MALNAD COLLEGE OF ENGINEERING, HASSAN

(An Autonomous Institution Affiliated to VTU, Belgaum)

Autonomous Programmes

Bachelor of Engineering

SYLLABUS

III and IV Semesters

(2nd Year)

DEPARTMENT OF
ELECTRICAL AND ELECTRONICS ENGINEERING

Academic Year 2022-23

VISION of the Department

To become a department of excellence in the domain of Electrical and Electronics Engineering producing competent engineers with research acumen having moral and social values.

MISSION of the Department

- Enhance industry and alumni interaction.
- Promote continuous quality up gradation of faculty and technical staff.
- Time to time modernization of departmental infrastructure to provide state of the art laboratories.
- Create research-oriented culture to invoke the desire and ability of lifelong learning among the students for pursuing successful career.
- Create and sustain environment of learning in which students acquire knowledge and learn to apply it professionally with due consideration of social and ethical values.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduates of the program will be able to

1. Design, analyze, operate and maintain equipment related to electrical and electronic industries with continuous integration with core and allied industries.

2. Use state of art laboratories and modern computer based tools to pursue a diverse range of career as engineers and researchers.

3. Bring out innovations to provide best solutions to electrical engineering problems.

4. Fulfill the needs of society in solving technical problems using engineering principles, tools and practices, in an ethical and responsible manner.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and teamwork**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Develop models, design, analyze and assess the performance of different types of electrical machines, control systems and generation, transmission, distribution, protection mechanisms in power systems.
PSO2: Demonstrate knowledge and hands-on competence in the application of circuit analysis and design, associated software and applications, analog and digital electronics and microcontrollers to build, test, operate and maintain electrical and electronic systems

Scheme of Evaluation (Theory Courses)

Assessment	Marks
CIE 1	**10**
CIE 2	**10**
CIE 3	**10**
Activities (Minimum 2)	**20**
SEE	**50**
Total	**100**

Scheme of Evaluation (Laboratory Courses)

Assessment	Marks
Continuous internal Evaluation in every lab session by the Course coordinator	**30**
Laboratory CIE conducted by the Course coordinator	**20**
SEE	**50**
Total	**100**

Scheme & Syllabus for II Year
B. E. - Electrical and Electronics Engineering
Academic Year 2022-2023

THIRD SEMESTER					
Course Category and Course Code		**Course Title**	**L-T-P**	**Credits**	**Contact Hours**
BS	21MA301	Linear Algebra and Integral Transforms	2-1-0	3	4
PCC	21EE302	Analog and Digital Electronic Circuits	4-0-0	4	4
PCC	21EE303	Transformers & Induction Machines	3-0-0	3	3
PCC	21EE304	Electric Power Generation, Transmission & Distribution	4-0-0	4	4
PCC	21EE305	Electrical and Electronics Measurements	3-0-0	3	3
PCC	21EE306	Transformers & Induction Machines Laboratory	0-0-1	1	2
PCC	21EE307	Analog and Digital Electronics Laboratory	0-0-1	1	2
HSMC	21UHV	Universal Human Values	1-0-0	1	2
BS	21BCM301	Bridge Mathematics-1 (Mandate Audit course for Diploma entry students)	0-0-0	0	3
			Total	**20**	**24**
PCC: Professional Core; PI: Mini and Major Project work /seminar/ Summer Internship and Research /Industrial Internship; BS: Basic Sciences; HSMC: Humanities and Social Science, Management Courses, UHV; AE: Ability Enhancement Course					

FOURTH SEMESTER					
Course Category and Course Code		**Course Title**	**L-T-P**	**Credits**	**Contact Hours**
BS	21MA401	Statistics and Complex Analysis	2-1-0	3	4
PCC	21EE402	Electrical Network Analysis	3-1-0	4	5
PCC	21EE403	Synchronous and Special Electrical Machines (Laboratory Integrated)	3-0-1	4	5
PCC	21EE404	Microcontrollers (Laboratory Integrated)	3-0-1	4	5
PCC	21EE405	Electric Networks and Measurements Laboratory	0-0-1	1	2
AE	21BE	Biology for Engineers	1-0-0	1	2
HSMC	21KNS*/ 21KNB*	Samskrutika Kannada/ Balake Kannada (Group A)	1-0-0	1	2
PI	21EE406	Summer Internship –I	0-0-1	1	--
BS	21BCM401	Bridge Mathematics-II (Mandate Audit course for Diploma entry students)	0-0-0	0	3
			Total	**19**	**26**
PCC: Professional Core; PI: Mini and Major Project work /seminar/ Summer Internship and Research /Industrial Internship; BS: Basic Sciences; HSMC: Humanities and Social Science, Management Courses; UHV, AE: Ability Enhancement Course					

Summer Internship-II: At the end of fourth Semester **four weeks** Summer Internship shall be carried out – Based On industrial/ Govt./ NGO/ MSME/ Rural Internship/ Innovation/ Entrepreneurship. Credited In fifth Semester. All the students admitted shall have to undergo mandatory internship of 04 weeks during the vacation of IV semesters. A University Viva-Voce examination shall be conducted during V semester and the prescribed credit shall be included in V semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirement

Course Title	**Linear Algebra and Integral Transforms**		
Course Code	**21MA301**	**L-T-P**	**(2-1-0) 3**
Exam	**3 Hrs.**	**Hours/Week**	**4**
SEE	**50 Marks**	**Total Hours**	**52**

Course Objective: To introduce linear algebra and transform calculus which may be employed as tools in solving engineering application problems.

