JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
(Established by Govt. of A.P., ACT No.30 of 2008)
ANANTHAPURAMU – 515 002 (A.P) INDIA

ELECTRICAL AND ELECTRONICS ENGINEERING

II B.TECH.

Semester– III

S.No.	Course Code	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	20A54302	Complex Variables & Transforms	BS	3	0	0	3
2.	20A02301T	Electrical Circuit Analysis	PC	3	0	0	3
3.	20A02302T	DC Machines & Transformers	PC	3	0	0	3
4.	20A04303T	Digital Logic Design	PC	3	0	0	3
5.	20A52301 20A52302 20A52303	**Humanities Elective – I** Managerial Economics & Financial Analysis Organizational Behavior Business Environment	HS	3	0	0	3
6.	20A02301P	Electrical Circuit Analysis Lab	PC	0	0	3	1.5
7.	20A02302P	DC Machines & Transformers Lab	PC	0	0	3	1.5
8.	20A04303P	Digital Logic Design Lab	PC	0	0	3	1.5
9.	20A05305	**Skill oriented course – I** Application development with Python	SC	1	0	2	2
10	20A52201	**Mandatory noncredit course – II** Universal Human Values	MC	3	0	0	0
11	20A99301	NSS/NCC/NSO Activities	MC	-	-	-	0
Total							**21.5**

Semester– IV

S.No.	Course Code	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	20A54402	Numerical Methods & Probability Theory	BS	3	0	0	3
2.	20A04404T	Analog Electronic Circuits	ES	3	0	0	3
3.	20A02401T	Power Electronics	PC	3	0	0	3
4.	20A02402T	AC Machines	PC	3	0	0	3
5.	20A02403T	Electromagnetic Field Theory	PC	3	0	0	3
6.	20A04404P	Analog Electronic Circuits Lab	PC	0	0	3	1.5
7.	20A02401P	Power Electronics Lab	PC	0	0	3	1.5
8.	20A02402P	AC Machines Lab	PC	0	0	3	1.5
9.	20A02404	**Skill oriented course – II** Circuits Simulation & Analysis using PSPICE	SC	1	0	2	2
10	20A99401	**Mandatory noncredit course – III** Design Thinking for Innovation	MC	2	1	0	0
Total							**21.5**
Community Service Internship (Mandatory) for 6 weeks duration during summer vacation							

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ELECTRICAL AND ELECTRONICS ENGINEERING

Note:

1. Eligible and interested students can register either for Honors or for a Minor in IV Semester as per the guidelines issued by the University
2. Students shall register for NCC/NSS/NSO activities and will be required to participate in an activity for two hours in a week during third semester.
3. Lateral entry students shall undergo a bridge course in Mathematics during third semester

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ANANTHAPURAMU – 515 002 (A.P) INDIA

ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	Numerical Methods & Probability Theory		L	T	P	C
20A54402	(Common to EEE, MECH)		3	0	0	3
Pre-requisite	Basic Equations and Basic Probability	**Semester**	**IV**			

Course Objectives:

This course aims at providing the student with the knowledge on various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations, the theory of Probability and random variables.

Course Outcomes (CO): Student will be able to

- Apply numerical methods to solve algebraic and transcendental equations
- Derive interpolating polynomials using interpolation formulae
- Solve differential and integral equations numerically
- Apply Probability theory to find the chances of happening of events.
- Understand various probability distributions and calculate their statistical constants.
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UNIT - I	**Solution of Algebraic & Transcendental Equations:**	8 Hrs

Introduction-Bisection method-Iterative method-Regula falsi method-Newton Raphson method
System of Algebraic equations: Gauss Jordan method-Gauss Siedal method.

UNIT - II	**Interpolation**	8 Hrs

Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.

UNIT - III	**Numerical Integration & Solution of Initial value problems to Ordinary differential equations**	9 Hrs

Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule
Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Modified Euler's Method-Runge-Kutta Methods.

UNIT - IV	**Probability theory:**	9 Hrs

Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation.

UNIT - V	**Random variables & Distributions**	9 Hrs

Probability distribution - Binomial, Poisson approximation to the binomial distribution and normal distribution-their properties-Uniform distribution-exponential distribution

Textbooks:

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Probability and Statistics for Engineers and Scientists, Ronald E. Walpole,PNIE.
3. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.

Reference Books:

1. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
2. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc17_ma14/preview
2. nptel.ac.in/courses/117101056/17
3. http://nptel.ac.in/courses/111105090

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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ANANTHAPURAMU – 515 002 (A.P) INDIA

ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	ANALOG ELECTRONIC CIRCUITS		L	T	P	C
20A04404T			3	0	0	3
Pre-requisite	Network Analysis, Electronic Devices and Circuits	Semester	IV			

Course Objectives:

- List various types of feedback amplifiers, oscillators and large signal Amplifiers.
- Explain the operation of various electronic circuits and linear ICs.
- Apply various types of electronic circuits to solve engineering problems
- Analyse various electronic circuits and regulated power supplies for proper understanding
- Justify choice of transistor configuration in a cascade amplifier.
- Design electronic circuits for a given specification.

