SAIRAM
COLLEGE OF ENGINEERING
Anekal, Bengaluru

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

2018 SCHEME COURSE OUTCOME

COURSE CODE	COURSE NAME	CO NUMBER	CO's
18MAT31	TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES	C231.1	Use Laplace transform and inverse Laplace transform in solving differential/ integral equation arising in network analysis, control systems and other fields of engineering.
		C231.2	Demonstrate Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
		C231.3	Make use of Fourier transform and Z-transform to illustrate discrete/continuous function arising in wave and heat propagation, signals and systems.
		C231.4	Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.
		C231.5	Determine the externals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.
18EE32	ELECTRIC CIRCUIT ANALYSIS	C232.1	Understand the basic concepts, basic laws and methods of analysis of DC and AC networks and reduce the complexity of network using source shifting, source transformation and network reduction using transformations.
		C232.2	Solve complex electric circuits using network theorems.
		C232.3	Discuss resonance in series and parallel circuits and also the importance of initial conditions and their evaluation.
		C232.4	Synthesize typical waveforms using Laplace transformation.
		C232.5	Solve unbalanced three phase systems and also evaluate the performance of two port networks.
18EE33	TRANSFORMERS AND GENERATORS	C233.1	Understand the construction and operation of 1-phase, 3-Phase transformers and Autotransformer.
		C233.2	Analyze the performance of transformers by polarity test, Sumpner's Test, phase conversion, 3-phase connection, and parallel operation.
		C233.3	Understand the construction and working of AC and DC Generators.
		C233.4	Analyze the performance of the AC Generators on infinite bus and parallel operation.
		C233.5	Determine the regulation of AC Generator by Slip test, EMF, MMF, and ZPF Methods.
18EE34	ANALOG ELECTRONIC CIRCUITS	C234.1	Obtain the output characteristics of clipper[1] and clamper circuits
		C234.2	Design and compare biasing circuits for transistor

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			amplifiers & explain the transistor switching.
		C234.3	Explain the concept of feedback, its types and design of feedback circuits
		C234.4	Design and analyze the power amplifier circuits and oscillators for different frequencies.
		C234.5	Design and analysis of FET and MOSFET amplifiers.
18EE35	DIGITAL SYSTEM DESIGN	C235.1	Develop simplified switching equation using Karnaugh Maps and Quine McClusky techniques.
		C235.2	Design Multiplexer, Encoder, Decoder, Adder, Subtractors and Comparator as digital combinational control circuits.
		C235.3	Design flip flops, counters, shift registers as sequential control circuits.
		C235.4	Develop Mealy/Moore Models and state diagrams for the given clocked sequential circuits.
		C235.5	Explain the functioning of Read only and Read/Write Memories, Programmable ROM, EPROM and Flash memory.
18EE36	ELECTRICAL AND ELECTRONICMEASUREMENTS	C236.1	Measure resistance, inductance and capacitance using bridges and determine earth resistance.
		C236.2	Explain the working of various meters used for measurement of Power, Energy & understand the adjustments, calibration & errors in energy meters.
		C236.3	Understand methods of extending the range of instruments & instrument transformers.
		C236.4	Explain the working of different electronic instruments.
		C236.5	Explain the working of different display and recording devices.
18EEL37	ELECTRICALMACHINES LABORATORY - 1	C237.1	Evaluate the performance of transformers from the test data obtained.
		C237.2	Connect and operate two single phase transformers of different KVA rating in parallel.
		C237.3	Connect single phase transformers for three phase operation and phase conversion.
		C237.4	Compute the voltage regulation of synchronous generator using the test data obtained in the laboratory.
		C237.5	Evaluate the performance of synchronous generators from the test data and assess the performance of synchronous generator connected to infinite bus.
18EEL38	ELECTRONICS LABORATORY	C238.1	Design and test rectifier circuits with and without capacitor filters.
		C238.2	Determine h-parameter models of transistor for all modes.
		C238.3	Design and test BJT and FET amplifier and oscillator circuits.
		C238.4	Realize Boolean expressions, adders and subtractors using gates.
		C238.5	Design and test Ring counter/Johnson counter, Sequence generator and 3 bit counters.