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

#	Course outcomes	Mapping to PO's	Mapping to PSO's
1	Utilise the concept of consistency of system of equations to solve the engineering application problems and compute the number of linearly independent vectors.	1,2	--
2	Examine for the existence of diagonalization of matrix, find the suitable matrix of transformations so as to get the required image and analyze the system of equations to compute the number of linearly independent Eigen vectors.	1,2	--
3	Apply Laplace transform on simple functions and compute Fourier series of periodic functions.	1,2	--
4	Examine for adopting different techniques of integration to compute Fourier series, Laplace transform of a given function.	1,2	--
5	Model the real-life problems/engineering application problems and solve the same.	1,2	--

MODULE-1 **14 Hrs.**

Linear Algebra: Importance of Matrices in engineering. Rank of a matrix. Consistency of nonhomogeneous and homogeneous system of equations, Solution of the system of linear equations by Gauss elimination method and Gauss – Seidel iterative method.

Special matrices-matrix of rotation, reflection, translation. To find the matrix of transformation when the image of some points is given. Applications of solution of system of equations to balance the chemical equations.

SLC: Traffic flow problem, To find the suitable combination of food stuff so as to get the desired nutrients as prescribed by a dietician.

MODULE-2 **12 Hrs.**

Linear Algebra: Eigen values and Eigen vectors, properties, Illustrative examples, applications-Stretching of an elastic membrane, to determine the growth of a population model. Role of eigenvalues, eigenvectors in determining natural frequency, mode shapes of equations of motions (Spring mass system).

Diagonalization and powers of 3X3 matrices when Eigen values are already given.

SLC: Stability analysis of differential equations which governs the dynamical systems using the concept of eigen value, eigen vectors.

MODULE-3 **14 Hrs.**

Fourier Series: Periodic functions and their graphical representation, to find Fourier series by change of interval method, To represent the experimental data as a Fourier series using the method - Practical

harmonic analysis. application of Fourier series in engineering-To represent the signal (wave form) in terms of Fourier series, Fourier series representation for the excitation described by the wave form, graphs of Fourier series approximating the given function.
SLC: Half range series method.

MODULE-4	**12 Hrs.**

Laplace Transforms: Introduction, Definition, Importance of Laplace transform in engineering applications, properties, Laplace transform of standard functions, Laplace transform of derivatives, Laplace transform of periodic functions, unit-step functions.
Inverse Laplace Transforms: Definition and general properties, Convolution theorem – illustrative examples, Initial value problems. To solve Applications of initial value problems in engineering using Laplace transform
SLC: Unit impulse functions (Dirac – delta function). Application of Fourier series to Laplace equation, heat conduction.

Note - Theorems and properties without proof. Applicable to all the Modules.

Text Books:

1. Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 44th edition, 2016.
2. Linear algebra by David c lay,3rd edition, Pearson education, 2002.

Reference Books:

1. R K Jain and S R K Iyengar, Advanced Engineering mathematics by Narosa publishers, 2nd edition, 2005.
2. Calculus by Thomas Finney, 9th edition, Pearson education, 2002.
3. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd. 8th Edition (Wiley student edition) 2004.

Course Title	**Analog and Digital Electronic Circuits**		
Course Code	**21EE302**	**L-T-P**	**(4-0-0) 4**
Exam	**3 Hrs.**	**Hours/Week**	**4**
SEE	**50 Marks**	**Total Hours**	**52**

Course Objective: The students will learn to design and analyse Analog and Digital Electronic Circuits.
Course Outcomes: At the end of course, students will be able to:

#	Course outcomes	Mapping to PO's	Mapping to PSO's
1	Analyse the working of electronic devices and perform small signal analysis of amplifier circuit employing FET/MOSFET devices.	1,2	2
2	Design operational amplifier based AC amplifier circuit configurations.	1,2	2
3	Design combinational logic circuits using basic gates.	1,2	2
4	Analyse state transition in various sequential logic circuits.	1,2	2

MODULE-1	**14 Hrs.**

Semiconductor Diodes: Introduction, Specification of diodes, Bridge rectifier, Clippers-Parallel clippers, positive peak clipping, negative peak clipping and double ended clipping; Clampers- positive clamping and negative clamping without bias; Zener Diode-working and characteristics of Zener diode, Zener diode as voltage regulator (regulation at supply side and regulation at load side).
Bipolar Junction Transistors: Introduction, Biasing of transistor, biasing transistor as an amplifier; Analysis of Voltage divider bias circuit for CE configuration (Exact analysis only). Emitter follower bias circuit, RC coupled amplifier and its frequency response.
JFET: Construction, Operation and Characteristics of JFETs, biasing of FET using Self-bias and Voltage divider bias circuits for CS configuration and its small signal analysis.

MOSFETs: Types of MOSFET, Construction, Operation and Characteristics of Enhancement type MOSFET. Biasing of Enhancement type MOSFET using voltage divider bias circuit and its small signal analysis.
SLC: Half wave and full wave rectifier; Series Clippers; clampers with DC bias; Construction, Operation and Characteristics of Depletion type MOSFET.

MODULE-2	14 Hrs.

Feedback Amplifiers: Feedback concept & feedback connection types. **Oscillators:** Introduction to Oscillators, BJT based RC Phase shift oscillator.
Operational Amplifiers & its Applications: Introduction, Inverting Amplifier, Non-inverting Amplifier, Voltage follower, Summing Amplifier, Difference Amplifier, Integrator and Differentiator, zero crossing detector, Schmitt trigger circuits.
SLC: Precision rectifiers using OPAMPs.

