704M B Soft Computing Techniques **B.Tech. VII Sem.**
	Scheme 2024	EE704M B Soft Computing Techniques **B.Tech. VII Sem.**	
31	AICTE	EE705A Generalized Theory of Electrical Machine **B.Tech. VII Sem./ B.Tech. (PTDC) VI Sem.**	EE705M A Generalized Theory of Electric Machines **B.Tech. VII Sem.**
	Scheme 2024	EE705M A Generalized Theory of Electric Machines **B.Tech. VII Sem.**	
32	AICTE	EE705C Advanced Indusstrial Electronics **B.Tech. VII Sem./ B.Tech. (PTDC) VI Sem.**	EE705M C Advanced Indusstrial Electronics **B.Tech. VII Sem.**
	Scheme 2024	EE705M C Advanced Indusstrial Electronics **B.Tech. VII Sem.**	

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S.No.	Schemes	Subject Code & Subject Name (Semester) Having Equivalence in Syllabus	Final Subject code & subject (after equivalence)
33	AICTE	EE701 High Voltage Engineering **B.Tech. VII Sem.**	EE701M High Voltage Engineering **B.Tech. VII Sem.**
	Scheme 2024	EE701M High Voltage Engineering **B.Tech. VII Sem.**	
34	AICTE	EE703 Power System Control **B.Tech. VII Sem**.	EE703M Power System Control **B.Tech. VII Sem.**
	Scheme 2024	EE703M Power System Control **B.Tech. VII Sem.**	

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S.No.	Schemes	Subject Code & Subject Name (Semester) Having Equivalence in Syllabus	Final Subject code & subject (after equivalence)
17	AICTE	EE804A Digital Image Processing **B.Tech. VIII Sem./ B.Tech. (PTDC) VIII Sem.**	EE62B Digital Image Processing **B.Tech. VI Sem.**
	Scheme 2024	EE802M A Digital Image Processing **B.Tech. VIII Sem.**	
	Scheme 2023	EE62B Digital Image Processing **B.Tech. VI Sem.**	

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COURSE CONTENTS

w.e.f. July 2023

Subject Code	Subject Name	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work					
EE33	Circuit Theory & Network Analysis	70	20	10	30	20	150	3	-	2	4

CIRCUIT THEORY & NETWORK ANALYSIS

Course objective:

1. To prepare the students to have a basic knowledge in the analysis of Electric Networks.
2. To verify various theorems and methods for a given network.
3. To acquire the basic knowledge of Graph theory and application of knowledge to solve the electrical network.
4. Understand the concept of resonance in series and parallel circuits.
5. Have a broad coverage in the field that of network functions and Synthesis of R-L, R-C and L-C networks.

Module-I: Review of Circuit Elements and Energy Sources

Energy sources, Source transformation, Sinusoidal steady state analysis, AC in inductance and capacitance, star-delta connection, Kirchhoff's laws, current &voltage division rules, nodal &Mesh Analysis of electrical circuits(with Power and Energy calculation).

Module-II: Network Theorems in AC & DC Circuits

Thevenin's, Norton's Superposition, maximum power transfer, Milliman's, Reciprocity, Substitution, Compensation and Tellegen's theorem

Module-III: Transient and Steady State Response for Arbitrary Inputs

Introduction to Transient and Steady State response of first order circuit (RL & RC) with dc and ac excitation, Transient and Steady State response of second order circuit (RLC) with dc and ac excitation, resonance (series and parallel).

Module-IV: Network Topology

Concept and terminology of network graphs (twigs, links, tree formation) formation of incidence, Tie-set matrix, Cut set matrix and their calculation, Tow port Network: Z, Y, Hybrid and G (inverse of H) parameter.

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Module-V: Network functions and Network Synthesis

Network functions Introduction to Laplace transformation and its application in electrical circuit analysis, driving point impedance and admittance, transfer impedance and admittance, introduction of passive filters (low pass, high pass, band pass, band stop). Network synthesis: Reliability concept, Hurwitz polynomials and its properties, positive real functions, Synthesis of R-L, R-C and L-C network, Foster and Cauer forms (1st and 2nd form).

List of Experiments:

1. Verification of Kirchhoff's current Law in AC circuit.
2. Verification of Kirchhoff's voltage Law in AC circuit.
3. Verification of Superposition theorem in AC circuit.
4. Verification of Thevenin's theorem in AC circuit.
5. Verification of Norton theorem in AC circuit.
6. Find out the resonance frequency in RLC series circuit.
7. Find out the resonance frequency in RLC parallel circuit.
8. Verification of Reciprocity theorem in AC circuit.
9. Measurement of phase angle, peak value of signal of AC circuit.

Text Books:

1. Vincent Del Toro, "Electrical engineering fundamentals", Tata McGraw Hill Pub, Second Edition.
2. Abhijeet Chakrabarti, "Circuit theory Analysis and Synthesis", Dhanpat Rai &Co.P.Ltd, Sixth Edition

Reference Books:

1. D.Roy Choudhury, "Network and Systems", Wiley Eastern Limited, Second Edition.
2. ME Van-Valken burg, "NetworkAnalysis",Third Edition

Course Code: **EE33**
Course category: **PCC**
Course Name: **Circuit Theory & Network Analysis**

At the end of the course, a student will be able to-

CO-1: Apply different network theorem to solve given network problems.
CO-2: Analyze transient and steady state response of R-L-Circuit.
CO-3: Analyze two port networks.
CO-4: Apply appropriate method to test for reliability and Synthesize network from given network driving point functions.
CO-5: Calculate the complex power and power factor using different methods.

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COURSE CONTENTS

w.e.f. July 2023

Subject Code	Subject Name	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work					
EE34	Analog & Digital Electronics	70	20	10	30	20	150	3	-	2	4

ANALOG & DIGITAL ELECTRONICS

Course Objectives

1. To provide a strong foundation on analog electronics.
2. To acquire the basic knowledge of Diode, transistors and their various applications
3. Have a broad coverage in the field that is relevant for engineers to design linear circuits using Op- amps.
4. To acquire the basic knowledge of Digital logic levels and application of knowledge to understand the digital electronics circuits.

Module-I: Basic Analog Devices & frequency response

Basic concept of the working of P-N junction diodes, Schottky Diodes, Zener Diodes, Application of diodes- Clipper circuits and clamper circuits, Zener based voltage regulator. Basic BJTs, Biasing of BJTs: CB, CE & CC configurations, Basic FET's, biasing of FET's Difference between JFET's and MOSFET's,

Module-II: Feedback Amplifiers

Feedback amplifier: Amplifier circuits using h-parameters, emitter-follower, frequency response of RC coupled amplifiers, General feedback structure, properties of negative feedback, Sinusoidal Oscillator; RC phase shift, Wein's bridge oscillator, Hartley & Collpitt's oscillators.

Module-III: Operational Amplifiers

Operational amplifier's: Input and output resistance, open loop gain, bias currents, Offset currents and voltages, differential mode gain, common mode gain, CMRR, Negative feedback, Inverting and non- inverting amplifiers, frequency response, Linear and nonlinear applications of OP-Amp.

Module-IV: Combinational Logic

Half adder & Full adder, Half subtracted & Full subtracted, BCD adder, series & parallel addition, Multiplexer, DE multiplexer, Encoder, Decoder.

Module-V: Sequential Logic

Flip flops, JK, RS, D, and T, master slave, shift registers, counters (Asynchronous &Synchronous counter) and latches.

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List of Experiments:

1. To obtain the characteristics of common base (CB) configuration of BJT.
2. To obtain the characteristics of common emitter (CE) configuration of BJT.
3. To perform and verify the application of op-amp as a non-inverting amplifiers.
4. To perform and verify the application of op-amp as an integrator.
5. To perform and verify the application of op-Amp as a differentiator.
6. Construction and verification of various types of flip-flops using Gate ICs.
7. Construction and verification of half adder, full adder, half sub tractor and Full sub tractor.
8. Construction of 3-bit down counter.
9. Construction and verification of 4-bit left shift register.

Text Books:

1. R.A. Gayakwad, "Op amps and Linear Integrated Circuits", PHI India, Fourth Edition.
2. Boylestad & Nashelsky, "Elect. Devices & Circuits" Pearson, Eleventh Edition.

Reference Book:

1. Morris Mano, "Logic & Computer Design Fundamentals", PHI India, Fifth Edition.
2. U.A. Bakshi , A.P. Godse "Electronic Devices & Circuits-I", Technical Publication, Third Edition

Course Code: **EE34**
Course category: **PCC**
Course Name: **Analog & Digital Electronics**

At the end of the course, a student will be able to-

CO-1: Analyze BJT &FET amplifier circuit in different configurations.
CO-2: Analyze high Frequency transistor amplifier circuits.
CO-3: Analyze various types of OP-AMP circuits.
CO-4: Develop various combinational Circuits using gates.
CO-5: Develop sequential logic using various flip-flops.

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COURSE CONTENTS

w.e.f. July 2023

Subject Code	Subject Name	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work					
EE35	Electrical Measurement & Measuring Instrument	70	20	10	30	20	150	3	-	2	4

ELECTRICAL MEASUREMENT & MEASURING INSTRUMENTS

Course Objective: After completion of this course students will be able to-

1. Analyze various types of errors in measurements.
2. Use various measuring instruments for Measurement of electrical quantities.