Course Outcomes (CO):

CO1. List various types of feedback amplifiers, oscillators and large signal amplifiers
CO2. Explain the operation of various electronic circuits and linear ICs
CO3. Apply various types of electronic circuits to solve engineering problems
CO4. Analyze various electronic circuits and regulated power supplies for proper understanding
CO5. Justify choice of transistor configuration in a cascade amplifier
CO6. Design electronic circuits for a given specification

UNIT - I	Multistage Amplifiers

Classification of amplifiers, different coupling schemes used in amplifiers, general analysis of cascade amplifiers, Choice of transistor configuration in a cascade amplifier, frequency response and analysis of two stage RC coupled and direct coupled amplifiers, principles of Darlington amplifier, Cascode amplifier.

UNIT - II	Feedback Amplifiers and Oscillators

Concepts of Feedback, Classification of Feedback Amplifiers, Transfer Gain with Feedback, General Characteristics of Negative-Feedback Amplifiers, Effect of Feedback on Amplifier characteristics, Analysis of a feedback Amplifiers - Voltage – Series, Current-Series, Current-shunt and Voltage–shunt.
Oscillators: Sinusoidal Oscillators, Conditions for oscillations, Phase-shift Oscillator, Wien Bridge Oscillator, L-C Oscillators (Hartley and Colpitts).

UNIT - III	Large Signal Amplifiers (Power Amplifiers)

Introduction, Classification, Class A large signal amplifiers, Second - Harmonic Distortion, Higher - Order Harmonic Generations, Transformer Coupled Class A Audio Power Amplifier, Efficiency of Class A, Class B, Class AB Amplifiers, Distortion in Power Amplifiers, Class C Power Amplifier.

UNIT - IV	Operational Amplifier

Introduction, Block diagram, Characteristics and Equivalent circuits of an ideal op-amp, Various types of Operational Amplifiers and their applications, Power supply configurations for OP-AMP applications, Inverting and non-inverting amplifier configurations. The Practical op-amp: Introduction, Input offset voltage, Offset current, Thermal drift, Effect of variation in power supply voltage, common-mode rejection ratio, Slew rate and its Effect, PSRR and Gain–bandwidth product, frequency limitations and compensations, transient response.

UNIT - V	Applications of OP-AMPs and Special ICs

Adder, Integrator, Differentiator, Difference amplifier and Instrumentation amplifier, Converters: Current to voltage and voltage to current converters, Active Filters: First order filters, second order low pass, high pass, band pass and band reject filters, Oscillators: RC phase shift oscillator, Wien bridge oscillator, Square wave generator.
Special Purpose Integrated Circuits: Functional block diagram, working, design and applications of

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ANANTHAPURAMU – 515 002 (A.P) INDIA

ELECTRICAL AND ELECTRONICS ENGINEERING

Timer 555 (Monostable & Astable), Functional block diagram, working and applications of VCO566, PLL565, Fixed and variable Voltage regulators.

Textbooks:

- Millman, Halkias and Jit , "Electronic Devices and Circuits" , 4th Edition , McGraw Hill Education (India) Private Ltd.,2015.
- Salivahanan and N. Suresh Kumar, " Electronic Devices and Circuits",4thEdition,McGrawHill Education(India)Private Ltd.,2017.
- Ramakanth A. Gayakwad, "Op-Amps& LinearICs",4thEdition, Pearson, 2017.

Reference Books:

- Millman and Taub, Pulse, Digital and Switching Waveforms, 3rdEdition, TataMcGraw-Hill Education, 2011.
- J. Milliman, C.C. Halkias and Chetan Parikh, "Integrated Electronics", 2ndEdition, McGraw Hill, 2010.
- David A. Bell, " Electronic Devices and Circuits", 5thedition,OxfordPress,2008.
- D. Roy Choudhury, "LinearIntegratedCircuits",2ndEdition, New Age International (p)Ltd,2003.

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ANANTHAPURAMU – 515 002 (A.P) INDIA

ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	POWER ELECTRONICS		L	T	P	C
20A02401T			3	0	0	3
Pre-requisite	Electrical circuits and semiconductor devices	Semester	IV			

Course Objectives:

The student will be able to:

- Understand the differences between signal level and power level devices.
- Analyze controlled rectifier circuits.
- Analyze the operation of DC-DC choppers.
- Analyze the operation of voltage source inverters.

Course Outcomes (CO):

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

- Understand the operation, characteristics and usage of basic Power Semiconductor Devices.
- Understand different types of Rectifier circuits with different operating conditions.
- Understand DC-DC converters operation and analysis of their characteristics.
- Understand the construction and operation of voltage source inverters, Voltage Controllers and Cyclo Converters.
- Apply all the above concepts to solve various numerical problem solving

UNIT - I	**Power Switching Devices**	9 Hrs

Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET, IGBT and GTO. Introduction to Galium Nitride and Silicon Carbide Devices.