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18MAT41	COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS	C241.1	Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory.
		C241.2	Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing.
		C241.3	Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.
		C241.4	Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
		C241.5	Construct joint probability distributions and demonstrate the validity of testing the hypothesis.
18EE42	POWER GENERATION AND ECONOMICS	C242.1	Describe the working of hydroelectric, steam, nuclear power plants and state functions of major equipment of the power plants.
		C242.2	Classify various substations and explain the functions of major equipments in substations.
		C242.3	Explain the types of grounding and its importance.
		C242.4	Infer the economic aspects of power system operation and its effects.
		C242.5	Explain the importance of power factor improvement.
18EE43	TRANSMISSION AND DISTRIBUTION	C243.1	Explain transmission and distribution scheme, identify the importance of different transmission systems and types of insulators.
		C243.2	Analyze and compute the parameters of the transmission line for different configurations.
		C243.3	Assess the performance of overhead lines.
		C243.4	Interpret corona, explain the use of underground cables.
		C243.5	Classify different types of distribution systems; examine its quality & reliability.
18EE44	ELECTRIC MOTORS	C244.1	Explain the construction, operation and classification of DC Motor, AC motor and Special purpose motors.
		C244.2	Describe the performance characteristics & applications of Electric motors.
		C244.3	Demonstrate and explain the methods of testing of DC machines and determine losses and efficiency.
		C244.4	Control the speed of DC motor and induction motor.
		C244.5	Explain the starting methods, equivalent circuit and phasor diagrams, torque angle, effect of change in excitation and change in load, hunting and damping of synchronous motors.
18EE45	ELECTROMAGNETIC FIELD THEORY	C245.1	Use different coordinate systems , Coulomb's Law and Gauss Law for the evaluation of electric fields produced by different charge configurations.
		C245.2	Calculate the energy and potential due to a system

			of charges & Explain the behavior of electric field across a boundary conditions.
		C245.3	Explain the Poisson's, Laplace equations and behavior of steady magnetic fields.
		C245.4	Explain the behavior of magnetic fields and magnetic materials.
		C245.5	Asses time varying fields and propagation of waves in different media.
18EE46	OPERATIONAL AMPLIFIERS AND LINEAR Ics	C246.1	Describe the characteristics of ideal and practical operational amplifier.
		C246.2	Design filters and signal generators using linear ICs.
		C246.3	Demonstrate the application of Linear ICs as comparators and rectifiers.
		C246.4	Analyze voltage regulators for given specification using op-amp and IC voltage regulators.
		C246.5	Summarize the basics of PLL and Timer.
18EEL47	ELECTRICAL MACHINES LABORATORY - 2	C247.1	Test DC machines to determine their characteristics and also to control the speed of DC motor.
		C247.2	Pre-determine the performance characteristics of DC machines by conducting suitable tests.
		C247.3	Perform load test on single phase and three phase induction motor to assess its performance.
		C247.4	Conduct test on induction motor to pre-determine the performance characteristics.
		C247.5	Conduct test on synchronous motor to draw the performance curves.
18EEL48	OP- AMP AND LINEAR ICS LABORATORY	C248.1	To conduct experiment to determine the characteristic parameters of OP-Amp
		C248.2	To design test the OP-Amp as Amplifier, adder, subtractor, differentiator and integrator.
		C248.3	To design test the OP-Amp as oscillators and filters.
		C248.4	Design and study of Linear IC's as multivibrator power supplies.
		C248.5	To design test the OP-Amp as ADC, DAC and Voltage Regulators
18EE51	MANAGEMENT AND ENTREPRENEURSHIP	C351.1	Explain the field of management, task of the manager, planning and steps in decision making.
		C351.2	Discuss the structure of organization, importance of staffing, leadership styles, modes of communication, techniques of coordination and importance of managerial control in business.
		C351.3	Explain the concepts of entrepreneurship and a businessman's social responsibilities towards different groups.
		C351.4	Show an understanding of role of SSI's in the development of country and state/central level institutions/agencies supporting business enterprises.
		C351.5	Discuss the concepts of project management, capital budgeting, project feasibility studies, need for project report and new control techniques.