Module-I: Performance characteristics & Errors in Measurement

analysis Limiting Errors, Types of Errors, statistical treatment of each data-Histogram, arithmetic mean, measure of dispersion from mean, range, deviation, average deviation, standard deviation, variance, normal and Gaussian curve of errors, precision index, probable error, average and standard deviation for normal curve, standard deviation of mean, standard deviation of standard deviation. Galvanometers construction and torque equation. Introduction to unit system, dimension and standard, Characteristic of instruments and measurement system-Static characteristic, errors in measurement, true value, static error, static correction, scale range and span, error calibration curve, Reproducibility and drift, repeatability, accuracy and precision, linearity, threshold, dead time, dead zone, resolution or discrimination.

Module-II: Analog instruments

Classification of analog instruments, operating force (deflecting Damping and controlling force), and Types of instruments (Permanent Magnet Moving Coil Moving Iron, Electrodynamometer, Hotwire, thermocouple, Electrostatic, Induction, Rectifier type- construction, torque equation, advantage and disadvantage of each) Errors in ammeter and voltmeter, Extension of range of instruments using shunt & multiplier.

Module-III: Measurement of Power

Power in AC and DC Circuit, Electrodynamometer wattmeter, low power factor wattmeter, Measurement of Power using instrument transformers, Measurement of power in three phase circuit by one, two & three wattmeter, three phase wattmeter, Measurement of reactive power by single wattmeter, Introduction to instrument transformer, Construction and working of instrument transformer, ration and phase angle errors in Current and Potential transformers method to reduce both ration and phase angle errors, Difference between CT and PT. Testing of CT and PT, Measurement of power using CT's & PT's.

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Module-IV: Measurement of Energy

Single phase induction type energy meter, Poly phase meters, Single phase and three phase VArH meters, Measurement of Volt ampere-hours, and Phantom loads. Principle of Potentiometer, Slide Wire DC potentiometer, Crompton's potentiometer, Potentiometer Calibration, Volt-ratio box, Practical application of DC Potential meter, Introduction to AC Potentiometer

Module-V: Miscellaneous Instruments & Measurements

Measurement of frequency-Vibrating Reed, Weston Frequency meter, Ratio type frequency meter, Power factor meter- Electro Dynamometer (type Single phase and three phases), Moving iron, Power Factor meter, Synchro scopes, Measurement of Low Resistance- Ammeter Voltmeter Method, Potentiometer method, Kelvin's double bridge, Ohm meter, Measurement of Medium Resistance- Ammeter Voltmeter Method, Substitution method, Wheatstone Bridge, Carey Foster Bridge Method. Measurement of High Resistance- Direct Deflection Method, Megger, loss of charge methods, Ohm meters (Series & Shunt Type) Multi meter, Earth resistance measurement, Q meters.

List of Experiments:-

1. Measurement of resistance by Wheatstone bridge.
2. Measurement of low resistance by Kelvin's double bridge,
3. To calibrate AC watt-hour meter by a standard wattmeter.
4. Measurement of iron losses Using Loyd's Fischer square method.
5. To plot the following characteristics of a given CT. Burden v/s Secondary current Burden v/s Secondary voltage
6. Measurement of three phase power by two wattmeter method.
7. Measurement of high resistance using megger.
8. Measurement of earth resistance using earth tester.
9. Testing of energy meter using phantom loading.

Text Books:

1. A.K. Sawhney, "A Course in Electrical & Electronics Measurements & Instrumentation", Dhanpat Rai & Co Pvt. Ltd. Sons Publications, Fifth Edition.

Reference books:

1. EW Golding & FC Widdis, "Electrical Measurement & Measuring Instruments", Wheeler Publishing, Fifth Edition.
2. Buckingham & Space Price, "Electrical Measurement" Prentice Hall, Fifth Edition.

Course Code: EE35
Course category: PCC
Course Name: Electrical Measurement & Measuring Instruments

After completion of this course students will be able to-

CO-1: Analyze the various types of errors and performance characteristics in measuring instrument.
CO-2: Select PMMC/MI/Induction/Dynamometer instruments based on application.
CO-3: Apply one, two and three wattmeter method to measure power and understand the types of instruments transformers
CO-4: Describe the construction and working principle of Energy meters and Potentiometer.
CO-5: Calculate various quantities like unknown (low, medium and high) resistance and frequency by various methods.

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COURSE CONTENTS

w.e.f. July 2023

Subject Code	Subject Name	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work					
EE41	Electrical Engineering Materials	70	20	10	-	-	100	3	1	-	4

ELECTRICAL ENGINEERING MATERIALS

Module-I: Conductors
Electron theory, conductivity, factor affecting conductivity, classification & properties of conducting materials. Effect of temperature variation, Alloys and their properties, properties and application of high Conductivity (Copper, aluminum, bronze & brass) & high resistivity (constantan, nichrome, carbon & platinum) materials, Application of conducting materials with their suitability in Electrical Machines, power systems, Electrical instruments etc. super conducting materials, their properties & Applications.

Module-II: Semiconductors
General concepts, energy band, types of semiconductors, intrinsic and extrinsic semiconductor, variation of electrical. conductivity, Elements having semiconducting properties, Fermi Dirac distribution, general application, Hall effect & its applications, conduction in semiconductors,drift and mobility, current flow in semi-conductors, P-N Junction formation by alloying Zener effect.

Module-III: Magnetic Materials
Magnetism, classification of magnetic materials (diamagnetic, paramagnetic and ferromagnetic), their properties & applications, Eddy currents, Hysteresis loop for hard and soft magnetic materials, magnetic susceptibility, coercive force, curie temperature, magnetostriction, Ferro-electric materials, piezo-electric materials & their properties.

Module-IV: Dielectrics & Insulators
Electrical, mechanical & chemical properties of insulating materials, Classification of Insulating materials, Liquid insulators (transformer oil and its properties), gaseous insulators, solid electrical insulating materials, resins and varnishes, Properties of gaseous, liquid and solid dielectric, dielectric as a field medium, electric conduction in gaseous, liquid and solid dielectric, Breakdown in dielectric materials, mechanical and electrical properties of dielectric materials, effect of temperature on dielectric materials, polarization, loss angle and dielectricloss.

Module-V: Special Materials
Photo emissive materials, nanomaterials, metamaterials, special conductive materials (materials to thermoelectric transformation, fuses, solder material etc.) material for photovoltaic cell

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Text Books:

1. Dr. C.S. Indulkar and Dr. S. Thiruvengadam, "Electrical Engineering Materials", S.Chand Publication.
2. S P Seth, "A course in Electrical Engineering Materials", Dhanpat Rai Publication, Third Edition.

Reference Books:

1. B.M.Tareev, "Materials for Electrical Engineering".
2. A. J. Dekker, "Electrical Engineering Materials", PHI,India Publication, First Edition.

Course Code: **EE41**
Course category: **PCC**
Course Name: **Electrical Engineering Material**

After the completion of this course students will able to-

CO-1: Select proper conducting material suitable for electrical machine, power system and various electrical measuring instruments.
CO-2: Analyse in depth the electrical and magnetic properties of various material.
CO-3: Explain superconductivity of magnetic materials with their applications in various fields. CO-**4**: Classify various insulating materials along with their properties.
CO-**5**: Elaborate the modern usage of special materials in engineering.

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Subject Code	Subject Name	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work					
EE42	Electrical Machine -I	70	20	10	30	20	150	3	-	2	4

ELECTRICAL MACHINES – I

Module-I: Transformer
Review of Single phase transformers, open circuit and short circuit test, Sumpner's test, polarity test, Power and distribution transformer, All day efficiency, Autotransformer working, equivalent circuit, comparison with two winding transformers and Phasor diagram.
Three Phase Transformer, construction, various groups and connections, harmonics in emf & magnetizing current, Scott Connection, Parallel operation

Module-II: Principles of Operation of Rotating Machines
Principle of electromagnetic energy conversion, Constructional details of ac machines, description of magnetic and electric circuits in cylindrical rotor and salient pole machine, concept of Armature & field winding.

Module-III: Generator
Principal of operation, EMF equation, classification on the basis of excitations, armature windings and its types, operating, characteristics, armature reaction and commutation, losses and efficiency.

Module-IV: DC Motor
Principal of operation, Torque equation, types of DC motors, starting methods and speed control, ward Leonard Method, solid state control, Swinburn's test, Hopkinson's test, braking Applications of DC machines

Module-V: Single Phase Induction Motor
EMF Equation of single Phase Induction motor, double field revolving theory, equivalent circuit, string methods and types of single phase Induction motor

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List of Experiment:

1. To conduct open circuit and short circuit tests on a 3-phase three winding transformer and determine the equivalent circuit parameters in pu.
2. To operate two single phase transformer of different KVA rating in parallel and plot the variation of current shared by each transformer v/s load current.
3. To conduct Sumpners test identical single phase transformer and determine their efficiency at various loads.
4. To separate hysteresis and eddy current losses of a single phase transformer at rated voltage and frequency by conducting no load tests at different frequencies keeping V/f constant.
5. To perform speed control of DC shunt motor using armature and field control plot the variation of speed with added resistance.
6. To perform direct load test on a DC shunt motor and plot the variation of (a) Input current (b) speed (c) torque (d) efficiency v/s output power.
7. To obtain magnetization characteristics of a DC machine. Estimate field circuit resistance of a DC shunt generator at rated speed. Measure field winding and armature winding resistance. Plot the external characteristics of DC shunt generator.
8. To make scott connection of two single phase transformer and to verify the current relation by drawing phasor diagram for balanced and unbalanced resistive load condition.
9. To conduct Swinburn's test on a dc shunt motor. Compute and plot the efficiency at various loads.
10. To conduct direct load test on DC Compound generator with (a) Shunt field alone (b) Cumulative and differential compounding for short shunt connections.

