Jabalpur Engineering College, Jabalpur

(Declared Autonomous by MP Govt., Affiliated to RGPV, Bhopal)

(AICTE Model Curriculum Based Scheme)

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

w.e.f. July 2023

S.No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours Per Week			Total Credits
				Theory			Practical			L	T	P	
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work					
1	MA32	BSC	Mathematics-III	70	20	10	-	-	100	3	1	-	4
2	CH32	HSMC	Energy & Environmental Engineering	70	20	10	-	-	100	3	1	-	4
3	EE33	PCC	Circuit Theory & Network Analysis	70	20	10	30	20	150	3	-	2	4
4	EE34	PCC	Analog & Digital Electronics	70	20	10	30	20	150	3	-	2	4
5	EE35	PCC	Electrical Measurement & Measuring Instrument	70	20	10	30	20	150	3	-	2	4
6	EE36	ESC	Software Lab	-	-	-	30	20	50	-	-	4	2
			Total	**350**	**100**	**50**	**120**	**80**	**700**	**15**	2	**10**	**22**
7	EE37	DLC	Self-Learning Presentation (SWAYAM/NPTEL/MOOC)	-	-	-	-	-	-	-	-	-	8
8	EE38	MC	NSS/NCC/Swatchhata Abhiyan/Rural Outreach	Qualifier									
Additional Course for Honours or Minor Specialization				Permitted to opt for maximum two additional MOOC courses in subject code EE37 for the award of Honours (Minor Specialization).									

Note: MOOC/NPTEL subjects shall be taken with permission of HOD/Coordinator

1 hour lecture (L) = 1 credit	1 hour Tutorial (T) = 1 credit	2 hour Practical (P) = 1 credit

BSC: Basic Science Course, HSMC: Humanities & Social Sciences including Management Course, PCC: Professional Core Course, ESC: Engineering Science Course, MC: Mandatory Course, DLC: Distance Learning Course

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(AICTE Model Curriculum Based Scheme and Syllabus)

Bachelor of Technology (B.Tech.) III Semester, Branch (EE/EC)

COURSE CONTENT **w.e.f. July 2023**

Subject Code	Subject Name	Maximum marks Allotted			Total marks	Hours/Week			Total Credit
MA32	MATHEMATICS-III	Theory			100	L	T	P	4
		End Sem	Mid-Sem Exam	Quiz/ Assignment		3	1	0	
		70	20	10					

Module 1: Transform Calculus-I (06 hours)

Fourier integrals, Fourier sine and cosine integrals, Fourier transform, Fourier sine and cosine transforms and their elementary properties, Convolution theorem, Application of Fourier transformations to solve the boundary value problems.

Module 2: Transform Calculus-II (10 hours)

Hankel and Mellin transformations with their elementary properties, Application of Hankel and Mellin transformations to solve the boundary value problems, Wavelet transforms, CWT, properties of CWT, Z- transform and inverse Z-transform of elementary functions, Shifting theorems, convolution theorem, Initial and final value theorem.

Module 3: Basic Probability (08 hours)

Probability spaces, Counting techniques, Probability measure, Conditional probability and Baye's theorem, Random variable and distribution function, Moment, Expected value and Variance of Random variables, Chebychev Inequality, Moment generating function. Bivariate discrete and continuous random variables, Independence of random variables.

Module 4: Probability Distributions (08 hours)

Measures of Central tendency: Moments, Skewness and Kurtosis. Discrete Distributions (Binomial, Poisson's distribution) Continuous Distributions (Normal, Exponential Distribution).

Module 5: Applied Statistics (08 hours)

Curve fitting by the method of least squares- Fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means and difference of standard deviations.

Books References:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publisher, 35th Edition, 2010.
2. S. Ross, A First Course in Probability, 6th Edition, Pearson Education India 2002.
3. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Edition, Wiley 1968. Statistics
4. Advanced Engineering Mathematics by B.S. Grewal, Khanna Publishers.
5. Higher Engineering Mathematics by B.V. Ramana TMH.
6. Prasanna Sahoo, Probability and Mathematical Statistics, Louisville KY 40292 USA.

Course Outcomes:

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

1. Understand the knowledge of transform calculus.
2. Solve the Boundary value problems by the using transform methods.
3. Determine the concept of Basic probability.
4. Apply probability distribution and statistics in various techniques dealing with engineering problems.

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H.O.D.
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Branch- Common to (CE/EE/EC/CSE/IT/IP/AI&DS /MT)
COURSE CONTENTS

w.e.f. July 2023

Subject Code	Subject Name	Maximum Marks Allotted			Total Marks	Hours/Week			Total Credits
CH32	Energy & Environmental Engineering	Theory							
		End Sem	Mid-sem Exam	Quiz/ Assignment		L	T	P	4
		70	20	10	100	3	1	-	

Module 1:

A. **Introduction to Energy Science:**
World & Indian Energy Scenario, Overview to Energy Systems, Energy sustainability and Environment. Fossil Fuels. Alternatives for fossil fuels: biomass, wind, solar, nuclear, wave, tidal, hydrogen & geothermal energy.