18EE52	MICROCONTROLLER	C352.1	Outline the 8051 architecture, registers, internal memory organization, addressing modes.
		C352.2	Discuss 8051 addressing modes, instruction set of 8051, accessing data and I/O port programming.
		C352.3	Develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic and arithmetic operations, data conversion and timer/counter programming.
		C352.4	Summarize the basics of serial communication and interrupts, also develop 8051 programs for serial data communication and interrupt programming.
		C352.5	Program 8051 to work with external devices for ADC, DAC, Stepper motor control, DC motor control, Elevator control
18EE53	POWER ELECTRONICS	C353.1	To give an overview of applications power electronics, different types of power semiconductor devices, their switching characteristics, power diode characteristics, types, their operation and the effects of power diodes on RL circuits.
		C353.2	To explain the techniques for design and analysis of single phase diode rectifier circuits.
		C353.3	To explain different power transistors, their steady state and switching characteristics and limitations.
		C353.4	To explain different types of Thyristors, their gate characteristics and gate control requirements.
		C353.5	To explain the design, analysis techniques, performance parameters and characteristics of controlled rectifiers, DC- DC, DC -AC converters and Voltage controllers.
18EE54	SIGNALS AND SYSTEMS	C354.1	Explain the generation of signals, behavior of system and the basic operations that can be performed on signals and properties of systems.
		C354.2	Apply convolution in both continuous and discrete domain for the analysis of systems given impulse response of a system.
		C354.3	Solve the continuous time and discrete time systems by various methods and their representation by block diagram.
		C354.4	Perform Fourier analysis for continuous and discrete time, linear time invariant systems.
		C354.5	Apply Z-transform and properties of Z transform for the analysis of discrete time systems.
18EE55	ELECTRICAL MACHINE DESIGN	C355.1	Identify and list, limitations, modern trends in design, manufacturing of electrical machines and properties of materials used in the electrical machines.
		C355.2	Derive the output equation of DC machine, discuss selection of specific loadings and magnetic circuits of DC machines, design the field windings of DC machine, and design stator and rotor circuits of a DC machine.
		C355.3	Derive the output equations of transformer, discuss selection of specific loadings, estimate the number

			of cooling tubes, no load current and leakage reactance of core type transformer.
		C355.4	Develop the output equation of induction motor, discuss selection of specific loadings and magnetic circuits of induction motor, design stator and rotor circuits of a induction motor.
		C355.5	Formulate the output equation of alternator, design the field windings of Synchronous machine, discuss short circuit ratio and its effects on performance of synchronous machines, design salient pole and non-salient pole alternators for given specifications.
18EE56	HIGH VOLTAGE ENGINEERING	**C356.1**	Explain conduction and breakdown phenomenon in gases, liquid dielectrics and breakdown phenomenon in solid dielectrics.
		C356.2	Summarize generation of high voltages and currents
		C356.3	Outline measurement techniques for high voltages and currents.
		C356.4	Summarize overvoltage phenomenon and insulation coordination in electric power systems.
		C356.5	Explain non-destructive testing of materials and electric apparatus, high-voltage testing of electric apparatus
18EEL57	MICROCONTROLLER LABORATORY	**C357.1**	Write assembly language programs for data transfer, arithmetic, Boolean and logical instructions and code conversions.
		C357.2	Write ALP using subroutines for generation of delays, counters, configuration of SFRs for serial communication and timers.
		C357.3	Perform interfacing of stepper motor and dc motor for controlling the speed, elevator, LCD, external ADC and temperature control.
		C357.4	Generate different waveforms using DAC interface.
		C357.5	Work with a small team to carryout experiments using microcontroller concepts and prepare reports that present lab work.
18EEL58	POWER ELECTRONICS LABORATORY	**C358.1**	Obtain static characteristics of semiconductor devices to discuss their performance.
		C358.2	Trigger the SCR by different methods
		C358.3	Verify the performance of single phase controlled full wave rectifier and AC voltage controller with R and RL loads.
		C358.4	Control the speed of a DC motor, universal motor and stepper motors.
		C358.5	Verify the performance of single phase full bridge inverter connected to resistive load.
18EE61	CONTROL SYSTEMS	**C361.1**	Analyze and model electrical and mechanical system using analogous.
		C361.2	Formulate transfer functions using block diagram and signal flow graphs.
		C361.3	Analyze the stability of control system, ability to determine transient and steady state time response.