Text Books:

1. Nagrath and Kothari, "Electrical Machines", TMH Publication, Second Edition.
2. Ashfaq Hussain, "Electrical Machines", Dhanpat Rai Publication, Second Edition.

Reference Books:

1. P.S.Bhimbra, "Electrical Machinery", Khanna Publication, First Edition.
2. LangsDorf, "AC machines", TMH Publication, Second Edition.

Course Code : EE42
Course category: PCC
Course Name : Electrical Machines-I

After the completion of this course students will able to-

CO-1: Explain the basic concept of Transformer and Rotating Machine.
CO-2: Analyze performance of Transformer and DC Machine.
CO-3: Evaluate the Parameter and performance of DC Machines & Single Phase Induction Motor and Transformer.

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Subject Code	Subject Name	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work					
EE44	Electrical & Electronic Instruments	70	20	10	30	20	150	3	-	2	4

ELECTRICAL & ELECTRONIC INSTRUMENTS

Module-I: Cathode Ray Oscilloscope (CRO)
Different parts of CRO; Block diagram, Electrostatic focusing, Electrostatic deflection, post deflection, acceleration , Screen for CRTs, Graticule, Vertical & Horizontal deflection system, Time base circuit, Oscilloscope probes, Application of CROs: Measurement' of phase, frequency and other application, Special purpose CROs-multi input, Dual trace, Dual beam, Sampling, Storage, Analog and digital oscilloscopes

Module-II: AC Bridges
Sources and detectors, Use of Bridges for measurement of inductance, Capacitance & Q factor Maxwell's bridge, Maxwell's inductance capacitance bridge, Hays bridge, Andertons bridge, Owen's Bridge, De-sauty's Bridge, Schering Bridge, High Voltage, Schering bridge, Measurement of relative permittivity, Heaviside Campbell bridge, Wiens bridge, Universal bridge, errors in Bridge circuit, Wagner's Earthing device, Q meter and its application.

Module-III: Transducers
Classification of transducer, Strain Gauge, Displacement Transducer (LVDT) & (RVDT), (RTD) Thermistor, Thermocouple, Piezo-Electric transducers, Optical Transducer, photo emissive, Photoconductive, photovoltaic, Photodiode, Phototransistor, Nuclear Radiation Detector, Capacitive Transducer.

Module-IV: Signal Generator
Signal Generator, Fixed & variable frequency AF oscillators, Sine wave generators, Standard signal generator, AF Sine and Square wave generator, Function generator, Square and pulse generator, Random noise generator, Sweep generator, TV Sweep generator, Marker generator, Sweep Marker generator, Wobbly scope, video pattern generator, Vectro-scope, Beat frequency Oscillator,
Wave analyzer: Harmonic Distortion Analyzer, Spectrum Analyzer, Network analyzer.

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Module- V: Digital Measurement and Instruments

Advantages of Digital instruments over analog instruments, Digital to analog conversion (DAC) Variable resistive type R-2R Ladder Type, Binary ladder, weighted converter using op amp and transistor, Practical DAC, Analog to digital conversion (ADC), ramp Technique, Dual slope, Integrating Type, Successive Approximations, digital voltmeters and multi-meters, Resolution and sensitivity of digital meter, PLC structure, Principal of operation, response time and application, Digital panel meter, Data acquisition system, Data Transmission and Telemetry, Digital display system and indicators instruments used in computer controlled instrumentation RS 232 & IEEE 488, GPIB electric interface.

List of Experiments:

1. Measurement of inductance of a coil using Hay's bridge.
2. Measurement of inductance of a coil using Anderson Bridge.
3. Measurement of inductance and capacitance using Maxwell's inductance- capacitance bridge.
4. Measurement of capacitance of a capacitor using Schering Bridge.
5. Measurement of frequency using Wein's bridge.
6. Measurement of Displacement using LVDT.
7. Measurement of speed of a Motor using photoelectric transducer.
8. Temperature measurement & Control using thermocouple & using thermistor.
9. Measurement of frequency of signal using CRO.
10. Measurement of force using strain gauge.

Text Book:

1. A.K. Sawhney, "Instrumentation and Measurements", Dhanpat Rai and Co. Ltd, Fourth Edition.

References Books:

1. H.S. Kalsi, "Electronics Instrumentation", TMH, Third Edition.
2. Helfric and Cooper, "Modern Electronic Instrumentation and Measurement Techniques", First Edition.

Course Code: **EE44**
Course Category: PCC
Course Name: **Electrical & Electronic Instruments**

After the completion of this course students will able to-

CO-1: Analyze different wave forms using CRO.
CO-2: Calculate inductance and capacitance with the help of AC bridges.
CO-3: Use transducers to convert non electrical quantities into electrical.
CO-**4**: Analyze different signal generator and wave analyzer.
CO-**5**: To analyze various conversion methods for Analog to Digital and vice versa and working of various Digital Instruments.

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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work					
EE51A	Wind & Solar Energy	70	20	10	-	-	100	3	1	-	4

WIND & SOLAR ENERGY SYSTEMS

Module -I: Introduction to Wind Energy:
Basic Introduction of renewable energy, Energy available from wind, basics of lift and drag, basics of wind energy conversion system, effect of density, angle of attack and wind speed, windmill rotors, horizontal and vertical axes rotors, drag, lift, torque and power coefficients, tip speed ratio, solidity of turbine, wind turbine performance curves, wind energy potential and site selection, basics of wind farm Development of Wind Power Generation.

Module -II: Wind Energy Systems:
Wind Power Conversion, Power Equation for wind turbine, Power converter for Wind Turbines, Control and Grid requirement for Modem Wind Turbines, Types of Wind Generators, Singly Excited Induction Generator (SEIG), Standalone operation of fixed and variable speed energy conversion systems, Capacitance Requirement, Doubly Fed Induction Generator (DFIG): Principle, Operation and their analysis, Vector Control of DFIG using an AC-DC AC converter, DFIG based Wind Energy Conversion Systems.

Module -III: Introduction to Solar Energy:
Energy available from the sun, spectral distribution, solar radiation outside the earth's atmosphere and at the earth's surface, solar radiation geometry, Instruments for solar radiation measurements, empirical equations for prediction of availability of solar radiation, radiation on tilted surface.

Module -IV: Solar Energy Systems:
Solar energy conversion into heat, types of solar collectors, evacuated and non-evacuated solar air Heater, concentrated collectors, thermal analysis of liquid flat plate collector, air heater and cylindrical solar energy thermal storage, heating and cooling of solar drier, solar refrigeration and air Conditioning, solar pond, heliostat, solar furnace photovoltaic system for power generation, Solar cell modules and arrays, solar cell types, material.

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Module -V: Economic Analysis:
Initial and annual cost, basic definitions, present worth calculations, repayment of loan in equal annual installments, annual savings, cumulative saving and life cycle cost, economic analysis of add on solar system, payback period, and clean development mechanism.

Text Books:

1. S. P. Sukhatme and J. K.Nayak, "Solar Energy Principles of Thermal Collection and Storage", McGraw Hill Education, Third Edition.
2. S. Sivanagaraju Pearson, "Generation and Utilization of Electrical Energy", New Delhi Second Edition.

Reference Books:

1. John A. Duffie, William A. Beckman, John Wiley, "Solar Engineering of Thermal Processes", New York, Fourth Edition.
2. Frank Krieth & John F Kreider, John Wiley "Principles of Solar Energy", New York, Third Edition.
3. Joshua Earnest, "Wind Power Technology, PHI, India Learning, New Delhi, Third Edition.

Course Code : EE51A
Course Category : PEC
Course Name : Wind & Solar Energy Systems

After the completion of the course, the students will be able to-

CO1: Explain constant wind power plant.

CO2: Compare different variable speed wind power plant.

CO3: Design Different Solar based Applications.

CO4: Carry out preliminary economic analysis of RE systems.

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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work					
EE52	Control System	70	20	10	30	20	150	3	-	2	4

CONTROL SYSTEM

Module - I
Modeling of dynamic systems: Electrical, Mechanical and hydraulic systems, Concept of transfer function, Laplace Transform, State space description of dynamic systems: Open and closed loop systems, Signal flow graph, Mason's formula, Components of control systems: Error detectors (Synchronous & Potentiometer), Servomotors (AC & DC), tacho-generators, power amplifier, stepper motors.