UNIT - II	**Rectifiers**	10 Hrs

Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape, power factor and effect of source inductance; Analysis of rectifiers with filter capacitance, Dual Converter -Numerical problems.

UNIT - III	**DC-DC CONVERTERS**	9 Hrs

Elementary chopper with an active switch and diode, concepts of duty ratio, control strategies and average output voltage: Power circuit, analysis and waveforms at steady state, duty ratio control and average output voltage of Buck, Boost and Buck- Boost Converters.

UNIT - IV	**INVERTERS**	10 Hrs

Single phase Voltage Source inverters – operating principle - steady state analysis, Simple forced commutation circuits for bridge inverters – Mc Murray and Mc Murray Bedford inverters, Voltage control techniques for inverters and Pulse width modulation techniques, single phase current source inverter with ideal switches, basic series inverter, single phase parallel inverter – basic principle of operation only, Three phase bridge inverters (VSI) – 180 degree mode – 120 degree mode of operation - Numerical problems.

UNIT - V	**AC VOLTAGE CONTROLLERS & CYCLO CONVERTERS:**	10 Hrs

AC voltage controllers – Principle of phase control – Principle of integral cycle control - Single phase two SCRs in anti parallel – With R and RL loads – modes of operation of Triac – Triac with R and RL loads – RMS load voltage, current and power factor - wave forms – Numerical problems.

Cyclo converters - Midpoint and Bridge connections - Single phase to single phase step-up and step-down cyclo converters with Resistive and inductive load, Principle of operation, Waveforms, output

voltage equation.
Textbooks:
1. M. H. Rashid, "Power Electronics: Circuits, Devices and Applications", 2nd edition, Prentice Hall of India, 1998 2. P.S.Bimbhra,"Power Electronics", 4th Edition, Khanna Publishers, 2010. 3. M. D. Singh & K. B. Kanchandhani, "Power Electronics", Tata Mc Graw Hill Publishing Company, 1998.
Reference Books:
1. Ned Mohan, "Power Electronics", Wiley, 2011. 2. Robert W. Erickson and Dragan Maksimovic, "Fundamentals of Power Electronics" 2nd Edition, Kluwer Academic Publishers, 2004. 3. Vedam Subramanyam, "Power Electronics", New Age International (P) Limited, 1996. 4. V.R.Murthy, "Power Electronics", 1st Edition, Oxford University Press, 2005. 5. P.C.Sen, "Power Electronics", Tata Mc Graw-Hill Education, 1987. 5. "Power Electronic Control of Alternating Current Motors" by J.M.D.Murphy
Online Learning Resources: **https://www.classcentral.com/course/youtube-electrical-power-electronics-47667/classroom** **https://onlinecourses.nptel.ac.in/noc21_ee01/preview**

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ANANTHAPURAMU – 515 002 (A.P) INDIA

ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	AC MACHINES		L	T	P	C
20A02402T			3	0	0	3
Pre-requisite	Electrical circuits, Magnetic circuits, DC machines and transformers	Semester	IV			

Course Objectives:

The students will be able to:

- Understand the fundamentals of AC machines, know equivalent circuit performance characteristics.
- Understand the methods of starting of Induction motors.
- Understand the methods of starting of Synchronous motors.
- Understand the parallel operation of Alternators.

Course Outcomes (CO):

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

- Understand the basics of ac machine windings, construction, principle of working, equivalent circuit of induction and synchronous machines.
- Analyze the phasor diagrams of induction and synchronous machine, parallel operation of alternators, synchronization and load division of synchronous generators.
- Apply the concepts to determine V and inverted V curves and power circles of synchronous motor.
- Analyze the various methods of starting in both induction and synchronous machines.

UNIT - I	**Fundamentals of AC machine windings**	9Hrs

Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single turn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis, Air-gap MMF distribution with fixed current through winding - concentrated and distributed, Sinusoidally distributed winding, winding distribution factors.

UNIT - II	**Induction Machines**	10 Hrs

Operating principle, Construction, Types (squirrel cage and slip-ring), Starting and Maximum Torque, Equivalent circuit, Phasor Diagram, Torque-Slip Characteristics, power flow in induction machines, Losses and Efficiency, No load and blocked rotor test, Circle diagram, performance characteristics, Numerical problems. Methods of starting, braking and speed control for induction motors, Doubly-Fed Induction Machines, crawling and cogging. Analysis of 3 phase induction motors with single phasing operation.

UNIT - III	**Synchronous generators**	10 Hrs

Constructional features, cylindrical rotor synchronous machine - generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation, EMF, MMF, ZPF and ASA methods. Operating characteristics of synchronous machines, Salient pole machine - two reaction theory, analysis of phasor diagram, power angle characteristics. Parallel operation of alternators - synchronization and load division.