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		C361.4	Illustrate the performance of a given system in time and frequency domains, stability analysis using Root locus and Bode plots.
		C361.5	Discuss stability analysis using Nyquist plots, Design controller and compensator for a given specification.
18EE62	POWER SYSTEM ANALYSIS – 1	C362.1	Model the power system components & construct per unit impedance diagram of power system.
		C362.2	Analyze three phase symmetrical faults on power system.
		C362.3	Compute unbalanced phasors in terms of sequence components and vice versa, also develop sequence networks.
		C362.4	Analyze various unsymmetrical faults on power system.
		C362.5	Examine dynamics of synchronous machine and determine the power system stability.
18EE63	DIGITAL SIGNAL PROCESSING	C363.1	Apply DFT and IDFT to perform linear filtering techniques on given sequences to determine the output.
		C363.2	Apply fast and efficient algorithms for computing DFT and inverse DFT of a given sequence
		C363.3	Design and realize infinite impulse response Butterworth and Chebyshev digital filters using impulse invariant and bilinear transformation techniques.
		C363.4	Develop a digital IIR filter by direct, cascade, parallel, ladder and FIR filter by direct, cascade and linear phase methods of realization.
		C363.5	Design and realize FIR filters by use of window function and frequency sampling method.
18EE643	COMPUTER AIDED ELECTRICAL DRAWING	C3643.1	Develop armature winding diagram for DC and AC machines
		C3643.2	Develop a Single Line Diagram of Generating Stations and substation using the standard symbols.
		C3643.3	Construct sectional views of core and shell types transformers using the design data
		C3643.4	Construct sectional views of assembled DC machine and their parts using the design data or the sketches
		C3643.5	Construct sectional views of assembled AC machine and their parts using the design data or the sketches
18EE647	SENSORS AND TRANSDUCERS	C3647.1	Use gauges and transducers to measure pressure, direction and distance.
		C3647.2	Discuss the use of light transducers and other devices used for the measurement of electromagnetic radiations.
		C3647.3	Explain the working of different temperature sensing devices.
		C3647.4	Discuss the principles and applications of audio electrical sensors and transducers used for the

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			measurement of sound.
		C3647.5	Discuss the use of sensors for the measurement of mass, volume and environmental quantities.
18EEL66	CONTROL SYSTEM LABORATORY	C366.1	Utilize software package and discrete components in assessing the time and frequency domain response of a given second order system.
		C366.2	Design, analyze and simulate Lead, Lag and Lag – Lead compensators for given specifications.
		C366.3	Determine the performance characteristics of ac and DC servomotors and synchro-transmitter receiver pair used in control systems.
		C366.4	Simulate the DC position and feedback control system to study the effect of P, PI, PD and PID controller and Lead compensator on the step response of the system.
		C366.5	Develop a script files to plot Root locus, Bode plot and Nyquist plot to study the stability of Control system
18EEL67	DIGITAL SIGNAL PROCESSING LABORATORY	C367.1	Explain physical interpretation of sampling theorem in time and frequency domains.
		C367.2	Evaluate the impulse response of a system.
		C367.3	Perform convolution of given sequences to evaluate the response of a system.
		C367.4	Compute DFT and IDFT of a given sequence using the basic definition and/or fast methods.
		C367.5	Provide a solution for a given difference equation. Design and implement IIR and FIR filters.
18EEMP68	MINI PROJECT	C368.1	Present the mini-project and be able to defend it.
		C368.2	Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
		C368.3	Habituated to critical thinking and use problem solving skills.
		C368.4	Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
		C368.5	Work in a team to achieve common goal. Learn on their own, reflect on their learning and take appropriate actions to improve it.
18EE71	POWER SYSTEM ANALYSIS – 2	C471.1	Formulate network matrices and models for solving load flow problems.
		C471.2	Perform steady state power flow analysis of power systems using numerical iterative techniques.
		C471.3	Solve issues of economic load dispatch and unit commitment problems.
		C471.4	Analyze short circuit faults in power system networks using bus impedance matrix.
		C471.5	Apply Point by Point method and Runge Kutta Method to solve Swing Equation.
18EE72	POWER SYSTEM PROTECTION	C472.1	Discuss performance of protective relays, components of protection scheme and relay