MODULE-3	12 Hrs.

Principles of Combinational Logic: Introduction to fundamentals of switching algebra, Gates and combinational networks. Realization of a logical function using only NAND and NOR gates. Canonical forms-SOP and POS forms, Simplification using Karnaugh maps-3,4 variables in SOP forms only.
Comparators, Encoders, Decoders, Multiplexers, Demultiplexers, Code converters: binary to grey, BCD to Excess-3
SLC: BCD to 7-segment display converter.

MODULE-4	12 Hrs.

Flip-flops and applications: Latches and Master-slave flip-flops. Registers. Binary ripple counters.
Sequential Circuit Design: Design of synchronous counters using clocked J-K flip-flops. Mealy and Moore models, State machine notation, Synchronous Sequential circuit analysis, Construction of state diagrams, counter design.
SLC: Ring and Johnson Counters.

Text Books:

1. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 11th Edition.
2. David A Bell, Electronic Devices and Circuits, 5th Edition.
3. Digital principles and applications, Donald P Leach, Albert Paul Malvino and Goutham Saha, 7th edition.
4. Donald D. Givone, Digital Principles and Design, Tata Mc-Graw Hill, 2002.

Reference Books:

1. V. K. Mehta and Rohit Mehta, Principles of Electronics, 11th Edition, S. Chand & Co.
2. R. D. Sudhakar Samuel, Logic Design – A Simplified Approach, Sanguine Technical Publishers, 2005.
3. Digital Logic Applications and Design, John M Yarbrough, Thomson Learning, 2001

Course Title	Transformers & Induction Machines		
Course Code	21EE303	L-T-P	(2-1-0) 3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40

Course Objective: The students will learn to analyze the performance of Transformers & Induction Motors.

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

#	Course outcomes	Mapping to PO's	Mapping to PSO's
1	Explain the construction and working of transformers and Induction motors.	1,2	1
2	Formulate equivalent circuit and mathematical modelling and analyse concepts of fundamental torque equations and rotating and oscillating fields in rotating machines	1,2	1
3	Evaluate the performance of transformers and Induction motors using various types of test data.	1,2	1
4	Solve & evaluate various types of numerical problems, with respect to transformers and Induction motors and will be able to handle and solve the problems associated with real life situation.	1,2	1

MODULE-1	10 Hrs.
Transformers: Construction and Practical considerations of 1phase & 3 phase core and shell type transformers, Principle of transformer action for voltage transformation, Ideal & practical transformers, EMF equation, Transformation ratio, Transformer operation under no load and load condition, Vector diagrams, Exact & approximate equivalent circuit, voltage regulation, losses, power efficiency & All day efficiency. **SLC:** Auto-transformer: Construction, saving of copper, Advantages/disadvantages, Methods of cooling,	
MODULE-2	**10 Hrs.**
OC-SC tests - Predetermination of efficiency & regulation, Polarity test, Sumpner's test, Parallel operation – need, conditions to be satisfied & load sharing.Choice of connection, All types of 3 phase transformer connection including open delta **SLC:** Special transformers and their applications.	
MODULE-3	**13 Hrs.**
Induction motors: Basic concepts, Construction, Concept of rotating magnetic field, Operating principle, Classification – 3-phase, Squirrel cage, Slip ring, . Phasor diagram of Induction motor under no load & load, equivalent circuit, losses & efficiency, performance evaluation (HP, Torque, efficiency, current & power factor). **SLC:** Construction and working principle of various types of single phase induction motors.	
MODULE-4	**13 Hrs.**
Torque-slip characteristics of motoring, Generating & Braking, Induction generator, No load & blocked rotor tests, Circle diagram & performance evaluation, , Necessity of starters, DOL, Star -Delta starter, Auto-transformer starting, Rotor resistance starting, Speed control: voltage, frequency & rotor resistance variation. **SLC:** Applications of three phase and single phase induction motors	

Text Books:

1. S. Langsdorf, Theory of Alternating Current Machines, 2nd Edition 1993, Tata McGraw Hill Publications.
2. Nagarath and Kothari, Electrical Machines, Tata McGraw Hill Publications.

Reference Books:

1. V. K.Mehta and Rohit Mehta, Electrical Machines, 2nd edition, S. Chand & Co.
2. Ashfaq Husain, Electrical Machines, Dhanapathrai & Co.

Course Title	Electrical Power Generation Transmission and Distribution		
Course Code	21EE304	L-T-P	(4-0-0) 4
Exam	3 Hrs.	Hours/Week	4
SEE	50 Marks	Total Hours	52

Course Objective: The students will gain knowledge of different electric power generation plants, tariff structures, basic aspects of power transmission and distribution.

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

#	Course outcomes	Mapping to PO's	Mapping to PSO's
1	Explain various methods of electric power generation.	1	1
2	Analyse various economic aspects of electrical power generation.	1,2	1
3	Analyse the performance of transmission lines.	1,2	1
4	Analyse the different types of DC and AC distributors.	1,2	1

MODULE-1 **13 Hrs.**

Electrical Power Generation: Advantages, disadvantages and site selection for hydro power generation, Thermal power plant, Nuclear power station, wind power plant and solar power plants. Hydro Power Generation: Classification of hydroelectric plants, General arrangement and operation, Power station structure & control. Thermal: Main portions, working, plant layout. Nuclear Power Station: Component of reactors, working, safety of nuclear power reactor. Diesel Electric Station: Diesel electric plants & component, choice and characteristics, plant layout and maintenance.

