INSTITUTE OF ENGINNERING AND TECHNOLOGY LUCKNOW

(An Autonomous Constituent Institute of Dr. A.P.J. Abdul Kalam Technical University, Lucknow)

Evaluation Scheme & Syllabus

For

B. Tech. Third Year

(Electrical Engineering)

AS PER

AICTE MODEL CURRICULUM

[Effective from the Session: 2020-21]

EVALUATION SCHEME - B.TECH 3rd YEAR (ELECTRICAL ENGINEERING)

SEMESTER V													
Sl. No.	**Subject Codes**	**Subject**	**Periods**			**Evaluation Scheme**				**End Semester**		**Total**	**Credit**
			L	**T**	**P**	**CT**	**TA**	**Total**	**PS**	**TE**	**PE**		
1		Power System - I	3	1	0	30	20	50		100		150	4
2		Control System	3	1	0	30	20	50		100		150	4
3		Electrical Machines-II	3	1	0	30	20	50		100		150	4
4		Departmental Elective-I	3	0	0	30	20	50		100		150	3
5		Departmental Elective-II	3	0	0	30	20	50		100		150	3
6		Power System-I Lab	0	0	2				25		25	50	1
7		Control System Lab	0	0	2				25		25	50	1
8		Electrical Machines - II Lab	0	0	2				25		25	50	1
9		Mini Project or Internship Assessment*****	0	0	2				50			50	1
10	NC	Constitution of India / Essence of Indian Traditional Knowledge	2	0	0	15	10	25		50			
11		MOOCs (Essential for Hons. Degree)											
		Total	**17**	**3**	**8**							**950**	**22**

**The Mini Project or internship (4 weeks) conducted during summer break after IV semester and will be assessed during V semester.*

Department Elective - I
Robotics
Sensors and Transducers
Industrial Automation and Control
Electrical Standards and Engineering Practices

Department Elective - II
Optimization Techniques
Neural Networks & Fuzzy System
Digital Signal Processing
Analog & Digital Communication

SEMESTER VI												
Sl. No.	**Subject Codes**	**Subject**	**Periods**			**Evaluation Scheme**				**End Semester**		**Total**	**Credit**
			L	**T**	**P**	**CT**	**TA**	**Total**	**PS**	**TE**	**PE**		
1		Power System-II	3	1	0	30	20	50		100		150	4
2		Microprocessor and Microcontroller	3	1	0	30	20	50		100		150	4
3		Power Electronics	3	1	0	30	20	50		100		150	4
4		Departmental Elective-III	3	0	0	30	20	50		100		150	3
5		Open Elective-I [Annexure - B(iv)]	3	0	0	30	20	50		100		150	3
6		Power System-II Lab	0	0	2				25		25	50	1
7		Microprocessor and Microcontroller Lab	0	0	2				25		25	50	1
8		Power Electronics Lab	0	0	2				25		25	50	1
10	NC	Essence of Indian Traditional Knowledge / Constitution of India	2	0	0	15	10	25		50			
11		MOOCs (Essential for Hons. Degree)											
		Total	**17**	**3**	**6**							**900**	**21**

Department Elective - III

Special Electrical Machines
Electrical Machine Design
Digital Control System
Electrical and Hybrid Vehicles

SEMESTER V

POWER SYSTEM-I

Pre-requisites of the course: Basic Electrical Engineering, Networks Analysis and Synthesis, Electromagnetic Field Theory.

Course Outcome		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO1	Describe the working principle and basic components of conventional power plants as well as the other aspects of power generation.	**K2**
CO2	Recognize elements of power system and their functions, as well as compare the different types of supply systems. Illustrate different types of conductors, transmission lines and various performance parameters of transmission line for short, medium and long transmission line.	**K4**
CO3	Calculate sag and tension in overhead lines with and without wind and ice loading. Classify different type of insulators, determine potential distribution over a string of insulator, string efficiency and its improvement.	**K4**
CO4	Compute the inductance and capacitance of single phase, three phase lines with symmetrical and unsymmetrical spacing, Composite conductors-transposition, bundled conductors, and understand the effect of earth on capacitance of transmission lines.	**K4**
CO5	Elucidate different types of cables and assess the Resistance and capacitance parameters of cables, grading of cables and compare overhead lines and cables.	**K4**

KL- Bloom's Knowledge Level (K1, K2, K3, K4, K5, K6)
K1 – Remember K2 – Understand K3 – Apply K4 – Analyze K5 – Evaluate K6 – Create

Detailed Syllabus:

UNIT-I (Power Generation):
Introduction: Basic structure of power system, sources of electric energy: conventional and non-conventional; Layout of Hydro-electric, Thermal and Nuclear power plants, Concept of cogeneration, combined heat and power, and captive power plants.
Load curve, load duration curve, Concept of Connected Load, Maximum Demand, Average load, Demand Factor, Load factor, Diversity Factor, Capacity Factor, Utilization factor, Plant use factor, Installed capacity, Reserves, role of load diversity in power system economy. Load Sharing between Base load and Peak Load

UNIT-II (Transmission & Distribution of Electric Power- I):
Single line diagram of Power system, choice of transmission voltage, Different kinds of supply system and their comparison.
Configurations of transmission lines: Types of conductors, Bundled Conductors, resistance of line, skin effect, Kelvin's law, Proximity effect,
Corona Effect, factors affecting the Corona, Corona Power Loss, Advantages and Disadvantages.
Performance of Lines: Representation of lines, short transmission lines, medium length lines, nominal T and л-representations, long transmission lines. The equivalent circuit representation of a long Line, A, B, C, D constants, Ferranti Effect.

UNIT-III (Transmission & Distribution of Electric Power- II):
Mechanical Design of Over Headlines: Catenary curve, calculation of sag & tension, effects of wind and ice loading, sag template, vibration dampers
Overhead line Insulators: Type of insulators and their applications, potential distribution over a string of insulators, methods of equalizing the potential, string efficiency

UNIT-IV (Transmission Line Parameters):
Inductance and Capacitance Calculations of Transmission Lines: Line conductors, inductance and capacitance of single phase and three phase lines with symmetrical and unsymmetrical spacing, Composite conductors-transposition, bundled conductors, and effect of earth on capacitance.

UNIT-V (Insulated Cables):
Insulated Cables: Introduction, insulation, insulating materials, Extra high voltage cables, grading of cables, insulation resistance of a cable, Capacitance of a single core and three core cables, Overhead lines versus underground cables, types of cables

Textbooks:

1. Kothari & Nagrath, "Power System Engineering", Tata McGraw-Hill Education
2. B.R. Gupta, "Generation of Electrical Energy", S. Chand Publication.
3. Chakrabarti A., Soni M.L., Gupta P.V., and Bhatnagar U.S., 'A textbook on Power Systems Engg.', Dhanpat Rai and Sons, New Delhi.
4. JB Gupta, 'A course in Power Systems', S.K. Kataria and Sons.
5. C.L. Wadhwa, "Electrical Power System", New age international Ltd. Third Edition.
6. A. J. Wood & B.F. Wollenburg, "Power Generation, Operation and Control "John Wiley & Sons.

Reference Books:

1. Wadhwa, C.L., 'Generation Distribution and Utilization of Electrical Energy', New Age International publishers.
2. Deshpande M.V, `Elements of Electrical Power systems Design', Pitman, New Delhi, PHI Learning Private Limited,
3. S.N. Singh, "Electric Power Generation, Transmission &Distribution", PHI Learning.

CONTROL SYSTEM

Pre-requisites of course: Basic signal systems

Course Outcome		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Obtain transfer functions to predict the correct operation of open loop and closed loop control systems and identify the basic elements, structures and the characteristics of feedback control systems.	**K3**
CO 2	Measure and evaluate the performance of basic control systems in time domain. Design specification for different control action.	**K4**
CO 3	Analyze the stability of linear time-invariant systems in time domain using Routh-Hurwitz criterion and root locus technique.	**K4**
CO 4	Determine the stability of linear time-invariant systems in frequency domain using Nyquist criterion and Bode plot.	**K4**
CO 5	Design different type of compensators to achieve the desired performance of control System by root locus and Bode plot method. Develop and analyze the intermediate states of the system using state space analysis.	**K5**

KL- Bloom's Knowledge Level (K1, K2, K3, K4, K5, K6)
K1 – Remember K2 – Understand K3 – Apply K4 – Analyze K5 – Evaluate K6 – Create

Detailed Syllabus:

Unit-I:
Control System Concepts: Elements of control systems, concept of open loop and closed loop systems, Examples and application of open loop and closed loop systems, Mathematical Modelling of Physical Systems (Electro Mechanical), Determination of transfer function by block diagram reduction techniques and signal flow method using Mason's gain formula, Basic Characteristics of negative feedback control systems.
Control System Components: Constructional and working concept of AC & DC servomotor, synchro's, stepper motor and tachometer.

Unit-II:
Time Response Analysis: Standard test signals, time response analysis of first and second order systems, time response specifications of second order system for unit step input, location of roots of characteristics equation and corresponding time response, steady state errors and error constants.
Basic modes of feedback control: Proportional, Derivative, Integral and PID controllers.

Unit-III:
Stability and Algebraic Criteria: Concept of stability and its necessary conditions, Routh-Hurwitz criteria and its limitations.
Root Locus Technique: Salient features of root locus plot, Procedure for plotting root locus, root contours.

Unit-IV:
Frequency Response Analysis: Frequency Response analysis from transfer function model, Construction of polar and inverse polar plots.

Stability in Frequency Domain: Nyquist stability criterion, Determination of gain and phase margin from Bode & Nyquist Plots, Correlation between time and Frequency Responses.

Unit-V

Introduction to Design: The design problems and preliminary considerations of lead, lag and lead-lag compensation networks, design of closed loop systems using compensation techniques in time and frequency domains.

State Space Technique: The concept of state & space, State-space model of physical system, conversion of state-space to transfer function model and vice-versa, State transition matrix, Concept of controllability and observability and their testing.

Text Books:

1. Nagrath & Gopal, "Control System Engineering", New age International.
2. K. Ogata, "Modern Control Engineering", Pearson India.
3. B.C. Kuo & Farid Golnaraghi, "Automatic Control System" McGraw Hill, 2018.
4. D. Roy Choudhary, "Modern Control Engineering", Prentice Hall of India.
5. Ambikapathy, "Control Systems",Khanna Publishers

Reference Books:

1. Norman S. Mise, Control System Engineering, Wiley Publishing Co.
2. Ajit K Mandal, "Introduction to Control Engineering" New Age International.
3. R.T. Stefani, B.Shahian, C.J.Savant and G.H. Hostetter, "Design of Feedback Control Systems" Oxford
   University Press.
4. Samarjit Ghosh, "Control Systems theory and Applications", Pearson Education

ELECTRICAL MACHINE-II

Pre-requisites of course: Basic Electrical Engineering, Electrical Machine-I

Course Outcome		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Demonstrate the constructional details and principle of operation of three phase Induction and Synchronous Machines.	**K3**
CO 2	Analyze the performance of the three phase Induction and Synchronous Machines using the phasor diagrams and equivalent circuits.	**K4**
CO 3	Select appropriate three phase AC machine for any application and appraise its significance.	**K4**
CO 4	Start and observe the various characteristics of three phase Induction & Synchronous Machines	**K4**
CO 5	Explain the principle of operation and performance of Single-Phase Induction Motor & Universal Motor.	**K3**

KL- Bloom's Knowledge Level (K1, K2, K3, K4, K5, K6)
K1 – Remember K2 – Understand K3 – Apply K4 – Analyze K5 – Evaluate K6 – Create

Detailed Syllabus:

Unit- I: Synchronous Machine-I

Constructional features, Armature winding, EMF Equation, Winding coefficients, Equivalent circuit and phasor diagram, Armature reaction, O. C. & S. C. tests, Voltage regulation using Synchronous Impedance method, MMF method, Potier's Triangle method, Voltage and frequency control (Governer system) of alternators , Parallel operation of synchronous generators, Operation on infinite bus, Synchronizing power and torque co-efficient.