Module - II
Time – domain analysis of closed loop systems: Test signals, time response of first and second order systems, Time domain performance specifications, Steady state error & error constants, Feedback control actions: Proportional, derivative and integral control.

Module - III
Concept of Stability, Necessary condition for stability, Routh-Hurwitz stability criterion, relative stability analysis, root locus technique.

Module - IV
Frequency response analysis and stability in frequency domain: Correlation between time and frequency response analysis. Polar Plots, Bode plots, Effect of adding pole and zeros, Nyquist stability criterion, gain margin and phase margin, relative stability from Nyquist plot, frequency domain compensation, lead, lag, lag-lead compensation.

Module - V
State Space Analysis: Concept of state, state space representation of systems, block diagram for state equation, transfer function decomposition, solution of state equation, concept of controllability and observability.

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Text Books:

1. D. Roy, Chaudhary, "Modern Control Systems", PHI India, Second Edition.
2. S. Salivahanan, R. Rengaraj, G.R. Venkatakrishnan, "Control System Engineering", Pearson, First Edition.
3. Stefani Shahian Savant,Hostetter, "Design of feedback control systems" Oxford, Fouth Edition.
4. B.S.Manke, "Control system engineering", Khanna Publishers, Twelfth Edition.

References Books:

1. B.C. Kuo and Farid Golnaraghi, "Automatic Control Systems", Wiley India, Eighth Edition.
2. M. Gopal, "Control system engineering", McGraw Hill, Fifth Edition.

List of Experiments:

1. MATLAB Based Experiments.

Course Code : EE52
Course Category : PCC
Course Name : Control System

After completion of this course students will be able to-

CO1: Model the electrical, mechanical and hydraulic system to obtain their transfer function.

CO2: Determination of time response and frequency response.

CO3: Estimate stability & state space analysis.

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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work					
EE53	Electrical Machines -II	70	20	10	30	20	150	3	-	2	4

ELECTRICAL MACHINES - II

Module - I: Basic Principles of Three Phase Induction Motor:
Constructional details, types – squirrel cage, slip ring, principle of operation, production of rotating magnetic field, speed / slip, rotor current and voltage, torque developed, condition for max. Torque, torque/slip and torque/speed characteristics, induced emf in stator and rotor winding

Module - II: Performance Analysis of Three Phase Induction Motor:
Rotor circuit model, stator circuit motor, complete equivalent circuit, referred to stator, approximate equivalent circuit, power flow diagram, circle diagram, no load & block rotor test, starters used with three phase induction motor- DOL, auto-transformer, star delta starter, effect of space harmonics on performance of three phase induction motor, cogging and crawling, different methods of speed control, pole changing, stator voltage control, variable frequency control.

Module - III: Synchronous Machine (Alternator)
Constructional details, advantages of rotating field, excitation system, EMF equation, armature winding coil span/pitch factor, distribution or breadth factor, armature leakage reactance, armature reaction in synchronous machine. Synchronous impedance, equivalent circuit and phasor & equivalent Circuit diagram of synchronous generator, voltage regulation, emf method, mmf method, ZPFC/potier delta method, two reaction theory, torque angle characteristic of salient pole synchronous machine determination of Xd & Xq, parallel operations of alternator, process of synchronization, significance of synchronizing power coefficient, transient condition of alternator, SCR cooling of synchronous machine.

Module - IV: Synchronous Machine (Motor)
Construction, principle of operation, main features of synchronous motor, torque developed, power flow equation for synchronous motor, phasor diagram, effect of varying field current, V & inverted V curves, starting of Synchronous motor, Hunting or phase swinging, Damper winding, Application of synchronous motor.

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Module -V: Fractional kW Motors

Shaded pole motor, Commutator motor, AC series motor, Universal motor, Repulsion motor, Servo motors, stepper motor, Introduce EV Motor, Brushless DC Motor, and SRM Motor.

Text Book:

1. Nagrath & Kothari, "Electrical Machines", TMH Publication, Fifth Edition.

Reference Books:

1. P.S. Bhimbra, "Electrical Machinery", Khanna Publication, Seventh Edition.
2. Ashfaq Hussain, Dhanpat Rai Publication, "Electrical Machines", Second Edition.
3. A.S.Langsdorf, "Theory of Alternating Current Machinery", Tata McGraw-Hill, Second Edition.

List of Experiments:

1. To perform the load test on 3-phase induction motor & determine torque, output power, input power, efficiency, p.f. and slip.
2. To perform No-load & Block rotor test on 3-phase induction motor.
3. Study of starters used with 3-phase induction motor.
4. To determine regulation of alternator using synchronous impedance method.
5. To determine regulation of alternator using potier triangle method(ZPF)
6. To Synchronise an incoming alternator to busbar using bright and dark lamp method.
7. To determine V and inverted V curves of synchronous motor.
8. Study of stepper motor.
9. Study of PMBLDC motor.
10. Study of Switch Reluctance Motor.

Course Code : EE53
Course Category : PCC
Course Name : Electrical Machines- II

After completion of this course students will be able to-

CO1: Analyze the performance of three phase induction motor in details.

CO2: Evaluate the parameters and performance on poly phase synchronous electric motors.

CO3: Explain application of special machines.

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Subject Code	Subject Name	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work					
EE62A	Engineering Economics & Management	70	20	10	-	-	100	3	1	-	4

ENGINEERING ECONOMICS & MANAGEMENT

Module-I:
Introduction to Engineering Economics and Managerial Economics Concept of Efficiency, Theory of demand, Elasticity of demand, Supply and Law of Supply in difference curves, Budget line, Welfare Analysis, Scope of Managerial Economics, Techniques and Applications of Managerial Economics.

Module-II:
Market Structure Perfect Competitions Imperfect – Monopolistic, Oligopoly, Duopoly sorbent features of price determination and Various Market Conditions.
Demand forecasting and cost estimation characteristics of forecasts, Forecasting Horizons, Steps to Forecasting, Forecasting Methods, Seasonal Adjustments, Forecasting Performance Measures, Cost Estimation, Elements of Cost and Computation of Material Variances, Break-Even Analysis.

Module-III:
Introduction: Concept, Development, Application and Scope of Industrial Management. Productivity: Definition, Measurement, Productivity Index, Types of Production System, Industrial Ownership.

Module-IV:
Management aspects, Functions of Management, Project Management, Value Engineering, Project Evaluation, Work Simplification- Process charts and Flow Diagrams, Production Planning, Decision Making.

Module-V:
Quality Control: Process Control, SQC, Control Charts, Single, Double and Sequential Sampling, Introduction to TQM.

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Text Books:

1. P.C. Tripathi & P.N. Reddy "Principles of Management", Fourth Edition.
2. Riggs J.L,"Engineering Economy", McGraw Hill, Fourth Edition.

Reference Books:

1. T.R. Banga and S.C. Sharma, "Mechanical Estimation and Costing", Seventeenth Edition 2015.
2. Thuesen H.G. "Engineering Economy", PHI,India,Fourth Edition.
3. Robert Lousier- Thomson,"Managements Fundamentals-Concepts, Applications, Skill Development "Third addition.

Course Code : EE62A
Course Category: OEC
Course Name : Engineering Economics and Management

After completion of this course students will be able to-

CO1: Understand the key management concepts, principles and contribution by different management thinkers.

CO2: Analyze and design organization for effective management.

CO3: Application of modern Management Techniques.

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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work					
EE62B	Digital Image Processing	70	20	10	-	-	100	3	1	-	4

DIGITAL IMAGE PROCESSING

Module -I:
Digital Image Fundamentals: Steps in Digital Image Processing – Components – Elements of Visual Perception–Image Sensing and Acquisition–Image Sampling and Quantization – Relationships between pixels – Color image fundamentals – RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms – DFT, DCT.

Module-II:
Image Enhancement: Spatial Domain: Gray level transformations – Histogram processing , Basics of Spatial Filtering, Smoothing 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:
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:
Image Segmentation: Edge detection, Edge linking via Hough transform , Thresholding , Region based segmentation , Region growing , Region splitting and merging , Morphological processing, erosion and dilation, Segmentation by morphological watersheds , basic concepts,Dam construction, Watershed segmentation algorithm.

Module-V:
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.

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Text books:

1. R.C.Gonzalez and Richard E Woods, "Digital Image Processing", Pearson Education, Fourth edition.
2. Anil.K.Jain, "Fundamentals of Digital Image Processing" Pearson Education,First Edition.

Reference Book:

1. B.Chanda and D. Dutta Majumdar, "Digital Image Processing and Analysis",PHI India, Second Edition.

Course Code : EE62B
Course Category : OEC
Course Name : Digital Image Processing

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

CO-1: Understand the basics of digital image processing. (Blooms cognitive level 1, 2)

CO-2: Operate on images using the techniques of smoothing, sharpening and enhancement. (Blooms cognitive level 3)

CO-3: Implement and Analyze the Images using various algorithms. (Blooms Cognitive level 3,4)

CO-4: Design adaptive algorithm suitable for image restoration, segmentation, compression, recognition etc. (Blooms cognitive level 6)

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Subject Code	Subject Name	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work					
EE63	Microprocessor & Microcontroller	70	20	10	30	20	150	3	-	2	4

MICROPROCESSOR & MICROCONTROLLER

Module-I:
Microprocessor 8086: Introduction to 16-bit 8086 microprocessors, architecture of 8086, pin configuration, interrupts, minimum mode and maximum mode, timing diagram, Memory interfacing, Comparative study of Salient features of 8086, 80286 and 80386.