UNIT - IV	**Synchronous motors**	10 Hrs

Principle of operation, methods of starting, Phasor diagram of synchronous motor, variation of current and power factor with excitation, V and inverted V curves, Hunting and use of damper bars, Synchronous condenser and power factor correction, Excitation and power circles.

UNIT - V	**Single-phase induction motors**	9 Hrs

Constructional features, double revolving field theory, equivalent circuit, determination of parameters. Split-phase starting methods and its applications, capacitor start and run single phase

motors, reluctance single phase motors, stepper motors, BLDC motors.
Textbooks:
1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013. 2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
Reference Books:
1. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002. 2. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010. 3. A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984. 4. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.
Online Learning Resources:
• **https://onlinecourses.nptel.ac.in/noc21_ee13/preview**

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ANANTHAPURAMU – 515 002 (A.P) INDIA

ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	ELECTROMAGNETIC FIELD THEORY		L	T	P	C
20A02403T			3	0	0	3
Pre-requisite	Magnetic circuits	Semester	IV			

Course Objectives:

- To understand the basic principles of electrostatics
- To understand the basic principles of magneto statics for time invariant and time varying fields
- To understand the principles of dielectrics, conductors and magnetic potentials

Course Outcomes (CO):

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

- Understand the concept of electrostatics
- Understand the concepts of Conductors and Dielectrics
- Understand the fundamental laws related to Magneto Statics
- Understand the concepts of Magnetic Potential and Time varying Fields

UNIT - I	**ELECTROSTATICS**	9 Hrs

Electrostatic Fields - Coulomb's Law - Electric Field Intensity (EFI) due to Line, Surface and Volume charges- Work Done in Moving a Point Charge in Electrostatic Field-Electric Potential due to point charges, line charges and Volume Charges - Potential Gradient - Gauss LawApplication of Gauss Law-Maxwell's First Law – Numerical Problems. Laplace and Poisson Equations - Solution of Laplace Equation in one Variable. Electric Dipole - Dipole Moment - Potential and EFI due to Electric Dipole - Torque on an Electric Dipole in an Electric Field – Numerical Problems.

UNIT - II	**CONDUCTORS AND DIELECTRICS**	9 Hrs

Behaviour of Conductors in an Electric Field-Conductors and Insulators – Electric Field Inside a Dielectric Material – Polarization – Dielectric Conductors and Dielectric Boundary Conditions – Capacitance-Capacitance of Parallel Plate, Spherical & Co-axial capacitors – Energy Stored and Energy Density in a Static Electric Field – Current Density – Conduction and Convection Current Densities – Ohm's Law in Point Form – Equation of Continuity – Numerical Problems.

UNIT - III	**MAGNETO STATICS**	11 Hrs

Static Magnetic Fields – Biot-Savart Law – Oersted's experiment – Magnetic Field Intensity (MFI) due to a Straight, Circular &Solenoid Current Carrying Wire – Maxwell's Second Equation. Ampere's Circuital Law and its Applications Viz., MFI Due to an Infinite Sheet of Current and a Long Current Carrying Filament – Point Form of Ampere's Circuital Law – Maxwell's Third Equation – Numerical Problems. Magnetic Force — Lorentz Force Equation – Force on Current Element in a Magnetic Field - Force on a Straight and Long Current Carrying Conductor in a Magnetic Field - Force Between two Straight and Parallel Current Carrying Conductors – Magnetic Dipole and Dipole moment – A Differential Current Loop as a Magnetic Dipole – Torque on a Current Loop Placed in a Magnetic Field – Numerical Problems.

UNIT - IV	**MAGNETIC POTENTIAL**	9 Hrs

Scalar Magnetic Potential and Vector Magnetic Potential and its Properties - Vector Magnetic Potential due to Simple Configuration – Vector Poisson's Equations. Self and Mutual Inductances – Neumann's Formulae – Determination of Self Inductance of a Solenoid and Toroid and Mutual Inductance Between a Straight, Long Wire and a Square Loop Wire in the Same Plane – Energy Stored and Intensity in a Magnetic Field – Numerical Problems.