UNIT – II: Synchronous Machine II

Two reaction theory, Transient and sub-transient reactance, Power flow equations of cylindrical and salient pole machines, Operating characteristics. Synchronous Motor - Starting methods, Effect of varying field current at different loads, V- curves, Hunting & damping, Synchronous condenser.

UNIT – III: Three phase Induction Machine - I

Constructional features, Rotating magnetic field, Principle of operation, Phasor diagram, Equivalent circuit, Torque and power equations, Torque- slip characteristics, No load & blocked rotor tests, Efficiency.

UNIT – IV: Three phase Induction Machine- II

Starting, Deep bar and double cage rotors, Cogging & Crawling, Speed control (with and without emf injection in rotor circuit).

UNIT – V: Single phase Induction Motor

Double revolving field theory, Equivalent circuit, No load and blocked rotor tests, Starting methods, Repulsion motor, Universal motor.

Text Books:

1. I J Nagrath & D.P. Kothari, "Electrical Machines", Tata McGraw Hill
2. Rajendra Prasad , "Electrical Machines", PHI
3. PS Bimbhra, "Electrical Machinery", Khanna Publisher
4. AE Fitggerald, C. Kingsley Jr and Umans, "Electric Machinery", McGraw Hill, International Student Edition.

Reference Books:

1. H. Cotton, "Electrical Technology", CBS Publication.
2. MG Say, "The Performance and Design of AC machines", Pit man& Sons.
3. PS Bimbhra, " Generalized Theory.

POWER SYSTEM LABORATORY - I

Pre-requisites of course: Basic understanding of Scilab/MATLAB/C/C++

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO1	Use programming tools /Software: Scilab, MATLAB or any C, C++ - Compiler and formulate a program/simulation model for calculation of various parameters related to transmission line.	**K6**

Note: Minimum ten experiments are to be performed from the following list, on a software platform preferably on Scilab, MATLAB, or any C, C++ - Compiler

1. Calculate the parameters of single-phase transmission line
2. Calculate the parameters of three phase single circuit transmission line
3. Calculate the parameters of three phase double circuit transmission line
4. Determine the ABCD constant for transmission line.
5. Simulate the Ferranti effect in transmission line
6. Calculate the corona loss of transmission line
7. Calculation of sag & tension of transmission line
8. Calculation of string efficiency of insulator of transmission line
9. Calculation for grading of underground cables
10. Simulate the skin effect in the transmission line
11. Calculation of ground clearance of transmission line
12. Calculate the parameters for underground cable.

Spoken Tutorial (MOOCs):

Spoken Tutorial MOOCs, ' Course on Scilab', IIT Bombay (http://spoken-tutorial.org/)

CONTROL SYSTEM LABORATORY

Pre-requisites of course: Basic understanding of Scilab/MATLAB or any equivalent open source software

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Determine the characteristics of control system components like ac servo motor, synchro, potentiometer, servo voltage stabilizer and use them in error detector mode.	**K4**
CO2	Compare the performance of control systems by applying different controllers / compensators.	**K5**
CO3	Analyze the behavior of dc motor in open loop and closed loop conditions at various loads & determine the response of 1^{st}& 2^{nd} order systems for various values of constant K.	**K5**
CO4	Apply different stability methods of time & frequency domain in control systems using software & examine their stability.	**K4**
CO5	Convert the transfer function into state space & vice versa & obtain the time domain response of a second order system for step input and their performance parameters using software.	**K5**

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)

K_1 – Remember K2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Note: Minimum 10 experiments are to be performed from the following list:

1. To determine speed-torque characteristics of an AC servomotor.
2. To study
   i) Synchro Transmitter characteristics.
   ii) Obtain Synchro Transmitter – Receiver output vs input characteristics.
3. To determine response of first order and second order systems for step input for various values of constant 'K' using linear simulator unit and compare theoretical and practical results.
4. To study characteristics of positional error detector by angular displacement of two servo potentiometers.
5. To simulate and compare the response of 2^{nd} order system with and without lead, lag, Lead- Lag compensator / simulate PID controller for transportation lag.
6. To study P, PI and PID temperature controller for an oven and compare their characteristics.
7. To study performance of servo voltage stabilizer at various loads using load bank.
8. To study behavior of separately excited dc motor in open loop and closed loop conditions at various loads.

Software based experiments (Scilab/MATLAB or any equivalent open source software**)**

9. To determine time domain response of a second order system for step input and obtain performance parameters.
10. To convert transfer function of a system into state space form and vice-versa.

11. To plot root locus diagram of an open loop transfer function and determine range of gain ‘k’ for stability.
12. To plot a Bode diagram of an open loop transfer function.
13. To draw a Nyquist plot of an open loop transfers functions and examine the stability of the closed loop system.

Spoken Tutorial (MOOCs):
Spoken Tutorial MOOCs, ' Course on Scilab', IIT Bombay (http://spoken-tutorial.org/)

Reference Books:
1. K.Ogata,“Modern Control Engineering” Prentice Hall of India.
2. Norman S.Nise, “Control System Engineering”, John Wiley & Sons.
3. M.Gopal, “Control Systems: Principles & Design” Tata McGraw Hill.

ELECTRICAL MACHINE-II LABORATORY

Pre-requisites of course: Basic Electrical engineering Lab**,** Electrical Machine-I Lab.

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Perform various tests and demonstrate the various characteristics of three phase induction motor.	**K4**
CO2	Demonstrate the working of three phase synchronous machine under different operating conditions.	**K4**
CO3	Evaluate the performance of single-phase induction motor under different operating conditions.	**K5**
CO4	Develop simulation models for Electrical Machines.	**K6**

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)

K_1 – Remember K2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Note: Minimum 10 experiments are to be performed from the following list:

1. To perform no load and blocked rotor tests on a three phase squirrel cage induction motor and determine equivalent circuit.
2. To perform load test on a three phase induction motor and draw Torque -speed characteristics
3. To perform no load and blocked rotor tests on a single phase induction motor and determine equivalent circuit.
4. To study speed control of three phase induction motor by varying supply voltage and by keeping V/f ratio constant.
5. To perform open circuit and short circuit tests on a three phase alternator.
6. To determine V-curves and inverted V-curves of a three phase synchronous motor.
7. To determine the direct axis reactance (Xd) and quadrature axis reactance (Xq) of synchronous machine.
8. To study synchronization of an alternator with the infinite bus by using: (i) dark lamp method (ii) two bright and one dark lamp method.
9. To determine speed-torque characteristics of three phase slip ring induction motor and study the effect of including resistance, or capacitance in the rotor circuit.
10. To determine speed-torque characteristics of single phase induction motor and study the effect of voltage variation.
11. To determine speed-torque characteristics of a three phase induction motor by (i) keeping v/f ratio constant (ii) increasing frequency at the rated voltage.
12. To draw O.C. and S.C. characteristics of a three phase alternator from the experimental data and determine voltage regulation at full load, and unity, 0.8 lagging and leading power factors.
13. To determine steady state performance of a three phase induction motor using equivalent circuit.
14. Load Test on Three Phase Alternator.

***The available experiments from above list may be performed on virtual lab on following virtual lab link::**

http://vlab.co.in/

SEMESTER VI

POWER SYSTEMS-II

Pre-requisites of course: Basic Electrical Engineering, Networks Analysis and Synthesis, Electromagnetic Field Theory, Power System-I, Electrical Machines-II

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO1	Identify power system components on one line diagram of power system and its representation including the behaviour of the constituent components and sub systems and Analyse a network under both balanced and unbalanced fault conditions and design the rating of circuit breakers.	**K4**
CO2	Perform load flow analysis of an electrical power network and interpret the results of the analysis.	**K4**
CO3	Describe the concept of travelling waves in transmission lines and use the travelling wave theory to determine the over voltage caused by surge propagation in transmission networks.	**K4**
CO4	Assess the steady state and transient stability of the power system under various conditions.	**K4**
CO5	Describe Operating Principle of a relay and classify them according to applications. Explain working principle of Circuit breaker and phenomenon of arc production and quenching.	**K3**

KL- Bloom's Knowledge Level (K1, K2, K3, K4, K5, K6)
K1 – Remember K2 – Understand K3 – Apply K4 – Analyze K5 – Evaluate K6 – Create

Detailed Syllabus:

UNIT-I (Fault Analysis in Power System):
One-line diagram, Impedance and reactance diagram, per unit system changing the base of per unit quantities, advantages of per unit system.

Symmetrical Components: Significance of positive, negative and zero sequence components, Average 3-phase power in terms of symmetrical components, sequence impedances and sequence networks.

Fault Calculations: Fault calculations, sequence network equations, single line to ground fault, line to line fault, double line to ground fault, three phase faults, faults on power systems, and faults with fault impedance, reactors and their location, short circuit capacity of a bus

UNIT-II (Load Flow Analysis):
Introduction, Formation of Z_{BUS} and Y_{BUS}, development of load flow equations, load flow solution using Gauss Siedel and Newton-Raphson method, Comparison of Gauss Siedel and Newton Raphson Method, approximation to N-R method, fast decoupled method.

UNIT-III (Travelling Waves in Power System):
Travelling Waves on Transmission Lines: Production of traveling waves, open circuited line, short circuited line, line terminated through a resistance, line connected to a cable, reflection and refraction at T-junction line terminated through a capacitance, capacitor connection at a T-junction, Attenuation of travelling waves, Bewley's Lattice diagram.

UNIT-IV (Stability in Power System):
Power flow through a transmission line, Stability and Stability limit, Steady state stability study, derivation of Swing equation, transient stability studies by equal area criterion. Factors affecting steady state and transient stability and methods of improvement.

UNIT-V (Introduction to Power System Protection):
Relays: Operating Principle of a general relay,
Basic Terminology: Relay, Energizing Quantity, setting, Pickup, drop out, Flag, fault clearing time, Relay time, Breaker time, Overreach, Underreach; Classification of Relays according to applications, according to time. Overcurrent Relay, Distance Protection, Differential Protection.
Circuit Breakers: Arc Phenomenon, Arc Extinction and its Methods, Restriking Voltage & Recovery Voltage, Circuit Breaker Rating.

Text Books:

1. D.P. Kothari & I.J. Nagrath, "Modern Power System Analysis" Tata Mc Graw Hill, 3rd Edition.
2. P.S.R. Murthy, "Operation and control in Power Systems" B.S. Publications.
3. W. D. Stevenson, "Elements of Power System Analysis", McGraw Hill
4. J. Wood & B.F. Wollenburg, "Power Generation, Operation and Control " John Wiley & Sons.
5. S. S. Rao, "Switchgear and Protection", Khanna Publishers.
6. B. Ravindranath and M. Chander, Power system Protection and Switchgear, Wiley Eastern Ltd.

Reference Books:

1. O.I. Elgerd, "Electric Energy System Theory" Tata McGraw Hill.
2. P. Kundur, "Power System Stability and Control Mc Graw Hill.
3. T. K. Nagsarkar & M.S. Sukhija,' Power System Analysis' Oxford University Press.
4. Hadi Sadat, "Power System Analysis", Tata McGraw Hill.
5. B. Ram and D. N. Vishwakarma, "Power System Protection and Switchgear", Tata Mc. Graw Hill

MICROPROCESSOR AND MICROCONTROLLER

Pre-requisites of course: Digital Electronics, Computer Basics

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Demonstrate the basic architecture of 8085 & 8086 microprocessors	K2
CO2	Illustrate the programming model of microprocessors & write program using 8085 microprocessor	K3
CO3	Interface different external peripheral devices with 8085 microprocessor	K3
CO4	Comprehend the architecture of 8051 microcontroller	K2
CO5	Compare advance level microprocessor & microcontroller for different applications	K4

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Detailed Syllabus:

Unit- I:
Types of Microprocessor Architecture: Harward & Princeton.

Intel 8085 microprocessor: Internal architecture (ALU, System bus, Registers, Timing & control unit, Address/data bus de-multiplexing).