Module-II:
Microprocessor 8086 Programming: Introduction set of 8086, Addressing modes, assembler directives & operations, assembly and machine language programming, subroutine call and returns, Concept of stack, Stack structure of 8086, timings and delays.

Module-III:
Input-Output interfacing: Memory Mapped I/O and Peripherals I/O. PPI 8255 Architecture and modes of operation, interfacing to 16-bit microprocessor and programming, DMA controller (8257) Architecture, Programmable interval timer 8254, USART 8251, 8-bit ADC/DAC interfacing and programming.

Module-IV:
Microcontroller 8051: Intel family of 8-bit microcontrollers, Architecture of 8051. I/O Configuration, interrupts, Interrupt structure and interrupt priorities, port structure and operation, accessing internal & external memories and different mode of operation, Memory organization, addressing mode, instruction set of 8051 and programming.

Module-V:
8051 Interfacing, Applications and serial communication: 8051 interfacing to ADC and DAC, Stepped motor interfacing, Timer/counter function, 8051 based thyristor firing circuit, 8051 connections to Rs-232, 8051 Serial communication, Serial communication modes, Serial communication programming, Serial port programming in C,PLC Controller.

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Text Books:

1. Hall Douglas V, "Microprocessor and interfacing, Programming and Hardware", Macmillan McGraw Hill, Second Edition.
2. Ray A.K. Burchandi K.M., "Advance microprocessor and peripherals", TMH ,First Edition.
3. V. Udayashankara and SJ.S. Mallikarjunaswany, "8051 Mictocontroller," McGraw Hill, First Edition.

Reference Books:

1. Kenneth J. Ayala, "The 8086 microprocessors Programming and interfacing the PC,First Edition.
2. Muhammad Ali Mazidi and Janice Gillespie Mazidi, "The 8051 Microcontroller and Embedded Systems", Pearson education, Second Edition.
3. Kenneth J. Ayala, "The 8051 Microcontroller Architecture", Third Edition,
4. Microsoft, "Notes on Microprocessor & Microcontroller".

List of Experiments:

1. To add two binary numbers each 8 byte long in 8086
2. To sort a string of 8-bit numbers in descending order in 8086
3. Program for searching for a number or character in a string for 8086
4. Program for string manipulations for 8086.
5. Interfacing ADC and DAC to 8086.
6. Write a program to add/ subtract two 8-bit numbers in 8085 and check for carry/ burrow
7. Assembly Language Programs of Microcontroller 8051
8. USART Operation in 8051.
9. Assembly Language Programs of Interfacing chips

Course Code : EE63
Course Category : PCC
Course Name : Microprocessor &Microcontroller

After completion of this course student will be able to-

CO1: Understand the working of processor and develop 8086 assembly level programs

CO2: Apply 8051 to interface peripheral and IOS in interrupt driven data transfer mode.

CO3: Interface various peripheral ICs like 8255, 8257, 8251,8254 with 8086 and Microprocessor.

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Subject Code	Subject Name	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work					
EE71A	Power Quality	70	20	10	-	-	100	3	1	-	4

POWER QUALITY

Module-I:
Introduction power quality: voltage quality, power quality evaluation Procedure, term anddefinition, general classes of power quality problem, causes & effect of power quality disturbance.

Module-II:
Voltage sags and interruption: sources of sags and interruption, estimating voltage sag performance, fundamental principles of protection monitoring sags.

Module-III:
Transients over voltages: sources of transients over voltages, principles of over voltage protection, utility capacitor switching transients, fundamentals of harmonicsand harmonics distortion, harmonic sources from commercial load and from industrial loads.

Module-IV:
Applied harmonics: harmonics distortion evaluations, principles for controlling harmonics,studies devices for controlling harmonic distortion, filters, and passive input filter standards of harmonics

Module-V:
Electromagnetic compatibility, constant frequency control, constant tolerance band control,variable tolerance band control, discontinuous current control

Text Books:
1. Roger C. Duggan, Mark F. McGranaghan, Surya Santoso, "Electrical Power System Quality", Third edition.
2. Jos Arrillaga, "Power System Harmonics",Wiley, Second Edition.

Reference Books:
1. Derek A. Paice, "Power Electronics Converter Harmonics", First Edition.
2. Angelo Baggini, "Handbook of Power Quality", Wiley, Third Edition.

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Course Code : EE71A
Course Category: PEC
Course Name : Power Quality

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

CO-1: Understand the major power quality problems.

CO-2: Understand and analyze harmonics in power systems.

CO-3: Use equipment that is required to measure the quality of power.

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Subject Code	Subject Name	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work					
EE71B	Digital Control System	70	20	10	-	-	100	3	1	-	4

DIGITAL CONTROL SYSTEM

Module-I:
Introduction: Digital Control Systems, quantization and quantization error, Z-transform, Z-transforms of elementary functions, properties of Z-transform, Inverse Z-transform, Z-transform method for solving difference equations

Module-II:
Z-plane Analysis of Discrete time Control Systems: Introduction, Impulse sampling and data hold, pulse transfer function, realization of digital controllers and digital filters

Module-III:
Design of Digital control systems by Conventional methods: Introduction, Mapping between s-plane and z-plane, transient and steady-state response analysis, Design based on frequency response methods, Analytical Design method.

Module-IV:
State Space Analysis: State space representation of digital systems, solving discrete state space equations, pulse transfer function matrix, discretization of continuous time state space equations, Liapunov stability analysis.

Module-V:
Pole placement and State Observers design: Controllability, Observability, useful transformations of state space analysis and design, Design through pole placement, state observer

Text Books:
1. I H Nagrath, "State Space methods and digital control systems", New Age International, Seventh Edition.
2. M.Gopal, "Digital Control and state variable Methods", Tata McGraw Hill, Fourth Edition.

Reference Book:
1. Katsuhiko Ogatta, "Discrete time Control Systems", Prentice Hall of India, Second Edition.

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Course Code : EE71B
Course Category: PEC
Course Name : Digital control system

After successful completion of the course, student will be able to-

CO-1: Acquire the knowledge of digital control system concepts. (Blooms cognitive level 1, 2)

CO-2: Analyse the considered digital control systems using state space and z domain technique (Blooms cognitive level 5)

CO-3: Design a digital controller to meet given performance specifications using conventional and recent methods (Bloom cognitive level -6)

CO-4: Examines the stability of the considered digital control systems using various techniques (Bloom cognitive level 5)

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Subject Code	Subject Name	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work					
EE72A	Advance Digital Communication	70	20	10	-	-	100	3	1	-	4

ADVANCE DIGITAL COMMUNICATION

Module-I:
Digital PAM, binary PAM formats, line coding, band limited digital PAM systems Nyquist pulse shaping, equalization, synchronization techniques, bit and frame synchronization. Coded pulse modulation, voice digitization rate (VDR) of PCM, DPCM, DM, ADM, CVSD, log PCM, their performance comparison, VDR reduction by speech coding, VOCODERS, noise performance of PCM and DM, Digital multiplexes. AT & T and CCITT hierarchies, quasi-synchronous multiplexes

Module-II:
Digital CW modulation, BPSK, DPSK, DEPSK, QPSK, M PSK, QASK, BFSK, Doubinary encoding, QPR coherent and non-coherent systems, error probabilities in PSK, DPSK, FSK, QPSK, 16QAM, MSK, QPR and bit.

Module-III:
Matched correlation and optimum filters and symbol error rate

Module-IV:
Spread Spectrum techniques: DS, CAMA, FH, PN sequence, power requirement PN-sequence code, and Walsh code.

Module-V:
ISDN & Value added communication system simulation & Analysis using MATLAB &Simulink Application using communication toolboxes.

Text Books:

1. Haykins, "Digital Communication", Mc Graw Hill, First Edition.
2. B.P. Lathi, "Modern Digital & Analog Communication", Oxford University Press, Fourth Edition.

Reference Book:

1. A B Carlson, "Communication Systems", Mc Graw Hill, Fifth Edition.

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Course Code: EE72A
Course Category: OEC
Course Name: Advance Digital Communication

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

CO-1: Understand and appreciate the need of various Modulation and spread spectrum techniques.

CO-2: Analyze the properties of basic Modulation techniques and apply them to Digital Communication.

CO-3: Design and develop the different types of Modulation techniques, equalizer to improve the performance under fading channels for various applications.

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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work					
EE74	Electrical Drives	70	20	10	30	20	150	3	-	2	4

ELECTRICAL DRIVES

Module-I:
Basic Concepts of Electric Drives: Elements of drive systems, Requirement of electric drives, Rating & Selection ofdrives, groups and individual drives, Constant power and Constant torque drives.
Motor Mechanism dynamics: Review of Characteristics of AC & DC motors, load characteristic, load-drive speed torque characteristics, quadrant speed torque characteristics. Mechanical Systems Stability of Electric drives, referred moment of inertia and torque of motor load combination, load equalization.

