DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY LONERE.

ELECTRICAL ENGINEERING DEPARTMENT

Structure and syllabus

Of

Third year B. Tech. (Electrical Engineering)

V Semester

Course Code	Course Name	Teaching Scheme			Evaluation Scheme					Credits
		L	P	T	Int	MSE	ESE	TW	Pr/OR	
EEL501	Electrical Machine-II	3	0	1	20	20	60	-	-	4
EEL502	Power System-II	3	0	0	20	20	60	-	-	3
EEL503	Control System-I	3	0	0	20	20	60	-	-	3
EEL504	Microprocessor and micro Controller	3	0	1	20	20	60	-	-	4
EEL505	Value Education, Human Rights and Legislative Procedures	2	0	0	20	20	60	-	-	2
EEL506	Elective-IV	3	0	0	20	20	60	-	-	3
EEL507	Elective-V	3	0	0	20	20	60	-	-	3
EEP508	Electrical Machine-II Lab	0	2	0	-	-	-	25	25	1
EEP509	Power System-II Lab	0	2	0	-	-	-	25	25	1
EEP510	Microprocessor and micro Controller Lab	0	2	0	-	-	-	25	25	1
EET511	Industrial Training	-	-	-	-	-	-	25	25	1
	TOTAL	20	06	02	140	140	420	100	100	26

Elective- IV: 1.Illumination engineering 2. Advances in Renewable Energy Sources. 3. Biomedical Instrumentation
Elective-V: 1.Electrical Mobility. 2 Power Plant Engineering. 3. Design and Analysis of Algorithms.

VI semester

Course Code	Course Name	Teaching Scheme			Evaluation Scheme					Credits
		L	P	T	Int	MSE	ESE	TW	Pr/OR	
EEL601	Control System-II	3	0	1	20	20	60	-	-	4
EEL602	Principles of Electrical Machine Design	3	0	1	20	20	60	-	-	4
EEL603	Power Electronics	3	0	0	20	20	60	-	-	3
EEL604	Elective-VI	3	0	0	20	20	60	-	-	3
EEL605	Elective-VII	3	0	0	20	20	60	-	-	3
EEL606	Elective-VIII	3	0	0	20	20	60	-	-	3
EEP607	Control System-II Lab	0	2	0	-	-	-	25	25	1
EEP608	Principles of Electrical Machine Design Lab	0	2	0	-	-	-	25	25	1
EEP609	Power Electronics Lab	0	2	0	-	-	-	25	25	1
	TOTAL	18	04	02	120	120	360	75	75	23

Elective-VI 1. Industrial automation and Control 2. Design of Experiments for engineers and Managers. 3. Artificial neural network.
Elective-VII 1. Switch Gear and Protection 2. Computer aided analysis and design 3. Mechatronics
Elective- VIII. 1. Rural Technology and Community Development. 2. Project Management 3. Knowledge Management

Semester: V

EEL501: ELECTRICAL MACHINE-II

Teaching scheme:
Theory: 3 hrs
Tutorial: 1 hr
Total credit: 4

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Electrical machine I	
Course outcome	To study different methods of speed control of AC and DC motor To study importance and procedure of different performance test on AC and DC motor. To determine different operating characteristics of AC and DC machines	
Unit	Contents	Contact Hrs
1	Basic Concepts in A.C. Machines: Classification of A.C. Machines, principle of operation and constructional features of synchronous and induction machines, rotating mmf waves in A.C. Machines	8
2	Armature windings: Introduction, ac machine windings, winding factors, the emf equation, harmonics in generated emf, causes of harmonics and their suppressions.	6
3	Synchronous Machines : Construction, types, armature reaction, circuit model of synchronous machine, determination of synchronous reactance, phasor diagram, power angle characteristics, parallel operation of synchronous generators, synchronizing to infinite bus bars, two axis theory, synchronous motor operation, characteristic curves, synchronous condenser, dynamics.	10
4	Three phase Induction (Asynchronous) Motor: Types of induction motor, flux and mmf waves, development of circuit model, power across air gap, torque and power output, oc and sc tests, circle diagram, starting methods, cogging and crawling, speed control, deep bar/ double cage rotor, induction generator, induction machine dynamics, high efficiency induction motors	10
5	Fractional Kilowatt Motors: Introduction, single phase induction motors, double revolving field theory, circuit model of single phase induction motor, determination of circuit parameters.	5
6	Special A.C. Machines: Single phase synchronous motors, permanent magnet ac motors, ac servomotors	5
	Ref Books: 1.Say M. G., "Design & performance of A.C. Machines", (Book Publications,3rd edition) 2..Bhimra P. S., "Electric Machines", (South Ex Publications, New Delhi) 3. D. P. Kothari, I. J. Nagrath,"Electric Machines ", Tata McGraw Hill Publication, Fourth edition, reprint 2012. 4. A. F. Puchstein, T.C. Lloyd, A.G. Conrad, "Alternating current machines", John Wiley and Sons, New York 1954. 5.• A.E. Fitzgerald, Charles Kingsley Jr., Stephen D. Umans ,"Electric Machinery ", Tata McGraw Hill Publication, sixth edition 2002	