Intel 8086 microprocessor: Internal architecture (Bus Interface Unit, Execution unit, Pipelining, Register organization), Pin Diagram, Memory addressing, Physical memory organization, Interrupts (hardware & software interrupts)

Unit-II:
Fundamental of Programming: Program structure & programming techniques for microprocessors, 8085 Addressing modes, 8085 Instruction set, Assembly language programming of 8085 microprocessor with examples (arithmetic operations on 8-bit numbers – add, subtract, multiply, divide, square & square root etc, largest/ smallest number; ascending/ descending order).

Unit-III:
I/O Interface: 8255 PPI, architecture, various modes of operation & control words, interfacing of 8255 with 8086.
Interfacing with I/O devices: Keyboard, display, stepper motor, D/A & A/D converter
Serial communication standards: Serial data transfer schemes, 8251 USART architecture & interfacing with 8086.

Unit-IV:
Introduction to microcontrollers: 8051 microcontroller - internal architecture, signals, I/O ports, memory organization & interfacing, timing and control, port operations.
Unit-V:
8051 Real Time Control: 8051 timers and counters, interrupts in 8051.
Comparison of Microprocessor, Microcontroller, PIC and ARM processors and their application areas.

Text Books:

1. Gaonkar, Ramesh S, “Microprocessor Architecture, programming and applications with the 8085” Pen ram International Publishing 5th Ed.
2. Avtar Singh & Walter A. Triebel “8088 & 8086 Microprocessor” Pearson Education.
3. Ray, A.K. & Burchandi, K.M., “Advanced Microprocessors and Peripherals: Architecture, Programaming and Interfacing” Tata Mc. Graw Hill.
4. AK Gautam, “Advanced Microprocessors”, Khanna Publishers.
5. 8051 Microcontroller – K. Ayala (Cengage learning)

Reference Books:

1. Brey, Barry B. “INTEL Microprocessors” Prentice Hall (India)
2. Aditya P Mathur, “Introduction to Microprocessor” Tata McGraw Hill
3. M. Rafiquzzaman, “Microprocessors- Theory & applications”, Pearson India.
4. B. Ram, “Advanced Microprocessor & Interfacing” Tata McGraw Hill
5. Liu and Gibson G.A., “Microcomputer Systems: The 8086/8088 Family Architecture Programming & Design” Pearson India.
6. Microprocessors and microcontrollers - N. Senthil Kumar, M. Saravanan and Jeevananthan (Oxford university press)

POWER ELECTRONICS

Pre-requisites of course: Basic Electrical Engineering, Network Analysis & Synthesis

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Demonstrate the characteristics as well as the operation of BJT, MOSFET, IGBT, SCR, TRIAC and GTO and identify their use in the power switching applications.	**K4**
CO2	Comprehend the non-isolated DC-DC converters and apply their use in different Power electronics applications.	**K3**
CO3	Analyze the phase controlled rectifiers and evaluate their performance parameters.	**K5**
CO4	Apprehend the working of single-phase ac voltage controllers, cyclo-converters and their various applications.	**K3**
CO5	Explain the single-phase and three phase bridge inverters differentiate between CSI and VSI and apply PWM for harmonic reduction.	**K4**

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Detailed Syllabus:

Unit-I: Power semiconductor devices:
Introduction: Concept of Power Electronics, scope and applications, desired Characteristics of controllable switches
Power semiconductor switches and their characteristics: Power Diode, Power BJT, Power MOSFET, IGBT, SCR, TRIAC, GTO.

Unit-II:
Thyristor: Rating & protection, Methods of SCR commutation, Gate Drive Circuit, Series and Parallel operation.
DC-DC Converters:Introduction, Control Strategies, Buck converter, Boost Converter, Buck-Boost converter, Analysis of buck converter, Switched Mode power Supply (SMPS).

Unit-III: Phase Controlled Converters:
Single phase half wave controlled rectifier with various loads, Effect of freewheelingdiode, Single phase fully controlled and half controlled bridge converters with various loads. Performance Parameters of single phase uncontrolled and controlled converters, three phase half wave converters, Three phase fully controlled and half controlled bridge converters, Effect of source impedance, Single phase and three phase dual converters

Unit-IV: AC Voltage Controllers:
Principle of On-Off and phase controls, Single phase ac voltage controller with resistive and inductive loads, sequence control, Introduction to Matrix converter.
Cyclo Converters: Basic principle of operation, single phase to single phase, three phase to single phase output voltage equation.

Unit-V: Inverters:

Single phase and Three phase bridge inverters, voltage source inverters, current source inverters, Voltage control of single phase inverters, Pulse width modulation, Introduction to Multi level inverter.

Text Books:

1. M.H. Rashid,"Power Electronics: Circuits, Devices & Applications", Prentice Hall of India
2. Ltd. 3rd Edition,2004.
3. Ned Mohan, T.M.Undeland and W.P.Robbins, "Power Electronics:Converters, Applications
4. and Design", Wiley India Ltd,2008
5. P.C. Sen, "Power Electronics", McGraw Hill Education (India) Pvt. Ltd.
6. P.S. Bhimbra, "Power Electronics", Khanna Publishers.

Reference Books:

1. M.S. Jamil Asghar, "Power Electronics" Prentice Hall of India Ltd., 2004
2. Chakrabarti&Rai, "Fundamentals of Power Electronics &Drives"DhanpatRai& Sons.
3. V.R. Moorthy, "Power Electronics: Devices, Circuits and Industrial Applications" Oxford
4. University Press,2007
5. S.N.Singh, "A Text Book of Power Electronics" DhanpatRai& Sons

POWER SYSTEM LAB-II

Pre-requisites of course: Power System-I Lab

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO1	Test various relays for different characteristics and compare with the performance characteristics provided by manufacturers.	**K4**
CO2	Select the power system data for load-flow and fault studies and to develop a program to solve power flow problem using NR and GS methods	**K6**
CO3	Analyze various types of short circuit faults	**K4**
CO4	Demonstrate different numerical integration methods and factors influencing transient stability	**K3**
CO5	Determine the effect of load in long transmission line	**K3**

Note: - Minimum 10 experiments are to be performed from the following list:

(A) Hardware Based Experiments:

1. To determine fault current for L-G, L-L, L-L-G and L-L-L faults at the terminals of an alternator at very low excitation.
2. To Study the over-current relay and the effect of PSM and TSM.
3. To study percentage differential relay.
4. To study Impedance, MHO and Reactance type distance relays and zones of protection.
5. To study Ferranti effect of a transmission line/cable.
6. To measure the dielectric Strength of transformer oil.
7. To study the Synchronization of alternator with infinite bus bar.
8. To determine positive sequence, negative sequence and zero sequence reactance of an alternator.
9. To Study the effect of different shape of electrodes on dielectric (air) breakdown.
10. To Study the gas actuated Buchholz relay for oil filled transformer.
11. To determine the sub-transient (xd″), transient (xd′) and steady state reactance (xd) of a synchronous machine.

*** The available Experiments from above list may be performed on virtual lab on following virtual lab link:**
http://vlab.co.in/

(B) Simulation Based Experiments (using Scilab/MATLAB or any other equivalent open source software platform)

1. To obtain formation of Y-bus.
2. Perform load flow analysis on a 3- Bus System using G-S Method.
3. Perform load flow analysis on a 3- Bus System using N-R Method.

4. To perform symmetrical fault analysis in a power system.
5. To perform unsymmetrical fault analysis in a power system.
6. Swing Curve by Step-by-Step Method.
7. Determination of the stability of a SMIB system in occurrence of a fault by solving the Swing equation by Euler's Method.

Text Books: -

1. Haadi Sadat, "Power System Analysis" Tata McGraw Hill.
2. T.K. Nagsarskar & M.S. Sukhija, Power System Analysis' Oxford University Press.
3. K. Umarao, "Computer Techniques and Models in Power System", Wiley

MICROPROCESSOR AND MICROCONTROLLER LAB

Pre-requisites of course: Digital Electronics, Computer Basics

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Study of microprocessor system	K2
CO2	Development of flow chart for understanding the data flow	K3
CO3	Learning assembly language to program microprocessor based system	K3
CO4	Interfacing different peripheral devices with the microprocessor	K4
CO5	Building logic for microprocessor based system	K4

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Note: Minimum ten experiments are to be performed from the following list (on 8085 / 8086 microprocessor)

1. To study 8085 / 8086 based microprocessor system
2. To perform mathematical operations (addition & subtraction) on two 8-bit numbers
3. To perform multiplication on two 8-bit numbers
4. To perform division on two 8-bit numbers
5. To develop and run a program for finding out the largest number from given two 8-bit numbers
6. To develop and run a program for finding out the smallest number from given two 8-bit numbers
7. To develop and run a program for arranging in ascending order of a given set of 8-bit numbers
8. To develop and run a program for arranging in descending order of a given set of 8-bit numbers
9. To perform conversion of temperature from degree F to degree C
10. To perform computation of square root of a given number
11. To obtain interfacing of 8255 – PPI with 8085 microprocessor
12. To perform microprocessor based traffic light control
13. To perform microprocessor based stepper motor operation through 8085 / 8086 kit
14. To obtain interfacing of DMA controller with 8085 / 8086 microprocessor

POWER ELECTRONICS LABORATORY

Pre-requisites of course: Basic Electrical Engineering, Network Analysis & Synthesis

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Demonstrate the characteristics and triggering of IGBT, MOSFET, Power transistor and SCR.	**K3**
CO2	Analyze the performance of single phase fully controlled bridge rectifiers under different loading conditions.	**K4**
CO3	Develop simulation models of power electronic circuits.	**K5**

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Note: Minimum 10 experiments are to be performed from the following list:.

1. To study triggering of (i) IGBT (ii) MOSFET (iii) power transistor
2. To study V-I characteristics of SCR and measure latching and holding currents.
3. To compare the R, RC & UJT trigger circuit for SCR.
4. To study the commutation circuit for SCR.
5. To study single phase fully controlled bridge rectifiers with resistiveand inductive loads.
6. To study single phase fully controlled bridge rectifiers with DC motor load.
7. To study three-phase fully controlled bridge rectifier with resistive and inductive loads.
8. To study single-phase ac voltage regulator with resistive and inductive loads.
9. To study single phase cyclo-converter
10. To study the four quadrant operation of chopper circuit
11. To study MOSFET/IGBT based single-phase bridge inverter.

Software based experiments (Scilab/MATLAB or any equivalent open source software)

12. To obtain the simulation of single phase half wave controlled rectifier with R and RL load and plot load voltage and load current waveforms.
13. To obtain simulation of single phase fully controlled bridge rectifier and plot load voltage and load current waveform for inductive load.

14. To obtain simulation of single phase full wave ac voltage controller and draw load voltage andload current waveforms for inductive load.

15. To obtain simulation of step down dc chopper with L-C output filter for inductive load and determine steady-state values of output voltage ripples in output voltage and load current.

Text/Reference Books:

1. M.H.Rashid, “Power Electronics: Circuits, Devices and Applications”, 3rd Edition, prentice Hall of India.

2. D.W. Hart, “Introduction to power Electronics” Prentice hall Inc.

DEPARTMENT ELECTIVE-I

ROBOTICS

Pre-requisites of course: Basic Mathematics.

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO1	Learn the basic terminology used in robotics.	**K2**
CO2	Conceptualize 3-D translation & orientation of robot arm kinematics.	**K3**
CO3	Understand different robotic actuators and power transmission systems.	**K3**
CO4	Classify the types of robotic grippers used in automation industries.	**K2**
CO5	Realization of robotic sensoric system and their interfacing with robot controller.	**K3**

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Detailed Syllabus:

UNIT I: INTRODUCTION

Classifications of robots, Flexible automation vs. Robotic technology, Robot components and degree of freedom, Robot joints, coordinates and reference frames, characteristics of robots, Robot workspace, role of robots in Industry 4.0; Robot safety and social robotics.