SLC: Power generating stations in Karnataka.

MODULE-2 **13 Hrs.**

Economics Aspects: Introduction, diversity factor, load factor, plant capacity factor, plant use factor, plant utilization factor, loss factor, load duration curve, energy load curve, power factor improvement methods. Numerical Examples. Overhead transmission line: sag, calculation of sag in conductors - (a) Suspended on level supports (b) Supports at different levels. Effect of wind and ice, Line parameter - Inductance: Calculation of inductance of single phase, three phase lines with Equilateral and unsymmetrical spacing, Line parameter - Capacitance: Capacitance-calculation for two wires and three phase Lines. Numerical Examples.

SLC: Power import and export across India and dispatch scenarios.

MODULE-3 **13 Hrs.**

Power transmission lines: Introduction, Classification of overhead transmission lines, Representation of transmission lines, Performance analysis of short transmission lines, Medium transmission lines (nominal T network). Long Transmission Lines (Condenser method).

SLC: Generalized circuit constants of nominal π network lines.

MODULE-4 **13 Hrs.**

Power Distribution Systems: Introduction, Radial and Ring main systems, D.C. Three-wire Systems, Different types of Distributors, Method of calculations, A.C. Distributors with concentrated loads-Numerical problems.

SLC: D.C. Distributor with Distributed Load fed at both ends.

Text Books:

1. Chakrabarti A., M.L. Soni, P.V. Gupta and U.S..Bhatnagar, Power System Engineering, Dhanpat Rai & Co. (Pvt.) Ltd., 2003.

Reference Books:

1. S. M. Singh, Electric Power Generation Transmission and Distribution, Prentice Hall of India.
2. V.K. Mehta, Rohit Mehta, Principles of Power System, S Chand Publications.

Course Title	Electrical and Electronic Measurements		
Course Code	21EE305	L-T-P	(3-0-0) 3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40

Course Objective: To gain knowledge about the construction, working principles and applications of measuring Instruments.

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

#	Course outcomes	Mapping to PO's	Mapping to PSO's
1	Discuss various techniques to measure resistance, inductance, capacitance and power.	1	2
2	Explain the working principle of electromechanical and digital measuring instruments.	1	2
3	Solve numerical problems on measuring electrical quantities.	1,2	2

MODULE-1 — 10 Hrs.

Measurement of Resistance, Inductance and Capacitance: DC bridges: Wheatstone's bridge-sensitivity, limitations. Kelvin's double bridge, Illustrative Examples. Earth resistance measurement by fall of potential method. **AC Bridges:** Sources & Detectors, Maxwell's inductance bridge, Anderson's bridge, Desauty's bridge, Schering bridge. Illustrative Examples. Extension of instrument ranges using Shunts and multipliers. **Instrument transformers:** Construction and operating principle of CT and PT, Application of CT and PT. Illustrative examples.

SLC: Megger and measurement of earth resistance.

MODULE-2 — 10 Hrs.

Measurement of Power, Energy, Power Factor and Frequency: Electrodynamometer type wattmeter: construction, theory & operation, two wattmeter and three wattmeter methods of measuring power, measurement of reactive power. Single phase induction type energy meter: construction and working principle, errors, adjustments, and illustrative examples. Single-phase dynamometer type power factor meter, Weston frequency meter and phase sequence indicator.

SLC: Digital power factor and frequency meters.

MODULE-3 — 10 Hrs.

Electronic and Digital Instruments: Introduction. Essentials of electronic instruments, Advantages of electronic instruments. Analog to digital converter, resolution, quantization error, True rms reading voltmeter. Digital voltmeters (DVM): Ramp type DVM, Integrating type DVM and Successive approximation DVM. Digital energy meter. Digital Maximum demand indicator.

SLC: Digital multimeters.

MODULE-4 — 10 Hrs.

Oscilloscopes: Block diagram of a general-purpose oscilloscope, front-panel details of a typical dual trace oscilloscope, method of measuring amplitude, phase, frequency, period, use of Lissajous patterns, Digital Storage Oscilloscope-working principle, Signal Generators and Function Generators.

Sensors: Temperature sensor and strain gauge.

SLC: Position and Proximity sensors.

Text Books:

1. A. K. Sawhney, Electrical and Electronic Measurements and Instrumentation, Dhanpatrai and Sons, New Delhi.
2. Cooper D. and A.D. Heifrick, Modern Electronic Instrumentation and Measuring Techniques, PHI.

Reference Books:

1. Golding and Widdies, Electrical Measurements and Measuring Instruments, Pitman.
2. David A. Bell, Electronic Instrumentation and Measurement, 2nd Edition, PHI, 2006.

Course Title	Transformers & Induction Machines Laboratory		
Course Code	21EE306	L-T-P	(0-0-1) 1
Exam	3 Hrs.	Hours/Week	2
SEE	50 Marks	Total Hours	24

Course Objective: The students will verify and understand the theoretical concepts by conducting experiments on transformers and induction machines.