EEL502: POWER SYSTEM-II

Teaching scheme:
Theory: 3 hrs
Tutorial: 1 hr
Total credit: 4

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Power system I	
Course outcome	To study different parameters of power system operation and control To study load flow and Diff. methods of reactive power control. To understand diff. methods of fault analysis and stability study	
Unit	Contents	Contact Hrs.
1	Economic Operation of Power Systems: Distribution of loads between units within a plant, Economic division of load between units in a plant, Transmission loss as a function of plant generation, Calculation of loss co-efficient, Distribution of load between plants, Introduction to unit commitment, Numerical examples	8
2	Load Flow Studies: Network model formulation, (Applications of iterative techniques like Gauss-Siedal method, and Newton-Rap son method, etc.) Numerical. Active Power Control Basic generator control, Load frequency control. Load, prime mover and governor model, Numerical examples	6
3	Reactive Power Control: System voltage and reactive power, Reactive power generation by synchronous machine, Excitation control, Automatic voltage regulator for alternator, Reactive power generation by turbo-generator, Synchronous compensators, Reactors, Capacitors, Static compensators. Introduction to power flow control, HVDC and Facts.	6
4	Symmetrical and unsymmetrical fault analysis: Symmetrical Components transformation analysis for, transformers, transmission lines and synchronous machines, Numerical examples. Fault analysis and evaluation of faults on loaded unloaded synchronous generator, Selection of circuit breakers, asymmetrical fault-evaluation of a) Line to ground b) Line to line c) Double line to ground d) single & double conductor open faults, Numerical examples	6
5	Stability: Dynamics of a synchronous machine, Power angle equation, Steady state stability, Equal area criterion, Numerical solution of swing equation, Factors affecting transient stability, Critical clearance angle, Numerical	6
6	Load dispatch center functions, Contingency analysis, preventive, emergency and restorative Control. power quality: def., causes, affects, slandered and mitigation methods	7
	Ref Books: 1. Stevension .W. D– Power System Analysis. (Tata Mcgraw Hill). 2. Ashfaq Hussian - Power System Analysis. (Tata Mcgraw Hill). 3. Nagrath & Kothari – Modern Power System Analysis.(Tata Mcgraw Hill). 4. Hadi Sadat- Power System Analysis (Tata Mcgraw Hill). 5. Prof A M Kulkarni IIT “Bombay Web Course on Power System Operation and Control”	

EEL503: CONTROL SYSTEM-I

Teaching scheme:
Theory: 3 hrs
Tutorial: 1 hr
Total credit: 4

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Network analysis and synthesis, numerical methods and C programming	
Course outcome	To know different basic concepts and components of a control system. To derive transfer functions of basic control system components. To perform stability analysis using time domain and frequency domain response on a given system	
Unit	Contents	Contact Hrs.
1	Introduction: Concept of open & closed loop control system, Servomechanism, Multivariable control system, Applications in non-engineering field.	8
2	Physical Systems and Transfer Function: a) Concept of system: physical system, Physical model, Linear and nonlinear systems, Time variant and invariant system. b) Equations of physical systems (Mass-Spring-Dashpot system, R-L-C series & parallel circuit) transfer function, Procedure of obtaining transfer function.	6
3	Block diagrams and Signal flow graphs: a) Block diagram algebra, Diagram reduction, and Numerical examples. b) Signal flow graph; Masons gain formula for deriving overall transfer function of systems. Feedback characteristics of control system: Concept of negative and positive feedback, Sensitivity of the system to parameter variation, using negative and positive feedback	6
4	Control system components: Derivation of transfer functions of following components a)DC servomotors (Armature and field control) b) AC servomotors, c) Synchros d) DC and AC tachogenerators , e) Potentiometer error detectors	6
5	Time domain analysis: Typical test signals, Time domain specifications, Steady state response, Types of system, Steady state error constants and steady state error, (With different input), Numerical examples, transient response, Numericals, Concept of stability, Determination of stability by Routh - Hurwitz criterion.	6
6	Frequency domain analysis: Introduction to frequency response, Advantages of frequency domain analysis, Polar plots, Numericals, Bode plots, Principle of argument, Nyquist criterion, Relative stability from Nyquist criterion, Numericals. Definition of Root Locus, Construction of root locus, and Stability from root locus plots, Root counters, Effect of addition of poles & zeros on root locus plots.	7
	Ref Books: 1 Ogata – Modern Control Engineering (Prentice Hall Of India). 2. Kuo .B. C– Automatic Control System.(Prentice Hall Of India). 3.Nagarath & Gopal – Control System(Willey Earstern) 4. Gopal .M. – Control System.(Prentice Hall Of India).	