UNIT II: KINEMATICS OF ROBOT

Matrix representation of robot kinematics, Transformation of matrix, Forward and Inverse Kinematics of robots, D-H Representation of Six Degree of Freedom Robot Arm.

UNIT III: ROBOT ACTUATORS AND POWER TRANSMISSION SYSTEMS

Characteristics of actuating systems, comparison of hydraulic, pneumatic and electrical actuating system, Mechanical transmission method (concept only) - Gear transmission, Belt drives, cables, Roller chains, Link-Rod systems, Rotary-to-Rotary motion conversion, Rotary-to-Linear motion conversion, Rack and Pinion drives, Lead screws, Ball Bearing screws.

UNIT IV: ROBOT GRIPPERS

Classification of End effectors, Drive system for grippers - Mechanical adhesive vacuum-magnetic-grippers. Hooks & scoops, Active and passive grippers.

UNIT V: ROBOT SENSORS, CONTROL HARDWARE AND INTERFACING

Sensor: Contact & Proximity, Position, Velocity, Force and Tactile, Introduction to Cameras, Vision applications in robotics; integration of robot controller with sensors, actuators & other supporting components.

TEXT BOOKS:

1. Saeed B. Niku, “Introduction to Robotics”, Pearson, 2011.
2. Deb S. R. and Deb S., “Robotics Technology and Flexible Automation”, Tata McGraw Hill Education Pvt. Ltd, 2010.
3. John J.Craig , “Introduction to Robotics”, Pearson, 2009.
4. Mikell P. Groover et. al., "Industrial Robots - Technology, Programming and Applications", McGraw Hill, New York, 2008.

REFERENCES:

1. Richard D Klafter, Thomas A Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Eastern Economy Edition, Prentice Hall of India Pvt. Ltd., 2006.
2. Fu K S, Gonzalez R C, Lee C.S.G, "Robotics : Control, Sensing, Vision and Intelligence", McGraw Hill, 1987
3. Spong & Vidyasagar, Robot Dynamics and Control, Mc Graw Hill
4. Subir K Saha, Robotics, Mc GrawHill
5. M. P. Groover, Ashish Dutta, Industrial Robotics, McGraw Hill

SENSORS AND TRANSDUCERS

Pre-requisites of course: Basic Electrical Engineering, Basic signals & systems

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Understand the working of commonly used sensors in industry for measurement of displacement, force and pressure.	**K3**
CO2	Recognize the working of commonly used sensors in industry for measurement of temperature, position, accelerometer, vibration sensor, flow and level.	**K3**
CO3	Identify the application of machine vision.	**K2**
CO4	Conceptualize signal conditioning and data acquisition methods.	**K2**
CO5	Comprehend smart sensors and their applications in automation systems.	**K4**

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Detailed Syllabus:

Unit- I:

Sensors & Transducer: Definition, Classification of transducers, Advantages and Disadvantages of Electrical Transducers; Measurement of displacement using Potentiometer, LVDT & Optical Encoder; Measurement of force using strain gauges & load cells; Measurement of pressure using LVDT based diaphragm & piezoelectric sensor.

Unit-II:

Measurement of temperature using Thermistors, Thermocouples & RTD, Concept of thermal imaging; Measurement of position using Hall effect sensors; Proximity sensor: Inductive, Capacitive & Photoelectric, Use of proximity sensor as accelerometer and vibration sensor; Flow Sensor: Ultrasonic & Laser; Level Sensor: Ultrasonic & Capacitive.

Unit -III:

Machine Vision: Introduction to machine vision, Difference between machine vision and computer vision; Imaging Sensors: CCD and CMOS; sensing & digitizing function in machine vision, image processing and analysis, training the vision system in a pick and place robot.

Unit-IV:

Signal Conditioning: Introduction, Functions of signal conditioning equipment, need for amplification of signals, Types of amplifiers.

Data Acquisition Systems and Conversion: Introduction, Objectives & configuration of data acquisition system, Analog & Digital IO, Counters, Timers, need of data conversion.

Unit V:

Smart Sensors: General Structure of smart sensors & its components, Characteristic of smart sensors: Self calibration, Self-testing & self-communicating, Application of smart sensors: Smart city, Industrial robots & electric vehicles.

Text Books:

1. DVS Murthy, Transducers and Instrumentation, PHI 2nd Edition 2013
2. D Patranabis, Sensors and Transducers, PHI 2nd Edition 2013.
3. S. Gupta, J.P. Gupta / PC interfacing for Data Acquisition & Process Control, 2nd ED / Instrument Society of America, 1994.

Reference Books:

1. Arun K. Ghosh, Introduction to measurements and Instrumentation, PHI, 4th Edition 2012.
2. A.D. Helfrick and W.D. cooper,Modern Electronic Instrumentation & Measurement Techniques,PHI – 2001
3. Hermann K.P. Neubert, “Instrument Transducers” 2nd Edition 2012, Oxford University Press.

INDUSTRIAL AUTOMATION & CONTROL

Pre-requisites of course: Digital Electronics

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO1	Understand the concept of automation, its terminology and basic communication protocol.	**K2**
CO2	Apply Relay logic for automation.	**K3**
CO3	Learn about PLC, its operation and application in automation.	**K3**
CO4	Analyze the industrial sensors, its terminology and how one can interface with PLC.	**K3**
CO5	Demonstrate Pneumatic system and its application in industry.	**K3**

KL- Bloom's Knowledge Level (K1, K2, K3, K4, K5, K6)
K1 – Remember K2 – Understand K3 – Apply K4 – Analyze K5 – Evaluate K6 – Create

Detailed Syllabus:

Unit1: Introduction of Automation system

Introduction to Industrial Automation, Requirement of automation systems, Application areas, Architecture of Industrial Automation system, Introduction of PLC and supervisory control and data acquisition (SCADA). Industrial communication protocols: modbus & profibus

Unit2: Automation using relay logic

Relay Circuits: Construction & Principle of Operation, Types of Relays, Relay as a memory element, Contactor Circuits, Advantages of Contactors over Relay, DOL circuit implementation using contactor, Automation problems based on relays, PLC Introduction: History & Current Trends, Basic Block Diagram of PLC, Classification of PLCs

Unit3: Automation using PLC

Types of PLC I/O: Analog and Digital, Sink and Source concept, PLC programming: Ladder diagram, Sequential flow chart, ladder programming, Timer instructions – On delay, Off delay, Cyclic and Retentive timers, Up /Down Counters, math instructions

Unit4: Industrial sensors and its application

Introduction to Industrial sensors: optical, inductive, capacitive Sensors, PNP and NPN senor concept, interfacing of sensors with PLC, 4-20 ma current loops, HART protocol, modes of HART protocol

Unit5: Basics of Pneumatics and its use in automation

Introduction to Pneumatics, Role in industries, Laws : Boyel's law, Charle's Law Bernoulli Equation, Humidity(Absolute & Relative) , Dew Point (ADP, PDP) Basic, Pneumatic System (Compressor, After coolers, Dryers, Air Tank, Service Unit (FRL), Actuators(single acting, double acting), Valves : 2/2 & 3/2 Valves ,Problems based on valves and actuator

Text Books:

1. Industrial Instrumentation and Control, by Singh, McGraw Hill.
2. Programmable Logic Controllers with Control Logix, by Jon Stenerson, Delmar Publishers, 2009
3. Webb John W. and Reis A. Ronald, “Programmable Logic Controllers Principles and Applications” PHI ,New Delhi, Latest edition
4. Bolton W, “Programmable Logic Controllers” Elsevier India Pvt. Ltd. New Delhi

Reference Books:

1. B. Pneumatic Systems-Principles and Maintenance Mazumdar S. R
2. John R Hackworth, “Programmable Logic Controllers” Pearson education New Delhi, Latest edition

ELECTRICAL STANDARDS AND ENGINEERING PRACTICES

Pre-requisites of course: Basic Electrical Engineering, Electrical Machines and Power System

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO1	Interpret different National & International Electrical Standards in practice	**K2**
CO2	Understand Indian standards for cables, lighting and motors.	**K3**
CO3	Understand Indian standards of transformers, LV & HV switchgears	**K3**
CO4	Demonstrate the basic guidelines for National codes and design practices	**K3**
CO5	Select the size and type of transformer, cable & switchgear for electrical applications.	**K4**

KL- Bloom's Knowledge Level (K1, K2, K3, K4, K5, K6)
K1 – Remember K2 – Understand K3 – Apply K4 – Analyze K5 – Evaluate K6 – Create

Detailed Syllabus:

Unit-I (Introduction of Standards and Design practices)

Different Electrical standards & codes, overview of Indian Standards and International Standards (IS, IEC, IEEE, NEMA and Building codes etc.).

General engineering design practices, selection of voltage level, role of electrical studies and design calculations (load flow, fault level calculation, earthing and lightning calculation, voltage drop) in distribution system planning. Feasibility study, thermal and electrical resistivity of soil, Study of electrical drawings/layouts and cost estimation.

Unit-II (Electrical Standards-I)

Overview of IS standards for cables (IS-7098 IS-8130, IS-10810, IS-1554, IS-1255), IS standards for lighting (IS-3646, IS-10322, IS-6665) and IS standards for motors (IS-325, IS-900, IS-2253, IS-4029, IS-15999) - basic terminologies, type test and routine tests.

Efficiency class of motors as per IS/IEC standard.

Unit-III (Electrical Standards-II)

Transformer types, overview of IS standards for transformer (IS-2026, IS-6600 IS-10028, IS-11171), IS standards for LV & HV switchgears (IS-8623, IS/IEC-60898, IS/IEC-62271, IS-3427, IS-9920, IS-12729) - basic terminologies, type test and routine tests.

Instrument transformers (CT & PT), Instrument safety factor, VA burden, knee point voltage and accuracy classes.

Unit-IV (National Codes and Design practices)

Overview of National electrical code, National Building Code of India, Cable types, installation practices, de-rating factors and bonding methods, Earthing and lightning protection system, touch and step potentials, Hazardous area classification, electrical equipments for different hazardous zones.

Unit-V (Equipment Sizing & Selection, CEA Regulations)

Load estimation, sizing and selection of transformers, cables and switchgears, CEA Regulations 2010 and amendments, safety and installation guidelines.

Reference Books:

1. Robert Alonzo, “Electrical Codes, Standards, Recommended Practices and Regulations 1st Edition”, Elsevier Inc.
2. Mohamed A El-Sharkawi, “Electric safety: practice and standards”, CRC Press.
3. Central Electricity Authority Regulations and Amendments.

DEPARTMENT ELECTIVE-II

OPTIMIZATION TECHNIQUES

Pre-requisites of course: Basic mathematics

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Understand the importance of optimization techniques in engineering applications	**K2**
CO2	Learn optimization methods for solving linear programming problems	**K3**
CO3	Learn optimization methods for solving nonlinear programming problems	**K3**
CO4	Be aware of the concept of simulation and modern methods of optimization	**K3**
CO5	Apply optimization techniques to electrical engineering problems	**K4**

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Detailed syllabus:

Unit I

Introduction to Optimization: Engineering application of Optimization, Statement of an optimization problem, Optimal problem formulation, Classification of optimization problem, Optimum design concepts: Definition of Global and Local optima using basic calculus concepts; Classical Optimization Techniques: Unconstrained Optimization - Single variable optimization, Constrained multivariable optimization with equality constraints - Lagrange multipliers method, Constrained multivariable optimization with inequality constraints - Kuhn-Tucker conditions.

Unit II

Linear Programming: Standard form of linear programming, Graphical solution, Simplex method, Big-M method, Duality theory, Decomposition principle, Transportation problem using North-West Corner rule and Least cost rule.

Unit III

Non-Linear Programming: Standard form of non-linear programming, One–Dimensional Minimization Methods - Unimodal function, Dichotomous search, interval halving method; Unconstrained Optimization Techniques - Univariate method, Steepest descent method; Constrained Optimization Techniques - Interior Penalty function method, Exterior penalty function method.