UNIT - V	**TIMEVARYING FIELDS**	10 Hrs

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ANANTHAPURAMU – 515 002 (A.P) INDIA

ELECTRICAL AND ELECTRONICS ENGINEERING

Faraday's Law of Electromagnetic Induction – It's Integral and Point Forms – Maxwell's Fourth Equation. Statically and Dynamically Induced E.M.F's – Simple Problems – Modified Maxwell's Equations for Time Varying Fields – Displacement Current. Wave Equations – Uniform Plane Wave Motion in Free Space, Conductors and Dielectrics – Velocity, Wave Length, Intrinsic Impedence and Skin Depth – Poynting Theorem – Poynting Vector and its Significance.'
Textbooks:
1. Sadiku, Kulkarni, "Principles of Electromagnetics", 6th Edition, Oxford University Press, 2015 2. William.H.Hayt, "Engineering Electromagnetics", Mc Graw Hill, 2010.
Reference Books:
1.J.D.Kraus, "Electromagnetics", 5th Edition, Mc Graw Hill Inc, 1999. 2. David K. Cheng, "Field & Electromagnetic Waves", 2nd Edition, 1989. 3. Joseph A. Edminister, "Electromagnetics", 2nd Edition, Schaum's Outline, Mc Graw Hill, 2017. 4. K.A. Gangadhar and P.M. Ramanathan, "Electomagnetic Field Theory", 8th Reprint, Khanna Publications, 2015.
Online Learning Resources:
• **https://www.classcentral.com/course/youtube-electrical-electro-magnetic-fields-47689/classroom** • **https://onlinecourses.nptel.ac.in/noc21_ee83/preview**

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ANANTHAPURAMU – 515 002 (A.P) INDIA

ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	ANALOG ELECTRONIC CIRCUITS LAB		L	T	P	C
20A04404P			0	0	3	1.5
Pre-requisite	NIL	Semester	IV			

Course Objectives:

- To learn basic techniques for the design of analog circuits, digital circuits and fundamental concepts used in the design of systems.
- To design and analyze multistage amplifiers, feedback amplifiers and OPAMP based circuits.
- To implement simple logical operations using combinational logic circuits
- To design combinational logic circuits, sequential logic circuits.

Course Outcomes (CO):

- Analyze various amplifier circuits.
- Design multistage amplifiers.
- Design OPAMP based analog circuits.
- Understand working of logic gates.
- Design and implement Combinational and Sequential logic circuits.

List of Experiments:

PARTA

List of Experiments:

1. Design and simulate two stage RC coupled amplifier for given specifications. Determine Gain and Bandwidth from its frequency response curve.
2. Design and simulate Darlington amplifier. Determine Gain and Bandwidth from its frequency response curve.
3. Design and simulate voltage series feedback amplifier for the given specifications. Determine the effect of feedback on the frequency response of a voltage series feedback amplifier.
4. Design RC Phase shift oscillator/Wien bridge oscillator and square wave generator for the given specifications. Determine the frequency of oscillation.
5. Analyze a Class B complementary symmetry power amplifier and observe the waveforms with and without cross-over distortion. Determine maximum output power and efficiency.
6. Design inverting and non-inverting amplifiers for the given specifications using OP-AMP and verify the same experimentally.
7. Design practical differentiator and integrator circuits using OP-AMP for the given specifications and verify the same practically.
8. Design a second order low pass and high pass active filters using OP-AMP using the given specifications. Verify them practically.
9. Design an astable multi-vibrator circuit for the given specifications using 555timer. Observe ON & OFF states of transistor in an astable multi-vibrator. Plot output waveforms.
10. Design an Monostable Multi-Vibrator circuit for the given specifications using 555 Timer. Plot output waveforms.

Note: Design & simulate any 6 experiments with Multisim/PSPICE or equivalent software and verify the results in hardware lab with discrete components.

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ANANTHAPURAMU – 515 002 (A.P) INDIA

ELECTRICAL AND ELECTRONICS ENGINEERING

PARTB

List of Experiments:

1. To study basic gates (AND, OR, NOT) and verify their truth tables.
2. Realization of Boolean Expressions using Gates
3. Design a3–bit Adder/Subtractor
4. Design and realization a 4–bitgray to Binary and Binary to Gray Converter
5. Design and construct basic flip-flops R-S, J-K, J-K Masterslave flip-flops using gates and verify their truth tables
6. Design and implementation of Mod-N synchronous counter using J-K flip-flops.
7. Design and implementation of i) Ring counter and ii) Johnson counter using 4 3 bit shift register
8. Design and realization of 8x1 MUX using 2x1 MUX

Note: Student has to perform minimum of 4 experiments using digital ICs

Online learning resources/Virtual Labs:
https://www.vlab.co.in/

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ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	POWER ELECTRONICS LAB		L	T	P	C
20A02401P			0	0	3	1.5
Pre-requisite	Power Electronics	Semester	IV			

Course Objectives:

- Understand and analyze various characteristics of power electronic devices with gate firing circuits and forced commutation techniques.
- Analyze the operation of single-phase half &fully-controlled converters and inverters with different types of loads.
- Analyze the operation of DC-DC converters, single-phase AC Voltage controllers, cyclo converters with different loads.
- Create and analyze various power electronic converters using PSPICE software.

Course Outcomes (CO):

By the end of the course the student will be able to:

- Understand and analyze various characteristics of power electronic devices with gate firing circuits and forced commutation techniques.
- Analyze the operation of single-phase half &fully-controlled converters and inverters with different types of loads.
- Analyze the operation of DC-DC converters, single-phase AC Voltage controllers, cyclo converters with different loads.
- Create and analyze various power electronic converters using PSPICE software.