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			terminology over current protection.
		C472.2	Explain the working of distance relays and the effects of arc resistance, power swings, line length and source impedance on performance of distance relays.
		C472.3	Discuss pilot protection, construction, operating principles and performance of differential relays and discuss protection of generators, motors, transformer and Bus Zone Protection.
		C472.4	Explain the construction and operation of different types of circuit breakers.
		C472.5	Outline features of fuse, causes of overvoltages and its protection, also modern trends in Power System Protection.
18EE732	MICRO- AND NANO-SCALE SENSORS AND TRANSDUCERS	C4732.1	Understand the differences between the sensor and transducer technology based on nanotechnology and nanofabrication for different types of pressure sensor based on nanotechnology and nanofabrication.
		C4732.2	Understand the basic concept, structure and experimental results of Motion & Acceleration Sensors, Gas and Smoke Sensors based on nanotechnology and nanofabrication.
		C4732.3	Understand the basic concept, structure and experimental results of Moisture Sensors, Optoelectronic and Photonic Sensors based on nanotechnology and nanofabrication.
		C4732.4	Make an informed selection of a sensor or transducer for a particular application
		C4732.5	Become knowledgeable in Integrated Sensor/Actuator Units and Special Purpose Sensors about the technologies that are available commercially at the present time.
18EE734	ADVANCED CONTROL SYSTEMS	C4734.1	Discuss state variable approach for linear time invariant systems in both the continuous and discrete time systems. Develop of state models for linear continuous – time and discrete – time systems.
		C4734.2	Apply vector and matrix algebra to find the solution of state equations for linear continuous – time and discrete – time systems. Define controllability and observability of a system and test for controllability and observability of a given system.
		C4734.3	Design pole assignment and state observer using state feedback.
		C4734.4	Develop the describing function for the nonlinearity present to assess the stability of the system.
		C4734.5	Develop Lyapunov function for the stability analysis of nonlinear systems.
18EE741	INDUSTRIAL DRIVES AND APPLICATIONS	C4741.1	Explain the advantages, choice and control of electric drive
		C4741.2	Explain the dynamics, generating and motoring

			modes of operation of electric drives
		C4741.3	Explain the selection of motor power rating to suit industry requirements
		C4741.4	Analyze the performance & control of DC motor drives using controlled rectifiers
		C4741.5	Analyze the performance & control of converter fed Induction motor, synchronous motor & stepper motor drives.
18EE744	SMART GRID	C4744.1	Explain the concept of Smart grid enables the ElectricNet and need of smart grid.
		C4744.2	Outline the benefits and drivers of DC Power delivery system.
		C4744.3	Summarize the Intelligrid Architecture for the smart grid.
		C4744.4	Explain the Efficient Electric End-use Technology Alternatives.
		C4744.5	Discuss Demand side planning and Evaluation.
18EEL76	POWER SYSTEM SIMULATION LABORATORY	C476.1	Develop a program in suitable package to assess the performance of medium and long transmission lines.
		C476.2	Develop a program in suitable package to obtain the power angle characteristics of salient and non-salient pole alternator.
		C476.3	Develop a program in suitable package to assess the transient stability under three phase fault at different locations in a of radial power systems.
		C476.4	Develop programs in suitable package to formulate bus admittance and bus impedance matrices of interconnected power systems.
		C476.5	Use suitable package to solve power flow problem for simple power systems, to study unsymmetrical faults at different locations in radial power systems and to study optimal generation scheduling problems for thermal power plants.
18EEL77	RELAY AND HIGH VOLTAGE LABORATORY	C477.1	Verify the characteristics of over current, over voltage, under voltage and negative sequence relay both electromagnetic and static type.
		C477.2	Verify the characteristics of microprocessor based over current, over voltage, under voltage relays and distance relay.
		C477.3	Show knowledge of protecting generator, motor and feeders. Analyze the spark over characteristics for both uniform and non-uniform configurations using High AC and DC voltages
		C477.4	Measure high AC and DC voltages and breakdown strength of transformer oil.
		C477.5	Draw electric field and measure the capacitance of different electrode configuration models. Show knowledge of generating standard lightning impulse voltage to determine efficiency, energy of impulse generator and 50% probability flashover voltage for air insulation.