Unit IV

Simulation: Definition, types of simulation, General process of simulation, advantages & disadvantages of simulation.

Project Management Techniques: PERT and CPM

Modern methods of Optimization: Genetic algorithm, working principle, fitness function, GA operators – crossover & mutation, comparison of GA with traditional methods.

Unit V

Case study (algorithm only): Economic load scheduling of power plant (without considering losses), maintenance scheduling of machines in manufacturing industry, fuzzy logic based speed control of DC machines.

Text Books:

1. S.S.Rao,"Optimization - Theory and Applications", Wiley-Eastern Limited.
2. D.E. Goldberg,"Genetic Algorithm in Search Optimization and Machine Learning ", Addision-Wesley Publication, 1989
3. Kwang Y. Lee, Mohamed A. El-Sharkawi, “Modern heuristic optimization techniques, Theory and applications to power systems”, Wiley-Interscience

Reference Books:

1. David G. Luenberger,"Introduction of Linear and Non-Linear Programming ", Wesley Publishing Company.
2. Polak,"Computational methods in Optimization ", Academic Press.
3. Pierre D.A., "Optimization Theory with Applications", Wiley Publications.
4. Kalyanmoydeb,"Optimization for Engineering Design: Algorithms and Examples", PHI Publication
5. L.P. Singh,"Advanced Power System Analysis and Dynamics ", Wiley Eastern Limited.
6. Olle I. Elewgerd " Electrical Energy System: An Introduction ", TMH Publication, New Delhi

NEURAL NETWORKS & FUZZY SYSTEMS

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Apply the concepts of feed forward neural networks and their learning techniques.	**K3**
CO2	Comprehend the architecture, develop algorithms and apply the concepts of back propagation networks.	**K5**
CO3	Differentiate between the fuzzy and the crisp sets, apply the concepts of fuzziness and the fuzzy set theory.	**K4**
CO4	Select the membership functions, write rules and develop the fuzzy controller for Industrial applications.	**K5**
CO5	Demonstrate the working of fuzzy neural networks and identify its applications.	**K3**

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Detailed syllabus:

Unit-I: Neural Networks-1(Introduction & Architecture):
Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques; perception and convergence rule, Auto-associative and hetro-associative memory.

Unit-II: Neural Networks-II (Back propogation networks):
Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propogation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting back propagation training, applications.

Unit-III: Fuzzy Logic-I (Introduction):
Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

Unit-IV: Fuzzy Logic –II (Fuzzy Membership, Rules):
Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications & Defuzzificataions, Fuzzy Controller, Industrial applications.

Unit-V: Fuzzy Neural Networks:
L-R Type fuzzy numbers, fuzzy neutron, fuzzy back propogation (BP), architecture, learning in fuzzy BP, inference by fuzzy BP, applications.

Text Books:

1. Kumar Satish, “Neural Networks” Tata Mc Graw Hill
2. S. Rajsekaran & G.A. Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications” Prentice Hall of India.

Reference Books:

1. Siman Haykin, “Neural Netowrks” Prentice Hall of India
2. Timothy J. Ross, “Fuzzy Logic with Engineering Applications” Wiley India

DIGITAL SIGNAL PROCESSING

Pre-requisites of course: Basic Signals & System, Network Analysis & Synthesis.

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Represent discrete sequence and LTI systems, frequency domain of discrete sequence. Compute Fourier transform. Draw structure of systems based on System type-IIR & FIR Systems.	**K2**
CO2	Describe sampling of signal and its reconstruction, processing of continuous time and discrete time signals. Sampling rate variation and application of multirate signal processing. Sampling effect in A/D and D/A conversion.	**K3**
CO3	Evaluate the response of LTI system and rational system function. Drive linear phase systems. Compute discrete Fourier transform (DFT) and calculate linear and circular convolution.	**K5**
CO4	Design IIR & FIR filters with the desired specification with the help of impulse invariant and bilinear transformation method for IIR, with the help of window techniques for FIR. Design Butterworth and Chebyshev filter response.	**K6**
CO5	Compute DFT using efficient algorithm like FFT in decimation in time and decimation in frequency both, using convolution property and Goertzel algorithm. Comparison between wavelet and Fourier transform. Application of WCT & DCT.	**K5**

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Detailed syllabus:

Unit-I:
Discrete-Time Signals and Systems:
Sequences, discrete time systems, LTI systems, frequency domain representation of discrete time signals and systems, discrete time signals and frequency domain representation, Fourier Transform.
Implementation of discrete time systems:
Structure for FIR system, Structure for IIR systems

Unit-II:
Sampling of Continuous Time Signals:
Sampling and reconstruction of signals, frequency domain representation of sampling, discrete time processing of continuous time signals, continuous time processing of discrete time signals, changing the sampling rate using discrete time processing, multi rate signal processing, digital processing of analog signals, over sampling and noise shaping in A/D and D/A conversion.

Unit-III:

Transform Analysis of LTI Systems:

Frequency response of LTI systems, system functions, frequency response for rational system functions, magnitude-phase relationship, all pass systems, minimum phase systems, and linear systems with generalized linear phase

Discrete Fourier Transform:

Discrete Fourier Transform, properties, linear convolution and circular convolution,

Unit-IV:

Filter Design Techniques:

Design of IIR filters using Impulse Invariant Response method and Bilinear Transformation method. Butterworth filters and Chebyshev Filter's response, Design of FIR filters by windowing, Kaiser Window method, optimum approximations of FIR filters,

Unit-V:

Efficient computation of the DFT:

FFT algorithms- decimation in time and decimation in frequency, Goertzel algorithm, Implementation of the DFT using convolution,

Introduction to wavelet transform:

Wavelet comparison with Fourier transforms, Applications of Wavelet cosine transform, Discrete cosine transform (DCT).

Text Books:

1. S. Salivahanan, "Digital Signal Processing", McGraw Hill Education (India) Private Limited.
2. Oppenheim A.V., Schafer, Ronald W. & Buck, John R,"Discrete Time Signal processing", Pearson Education .

Reference Books:

1. Proakis, J.G. &Manolakis, D.G.," Digital Signal Processing: Principles Algorithms and Applications", Prentice Hall of India.
2. Rabiner, L.R. and Gold B., "Theory and applications of DSP", Prentice Hall of India.
3. Oppenheim, Alan V. &Willsky, Alan S. , "Signals and Systems" , Prentice Hall of India, 2nd Edition
4. Johnson, J.R. , "Introduction to Digital Signal Processing", Prentice Hall of India.

ANALOG & DIGITAL COMMUNICATION

Pre-requisites of course: Basic Signals & Systems.

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Understand the Amplitude Modulation in communication system.	**K_2**
CO2	Comprehend the Frequency & Phase modulation.	**K_2**
CO3	Realize the Pulse Modulation Techniques.	**K_2**
CO4	Get the Digital Modulation Techniques and their use in communication system.	**K_2**
CO5	Apply the concept of Information Theory in Communication Engineering.	**K_3**

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Detailed Syllabus:

UNIT I
Elements of communication system and its limitations, Amplitude modulation and detection, Generation and detection of DSB-SC, SSB and vestigial side band modulation, carrier acquisition AM transmitters and receivers, Superhetrodyne Receiver, IF amplifiers, AGC circuits, Frequency Division multiplexing.

Unit II
Angle Modulation: Basic definition, Narrow-Band and wideband frequency modulation, transmission bandwidth of FM signals, Generation and detection of frequency modulation, Generation and detection of Phase Modulation.
Noise: External noise, internal noise, noise calculations, signal to noise ratio.

Unit III
Pulse Modulation: Introduction, sampling process, Analog Pulse Modulation Systems, Pulse Amplitude Modulation (PAM), Pulse width modulation (PWM) and Pulse Position Modulation (PPM).
Waveform coding Techniques: Discretization in time and amplitude, Quantization process, quantization noise, Pulse code Modulation, Differential Pulse code Modulation, Delta Modulation and Adaptive Delta Modulation.

Unit IV
Digital Modulation Techniques: Types of digital modulation, waveforms for amplitude, frequency and phase shift keying, coherent and non-coherent methods for the generation of ASK, FSK and PSK. Comparisons of above digital modulation techniques.

Unit V
Time Division Multiplexing: Fundamentals, Electronic Commutator, Bit/byte interleaving, TI carrier system, synchronization and signaling of TI, TDM and PCM hierarchy, synchronization techniques.
Introduction to Information Theory: Measure of information, Entropy & Information rate, channel capacity, Hartley Shannan law, Huffman coding, shannan Fano coding.

Text Books:

1. Simon Haykin,“ Communication Systems” John Wiley & Sons 4th Edition
2. G.Kennedy and B. Davis,” Electronic Communication Systems” 4th Edition, Tata McGraw Hill
3. Simon Haykin, “Digital Communications” John Wiley & Sons
4. T.L. Singal, “Analog & Digital Communication”, Tata Mc Graw Hill

Reference Books:

1. B.P. Lathi, “Modern Analog & Digital Communication Systems” Oxford University Press.
2. Taub & Schilling, “Communication System: Analog and Digital” Tata Mc Graw Hill
3. R.P. Singh & S.D. Sapre, “Communication Systems Analog and Digital” Tata McGraw Hill.

DEPARTMENT ELECTIVE-III

SPECIAL ELECTRICAL MACHINES

Pre-requisites of course: Electrical Machines-I & Electrical Machines-II.

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Describe the working principle, Constructional Features of different types of electrical machines including the fractional kilowatt machines.	**K2**
CO2	Analyse torque- speed characteristics of different electrical machines and interpret their performance and identify the suitable machine for an operation.	**K4**
CO3	Study different types of control techniques for a machine and identify the best control strategy based upon different constraints.	**K4**
CO4	Illustrate the use of stepper, BLDCs, SRM, and other special machines in the area of the various industrial and domestic as well as commercial applications of various fractional kilowatt machines.	**K3**

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Detailed Syllabus:

Unit-I: Induction Machines: Concept of constant torque and constant power controls, SEIG, DFIG: Operating Principle, Equivalent Circuit, Characteristics, Applications, Linear Induction Motors. Construction, principle of operation, Linear force, and applications.

Two Phase AC Servomotors: Construction, torque-speed characteristics, performance and applications.

Unit-II: Stepper Motors: Constructional features, Principle of operation, Variable reluctance motor, Hybrid motor, Single and multistack configurations, Torque equations, Characteristics, Drive circuits, Microprocessor control of stepper motors, Closed loop control, Applications.

Unit-III: Switched Reluctance Motors: Constructional features, Rotary and Linear SRM, Principle of operation, Torque production, performance characteristics, Methods of Rotor position sensing, Sensor less operation, Closed loop control and Applications

UNIT-IV Permanent Magnet Machines: Permanent Magnet synchronous generator Operating Principle, Equivalent Circuit, Characteristics, Permanent magnet DC motors, sinusoidal PMAC motors, their important features and applications, PCB motors,

Permanent Magnet Brushless D.C. Motors: Principle of operation, Types, Magnetic circuit analysis, EMF and torque equations, Commutation, Motor characteristics and control, Applications.

UNIT-V: Single phase synchronous motor; construction, operating principle and characteristics of reluctance and hysteresis motors;

Single Phase Commutator Motors: Construction, principle of operation, characteristics of universal and repulsion motors;

TEXT BOOKS:

1. K.Venkataratnam, ‘Special Electrical Machines’, Universities Press (India) Private Limited, 2008.
2. T.J.E Miller, ‘Brushless Permanent Magnet and Reluctance Motor Drives’, Clarendon Press, Oxford, 1989.
3. P.S. Bimbhra "Generalized Theory of Electrical Machines" Khanna Publishers.

Reference Books:

1. T. Kenjo, ‘Stepping Motors and Their Microprocessor Controls’, Clarendon Press London, 1984.
2. M.G. Say "Alternating current Machines" Pitman & Sons.

ELECTRICAL MACHINE DESIGN

Pre-requisites of course: Electrical Machine-I & Electrical Machine-II.