List of Experiments:

Minimum eight experiments from the following list are required to be conducted

1. Study of Characteristics of SCR, MOSFET & IGBT
2. Gate firing circuits for SCR's: (a) R triggering (b) R-C triggering
3. Single Phase AC Voltage Controller with R and RL Loads
4. Single Phase fully controlled bridge converter with R and RL loads
5. Forced Commutation circuits (Class A, Class B, Class C, Class D & Class E)
6. DC Jones chopper with R and RL Loads
7. Single Phase Parallel, inverter with R and RL loads
8. Single Phase Cycloconverter with R and RL loads
9. Single Phase Half controlled converter with R and RL load
10. Single Phase Fully controlled converter with R and RL load
10. Three Phase half controlled bridge converter with R,RL-load
11. Three Phase fully controlled bridge converter with R,RL-load
11. Single Phase series inverter with R and RL loads
12. Single Phase Bridge converter with R and RL loads
13. Single Phase dual converter with RL loads

References:

1. O.P. Arora, "Power Electronics Laboratory: Theory, Practice and Organization (Narosa series in Power and Energy Systems)", Alpha Science International Ltd., 2007.
2. M.H.Rashid, "Simulation of Electric and Electronic circuits using PSPICE", M/s PHI Publications.
3. PSPICE A/D user's manual – Microsim, USA.
4. PSPICE reference guide – Microsim, USA. 5. MATLAB and its Tool Books user's manual and – Math works, USA.

Online Learning Resources/Virtual Labs:

- **http://vlabs.iitb.ac.in/vlabs-ev/labs/mit_bootcamp/power_electronics/labs/index.php**

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(Established by Govt. of A.P., ACT No.30 of 2008)
ANANTHAPURAMU – 515 002 (A.P) INDIA

ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	AC MACHINES LAB		L	T	P	C
20A02402P			0	0	3	1.5
Pre-requisite	AC Machines	Semester	IV			

Course Objectives:

- Analyze and apply load test, no-load and blocked-rotor tests for construction of circle diagram and equivalent circuit determination in a single phase induction motor.
- Predetermine regulation of a three-phase alternator by synchronous impedance &m.m.f methods.
- Predetermine the regulation of Alternator by Zero Power Factor method Xd and Xq determination of salient pole synchronous machine.
- Evaluate and analyze V and inverted V curves of 3 phase synchronous motor

Course Outcomes (CO):

By the end of the course, the student will be able to:

- Analyze and apply load test, no-load and blocked-rotor tests for construction of circle diagram and equivalent circuit determination in a single phase induction motor.
- Predetermine regulation of a three-phase alternator by synchronous impedance &m.m.f methods.
- Predetermine the regulation of Alternator by Zero Power Factor method Xd and Xq determination of salient pole synchronous machine.
- Evaluate and analyze V and inverted V curves of 3 phase synchronous motor

List of Experiments:

All the following ten experiments are required to be conducted

1. No-load & Blocked-rotor tests on Squirrel cage Induction motor.
2. Load test on three phase slip ring Induction motor.
3. Speed control of three phase induction motor
4. Rotor resistance starter for slip ring induction motor
5. Load test on single phase induction motor.
6. Determination of Equivalent circuit of a single phase induction motor.
7. Predetermination of Regulation of a three phase alternator by synchronous impedance &m.m.f methods.
8. Predetermination of Regulation of three-phase alternator by Z.P.F. method.
9. Determination of Xd and Xq of a salient pole synchronous machine by slip test.
10. V and inverted V curves of a 3-phase synchronous motor.

References:

1. D. P.Kothari and B. S. Umre, “Laboratory Manual for Electrical Machines” I.K International Publishing House Pvt. Ltd, 2017.
2. D.R. Kohli and S.K. Jain, “A Laboratory Course in Electrical Machines” NEM Chand & Bros.

Online Learning Resources/Virtual Labs:

- **http://vem-iitg.vlabs.ac.in/**
- http://em-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical Engineering
- http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/experimentlist.html

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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ANANTHAPURAMU – 515 002 (A.P) INDIA

ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	CIRCUITS SIMULATION AND ANALYSIS USING PSPICE		L	T	P	C
20A02404			1	0	2	2
Pre-requisite	Electrical Circuits, Power Electronics	Semester	IV			

Course Objectives:

- Simulation of various circuits using PSPICE software.
- Simulation of single-phase half & fully-controlled converters, and inverters
- Simulation of single-phase AC Voltage controllers with different loads.

Course Outcomes (CO)

By the end of the course, the student will be able to:

- Simulation of various circuits using PSPICE software.
- Simulation of single-phase half & fully-controlled converters, and inverters
- Simulation of single-phase AC Voltage controllers with different loads.