B. **Batteries:**
Classification of Batteries, Important Applications, Lead-Acid battery, Ni-Cd battery & Li battery. Fuel Cell: Hydrogen-Oxygen Fuel cell.

Module2: Environmental Pollution A:

I. **Air Pollution**
Causes, Effects & Control Measures of Air Pollution: Primary and Secondary air pollutants and photo-chemical smog. Climate changes, Global warming, Ozone layer depletion. Pollution case studies: Bhopal gas Disaster and London smog Disaster.

II. **Water Pollution**
Definition, Causes, Effects and Control Measures (Primary & Secondary waste water treatment), Acid Rain and Marine pollution. Pollution case studies: Minamata Tragedy, Ganga Action Plan, Major oil spills of the 20^{th} & 21^{st} century. Water conservation, Rain water harvesting and Water Shed Management.

III. **Noise Pollution**
Causes, Effects & Control Measures.

Module3: Environmental Pollution B:

I. Sources, Adverse effects and Control measures of Soil Pollution, Thermal Pollution, Nuclear Pollution & Nuclear hazards. Major case studies.

II. Solid waste management: Municipal Solid Waste (MSW), Collection and disposal methods. Disaster Management.

III. Introduction to carbon footprint, ways to reduce carbon footprint, Carbon trading.

Module 4: Ecosystem & Biodiversity:

Concept of an ecosystem; Structure and function of an ecosystem; Producers, consumers and decomposers; Energy flow in the ecosystem; Ecological succession; Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of the following ecosystem (a.)Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Introduction ,Definition: genetic, species and ecosystem diversity; Bio-geographical classification of India; Value of biodiversity: Biodiversity at global & National levels; India as a mega-diversity nation; Hot-spots of biodiversity; Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; Endangered and Endemic species of India; Conservation of Biodiversity: In-situ and Ex-situ conservation of biodiversity. Environment Protection Act.

Module 5: Corrosion & its prevention:

Theories of Corrosion and Mechanism – Dry (Direct Chemical attack), Wet (Electro Chemical Theory) Atmospheric corrosion, Galvanic Series, Galvanic and Concentration Cell Corrosion, Corrosion by sea water. Factors Influencing and Control of Corrosion – Proper Design, Use of pure metal and metal alloys, passivity, cathodic protection – Sacrificial anode and Impressed Current. Modifying the environment, Use of inhibitors.

Protective coatings:

Hot dipping, Electroplating, Metal spraying metal cladding & cementation.

TEXT BOOKS

1. A text book of Engineering Chemistry by Jain & Jain, Dhanpat Rai Publishing Company, New Delhi
2. Chemistry of Engineering Materials by C.P. Murthy, C.V. Agarwal and A. Naidu BS Publication Hyd.
3. A text book of Environmental Chemistry and Pollution control by S.S. Dara & Dr. D. D. Mishra, S. Chand & Co, New Delhi
4. Energy,Environment Ecology and Society by Dr.Pushpendra,Vayu Education of India New Delhi
5. Energy, Environment Ethics and Society, by Dr.S.Deswal & Dr.A.Deswal Dhanpat Rai Publishing Company, New Delhi

REFERENCE BOOKS

1. J.C. Kuriakose and J. Rajaram, "Chemistry in Engineering and Technology", Vol.1 & 2, Tata Mcgraw Hill Publishing Company (P) Ltd., New Delhi
2. Mars G. Fontana, "Corrosion Engineering", Tata Mcgraw Hill Publishing Company (P) Ltd., New Delhi.
3. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
4. J.P.Gupta, A Text book of Energy, Environment Ethics & Society" Dhanpat Rai Publishing Company.

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COURSE OUTCOME: At the end of the course the student will be able to

CO1	Apply the concept of sustainability of renewable energy to overcome the shortcoming of energy from non-renewable sources. Understanding of Energy devices.
CO2	Develop an understanding related to Water, Air and Noise pollution.
CO3	Understand the importance of Soil, Thermal and Nuclear pollution. Illustrate municipal practices in solid waste management. Define carbon footprints.
CO4	Understand the interrelationship of different species in variety of ecosystems. Conservation of Biodiversity & awareness of Environmental protection Act.
CO5	Recognize the origin as well as types of corrosion and apply appropriate protection mechanism to control corrosion.

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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 (1^{st} and 2^{nd} 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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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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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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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work					
EE36	Software Lab	-	-	-	30	20	50	-	-	4	2

Software Lab

1. Introduction to MATLAB & Python.
2. Use of various libraries of Python for Data analysis & Visualization (Pandas, NumPy, Matplotlibetc)
   a. To create a Data frames.
   b. Exercises on already existed Data frames.
3. Write a Program in MATLAB to Plot
   a. Straight Line
   b. Parabola
   c. Circle
   d. Circular Helix
4. Write a Program in MATLAB to Plot
   a. Sine & Cosine Waveform
   b. 3 phase Sinusoidal Waveform
   c. Exponentially Decaying Sine wave
5. Simulate Series RLC Circuit for Various measurements (V IP) in MATLAB Simulink.
6. Design a MATLAB Simulation model to convert AC Voltage in to DC voltage using half and full wave Rectifier.

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