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Classify insulating materials for electrical machines and calculate mmf and magnetizing current.	**K5**
CO2	Design the core, yoke, windings and the cooling system of a transformer.	**K6**
CO3	Illustrate the core and armature design of DC and 3-phase synchronous machine. Design design of three phase induction motors, field system of DC machine and synchronous machines.	**K6**
CO4	Analyse computer aided design approaches and apply the concepts of of optimization for the design of transformer, dc machine, three phase induction and synchronous machines.	**K6**

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Detailed syllabus:

UNIT-I

Basic Considerations: Basic concept of design, limitation in design, standardization, modern trends in design and manufacturing techniques, Classification of insulating materials. Calculation of total mmf and magnetizing current.

UNIT-II

Transformer Design: Output equation, design of core, yoke and windings, overall dimensions,
Computation of no load current to voltage regulation, efficiency and cooling system designs.

UNIT-III:

Design of rotating machines - I: Output equations of rotating machines, specific electric and magnetic loadings, factors affecting size of rotating machines, separation of main dimensions, election of frame size, Core and armature design of dc and 3-phase ac machines

Unit-IV:

Design of rotating machines - II: Rotor design of three phase induction motors, Design of field system of DC machine and synchronous machines. Estimation of performance from design data.

Unit-V:

Computer Aided Design: Philosophy of computer aided design, advantages and limitations.

Computer aided design approaches analysis, synthesis and hybrid methods. Concept of optimization and its general procedure. Flow charts and 'c' based computer programs for the design of transformer, dc machine, three phase induction and synchronous machines

Text Books:

1. K. Sawhney, "A Course in Electrical Machine Design" Dhanpat Rai & Sons.
2. K.G. Upadhyay, " Conventional and Computer Aided Design of Electrical Machines" Galgotia Publications.

Reference Books:

3. M.G. Say, "The Performance and Design of AC Machines" Pitman & Sons.
4. A.E. Clayton and N.N. Hancock, "The Performance and Design of D.C.Machines" Pitman & Sons.
5. S.K. Sen, "Principle of Electrical Machine Design with Computer Programming" Oxford and IBM Publications.

DIGITAL CONTROL SYSTEM

Pre-requisites of course: Control System

Course Outcome		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Represent discrete time systems under the form of z-domain transfer functions and state-space models.	**K3**
CO 2	Obtain the model of discrete-time systems by pulse transfer function.	**K4**
CO 3	Analyze stability, transient response and steady state behaviour of linear discrete-time systems, analytically and numerically using tools such as MATLAB and Simulink	**K4**
CO 4	Design sampled data control systems.	**K5**
CO 5	Describe Discrete state space model and test controllability and observability of systems.	**K5**

KL- Bloom's Knowledge Level (K1, K2, K3, K4, K5, K6)
K1 – Remember K2 – Understand K3 – Apply K4 – Analyze K5 – Evaluate K6 – Create

Detailed syllabus:

Unit 1: Introduction to digital control
Introduction, Discrete time system representation, Mathematical modelling of sampling process, Data reconstruction.

Unit 2: Modelling discrete-time systems by pulse transfer function
Revisiting Z-transform, Mapping of s-plane to z-plane, Pulse transfer function, Pulse transfer function of closed loop system, Sampled signal flow graph.

Unit 3: Stability analysis of discrete time systems
Jury stability test, Stability analysis using bi-linear transformation. Time response of discrete systems: Transient and steady state responses, Time response parameters of a prototype second order system.

Unit 4: Design of sampled data control systems:

Root locus method, Controller design using root locus, Root locus-based controller design using MATLAB, Nyquist stability criteria, bode plot, Lead compensator design using Bode plot, Lag compensator design using Bode plot, Lag-lead compensator design in frequency domain.

Unit 5: Discrete state space model

Introduction to state variable model, Various canonical forms, Characteristic equation, state transition matrix, Solution to discrete state equation. Controllability, observability and stability of discrete state space models: Controllability and observability, Stability, Lyapunov stability theorem.

References:

1. B. C.Kuo, Digital Control Systems, Oxford University Press, 2/e, Indian Edition, 2007.
2. K. Ogata, Discrete Time Control Systems,Prentice Hall, 2/e, 1995.
3. M. Gopal, Digital Control and State Variable Methods, Tata Mcgraw Hill, 2/e, 2003.
4. G. F. Franklin, J. D.Powell and M. L. Workman, Digital Control of Dynamic Systems, Addison Wesley, 1998, Pearson Education,Asia, 3/e, 2000.
5. K. J.Astroms and B. Wittenmark, Computer Controlled Systems - Theory and Design,Prentice Hall, 3/e, 1997.

ELECTRIC AND HYBRID VEHICLES

Pre-requisites of course: Electrical Machines, Power Electronics

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO1	Choose a suitable drive scheme for developing an electric hybrid vehicle depending on resources	**K3**
CO2	Design and develop basic schemes of electric vehicles and hybrid electric vehicles.	**K6**
CO3	Choose proper energy storage systems for vehicle applications	**K5**
CO4	Identify various communication protocols and technologies used in vehicle networks.	**K4**

KL- Bloom's Knowledge Level (K1, K2, K3, K4, K5, K6)
K1 – Remember K2 – Understand K3 – Apply K4 – Analyze K5 – Evaluate K6 – Create

Detailed Syllabus:

Unit1:

Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles.

Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance.

Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

Unit2: Electric Propulsion unit:

Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

Unit3: Energy Storage:

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

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Unit4: Sizing the drive system:

Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems

Unit5: Energy Management Strategies:

Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

Text Books:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003

Reference Books:

1. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003
2. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004

B.Tech.
V & VI Semester

1	KNC501/ KNC601	CONSTITUTION OF INDIA, LAW AND ENGINEERING

CONSTITUTION OF INDIA, LAW AND ENGINEERING

L:T: P: 2: 0:0

Module 1--Introduction and Basic Information about Indian Constitution:

Meaning of the constitution law and constitutionalism, Historical Background of the Constituent Assembly, Government of India Act of 1935 and Indian Independence Act of 1947,Enforcement of the Constitution, Indian Constitution and its Salient Features, The Preamble of the Constitution, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Parliamentary System, Federal System, Centre-State Relations, Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India, Emergency Provisions: National Emergency, President Rule, Financial Emergency, and Local Self Government – Constitutional Scheme in India.

Module 2-Union Executive and State Executive:

Powers of Indian Parliament Functions of Rajya Sabha, Functions of Lok Sabha, Powers and Functions of the President, Comparison of powers of Indian President with the United States, Powers and Functions of the Prime Minister, Judiciary – The Independence of the Supreme Court, Appointment of Judges, Judicial Review, Public Interest Litigation, Judicial Activism, LokPal, Lok Ayukta, The Lokpal and Lok ayuktas Act 2013, State Executives – Powers and Functions of the Governor, Powers and Functions of the Chief Minister, Functions of State Cabinet, Functions of State Legislature, Functions of High Court and Subordinate Courts.

Module 3- Introduction and Basic Information about Legal System:

The Legal System: Sources of Law and the Court Structure: Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law, Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court). Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration. Contract law, Tort, Law at workplace.

Module 4- Intellectual Property Laws and Regulation to Information:

Intellectual Property Laws: Introduction, Legal Aspects of Patents, Filing of Patent Applications, Rights from Patents, Infringement of Patents, Copyright and its Ownership, Infringement of Copyright, Civil Remedies for Infringement, Regulation to Information-Introduction, Right to Information Act, 2005, Information Technology Act, 2000, Electronic Governance, Secure Electronic Records and Digital Signatures, Digital Signature Certificates, Cyber Regulations Appellate Tribunal, Offences, Limitations of the Information Technology Act.

Module 5 -Business Organizations and E-Governance:

Sole Traders, Partnerships: Companies: The Company's Act: Introduction, Formation of a Company, Memorandum of Association, Articles of Association, Prospectus, Shares, Directors, General Meetings and Proceedings, Auditor, Winding up.

E-Governance and role of engineers in E-Governance, Need for reformed engineering serving at the Union and State level, Role of I.T. professionals in Judiciary, Problem of Alienation and Secessionism in few states creating hurdles in Industrial development.

COURSE OBJECTIVE:

- To acquaint the students with legacies of constitutional development in India and help those to understand the most diversified legal document of India and philosophy behind it.
- To make students aware of the theoretical and functional aspects of the Indian Parliamentary System.
- To channelize students' thinking towards basic understanding of the legal concepts and its implications for engineers.
- To acquaint students with latest intellectual property rights and innovation environment with related regulatory framework.
- To make students learn about role of engineering in business organizations and e-governance.

COURSE OUTCOME: At the end of the course, learners should be able to-

1. Identify and explore the basic features and modalities about Indian constitution.
2. Differentiate and relate the functioning of Indian parliamentary system at the center and state level.
3. Differentiate different aspects of Indian Legal System and its related bodies.
4. Discover and apply different laws and regulations related to engineering practices.
5. Correlate role of engineers with different organizations and governance models

Pedagogy: Lecture, Problem based learning, Group discussions, Visual media, Films, Documentaries, Debate forums.

Suggested Readings:

- Brij Kishore Sharma: *Introduction to the Indian Constitution*, 8th Edition, PHI Learning Pvt. Ltd.
- Granville Austin: *The Indian Constitution: Cornerstone of a Nation (Classic Reissue)*, Oxford University Press.
- Subhash C. Kashyap: *Our Constitution: An Introduction to India's Constitution and constitutional Law*, NBT, 2018.
- Madhav Khosla: *The Indian Constitution*, Oxford University Press.
- PM Bakshi: *The Constitution of India*, Latest Edition, Universal Law Publishing.
- V.K. Ahuja: *Law Relating to Intellectual Property Rights* (2007)
- Suresh T. Viswanathan: *The Indian Cyber Laws, Bharat Law House*, New Delhi-88
- P. Narayan: Intellectual Property Law, Eastern Law House, New Delhi
- Prabudh Ganguli: *Gearing up for Patents: The Indian Scenario*, Orient Longman.
- BL Wadehra: Patents, Trademarks, *Designs and Geological Indications Universal Law* Publishing - LexisNexis.
- *Intellectual Property Rights: Law and Practice, Module III* by ICSI (only relevant sections)
- Executive programme study material Company Law, Module II, by ICSI (The Institute of Companies Secretaries of India) (Only relevant sections i.e., Study 1, 4 and 36).https://www.icsi.edu/media/webmodules/publications/Company%20Law.pdf
- Handbook on e-Governance Project Lifecycle, Department of Electronics & Information Technology, Government of India, https://www.meity.gov.in/writereaddata/files/e-Governance_Project_Lifecycle_Participant_Handbook-5Day_CourseV1_20412.pdf
- Companies Act, 2013 Key highlights and analysis by PWC. https://www.pwc.in/assets/pdfs/publications/2013/companies-act-2013-key-highlights-and-analysis.pdf

Referred Case Studies:

- Keshavanand Bharati V. State of Kerala, AIR 1973 SC 1461.
- Maneka Gandhi V. Union of India AIR, 1978 SC 597.
- S.R. Bammai V. Union of India, AIR 1994 SC 1918.
- Kuldip Nayyar V. Union of India, AIR 2006 SC312.
- A.D.M. Jabalpur V. ShivkantShakla, AIR 1976 SC1207.
- Remshwar Prasad V. Union of India, AIR 2006 SC980.
- Keshav Singh in re, AIR 1965 SC 745.
- Union of India V. Talsiram, AIR 1985 SC 1416.
- Atiabari Tea Estate Co.V. State of Assam, AIR 1961SC232.
- SBP & Co. Vs. Patel Engg. Ltd. 2005 (8) SCC 618.
- Krishna Bhagya Jala Nigam Ltd. Vs. G. Arischandra Reddy (2007) 2 SCC 720.
- Oil & Natural Gas Corporation Vs. Saw Pipes Ltd. 2003 (4) SCALE 92 – 185.