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

#	Course outcomes	Mapping to PO's	Mapping to PSO's
1	Demonstrate experimental skills for testing transformers.	1,2,9,10	1
2	Demonstrate skill to operate Transformers and Induction machines in normal and special conditions.	1,2,9,10	1
3	Demonstrate experimental skills for testing and speed control of induction machines.	1,2,9,10	1

List of Experiments

1. SC & OC test 1-phase transformer & predetermination of efficiency & regulation for different loads & PFs; verification by direct loading for UPF.
2. Sumpner's test.
3. Polarity test and parallel operation of two dissimilar 1-phase transformers.
4. Connection of three 1-phase transformers in star-delta and determination of efficiency & regulations for balanced direct loading (UPF).
5. Load test on 3-phase Induction motor – performance evaluation (Torque-speed, BHP-efficiency, BHP-PF, slip-BHP).
6. No load and Blocked rotor test on three-phase slip ring IM: Circle Diagram of 3 phase Induction Motor- performance evaluation.
7. Determination of equivalent circuit parameters of 1- phase induction motor-performance evaluation.
8. Speed control of 3-phase Induction motor-Stator voltage control & rotor resistance control (performance circuits for at least two different voltages/two rotor resistance valves).
9. Load test on Induction generator and performance calculations.
10. Load test on 1-phase Induction motor.

Course Title	Analog and Digital Electronics Laboratory		
Course Code	21EE307	L-T-P	(0-0-1) 1
Exam	3 Hrs.	Hours/Week	2
SEE	50 Marks	Total Hours	24

Course Objective: The students will design and analyze analog and digital electronics circuits.

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

#	Course outcomes	Mapping to PO's	Mapping to PSO's
1	Analyse the characteristics of various analog electronic devices.	1,2,9,10	2
2	Design amplifiers and oscillators for given design specification.	1,2,9,10	2
3	Test the operability of logic gates and implement simple logic circuits to solve a given problem.	1,2,9,10	2
4	Verifying the operability of Flip Flops and design sequential logic circuits using them.	1.2.9.10	2

List of Experiments

1. Diode Clipping circuits.
2. Testing of a single stage BJT based RC coupled amplifier and determination of frequency response, input and output characteristics.
3. Design RC phase shift oscillator and determination of frequency of oscillation.
4. Inverting, Non-inverting and Voltage follower.
5. Integrator and Differentiator.
6. Zero crossing detector and Schmitt trigger circuit.
7. Simplification, realization of Boolean expressions using logic gates/Universal gates.
8. Realization of Binary to Gray code conversion and vice versa.
9. Testing Ring counter/Johnson counter; Design of Sequence generator.
10. Truth table verification of flip-flops: (i) J K Master slave (ii) T type and (iii) D type.
11. Realisation of SISO, SIPO, PISO, PIPO shift registers.
12. Truth table verification of 1-bit and 2-bit comparator.

Course Title	UNIVERSAL HUMAN VALUES		
Course Code	21UHV	L-T-P	(0-1-0) 1
Exam	3 Hrs.	Hours/Week	2
SEE	50 Marks	Total Hours	28

Course Objective: The students will learn to design and analyse Analog and Digital Electronic Circuits.

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

#	Course outcomes	Mapping to PO's	Mapping to PSO's
1	Start exploring themselves, get comfortable with each other and with the teacher and they start appreciating the need and relevance for the course. Also, they are able to note that the natural acceptance (intention) is always for living in harmony.	PO6, PO7, PO8, PO9, PO12	-
2	Differentiate between the characteristics and activities of different orders and study the mutual fulfillment among them and need to take appropriate steps to ensure right participation (in terms of nurturing, protection and right utilization) in the nature.	PO6, PO7, PO8, PO9, PO12	-
3	Present sustainable solutions to the problems in society and nature. They are also able to see that these solutions are practicable and draw roadmaps to achieve them.	PO6, PO7, PO8, PO9, PO12	-

MODULE-1 **8 Hrs.**

Introduction to Value Education: Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations

MODULE-2 **6 Hrs.**

Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self Lecture, Understanding Harmony in the Self Tutorial, Harmony of the Self with the Body to ensure self-regulation and Health.

MODULE-3 **6Hrs.**

Harmony in the Family, Nature and Existence: Harmony in the Family – the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Understanding Harmony in the Society, Vision for the Universal Human Order.

Whole existence as Coexistence: Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

MODULE-4 **8 Hrs.**

Implications of the Holistic Understanding – a Look at Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models, Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.

Course Title	Statistics and Probability		
Course Code	21MA401	L-T-P	(2-1-0) 3
Exam	3 Hrs.	Hours/Week	4
SEE	50 Marks	Total Hours	52

Course Objective: To introduce the concept of probability distribution functions, hypothesis testing, complex analysis to apply in engineering application problems.

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

#	Course outcomes	Mapping to PO's	Mapping to PSO's
1	Fit a suitable curve/regression line for the given experimental data, probability and joint probability.	1,2	--
2	Validate an assumption through "hypothesis testing" (that is the assumption is not simply because of chance).	1,2	--
3	Analyze the problems connected with probability to apply suitable probability distribution and also, predict the probability in the long run for Markov chain based problems.	1,2	--
4	Model real life problems/engineering application problems and solve the same.	1,2	--

MODULE-1 **14 Hrs.**

Statistics: Correlation –, Karl Pearson coefficient of correlation and Spearman's rank correlation coefficient. Physical interpretation of numerical value of the rank correlation coefficient. Linear Regression analysis (when the experimental output depends on one input). Illustrative examples from engineering field, multiple regression analysis. (When the experimental output depends on two inputs).