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18EEP78	PROJECT PHASE – I	C478.1	Demonstrate a sound technical knowledge of their selected project topic.
		C478.2	Undertake problem identification, formulation and solution.
		C478.3	Design engineering solutions to complex problems utilizing a systems approach.
		C478.4	Communicate with engineers and the community at large in written an oral forms.
		C478.5	Develop interactive, communication, organization, time management, and presentation skills.
18EE81	POWER SYSTEM OPERATION AND CONTROL	C481.1	Describe various levels of controls in power systems, architecture and configuration of SCADA.
		C481.2	Develop and analyze mathematical models of Automatic Load Frequency Control.
		C481.3	Develop mathematical model of Automatic Generation Control in Interconnected Power system
		C481.4	Discuss the Control of Voltage , Reactive Power and Voltage collapse.
		C481.5	Explain security, contingency analysis, state estimation of power systems
18EE821	FACTS AND HVDC TRANSMISSION	C4821.1	Discuss transmission interconnections, flow of Power in an AC System, limits of the loading capability, dynamic stability considerations of a transmission interconnection and controllable parameters. Explain the basic concepts, definitions of flexible ac transmission systems and benefits from FACTS technology.
		C4821.2	Describe shunt controllers, Static Var Compensator and Static Compensator for injecting reactive power in the transmission system in enhancing the controllability and power transfer capability.
		C4821.3	Describe series Controllers Thyristor-Controlled Series Capacitor (TCSC) and the Static Synchronous Series Compensator (SSSC) for control of the transmission line current.
		C4821.4	Explain advantages of HVDC power transmission, overview and organization of HVDC system. Describe the basic components of a converter, the methods for compensating the reactive power demanded by the converter.
		C4821.5	Explain converter control for HVDC systems, ommutation failure, control
18EE822	ELECTRICAL ESTMATION AND COSTING	C4822.1	Explain general principles of estimation and major applicable I.E. rules.
		C4822.2	Discuss wiring methods, cables used, design of lighting points and sub-circuits, internal wiring, wiring accessories and fittings, fuses and types.
		C4822.3	Discuss estimation of service mains and power circuits.
		C4822.4	Discuss estimation of overhead transmission and distribution system its components.

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		C4822.5	Discuss types of substation, main components and estimation of substation.
18EEP83	PROJECT WORK PHASE -II	C483.1	Present the project and be able to defend it.
		C483.2	Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
		C483.3	Habituated to critical thinking and use problem solving skills.
		C483.4	Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
		C483.5	Work in a team to achieve common goal. Learn on their own, reflect on their learning and take appropriate actions to improve it.
18EEI85	INTERNSHIP	C485.1	Gain practical experience within industry in which the internship is done. Acquire knowledge of the industry in which the internship is done.
		C485.2	Apply knowledge and skills learned to classroom work.
		C485.3	Develop a greater understanding about career options while more clearly defining personal career goals.
		C485.4	Experience the activities and functions of professionals.
		C485.5	Develop and refine oral and written communication skills.

HEAD OF THE DEPARTMENT
Prof. MALINI K V