List of Experiments:

I Simulation of Electrical Circuits

a) DC & AC Circuits
b) Mesh Analysis
c) Nodal Analysis
d) Transient Response

II Simulation of Power Electronic Circuits

a) Single-phase half wave, Semi and full converters with RLE loads.
b) Three-phase half wave, Semi and full converters with RLE loads.
c) Buck, Boost and Buck-Boost Converters
d) Single-phase AC voltage controller
e) Single and Three phase Quasi Square wave and PWM Inverters.

References:

1. Simulation of Power Electronics Circuit, M B Patil, V Ramanarayan and V T Ranganat, Alpha Science International Ltd., 2009.
2. Simulation of Electric and Electronic circuits using PSPICE – by M.H.Rashid, M/s PHI Publications.
3. PSPICE A/D user's manual – Microsim, USA.
4. PSPICE reference guide – Microsim, USA.
5. MATLAB and its Tool Books user's manual and – Mathworks, USA

Online Learning Resources/Virtual Labs:

- http://vlabs.iitb.ac.in/vlabs- ev/labs/mit_bootcamp/power_electronics/labs/index.php

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ANANTHAPURAMU – 515 002 (A.P) INDIA

ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	Design Thinking for Innovation		L	T	P	C
20A99401	(Common to All branches of Engineering)		2	1	0	0
Pre-requisite	NIL	Semester	IV			

Course Objectives:

The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

Course Outcomes (CO):

- Define the concepts related to design thinking.
- Explain the fundamentals of Design Thinking and innovation
- Apply the design thinking techniques for solving problems in various sectors.
- Analyse to work in a multidisciplinary environment
- Evaluate the value of creativity
- Formulate specific problem statements of real time issues

UNIT - I	Introduction to Design Thinking	10 Hrs

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT - II	Design Thinking Process	10 Hrs

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brain storming, product development

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT - III	Innovation	8 Hrs

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

UNIT - IV	Product Design	8 Hrs

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.

Activity: Importance of modelling, how to set specifications, Explaining their own product design.

UNIT - V	Design Thinking in Business Processes	10 Hrs

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.

Activity: How to market our own product, About maintenance, Reliability and plan for startup.

Textbooks:

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ANANTHAPURAMU – 515 002 (A.P) INDIA

ELECTRICAL AND ELECTRONICS ENGINEERING

1. Change by design, Tim Brown, Harper Bollins (2009)
2. Design Thinking for Strategic Innovation, Idris Mootee, 2013, John Wiley & Sons.

Reference Books:

1. Design Thinking in the Classroom by David Lee, Ulysses press
2. Design the Future, by Shrrutin N Shetty, Norton Press
3. Universal principles of design- William lidwell, kritinaholden, Jill butter.
4. The era of open innovation – chesbrough.H

Online Learning Resources:

https://nptel.ac.in/courses/110/106/110106124/
https://nptel.ac.in/courses/109/104/109104109/
https://swayam.gov.in/nd1_noc19_mg60/preview

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ANANTHAPURAMU – 515 002 (A.P) INDIA

ELECTRICAL AND ELECTRONICS ENGINEERING

COMMUNITY SERVICE PROJECT

……Experiential learning through community engagement

Introduction

- Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development
- Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
- Community Service Project is meant to link the community with the college for mutual benefit. The community will be benefited with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and also emerge as a socially responsible institution.

Objective

Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

- To sensitize the students to the living conditions of the people who are around them,
- To help students to realize the stark realities of the society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- To help students to initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

Implementation of Community Service Project

- Every student should put in a 6 weeksfor the Community Service Project during the summer vacation.
- Each class/section should be assigned with a mentor.
- Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, house-wives, etc
- A log book has to be maintained by each of the student, where the activities undertaken/involved to be recorded.
- The logbook has to be countersigned by the concerned mentor/faculty incharge.

- Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
- The final evaluation to be reflected in the grade memo of the student.
- The Community Service Project should be different from the regular programmes of NSS/NCC/Green Corps/Red Ribbon Club, etc.
- Minor project report should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.
- Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training

Procedure

- A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, so as to enable them to commute from their residence and return back by evening or so.
- The Community Service Project is a twofold one –
    - First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
    - Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –
        - Agriculture
        - Health
        - Marketing and Cooperation
        - Animal Husbandry
        - Horticulture
        - Fisheries
        - Sericulture
        - Revenue and Survey
        - Natural Disaster Management
        - Irrigation
        - Law & Order
        - Excise and Prohibition
        - Mines and Geology
        - Energy
        - Internet
        - Free Electricity
        - Drinking Water

EXPECTED OUTCOMES

BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS

Learning Outcomes

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ANANTHAPURAMU – 515 002 (A.P) INDIA

ELECTRICAL AND ELECTRONICS ENGINEERING

- Positive impact on students' academic learning
- Improves students' ability to apply what they have learned in "the real world"
- Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development
- Improved ability to understand complexity and ambiguity