Probability: Discrete Random Variables: Definitions of PDF & CDF: Expectation and Variance: Binominal pdf- Illustrative examples.

SLC: Poisson probability distribution function- Illustrative examples.

MODULE-2 **12 Hrs.**

Continuous Random Variables: Definition of PDF and CDF, Expectation and Variance, illustrative examples. Shaft conforms, Detection of signal.

Probability distribution: Exponential pdf, Normal/Gaussian pdf. Discussion on the choice of PDF. Illustrative examples from engineering field.

SLC: Uniform pdf, Digital transmission channel.

MODULE-3 **14 Hrs.**

Confidence intervals & Hypothesis analysis: Introduction, Testing a hypothesis, central limit theorem-statement, Level of significance, Simple sampling of attributes, confidence intervals, Test of significance for large samples, Comparison of large samples, Student's t-distribution, Chi-square distribution.

SLC: Current measurement problems, Propellant burning rate, process-capacity problem, drying time problem, Two catalyst effect on chemical reaction.

MODULE-4 **12 Hrs.**

Joint Probability Distribution & Stochastic Processes: Concept of joint probability, Joint distributions of discrete random variables, Independent random variables-problems. Joint expectation, co-variance, and correlation.

Markov Chains: Introduction, stochastic matrices, fixed probability vectors and regular stochastic matrices. Application of Markov chain to determine the voting tendencies

SLC: Estimating the population distribution of a city due to migration.

Note - Theorems and properties without proof. Applicable to all the Modules.

Text Books:

1. Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 44thEdition, 2016.
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd 9th edition, 2014.
3. B V Ramana Higher Engineering Mathematics, Tata McGraw Hill Publications, 2nd edition, 2007

Reference Books:

1. Scott L.Miller, DonaldG. Childers: "Probability and Random Process with application to Signal Processing", Elsevier Academic Press, 2nd Edition, 2013.
2. Statistics for engineers and Scientists, William Navide, Mc-Graw hill education, India pvt. Ltd., 3rd edition 2014.
3. T.Veerarajan: "Probability, Statistics and Random Process", 3rd Edition, Tata McGraw Hill Co., 2008.
4. Theory and problems of probability, Seymour Lipschutz and marclarslipson, Schaum out line series, 2nd edition.

Course Title	**Electrical Network Analysis**		
Course Code	**21EE402**	**L-T-P**	**(3-1-0) 4**
Exam	**3 Hrs.**	**Hours/Week**	**5**
SEE	**50 Marks**	**Total Hours**	**52**

Course Objective: Students will learn to analyse electrical networks using various techniques.

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

#	Course outcomes	Mapping to PO's	Mapping to PSO's
1	Apply basic laws and network theorems to model and analyse DC and AC circuits.	1,2	2
2	Analyse three-phase circuits and resonant circuits in sinusoidal steady state.	1,2	2
3	Analyse electrical networks using initial conditions, Laplace Transforms and two port models.	1,2	2

MODULE-1 **13 Hrs.**

Circuit Analysis: Source transformation, Loop and node analysis with linearly dependent and independent sources for dc and ac networks.

Network Theorems: Superposition, reciprocity, Thevenin's, maximum power transfer, Millman's theorems for dc and ac circuits.

SLC: Dual circuits, Norton's theorem.

MODULE-2 **13 Hrs.**

Resonant circuits: Series resonance, quality factor, frequency response, half power frequencies, bandwidth, selectivity, frequency at which VC and VL is maximum. parallel resonance, R-L -C, RL-C and RL-RC circuits.

Three-phase circuits: Numbering and interconnection of three phases, voltage, currents and power in star and delta connections. Analysis of balanced & unbalanced star and delta connected loads.

SLC: Measurement of active and reactive power.

MODULE-3 **13 Hrs.**

Initial conditions: Integro-differential equations for networks, behaviour of R, L, and C at the instant of switching and at final conditions, initial and final conditions in networks.

Laplace Transforms for waveform synthesis: Waveform synthesis of periodic and aperiodic signals gate function.

SLC: Classical method of analysis for first order circuits.

MODULE-4 **13 Hrs.**

Laplace Transforms for circuit analysis: Concept of transformed impedance, analysis of circuits by using transformed network, initial and final value theorems and their applications to networks, transfer functions, convolution theorem.

Two Port Networks: Z-parameters, Y-parameters, ABCD-parameters, h-parameters, relationship among parameter sets. Calculation of these parameters for resistive networks.

SLC: Concept of poles and zeros.

Text Books:

1. Charles K. Alexander and Mathew NO Sadiku, Fundamentals of Electric Circuits, TMH, III Edition.
2. Van Valkenburg, Network Analysis, PHI / Pearson Education, 2006.

Reference Books:

1. Hayt, Kemmerly and Durbin, Engineering Circuit Analysis, TMH, 6th Edition.
2. Roy Choudhury, Networks and Systems, New age Publication, 2nd Edition.
3. Smarajit Ghosh, Network Theory: Analysis and Synthesis, PHI, 2005.

Course Title	**Synchronous and Special Electrical Machines**		
Course Code	**21EE403**	**L-T-P**	**(3-0-1) 4**
Exam	**3 Hrs.**	**Hours/Week**	**5**
SEE	**50 Marks**	**Total Hours**	**52**

Course Objective: The students will analyse and test different types of synchronous machines and Special Electrical Machines.