**** (Other relevant case studies can be consulted by the teacher as per the topic).**

Prescribed Legislations:

1. Information Technology Act, 2000 with latest amendments.
2. RTI Act 2005 with latest amendments.
3. Information Technology Rules, 2000
4. Cyber Regulation Appellate Tribunal Rules, 2000

Suggested aid for Students and Pedagogic purpose

- RSTV debates on corporate law, IPR and patent issues
- NPTEL lectures on IPR and patent rights

Episodes of 10 -part mini TV series "Samvidhan: The Making of Constitution of India" by RSTV.

B.Tech.
V & VI Semester

2	KNC502/ KNC602	INDIAN TRADITION, CULTURE AND SOCIETY

INDIAN TRADITIONS, CULTURAL AND SOCIETY

L: T:P: 2: 0:0

Module 1- Society State and Polity in India

State in Ancient India: Evolutionary Theory, Force Theory, Mystical Theory Contract Theory, Stages of State Formation in Ancient India, Kingship , Council of Ministers Administration Political Ideals in Ancient India Conditions' of the Welfare of Societies, The Seven Limbs of the State, Society in Ancient India, Purusārtha, Varnāshrama System, Āshrama or the Stages of Life, Marriage, Understanding Gender as a social category, The representation of Women in Historical traditions, Challenges faced by Women. Four-class Classification, Slavery.

Module 2- Indian Literature, Culture, Tradition, and Practices

Evolution of script and languages in India: Harappan Script and Brahmi Script. The Vedas, the Upanishads, the Ramayana and the Mahabharata, Puranas, Buddhist And Jain Literature in Pali,Prakrit And Sanskrit, Kautilya's Arthashastra, Famous Sanskrit Authors, Telugu Literature, Kannada Literature,Malayalam Literature ,Sangama Literature Northern Indian Languages & Literature, Persian And Urdu ,Hindi Literature

Module 3- Indian Religion, Philosophy, and Practices

Pre-Vedic and Vedic Religion, Buddhism, Jainism, Six System Indian Philosophy, Shankaracharya, Various Philosophical Doctrines , Other Heterodox Sects, Bhakti Movement, Sufi movement, Socio religious reform movement of 19th century, Modern religious practices.

Module 4-Science, Management and Indian Knowledge System

Astronomy in India, Chemistry in India, Mathematics in India, Physics in India, Agriculture in India, Medicine in India ,Metallurgy in India, Geography, Biology, Harappan Technologies, Water Management in India, Textile Technology in India ,Writing Technology in India Pyrotechnics in India Trade in Ancient India/,India's Dominance up to Pre-colonial Times

Module 5- Cultural Heritage and Performing Arts

Indian Architect, Engineering and Architecture in Ancient India, Sculptures, Seals, coins, Pottery, Puppetry, Dance, Music, Theatre, drama, Painting, Martial Arts Traditions, Fairs and Festivals, Current developments in Arts and Cultural, Indian's Cultural Contribution to the World. Indian Cinema

COURSE OBJECTIVES:

- The course aims at imparting basic principles of thought process, reasoning and inference to identify the roots and details of some of the contemporary issues faced by our nation and try to locate possible solutions to these challenges by digging deep into our past.
- To enable the students to understand the importance of our surroundings and encourage the students to contribute towards sustainable development.
- To sensitize students towards issues related to 'Indian' culture, tradition and its composite character.

- To make students aware of holistic life styles of Yogic-science and wisdom capsules in Sanskrit literature that are important in modern society with rapid technological advancements and societal disruptions.
- To acquaint students with Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system.

COURSE OUTCOMES: Ability to understand, connect up and explain basics of Indian Traditional knowledge modern scientific perspective.

Suggested Pedagogy for Teachers

- Project based learning
- Case studies
- Group discussion
- Presentations

Suggested Text & Reference Books

1. V. Sivaramakrishna (Ed.), *Cultural Heritage of India-Course Material*, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2. S. Baliyan, *Indian Art and Culture*, Oxford University Press, India
3. Swami Jitatmanand, *Modern Physics and Vedant*, Bharatiya Vidya Bhavan
4. Romila Thapar, *Readings In Early Indian History* Oxford University Press , India
5. Fritz of Capra, Tao of Physics
6. Fritz of Capra, The wave of Life
7. V N Jha (English Translation), *Tarkasangraha of Annam Bhatta,* Inernational Chinmay Foundation,Velliarnad,Amaku,am
8. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta
9. GN Jha (Eng. Trans.) Ed. R N Jha, *Yoga-darshanam with Vyasa Bhashya*, Vidyanidhi Prakasham, Delhi,2016
10. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016
11. P R Sharma (English translation), Shodashang Hridayam
12. Basham, A.L., *The Wonder that was India* (34th impression), New Delhi, Rupa & co
13. Sharma, R.S., *Aspects of Political Ideas and Institutions in Ancient India*(fourth edition), Delhi, Motilal Banarsidass,

B.Tech. VI Semester

OPEN ELECTIVE-I

KOE-061	REAL TIME SYSTEMS
KOE-062	EMBEDDED SYSTEM
KOE-063	INTRODUCTION TO MEMS
KOE-064	OBJECT ORIENTED PROGRAMMING
KOE-065	NUMERICAL TECHNIQUES
KOE066	GIS & REMOTE SENSING
KOE-067	UNDERSTANDING THE HUMAN BEING COMPREHENSIVELY-HUMAN ASPIRATIONS AND ITS FULFILLMENT

KOE-061 REAL TIME SYSTEMS

Unit	Topics	Lectures
I	**Introduction** Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Dead-lines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.	8
II	**Real Time Scheduling** Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Rate Monotonic Algorithm, Offline Versus Online Scheduling, Scheduling Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems.	8
III	**Resources Sharing** Effect of Resource Contention and Resource Access Control (RAC), Non-preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority- Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Preemption Ceiling Protocol, Access Control in Multiple-Module Resources, Controlling Concurrent Accesses to Data Objects.	8
IV	**Real Time Communication** Basic Concepts in Real time Communication, Soft and Hard RT Communication systems, Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols.	
V	**Real Time Operating Systems and Databases** Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Characteristic of Temporal data, Temporal Consistency, Con-currency Control, Overview of Commercial Real Time databases.	8

Text Books:

1. Real Time Systems – Jane W. S. Liu, Pearson Education Publication.

Reference Books:

1. Real Time Systems – Mall Rajib, Pearson Education
2. Real-Time Systems: Scheduling, Analysis, and Verification – Albert M. K. Cheng, Wiley.

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Describe concepts of Real-Time systems and modeling.
2. Recognize the characteristics of a real-time system in context with real time scheduling.
3. Classify various resource sharing mechanisms and their related protocols.
4. Interpret the basics of real time communication by the knowledge of real time models and protocols.
5. Apply the basics of RTOS in interpretation of real time systems.

KOE-062 EMBEDDED SYSTEM

COURSE OBJECTIVE: *After completion of the course student will be able to:*

1. Attain the knowledge of embedded system and its development environment.
2. Gain the knowledge of RTOS based embedded system design and its applications.

COURSE OUTCOME: *After completion of the course student will be able to:*

CO1: Understand the basics of embedded system and its structural units.
CO3: Analyze the embedded system specification and develop software programs.
CO3: Evaluate the requirements of the programming embedded systems, related software architecture.
CO3: Understand the RTOS based embedded system design.
CO3: Understand all the applications of the embedded system and designing issues.

KOE-062 EMBEDDED SYSTEM		
Unit	**Topic**	**Lectures**
1	Introduction to Embedded Systems: Introduction to Embedded Systems – The build process for embedded systems- Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.	**8**
2	Embedded Networking: Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols – RS232 standard – RS422 – RS485 – CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) –need for device drivers.	**8**
3	Embedded Firmware Development Environment: Embedded Product Development Life Cycle objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model.	**8**
4	RTOS Based Embedded System Design: Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non preemptive scheduling, Task communication shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of Real time Operating systems: Vx Works, чC/OS-II, RT Linux.	**8**
5	Embedded System Application Development: Design issues and techniques Case Study of Washing Machine- Automotive Application- Smart card System Application.	**8**

Text Books:

1. Wayne Wolf, "Computers as Components: Principles of Embedded Computer System Design", Elsevier, 2006.
2. Michael J. Pont, "Embedded C", Pearson Education , 2007.
3. Steve Heath, "Embedded System Design", Elsevier, 2005.
4. Muhammed Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, "The 8051
5. Microcontroller and Embedded Systems", Pearson Education, Second edition, 2007.

KOE-063 INTRODUCTION TO MEMS

COURSE OBJECTIVE: *After completion of the course student will be able to:*

1. Understand the Basic concept of MEMS, Mechanics of Beam and Diaphragm Structures, Air Damping and Electrostatic Actuation.
2. Know the knowledge of Thermal Effects and the Applications of MEMS in RF.

COURSE OUTCOME: *After completion of the course student will be able to:*

CO1: Understand the Basic concept of MEMS Fabrication Technologies, Piezoresistance Effect, Piezoelectricity, Piezoresistive Sensor.
CO2: Explain Mechanics of Beam and Diaphragm Structures.
CO3: Understand the Basic concept of Air Damping and Basic Equations for Slide-film Air Damping, Couette-flow Model, Stokes-flow Model.
CO4: Know the concept of Electrostatic Actuation.
CO5: Understand the applications of MEMS in RF

KOE-063 INTRODUCTION TO MEMS		
Unit	**Topic**	**Lectures**
1	**Introduction to MEMS:** MEMS Fabrication Technologies, Materials and Substrates for MEMS, Processes for Micromachining, Characteristics, Sensors/Transducers, Piezoresistance Effect, Piezoelectricity, Piezoresistive Sensor.	**8**
2	**Mechanics of Beam and Diaphragm Structures:** Stress and Strain, Hooke's Law. Stress and Strain of Beam Structures: Stress, Strain in a Bent Beam, Bending Moment and the Moment of Inertia, Displacement of Beam Structures Under Weight, Bending of Cantilever Beam Under Weight.	**8**
3	**Air Damping:** Drag Effect of a Fluid: Viscosity of a Fluid, Viscous Flow of a Fluid, Drag Force Damping, The Effects of Air Damping on Micro-Dynamics. Squeeze-film Air Damping: Reynolds' Equations for Squeeze-film Air Damping, Damping of Perforated Thick Plates. Slide-film Air Damping: Basic Equations for Slide-film Air Damping, Couette-flow Model, Stokes-flow Model.	**8**
4	**Electrostatic Actuation:** Electrostatic Forces, Normal Force, Tangential Force, Fringe Effects, Electrostatic Driving of Mechanical Actuators: Parallel-plate Actuator, Capacitive sensors. Step and Alternative Voltage Driving: Step Voltage Driving, Negative Spring Effect and Vibration Frequency.	**8**
5	**Thermal Effects:** Temperature coefficient of resistance, Thermo-electricity, Thermocouples, Thermal and temperature sensors. **Applications of MEMS in RF** MEMS Resonator Design Considerations, One-Port Micromechanical Resonator Modeling Vertical Displacement Two-Port Microresonator Modeling, Micromechanical Resonator Limitations.	**8**

Text & Reference Books:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalakrishnan, K. N. Bhat and V. K. Atre, "Micro and smart systems", Wiley India, 2010.
2. S.M. Sze, "Semiconductor Sensors", John Wiley & Sons Inc., Wiley Interscience Pub.
3. M.J. Usher, "Sensors and Transducers", McMillian Hampshire.
4. RS Muller, Howe, Senturia and Smith, "Micro sensors", IEEE Press.

KOE-064 OBJECT ORIENTED PROGRAMMING

COURSE OBJECTIVE: After completion of the course student will be able to:

1. Understand the Basic concept of Object Orientation, object identity and Encapsulation.
2. Know the knowledge of Basic Structural Modeling, Object Oriented Analysis and C++ Basics.