Personal Outcomes

- Greater sense of personal efficacy, personal identity, spiritual growth, and moral development
- Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills

Social Outcomes

- Reduced stereotypes and greater inter-cultural understanding
- Improved social responsibility and citizenship skills
- Greater involvement in community service after graduation

Career Development

- Connections with professionals and community members for learning and career opportunities
- Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity

Relationship with the Institution

- Stronger relationships with faculty
- Greater satisfaction with college
- Improved graduation rates

BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS

- Satisfaction with the quality of student learning
- New avenues for research and publication via new relationships between faculty and community
- Providing networking opportunities with engaged faculty in other disciplines or institutions
- A stronger commitment to one's research

BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES

- Improved institutional commitment
- Improved student retention
- Enhanced community relations

BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY

- Satisfaction with student participation
- Valuable human resources needed to achieve community goals
- New energy, enthusiasm and perspectives applied to community work
- Enhanced community-university relations.

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT

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ANANTHAPURAMU – 515 002 (A.P) INDIA

ELECTRICAL AND ELECTRONICS ENGINEERING

The following the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions and modifications. Colleges are expected to focus on specific local issues for this kind of projects. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of projects. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting shall be ensured.

For Engineering Students

1. **Water facilities and drinking water availability**
2. **Health and hygiene**
3. **Stress levels and coping mechanisms**
4. **Health intervention programmes**
5. **Horticulture**
6. **Herbal plants**
7. **Botanical survey**
8. **Zoological survey**
9. **Marine products**
10. **Aqua culture**
11. **Inland fisheries**
12. **Animals and species**
13. **Nutrition**
14. **Traditional health care methods**
15. **Food habits**
16. **Air pollution**
17. **Water pollution**
18. **Plantation**
19. **Soil protection**
20. **Renewable energy**
21. **Plant diseases**
22. **Yoga awareness and practice**
23. **Health care awareness programmes and their impact**
24. **Use of chemicals on fruits and vegetables**
25. **Organic farming**
26. **Crop rotation**
27. **Floury culture**
28. **Access to safe drinking water**
29. **Geographical survey**
30. **Geological survey**
31. **Sericulture**
32. **Study of species**
33. **Food adulteration**
34. **Incidence of Diabetes and other chronic diseases**
35. **Human genetics**

36. **Blood groups and blood levels**
37. **Internet Usage in Villages**
38. **Android Phone usage by different people**
39. **Utilisation of free electricity to farmers and related issues**
40. **Gender ration in schooling lvel- observation.**

Complimenting the community service project the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programmesare;

Programmes for School Children

1. Reading Skill Programme (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films
6. Awareness Programme on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Programme on Socially relevant themes.

Programmes for Women Empowerment

1. Government Guidelines and Policy Guidelines
2. Womens' Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social Entrepreneurship

General Camps

1. General Medical camps
2. Eye Camps
3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharath
7. AIDS awareness camp
8. Anti Plastic Awareness
9. Programmes on Environment
10. Health and Hygiene
11. Hand wash programmes
12. Commemoration and Celebration of important days

Programmes for Youth Empowerment

1. Leadership
2. Anti-alcoholism and Drug addiction
3. Anti-tobacco
4. Awareness on Competitive Examinations
5. Personality Development

Common Programmes

1. Awareness on RTI
2. Health intervention programmes

3. Yoga
4. Tree plantation
5. Programmes in consonance with the Govt. Departments like –
    i. Agriculture
    ii. Health
    iii. Marketing and Cooperation
    iv. Animal Husbandry
    v. Horticulture
    vi. Fisheries
    vii. Sericulture
    viii. Revenue and Survey
    ix. Natural Disaster Management
    x. Irrigation
    xi. Law & Order
    xii. Excise and Prohibition
    xiii. Mines and Geology
    xiv. Energy

Role of Students:

- Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.
- For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
- As and when required the College faculty themselves act as Resource Persons.
- Students can work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.
- And also with the Governmental Departments. If the programme is rolled out, the District Administration could be roped in for the successful deployment of the programme.
- An in-house training and induction programme could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

Timeline for the Community Service Project Activity

Duration: 8 weeks

1. Preliminary Survey (One Week)

- A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
- A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.
- The Governmental agencies, like revenue administration, corporation and municipal authorities and village secreteriats could be aligned for the survey.

2. Community Awareness Campaigns (One Week)

- Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmes to be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

3. Community Immersion Programme (Three Weeks)

Along with the Community Awareness Programmes, the student batch can also work with any one of the below listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to the experiential learning about the community and its dynamics. Programmes could be in consonance with the Govt. Departments.

4. Community Exit Report (One Week)

- During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks work to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that particular habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University.

  Throughout the Community Service Project, a daily log-book need to be maintained by the students batch, which should be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the students and guide them.