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

#	Course outcomes	Mapping to PO's	Mapping to PSO's
1	Demonstrate the knowledge of theory of electromagnetic energy conversion.	1,2	2
2	Explain the construction and principles of operation of Synchronous generators & Special electrical motors.	1,2	2
3	Conduct tests on Synchronous machines and special electrical machines and analyse their performance.	1,2	2
4	Solve the numerical problems and practical problems associated with synchronous machines and special machines	1,2	2

MODULE-1 **10 Hrs.**

Synchronous Machines: Basic principles of operation, construction of salient & non-salient pole synchronous machines, Generated EMF considering the effect of distribution and short chording of winding, causes of harmonics and its elimination, slot harmonics, methods of reducing slot harmonics. Numerical Problems.

SLC: Different types of windings.

MODULE-2 **10 Hrs.**

Voltage Regulation: Armature reaction, reasons for voltage drops in synchronous machines, EMF, MMF & ZPF methods of determining voltage regulations, comparative studies. Numerical Problems

SLC: ASA method of Voltage regulation.

MODULE-3 **10 Hrs.**

Salient pole Synchronous Machines: Salient pole synchronous machines, Two reaction theory, concept of Xd & Xq, phasor diagram, Power output, Power angle diagram, Reluctance power, Slip test. Synchronization of Alternator with infinite bus bar, Parallel operation of alternators, synchronising current, synchronising power, Effect of change of excitation and input power, Load sharing, Numerical Problems.

SLC: Hunting in synchronous machines, Damper winding's.

MODULE-4 **10 Hrs.**

Special Machines: Introduction, Variable Reluctance Stepper Motor, Permanent Magnet Stepper Motor, Hybrid Stepper Motor, Windings in Stepper Motors, working principle, Torque Equation, Applications of Stepper Motor

Classifications of permanent magnet motors, Construction and working principle of Permanent Magnet DC (PMDC) motor, Brushless Permanent Magnet DC (BLDC) Motors, Applications of permanent magnet motors.

Text Books:

1. P. S. Bhimbra, Electric Machinery, Khanna Publishers.
2. I. J. Nagrath & D. P. Kothari, Electric machines, 3rd edition, TMH.
3. Janardhanan E.G. Special Electrical Machines, PHI

Reference Books:

1. A. S. Langsdorf, Theory of Alternating Current Machines, 2nd Edition 1993, Tata McGraw Hill Publications.
2. V. K. Mehta and Rohit Mehta, Electrical Machines, 2nd edition, S. Chand & Co.
3. N. N parker Smith, Problems in Electrical Engineering, CBS publishers.
4. K Venkataratnam, Special Electrical Machines, University Press.

List of Experiments	**12 Hrs.**

1. OC and SC Test and predetermination of Voltage Regulation of Alternator by EMF and MMF methods.
2. Voltage regulation of an alternator by zero power factor method.
3. Determination of Xd , Xq & regulation of a salient pole alternator by Slip rest
4. Performance of synchronous generator connected to infinite bus, constant power-variable excitation & vice versa
5. V and inverted V curves of a synchronous motor.
6. Speed control of Stepper motor and Permanent magnet motors.

Course Title	**Microcontrollers**		
Course Code	**21EE404**	**L-T-P**	**(3-0-1) 4**
Exam	**3 Hrs.**	**Hours/Week**	**5**
SEE	**50 Marks**	**Total Hours**	**52**

Course Objective: Students are able to apply programming skills to write programs on 8051 microcontroller and also able to develop schemes to interface basic devices with 8051 microcontroller.

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

#	Course outcomes	Mapping to PO's	Mapping to PSO's
1	Explain fundamentals of microprocessors and microcontrollers.	1,5	2
2	Describe the Instruction set structure of 8051 microcontroller	1,5	2
3	Demonstrate basic programming skills in assembly level language.	1,2,5	2
4	Demonstrate the skill of interfacing 8051 with various peripherals which are used in various applications.	1,2,5	2

MODULE-1 **10 Hrs.**

Introduction: Introduction to Microprocessors, Microcontroller and Microcomputer, 8051 Microcontroller: Simple block diagram of 8051, Pin details of 8051 and their functions, Architecture of 8051- ALU, CPU registers, Stack and SP, Oscillator and Reset circuit, Internal Memory Organization of 8051 – RAM, Special function registers, ROM.

Programming 8051 Microcontroller: Instruction Set of 8051, Opcode fetch from ROM, Instruction, opcode, operand, Different addressing modes of 8051.

SLC: Different types of memory, applications of Microprocessors and Microcontrollers

MODULE-2 **10 Hrs.**

Classification of 8051 Instructions: Data transfer instructions and programming using data transfer instructions. Logical instructions- Byte level logical Operations, rotate and Swap Operations, programming using Logical instructions, Bit Manipulation Instructions- Bit addressable area in internal RAM, Bit addressable SFRs, programming using Bit Manipulation Instructions, Arithmetic Instructions- Flags, Incrementing and Decrementing, Addition, Subtraction, Multiplication and Division, Decimal Adjust, programming using Arithmetic Instructions.

SLC: Code conversions and Programming on code conversions, Programming using subroutines.

MODULE-3	10 Hrs.

Branching instructions: Classification of Jump and Call instructions, Difference between Jump and Call instructions, , programming using Branching instructions, Programming using indexing and looping on 8-bit and 16-bit data , Subroutines.

8051 Programming in C: Basics of C Programming- Structure of C, Data types and time delay in 8051, Programming 8051 timers in C- Basics of Timers, Timer 0 and Timer 1 registers, Different modes of Timer-Mode 0, Mode 1 and Mode 2 Programming, Counter programming- Different modes of Counters, Mode 2 Programming.