COURSE OUTCOME: After completion of the course student will be able to:

CO1: Understand the Basic concept of Object Orientation, object identity and Encapsulation.
CO2: Understand the Basic concept of Basic Structural Modeling.
CO3: Know the knowledge of Object oriented design, Object design.
CO4: Know the knowledge of C++ Basics.
CO5: Understand the Basics of object and class in C++.

KOE-064 OBJECT ORIENTED PROGRAMMING		
Unit	**Topic**	**Lectures**
1	Introduction: The meaning of Object Orientation, object identity, Encapsulation, information hiding, polymorphism, generosity, importance of modelling, principles of modelling, object oriented modelling, Introduction to UML, conceptual model of the UML, Architecture.	**8**
2	Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams. Class &Object Diagrams: Terms, concepts, modelling techniques for Class & Object Diagrams. Collaboration Diagrams: Terms, Concepts, depicting a message, polymorphism in collaboration Diagrams, iterated messages, use of self in messages. Sequence Diagrams: Terms, concepts, depicting asynchronous messages with/without priority, call-back mechanism, broadcast messages. Basic Behavioural Modeling: Use cases, Use case Diagrams, Activity Diagrams, State Machine , Process and thread, Event and signals, Time diagram, interaction diagram, Package diagram. Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams	**8**
3	Object Oriented Analysis: Object oriented design, Object design, Combining three models, Designing algorithms, design optimization, Implementation of control, Adjustment of inheritance, Object representation, Physical packaging, Documenting design considerations. Structured analysis and structured design (SA/SD), Jackson Structured Development (JSD).Mapping object oriented concepts using non-object oriented language, Translating classes into data structures, Passing arguments to methods, Implementing inheritance, associations encapsulation. Object oriented programming style: reusability, extensibility, robustness, programming in the large. Procedural v/s OOP, Object oriented language features. Abstraction and Encapsulation.	**8**
4	C++ Basics : Overview, Program structure, namespace, identifiers, variables, constants, enum, operators, typecasting, control structures C++ Functions : Simple functions, Call and Return by reference, Inline functions, Macro Vs. Inline functions, Overloading of functions, default arguments, friend functions, virtual functions	**8**
5	Objects and Classes : Basics of object and class in C++, Private and public members, static data and function members, constructors and their types, destructors, operator overloading, type conversion. Inheritance : Concept of Inheritance, types of inheritance: single, multiple, multilevel, hierarchical, hybrid, protected members, overriding, virtual base class Polymorphism : Pointers in C++, Pointes and Objects, this pointer, virtual and pure virtual functions, Implementing polymorphism	**8**

Text Books:

1. James Rumbaugh et. al, “Object Oriented Modeling and Design”, PHI
2. Grady Booch, James Rumbaugh, Ivar Jacobson, “The Unified Modeling Language User Guide”, Pearson Education
3. Object Oriented Programming with C++, E Balagurusamy, TMH

Reference Books:

1. R. S. Salaria, Mastering Object Oriented Programming with C++, Khanna Publishing House
2. C++ Programming, Black Book, Steven Holzner, dreamtech
3. Object Oriented Programming in Turbo C++, Robert Lafore, Galgotia
4. Object Oriented Programming with ANSI and Turbo C++, Ashok Kamthane, Pearson
5. The Compete Reference C++, Herbert Schlitz, TMH
6. C++ and Object Oriented Programming Paradigm, PHI
7. C++ : How to Program, 9th Edition, Deitel and Deitel, PHI

KOE 065 NUMERICAL TECHNIQUES

COURSE OBJECTIVE: Students undergoing this course are expected to-

1. Understand about the basics of numerical techniques and its applications to Engineering Problems.

COURSE OUTCOME: After completion of the course student will be able to-

CO1: Understand about the basics of Ordinary Differential Equations, Separable equations, Equations made separable by change of variables.
CO2: Retrieve the information content of Power series method.
CO3: Apply problem specific Bessel's equation, Bessel Functions to engineering applications.
CO4: Understand about the basics of matrix, Eigen values and eigen vectors.
CO5: Analysis of Stage wise Processes by the Calculus of Finite Differences, Countercurrent Liquid- Liquid Extraction.

KOE 065 NUMERICAL TECHNIQUES		
Unit	**Topic**	**Lectures**
1	Ordinary Differential Equations, Separable equations, Equations made separable by change of variables, Homogeneous Equations, Equations with first order and first degree with linear coefficients, Exact equations, Linear equation of first order, Bernoulli's equation, Other integrating factors, Integration of Exact equations, Equations of first order and higher degree, Clairaut's equation, Singular solutions, Equations with missing terms, General properties of Linear equations, Linear equations with constant coefficients, Determination of the complementary function, exponential functions, Determination of the particular integral, the Euler equation, Simultaneous Linear Differential equations.	**8**
2	Power series method, theory of the power series method, Legendre's equation, Legendre's Polynomials, Frobenius Method.	**8**
3	Bessel's equation, Bessel Functions Jv(x), Bessel Functions Jv(x) for any $v \geq 0$. Gamma Function, Solution J-v(x) of the Bessel Equation, Backbones of Bessel's Theory, Jv(x) with $v = \pm 1/2, \pm 3/2, \pm 5/2$.	**8**
4	Definition of matrix, Some special definitions and operations involving matrices, Determinants, Theorems on determinants, Inverse of a matrix, Orthogonal and unitary matrix. Orthogonal vectors, System of linear equations, Systems on n equations with n unknowns, Cramer's Rule, Eigen values and eigen vectors.	**8**
5	Analysis of Stage wise Processes by the Calculus of Finite Differences, Countercurrent Liquid- Liquid Extraction, Solution of Difference Equations, Stirred-Tank Reactor System, Distillation in a Plate Column, Unsteady-state Operation, Starting a Stirred-tank Reactor, Rate at which a Plate Absorber Approaches Steady State.	**8**

Text & Reference books:

1. Mickley, Reid and Sherwood, "Applied Mathematics in Chemical Engineering", Tata McGraw Hill, New Delhi (1981).
2. E. Kreyszig, "Advanced Engineering Mathematics", 8th edition, John Wiley and Sons (1999).
3. M. R. Spiegel, "Advanced Mathematics for Engineers and Scientists", Schaum Outline Series, McGraw Hill, (1971).
4. Chandrika Prasad, Reena Garg, "Advanced Engineering Mathematics", Khanna Publishing house

KOE 066 GIS & REMOTE SENSING

COURSE OBJECTIVE: *Students undergoing this course are expected to-*

1. Understand about the principles of GIS, Remote Sensing, Spatial Systems, and its applications to Engineering Problems.

COURSE OUTCOME: *After completion of the course student will be able to-*

CO1: Understand about the principles of Remote Sensing and its advantages and limitations.
CO2: Retrieve the information content of remotely sensed data.
CO3: Apply problem specific remote sensing data for engineering applications.
CO4: Analyze spatial and attribute data for solving spatial problems.
CO5: Create GIS and cartographic outputs for presentation

KOE-066 GIS & REMOTE SENSING		
Unit	**Topic**	**Lectures**
1	Basic component of remote sensing (RS), advantages and limitations of RS, possible use of RS techniques in assessment and monitoring of land and water resources; electromagnetic spectrum, energy interactions in the atmosphere and with the Earth's surface; major atmospheric windows; principal applications of different wavelength regions; typical spectral reflectance curve for vegetation, soil and water, spectral signatures.	**8**
2	Different types of sensors and platforms; contrast ratio and possible causes of low contrast; aerial photography; types of aerial photographs, scale of aerial photographs, planning aerial photography- end lap and side lap; stereoscopic vision, requirements of stereoscopic photographs; air-photo interpretation- interpretation elements;	**8**
3	Photogrammetry- measurements on a single vertical aerial photograph, measurements on a stereo-pair- vertical measurements by the parallax method; ground control for aerial photography; satellite remote sensing, multispectral scanner- whiskbroom and push-broom scanner; different types of resolutions; analysis of digital data- image restoration; image enhancement; information extraction, image classification, unsupervised classification, supervised classification, important consideration in the identification of training areas, vegetation indices.	**8**
4	Microwave remote sensing. GI Sand basic components, different sources of spatial data, basic spatial entities, major components of spatial data, Basic classes of map projections and their properties. .	**8**
5	Methods of data input into GIS, Data editing, spatial data models and structures, Attribute data management, integrating data (map overlay) in GIS, Application of remote sensing and GIS for the management of land and water resources.	**8**

Text & Reference Books:

1. Reddy Anji, M. 2006. Textbook of Remote Sensing and Geographical Information Systems. BS Publications, Hyderabad.
2. Elangovan, K. 2006. GIS Fundamentals Applications and Implementations. New India Publication Agency, New Delhi.
3. George Joseph. 2005. Fundamentals of Remote Sensing. 2nd Edition. Universities Press (India) Private Limited, Hyderabad.
4. Jensen, J.R. 2013. Remote Sensing of the Environment: An Earth Resource Perspective. Pearson Education Limited, UK.
5. Lillesand, T., R.W. Kiefer and J. Chipman. 2015. Remote Sensing and Image Interpretation. 7th Edition, John Wiley and Sons Singapore Pvt. Ltd., Singapore.
6. Sabins, F.F. 2007. Remote Sensing: Principles and Interpretation. Third Edition, Waveland Press Inc., Illinois, USA.

KOE-067 UNDERSTANDING THE HUMAN BEING COMPREHENSIVELY – HUMAN ASPIRATIONS AND ITS FULFILLMENT

Course Objectives:

1. To help the students having the clarity about human aspirations, goal, activities and purpose of life.
2. To facilitate the competence to understand the harmony in nature/existence and participation of human being in the nature/existence.
3. To help the students to develop the understanding of human tradition and its various components.

Course Methodology:

1. The methodology of this course is exploration and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. It is free from any dogma or set of do's and don'ts related to values.
3. It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated and encouraged to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.
4. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student leading to continuous self-evolution.
5. This self-exploration also enables them to critically evaluate their preconditioning and present beliefs.

KOE-067 UNDERSTANDING THE HUMAN BEING COMPREHENSIVELY- HUMAN ASPIRATIONS AND ITS FULFILLMENT		
Unit	**Topic**	**Lectures**
1	**Introduction:** The basic human aspirations and their fulfillment through Right understanding and Resolution; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution.	**8**
2	**Understanding Human being and its expansion:** The domain of right understanding starts from understanding the human being (the knower, the experience and the doer); and extends up to understanding nature/existence – its interconnectedness and co-existence; and finally understanding the role of human being in existence (human conduct).	**8**
3	**Activities of the Self:** Understanding the human being comprehensively is the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Reasons for harmony/contradiction in the self.	**8**
4	**Understanding Co-existence with other orders:** The need and the process of inner evolution (through self-exploration, selfawareness and self-evaluation)- particularly awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to comprehensive knowledge about the existence).	**8**
5	**Expansion of harmony from self to entire existence:** Understanding different aspects of All-encompassing Resolution (understanding, wisdom, science etc.), Holistic way of living for Human Being with All-encompassing Resolution covering all four dimensions of human endeavour viz., realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from self to Nature and entire Existence.	**8**

Reference Books:

1. A Foundation Course in Human Values and Profession Ethics (Text Book and Teachers' Manual), R. R. Gaur, R. Sangal, G. P. Bagaria (2010), Excel Books, New Delhi [ISBN 978-8-174-46781-2]
2. Avartansheel Arthshastra, A. Nagraj, Divya Path Sansthan, Amarkantak, India
3. Economy of Permanence – (a quest for social order based on non-violence), J. C. Kumarappa (2010), Sarva-Seva-Sangh-Prakashan, Varansi, India
4. Energy and Equity, Ivan Illich (1974), The Trinity Press, Worcester & Harper Collins, USA
5. Ishandi Nau Upnishad, Shankaracharya, Geeta press, Gorakhpur,
6. Manav Vyavahar Darshan, A. Nagraj, Divya Path Sansthan, Amarkantak, India
7. Manaviya Sanvidhan, A. Nagraj, Divya Path Sansthan, Amarkantak, India