Module-II:
DC Drives: Starting & braking of conventional, Phase controlled and chopper-controlled drives, Transient & Steadystate analysis, Energy recovery systems.

Module-III:
Induction Motor Drives: Conventional method of starting braking and speed control, PWM, (VSI) Voltage sourceInverter and Current Sources (CSI) fed IM drives, cyclo-converter fed drive, Vector control drives.
Slip Controlled IM Drives: Review of Conventional methods & converter controlled-Crammers & Scherbius drives;rotor impedance control.

Module-IV:
Synchronous Motors Drives: VSI and CSI fed; self-controlled-Brush less &. Commutator less dc & ac motor drives

Module-V:
Special Drives: Fundamentals of Switched reluctance motors, Stepper Motors, Permanent Magnet Motor Introductionto vector control; Digital control of drives.
Case Studies Electric traction, steel & cements plants, textile & paper mills, machine tool drive and CNC, electriccars.

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Text Books:

1. Pillai S. K., "A first course on Electrical Drives", Wiley Eastern, Second edition
2. Dubey G. K., "Power Semiconductor Controlled Drives", Prentice-Hall, Englewood Cliffs, First Edition.
3. Dubey G. K., "Fundamentals of Electrical Drives", Narosa Publishing Hous, Second Edition.
4. P.V. Rao, "Power semiconductor Drives", BS Publications, Fourth Edition.

Reference Books:

1. Bose B. K., "Power Electronics and AC Drives", Prentice-Hall, First Edition.
2. Murphy M. D. and Tumbuli F., "Power Electronic Control of AC Motors", Pergamon Press, OxfordUniversity Press, First Edition.

List of Experiments:

1. To perform Speed Torque characteristics of a separately excited DC motor using open and close loop armature voltage control.
2. To perform Speed Torque characteristics of a separately excited DC motor using open and close loop armature field control.
3. To perform four- quadrant Speed Torque characteristics of a separately excited DC motor using open and close loop control.
4. To perform Speed Torque characteristics of single phase Induction motor using open loop controlled V/f method.
5. To perform Speed Torque characteristics of single phase Induction motor using close loop controlled V/f method.
6. To perform Speed Torque characteristics of three phase Induction motor using open loop controlled V/f method.
7. To perform Speed Torque characteristics of three phase Induction motor using close loop controlled V/f method.
8. To perform Speed Torque characteristics of permanent magnet synchronous motor (PMSM) using open loop control.
9. To perform Speed Torque characteristics of permanent magnet Brush less DC motor (PMBLDC) using open loop control.
10. To perform Speed Torque characteristics of permanent magnet Brush less DC motor (PMBLDC) using close loop control.
11. To perform Speed Torque characteristics of Switch Reluctance Motor (SRM) using open loop control.
12. To perform Speed Torque characteristics of Switch Reluctance Motor (SRM) using close loop control.

Course Code : EE74
Course Category: PCC
Course Name : Electrical Drives

After completion of this course student will be able to-

CO-1: Relation between Power Electronic switches and Machines to from a drive.

CO-2: Application of various converter topology in association with Machines.

CO-3: Discussion of special drives and case studies.

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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work					
EE75	Switchgear & Protection	70	20	10	30	20	150	3	-	2	4

SWITCHGEAR & PROTECTION

Module-I: Relays:
General consideration, sensing of fault, primary and back up protection, basic requirements of protective relaying, classification of relays, construction of electromagnetic relays, induction type relay principle, inverse time and definite time characteristics, over current, over voltage, directional, distance relays, differential buchholz and negative phase sequence relays.

Module-II: Advance relays:
Static Relays: Classification of static relays, block diagram & components of static relays, cooperators, static over current, static directional, static distance and static differential relays. Microprocessor based relays: General considerations, flow chart and software development for protection, microprocessor based over current relay, directional relay, distance relay, security and reliability. Numerical relays: Principle, characteristics and operation of numerical relay. FPGA based relays

Module- III: Protection:
Types and detection of faults and their effects, alternator protection scheme, power Transformer protection, generation-transformer unit protection scheme, busbar protection, transmission line protection, frame leakage protection, pilot relay scheme.

Module-IV: Switchgear:
Fuse: Characteristics, types of fuses, selection of fuses, construction and application of HRC fuses. Circuit breaker: basic principle of operation, arc phenomenon, initiation and maintenance of arc, arc interruption methods, arc voltage and current waveform in AC circuit break in re-striking and recovery voltage, current chopping, rating of circuit breakers, breaking capacity, making capacity, short time rating, working principle and important features of oil CB, minimum oil CB, air blast CB, Vacuum CB and SF6 CB, auto high-speed re- closing.

Module-V: Over voltage protection and neutral grounding:
Surge over voltages: Causes of over voltages, lightning phenomenon, protection of transmission line against Over voltage, klydonograph and magnetic link, switching surges, surge diverters Peterson coil and insulation coordination. Neutral grounding: Resistance earthling, reactance earthling, resonance earthling,voltage transformer earthling, earthling transformer.

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Text Books:

1. Y.G. Painthankar S.R. Bhide, "Fundamentals of Power System Protection", PHI, Second edition
2. Sunil S.Rao, "Switchgear and Protection", Khanna Pub New Delhi, Fourteenth Edition.
3. C.L. Wadhwa, "Electrical Power Systems", Newage International (P) Ltd, Eight Edition.

References Books:

1. B.Ravindranath and N Chander, "Power System Protection & Switchgear", Wiley Eastern Ltd, Second Edition.
2. Badri Ram Vishwakarma, "Power System Protection and Switchgear", Tata McGravy Hill, Third Edition.
3. T.S. Madhav Rao, "Power System Protection: Static Relays with Microprocessor Application", McGraw Hill Pub., Second Edition.
4. S.R.Bhinde., "Digital Power System Protection", Fourth Edition.

List of experiments:

1. To plot operating characteristics by performing operation of inverse definite minimumtime (IMDT) relay.
2. To check the percentage setting of percentage differential relay by performing operation.
3. To find the pick-up value and reset value of instantaneous relay by performingoperation.
4. To perform operation and plot the directional characteristics of directional over currentrelay on R-X diagram.
5. To perform operation and plot characteristics of over/under voltage microcontroller-based relay.
6. To check the microcontroller based over current relay and plot the curves.
7. To plot the directional characteristics of microprocessor based directional relay byperforming operation.
8. To perform operation and plot characteristics of microprocessor based differential relay.

Course Code : EE75
Course Category: PCC
Course Name : Switchgear & Protection

After completion of this course student will be able to-

CO-1: Categorize various types of relays and their working

CO-2: Explain the types, working and application of circuit breakers.

CO-3: Illustrate Protection of Bus-bar, transmission line, transformers and alternator.

CO-4: Develop and design of various protection schemes.

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Subject Code	Subject Name	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work					
EE81B	SCADA System & Applications	70	20	10	-	-	100	3	1	-	4

SCADA SYSTEM & APPLICATIONS

Module-I
Introduction to SCADA and PLC: SCADA: Data acquisition system, evaluation of SCADA, communication technologies, monitoring and supervisory functions. PLC: Block diagram, programming languages, Ladder diagram, Functional Block diagram, Applications, Interfacing of PLC with SCADA.

Module-II
SCADA system components: Schemes, Remote Terminal Unit, Intelligent Electronic Devices, Communication Network, SCADA server.

Module-III
SCADA Architecture-Various SCADA Architectures, advantages and disadvantages of each system, single unified standard architecture IEC 61850 SCADA / HMI Systems.

Module-IV
SCADA Communication-Various industrial communication technologies- wired and wireless methods and fibre optics, open standard communication protocols.

Module-V
Operation and control of interconnected power system-Automatic substation control, SCADA configuration, Energy management system, system operating states, system security, state estimation. Unit
VI: SCADA applications Utility applications, transmission and distribution sector operation, monitoring analysis and improvement. Industries oil gas and water. Case studies, implementation, simulation exercises.

Text Book:
1. Stuart A Boyer, "SCADA supervisory control and data acquisition", First Edition.

Reference Book:
1. Gordan Clark, Deem Reynders, "Practical Modem SCADA Protocols", First Edition.

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Course Code : EE81B
Course Category: PEC
Course Name : SCADA System & Applications

After completion of this course student will be able to-

CO1: Understanding of Supervisory control & Data acquisition.

CO2: Design of SCADA systems with establishment of communication protocols.

CO3: Application of the SCADA to utilities for their operation & control.

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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work					
EE81C	Renewable & Non-Conventional Energy Sources	70	20	10	-	-	100	3	1	-	4

RENEWABLE & NON-CONVENTIONAL ENERGY SOURCES

Module-I

Renewable Energy Systems Energy Sources, Comparison of Conventional and non-conventional, renewable and non-renewable sources. Statistics of world resources and data on different sources globally and in Indian context, Significance of renewable sources and their exploitation, Energy planning, Energy efficiency and management.

Module-II

Wind Energy System Wind Energy, Wind Mills, and Grid connected systems. System configuration, working principles, limitations, Effects of wind speed and grid conditions, Grid independent systems - wind-battery, wind diesel, wind hydro biomass etc. wind operated pumps, controller for energy balance .Small Hydro System Grid connected system, system configuration, working principles, limitations. Effect of hydro potential and grid condition, Synchronous versus Induction Generator for standalone systems, Use of electronic load controllers and self-excited induction generators Wave Energy System: System configuration: grid connected and hybrid systems.