SLC: Timer Mode 3 Programming in C, Counter mode 0 and 1 programming in C, Programming internal interrupts in C.

MODULE-4	10 Hrs.

8051 Serial Port Programming in C: Basics of Serial Communication, Serial Communication Registers, 8051 connections to RS-232, 8051 Serial Port Programming in C. Basics of Interrupts in 8051, Programming external hardware interrupts in C.

Interfacing Techniques: Introduction to I/O Ports, Relays and Opto-isolator interfacing, LCD interfacing, Keyboard interfacing, DAC interfacing, Sensor interfacing, 4 step sequence Stepper Motor interfacing, DC motor interfacing using PWM.

SLC: 8 step sequence Stepper Motor interfacing, Seven segment LED Display Interfacing.

Text Books:

1. Kenneth Ayala, The 8051 Microcontroller, 3rd Edition, Thomson Learning, 2007.
2. M A Mazidi, J G Mazidi and R D Mckinlay, The 8051 Microcontroller and Embedded Systems Using Assembly and C, 2nd Edition, Prentice Hall India, 2007.

Reference Books:

1. Myke Predko, Programming & Customizing 8051 the Microcontroller, Tata MGH.

List of Experiments	12 Hrs.

Part A: Assembly Level Programming

1. Simple programs using mainly data transfer instructions: Block move, Exchange, Finding largest and smallest element in an array.
2. Programs involving arithmetic operations like addition, subtraction, multiplication and division, square, cube of 8 bit data bytes.
3. Programs involving arithmetic operations like addition and subtraction of 16 bit data bytes.
4. Programs involving looping, indexing and counting.
5. Programs requiring logical operations like logical OR, AND, XOR, shift and rotate.

Part B: Interfacing

1. Interfacing LED to 8051.
2. Interfacing Push button switch to 8051.
3. Programming 8051 to use external hardware interrupts.
4. Blink LEDs using Timers of 8051
5. Interfacing bidirectional DC motor to 8051.
   Interfacing stepper motor with 8051.

Course Title	Electric Networks and Measurements Laboratory		
Course Code	21EE405	L-T-P	(0-0-1) 1
Exam	3 Hrs.	Hours/Week	2
SEE	50 Marks	Total Hours	24

Course Objective: Students will gain hands-on experience about circuit analysis and measurements.
Course Outcomes: At the end of course, students will be able to:

#	Course outcomes	Mapping to PO's	Mapping to PSO's
1	Demonstrate the skills to apply network theorems to analyze Electric circuits.	1,2,9,10	2
2	Demonstrate the experimental skills to measure Resistance, Inductance, Capacitance and Power.	1,2,9,10	2
3	Analyse the measurement error and reliability of electrical measuring equipment.	1,2,9,10	2

List of Experiments

1. Verification of Kirchhoff's laws: KCL & KVL.
2. Verification of Thevenin's Theorem.
3. Verification of Maximum Power Transfer Theorem.
4. Verification of Superposition Theorem.
5. Measurements of power in three phase circuits using two wattmeters.
6. Computation of measurement error in a single phase energy meter.
7. Computation of measurement error in a three phase energy meter.
8. Measurement of low resistance using Kelvin's Double Bridge.
9. Measurement of inductance and determination of Q- factor.
10. Measurement of capacitance & determination of dissipation factor.

Course Title	Biology for Engineers		
Course Code	21BEEC/EE/EI408	L-T-P-C	(1-0-0)1
Exam	3 Hrs.	Hours/Week	1
CIE	100 Marks	Total Hours	14

Course Outcomes: At the end of the course, student will be able:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	To familiarize engineering students with basic biological concepts in an engineering perspective	PO1, PO3, PO12	
2.	To involve students in an interdisciplinary vision of biology and engineering		
3.	To gain the realization of translation of natural engineering in biological systems into novel devices in man-made engineering domain.		
4.	To develop automation-based engineering models by employing the natural automation concepts in human body.		

MODULE-1	3 Hrs

Introduction to Human Anatomy: Overview of human anatomy, Structural organization of the human body - cardiovascular system, endocrine system, digestive system, respiratory system, excretory system, lymphatic system, nervous system, muscular system and skeletal system.

MODULE-2	4 Hrs

Receptors (Sensors) and Effectors (Actuators): Comparative study of biological principles with Electrical principles, Sense Organs; External and Internal sense organs, Effectors; Muscles and glands, brief introduction to Sensory and motory nerves, Comparative Study of Sensors and Actuators (Engineering system) based on the concepts of Receptors and Effectors in Human body

MODULE-3	3 Hrs

Communication system in Human Body: Nervous system; Neurons, Organ of human body, Nerves; Cranial nerves, Spinal nerves and visceral nerves, Functioning of various nerves as Sensory nerves, Motory nerves and Relay nerves, Comparison of natural communication system with the design of engineering system

MODULE-4	4 Hrs

Controls involved in Human Body: Introduction to Open loop and Closed loop system, Role of Endocrine system in control process of many parameters, study of natural Control in various biological systems, Extending the concept of Biological Open loop and closed loop systems to the field of automation, Case studies.

Text Books:

1. B D Chaurasia's, Handbook of General Anatomy, 4th Edition
2. Johnson A T (2018), Biology for Engineers, CRC Press

References:

- Google links