Module-III

Solar Radiation Extra-terrestrial solar radiation, terrestrial solar radiation, Solar thermal conversion, Solar Photo tonic System Solar cell, Solar cell materials, efficiency, Characteristics of PV panels under varying insulation. PV operated lighting and water pumps, characteristics of motors and pumps connected to PV panels.

Biomass Energy System: System configuration, Biomass engine driven generators, feeding loads in stand-alone or hybrid modes, Biomass energy and their characteristics.

Module-IV

Energy from oceans Ocean temperature difference, Principles of OTEC, plant operations,

Geothermal Energy Electric Energy from gaseous cells, Magneto-hydro generated energy, Non-hazardous energy from nuclear wastes, Possibilities of other modern non-conventional energy sources.

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Module-V

Electric Energy Conservation Energy efficient motors and other equipment, Energy saving in Power Electronic controlled drives. Electricity saving in pumps, air-conditioning, power plants, process industries, illumination etc., Methods of Energy Audit

Measurements systems; efficiency measurements energy regulation, typical case studies, various measuring devices analog and digital, use of thyristors.

Text Books:

1. John Twidell & Toney Weir, "Renewable Energy Resources", E & F N Spon, Third Edition.
2. El-Wakil, "Power Plant Technology", McGraw Hill, First Edition.
3. Rai G D, "Non-conventional Energy Resources", Khanna Publication, Third Edition.

Reference Books:

1. F Howard E. Jordan, "Energy-Efficient Electric Motor & their Application", Plenum Press, New York, USA, Second Edition.
2. Anna Mani, "Wind Energy Resource Survey", Allied Publishers Ltd., New Delhi, Second Edition.

Course Code : EE81C
Course Category : PEC
Course Name : Renewable & Non-Conventional Energy Sources

After completion of this course student will be able to-

CO1: Understand the need of energy conversion and the various methods of energy storage.

CO2: Explain the field applications of renewable energy sources.

CO3: Illustrate the concepts of Direct Energy Conversion systems & their applications.

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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work					
EE82C	Computer Networks	70	20	10	-	-	100	3	1	-	4

COMPUTER NETWORKS

Module-I
Introduction: Network applications, network hardware, network software, reference models: OSI, TCP/IP, Internet, Connection oriented network - X.25, frame relay. THE PHYSICAL LAYER: Theoretical basis for communication, guided transmission media, wireless transmission, the public switched telephone networks, mobile telephone system.

Module-II
The Data Link Layer: Design issues, error detection and correction, elementary data link protocols, sliding window protocols, example data link protocols - HDLC, the data link layer in the internet. **The Medium Access Sublayer**: Channel allocations problem, multiple access protocols, Ethernet, Data Link Layer switching, Wireless LAN, Broadband Wireless, Bluetooth

Module-III
The Network Layer: Network layer design issues, routing algorithms, Congestion control algorithms, Internet working, the network layer in the internet (IPv4 and IPv6), Quality of Service.

Module-IV
The Transport Layer: Transport service, elements of transport protocol, Simple Transport Protocol, Internet transport layer protocols: UDP and TCP.

Module-V
The Application Layer: Domain name system, electronic mail, World Wide Web: architectural overview, dynamic web document and http.
Application Layer Protocols: Simple Network Management Protocol, File Transfer Protocol, Simple Mail Transfer Protocol, Telnet.

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Text Book:

1. A.S. Tanenbaum, "Computer Networks", Pearson Education, Fourth Edition.

Reference Books:

1. Behrouz A. Forouzan, "Data communications and Networking, McGraw-Hill India, Fourth Edition,
2. James F. Kurose Keith W. Ross, "Computer Networking: A top down approach", Pearson Education, India, Sixth Edition.

Course Code : EE82C
Course Category: OEC
Course Name : Computer Networks

After completion of this course student will be able to-

CO-1: Identify different process dynamics in process industries and their control schemes.

CO-2: Analyze and Design different types of mechanical, optical sensor and actuators.

CO-3: Differentiate process controller's their stability and tuning.

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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work					
EE704M A	Power System Planning & Reliability	70	20	10	-	-	100	3	1	-	4

POWER SYSTEM PLANNING & RELIABILITY

Module-I: **Review of Probability Theory:** Element of probability theory, Probability Distribution, Random variable, Density and distribution functions. Reliability function, MTIF, Hazard rate function, Bathtub curve, Conditional probability, Binominal distribution, Poisson distributions, Normal distribution, Exponential distribution, Weibull distribution.

Module-II: **Reliability of Engineering Systems:** Component reliability, Reliability of systems with non-repairable components, Series configuration, Parallel configuration, combined series-parallel systems, System structure function, Minimal tie-set, Minimal cut-set and Decomposition methods. Repairable systems, MARKOV analysis, Load sharing system, Standby systems, degraded systems.

Module-III: **Reliability of Engineering Systems**: Reliability model of a generating unit, State space methods, Combing states, sequential addition method, Load modelling, Cumulative load model, merging of generation and load models, Loss of load probability, Percentage energy loss, Probability and frequency of failure, operating reserve calculations.

Module-IV: Power Network Reliability: Weather effect on transmission lines, Common mode failures, Switching after faults, three state components, normally open paths, Distribution system reliability.

Module-V: **Composite System Reliability**: Bulk Power supply systems, Effect of varying load, Inter connected systems, correlated and uncorrelated load models, Cost and worth of reliability.
Reliability Improvement & Testing: Reliability growth process, Growth curve, Growth model, Reliability life testing, Test time calculations, Length of test, Burn in testing, Acceptance testing, Accelerated life testing, Environmental test, Reliability estimations.

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Text Book:

1. J. Endreny, "Reliability Modelling in Electric Power Systems", John Wiley & Sons.

Reference Book:

1. Roy Billinton & Ronald, Nallan, "Reliability Evaluation of Power Systems", Plenum Press, New York

Course Code : EE704M A
Course Category: PEC
Course Name : Power System Planning & Reliability

After completion of this course student will be able to-

CO-1: Illustrate the basic concepts and techniques of modern reliability theory.
CO-2: Apply the approaches and techniques to assess reliability of Power systems.
CO-3: Introduce the principles and techniques of Quality Control and their practical uses in Design and monitoring of Power systems

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Bachelor of Technology (B.Tech.) VII Semester (Electrical Engineering)

COURSE CONTENTS

w.e.f.July 2024

Subject Code	Subject Name	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work					
EE704M B	Soft Computing Techniques	70	20	10	-	-	100	3	1	-	4

SOFT COMPUTING TECHNIQUES

Module-I: Introduction to Soft Computing
Concept of computing systems, "Soft" computing versus "Hard" computing, Characteristics of Soft computing, Requirement of Soft computing, Major areas of Soft Computing, Applications of Soft Computing techniques

Module-II: Artificial Neural Networks
Biological neurons and its working, Simulation of biological neurons to problem solving, Different ANNs architectures, Leaming rules and various activation functions,Training techniques for ANNs, Functional link network, Back propagation algorithm network and Radial basis function network, Applications of ANNs to solve some real life problems.

Module-III: Genetic Algorithms
Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques, Basic GA framework and different GA architectures, GA operators: Encoding, Crossover, Selection, Mutation, etc, Solving single-objective, optimization problems using GAs.

Module-IV: Fuzzy logic
Introduction to Fuzzy logic, Fuzzy sets and membership functions, Operations on Fuzzy sets, Fuzzy relations, rules, propositions, implications and inferences, Defuzzification techniques, Fuzzy logic controller design, Some applications of Fuzzy logic.

Module-V: Multi-objective Optimization Problem Solving
Concept of multi-objective optimization problems (MOOPs) and issues of solving them, Multi-Objective Evolutionary Algorithm (MOEA), Non-Pareto approaches to solve MOOPs, Pareto-based approaches to solve MOOPs, Some applications with MOEAs.

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Text Books:

1. Nikola K. Kasabov, "Foundations of Neural Networks, Fuzzy Systems Engineering", MIT Press, 1998.
2. Rajasekaran and pai, "Neural Network, Fuzzy logic & Genetic Algorithms", PHI Learing
3. Ahmed M. Ibrahim, "Fuzzy Logic for Embedded Systems Applications", Elesvier Press

Reference Books:

1. S N Shivanandan, SN Deepa , "Principles of soft computing", Wiley India (P) Ltd, first edition 2007.
2. Melanie Mitchell, "An Introduction to Genetic Algorithms", MIT Press, 2000.
3. David E. Goldberg, "Genetic Algorithms In Search, Optimization And Machine Learning", Pearson Education.
4. S. Rajasekaran, and G. A. Vijayalakshmi, "Neural Networks, Fuzzy Logis and Genetic Algorithms Synthesis, and Applications", Prentice Hall of India, 2007.

Course Code : EE704M B
Course Category: PEC
Course Name : Soft Computing Techniques

After completion of this course student will be able to-

CO-1: Understand concepts, technologies, principle of soft computing with its usage in various applications.

CO-2: Develop application on different soft computing techniques like Fuzzy, GA, Neural network and Multi-objective Evolutionary optimization algorithm.

CO-3: Implement Neuro-Fuzzy, Neuro-Fuzzy-GA and Multi-objective Evolutionary expert system.

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EE705M A	Generalized Theory of Electrical Machines	70	20	10	-	-	100	3	1	-	4

GENERALISED THEORY OF ELECTRICAL MACHINES

Module-I: Generalized Theory : Conversions - Basic two pole machines - Transformer with movable secondary - Transformer voltage and speed voltage Kron's primitive machine Analysis of electrical machines.

Module-II: Linear Transformation: Invariance of Power - Transformations from displaced brush axis, three phases to two phase, rotating axes to stationary axes Transformed impedance matrix Torque calculations.

Module-III: DC Machines: Generalized Representation - Generator and motor operation - Operation with displaced brushes - Steady state and transient analysis - sudden short circuit - Sudden application on inertia load - Electric braking of DC motors.

Module-IV: AC Machines: Synchronous Machines: Generalized Representation - Steady state analysis Transient analysis - Electro-mechanical transients. Induction Machines : Generalized representation performance equation - steady state analysis - Transient analysis Double case machine - Harmonics - Electric braking.

Module-V: Special Machines: Generalized Representation and steady state analysis of Reluctance motor Brushless DC Motor - Variable Reluctance Motor Single phase series motor.

Text Book:

1. Gupta J.B., "Theory & Performance of Electrical Machines", S.K.Kataria & Sons, New Delhi.

Reference Book:

1. Bimbhra P.S., "Generalized Circuit Theory of Electrical Machines", Khanna Pub Ltd. Fifth Edition

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Course Code : EE705M A
Course Category: OEC
Course Name : Generalized Theory of Electrical Machines

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

CO-1: Analyze and apply the concept of steady state analysis and electrical transients in polyphase machines

CO-2: The generator and motor operation in steady state and transient conditions

CO-3: Evaluate the basic operation and performance of special machines and can select special machines for different purpose.

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Subject Code	Subject Name	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work					
EE705M C	Advanced Industrial Electronics	70	20	10	-	-	100	3	1	-	4

ADVANCED INDUSTRIAL ELECTRONICS

Module-I
Introduction to modem power conductor devices: Gate tum off thyristor (GTO), Insulated Gate Bipolar Junction Transistor (IGBT), Power BJT, Power MOSFET, MOS controlled thyristor (MCT), Reverse conducting thyristor (RCT), Smart Power Devices (Power ICs) Rating, Static and dynamic characteristics, Safe operating areas, Protections of devices, Devices selection.

Module -II
DC to DC conversion, Buck Boost and Buck Boost converters (Circuit Configuration and analysis with different types of loads) Power factor, Harmonics and effect of source inductance in converter circuits. Resonant DC, DC converters, Switched mode power supply (SMPS).

Module- I I I
Concept of PWM in converters, Unity power factor converters, Voltage source inverters (VSI), Current source inverters (CSI), Application of VSI and CSI in induction motor control

Module-IV
Non Drive applications of power electronics inverters, Uninterruptedpower supply (UPS), Induction heating, Metal cutting, Active power line conditioning.

Module-V
Vector controlled and slip power controlled induction motor drives, Application of microprocessor, Micro controllers and DSP in Machine drives.

Text Books:

1. M.H. Rashid, "Power Electronics", Tata McGraw Hill Pub.
2. J.G. Kassakian, MF Schlecht and G.C. Verghese , "Principle of Power Electronics"

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Reference Books:

1. Dubey G.K , "Power Semiconductor Controlled Drives", Engle Wood Cliffe NJ, Prentice Hall
2. DC Griffith, "Uninterruptible power supply", Marcell Dekker, NY.

Course Code : EE705M C
Course Category: OEC
Course Name : Advanced Industrial Electronics

After successful completion of the course, student will be able to-

CO-1: Theoretical and practical knowledge on modem day semiconductor devices, their characteristics and control.
CO-2: Knowledge of power conditioners and their application.
CO-3: Working knowledge of static applications of advanced power electronics like UPS, DC to DC converters etc.

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		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work					
EE701M	High Voltage Engineering	70	20	10	30	20	150	3	-	2	4

HIGH VOLTAGE ENGINEERING

Module-I:
Breakdown mechanism in gases: ionization, ionization processes, Townsend's mechanism, time lag for breakdown, Streamer theory, Paschen's law, effect of temperature on B.D. Voltage, Desirable properties of a gaseous insulation, SF6 as an insulator, vacuum as a dielectric.
Breakdown of gases in uniform and non-uniform fields: factors affecting time lag for BD, BD in a uniform AC field, BD under impulse voltage, volt time characteristics BD in non-uniform field, degree of non-uniformity, effect of polarity of electrode on BD voltages, corona: corona loss on conductor at DC voltage, corona loss on conductor at AC voltage.

Module-II Breakdown in liquids, solids, composite insulation and applications of insulating materials
Breakdown in liquid and solids : Break down in liquids, classification of liquids, B.D. in pure liquids, B.D. in commercial liquids, different theories of B.D. in liquids Different theories of B.D. in solids, intrinsic B.D. electromechanical B.D. thermal B.D. mechanism of B.D. occurring after prolonged operation, B.D. of composite dielectrics Partial discharge Applications of insulating materials.

Module-III Generation for HV testing
Generation of High Voltage: Impulse voltage, impulse voltage generation, single stage IG circuits- their analysis, multistage IG, constructional details of IG. Generation of High AC voltage: Cascaded transformer, series resonant transformer, tesla coil Generation of high DC voltage- half and full wave rectifier, voltage double circuit.

Module-IV HV Measurements
Measurement of impulse voltage by sphere gap, Measurement of AC, DC high voltage, sphere gap, voltage dividers, Measurement of dielectric constant and loss factor, Partial discharge measurements, impulse analyzer system.

Module -V Over voltage and insulation coordination
Charge formation in clouds, lightning surges, switching surges, protection against over- voltages, surge diverters, surge modifiers

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High voltage testing of power apparatus
Impulse testing of power transformer, testing of cables and some HV apparatus, testing of insulators, bushings, isolators and circuit breakers

Text Books:

1. M.S. naidu and V.Kamaraju, "High Voltage Engineering", Tata Mc Graw Hill, Fifth Edition.
2. D.V. Razevig "High Voltage Engineering", translated by Dr. M.P. Chourasia Khanna Pub, Second Edition.

Refrence Books:

1. E. Kuffel & W.S. Zingal, "High Voltage Engineering", Newres publication, Second Edition.
2. Kuffel & Abdulah, "High Voltage Engineering", First Edition.
3. C.L. Wadhana, "High Voltage Engineering", new age International Publication, Third Edition.

List of Experiments:

1. Various standards for high voltage testing of electrical apparatus
2. IE, IEC Standards
3. High voltage laboratories layout
4. Indoor and outdoor laboratory
5. Testing facilities
6. Safety precautions

Course Code : EE701M
Course Category: PCC
Course Name : High voltage

After completion of this course student will be able to-

CO-1: Understanding of breakdown phenomenon in gaseous dielectric in different field.

CO-2: Understanding of breakdown in liquid and solid dielectrics.

CO-3: Understanding of generation and measurement of high voltages and testing of different equipment.

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EE703M	Power System Control	70	20	10	30	20	150	3	-	2	4

POWER SYSTEM CONTROL

Module-I: General problems associated with modem interconnected power systems, deregulation of electric utilities , Competitive market for generation, power system restructuring, congestion, available transfer capacities, pricing of energy.

Module-II: Distribution in deregulated market, the development in competition, demand side management, Maintaining distribution planning, transmission expansion in new environment, Transmission in open access, Unbundling Generation, Transmission and distribution, BOT, ISO power exchange (PX). Energy market and terms related to energy market.

Module-III: Introduction to SCADA, Introduction to Flexible AC Transmission System (FACTS), Voltage quality in power systems, Distributed generation. Phasor measurements unit-concept, working and applications in wide area, online monitoring of power system.

Module-IV: MW Frequency control - Coherency, Control area, modeling of speed control mechanism, load damping, block diagrammatic representation of single and two area interconnected system, static and dynamic response, optimum parameter adjustment.

Module-V: MVAR Voltage Control - Difference in control strategy over MW-f-control characteristics of an exciting system, DC AC and static excitation system, general block diagram representation of voltage regulators.

Text Books:

1. P.S. Kundur, Prabha Kundur, "Power System Stability and Control" ,McGraw HillEducation.
2. D.P.Kothari and I.J.Nagrath, "Modem Power System Analysis",Tata Mc-Graw Hill Publishing Company, Third Edition.

Reference Books:

1. C.L.Wadhwa, "Electrical Power Systems", New-Age International Publishers", Sixth edition.
2. PSR Murthy," Power System Operation and Control",McGraw Hill Publishing

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Course Code : EE703M
Course Category: PCC
Course Name : Power System Control

After completion of this course student will be able to-

CO-1: Explain power system restructuring and deregulation.
CO-2: Determine voltage control methods in an interconnected system.
CO-3: Analyze frequency control in an interconnected system.

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