EEL504-.MICROPROCESSOR AND MICRO CONTROLLER

Teaching scheme:
Theory: 3 hrs
Tutorial: 1 hr
Total credit: 4

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Digital electronics, electronics devices and circuits	
Course outcome	To know the architecture of 8085 and 8051. To understand interfacing and interrupt features of 8085 and 8051. To develop program for basic applications.	
Unit	Contents	Contact Hrs.
1	Architecture of 8085 Microprocessor and Programming: Functional Block Diagram, Registers, ALU, Bus systems, Timing and control signals, Machine cycles and timing diagrams. Instruction formats, Addressing modes, Instruction set, Need for Assembly language, Development of Assembly language programs.	8
2	Interfacing: Memory Interfacing: Interface requirements, Address space partitioning, Buffering of Buses, timing constraints, Memory control signals, Read and write cycles, interfacing SRAM, EPROM and DRAM sections. I/O Interfacing: Memory mapped I/O Scheme, I/O mapped I/O scheme, Input and Output cycles, Simple I/O ports, Programmable peripheral interface (8255). Data transfer schemes: Programmable data transfer, DMA data transfer, Synchronous, Asynchronous and interrupt driven data transfer schemes, Interfacing, Simple keyboards and LED displays.	6
3	Interrupts and DMA: Interrupt feature, Need for interrupts, Characteristics of Interrupts, Types of Interrupts, Interrupt structure, Methods of servicing interrupts, Development of Interrupt service subroutines, Multiple interrupt request and their handling, need for direct memory access, Devices for Handling DMA, Programmable DMA controller 8237.	6
4	Applications: Interfacing of A/D converters (ADC 0800/ADC 0808/ADC 0809), Interfacing of D/A converters (DAC 0800), Waveform generators, Multiplexed seven segment LED display systems, Measurement of frequency, phase angle and power factor-Traffic light controller, Stepper motor control	6
5	Intel 8051 Microcontroller : Architecture of 8051, Memory Organization, Addressing modes, Instruction set, Boolean processing, Simple programs	6
6	8051 Peripheral Functions : 8051 interrupt structures, Timer and serial functions, parallel port features : Modes of operation, Power control, features, Interfacing of 8051, Typical applications, MCS 51 family features	7
	Ref Books: 1. Goankar, R.S., "Microprocessor Architecture Programming and Applications with the 8085/8080A", 3rd Edition, Penram International Publishing House, 1997. 2. Singh. I.P., "Microprocessor Systems", Module 9: Microcontrollers and their Applications", IMPACT Learning Material Series IIT, New Delhi, 1997. 3. Douglas, V.Hall. "Microprocessor and Interfacing Programming and Hardware", 2ndEdition, McGraw Hill Inc., 1992. 4. Kenneth, L.Short., "Microprocessors and Programmed Logic", Prentice Hall of India, 2nd Edition, 1987	

EEL505: VALUE EDUCATION, HUMAN RIGHTS AND LEGISLATIVE PROCEDURES

Teaching scheme:
Theory: 2 hrs
Total credit: 2

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Human Values and engg ethics	
Course outcome	To understand value of education and self-development To develop good values and character To know Human right and legislative procedure	
Unit	Contents	Contact Hrs.
1	Values and Self Development-Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non-moral valuation, Standards and principles, Value judgments.	8
2	Importance of cultivation of values, Sense of duty, Devotion, Self-reliance, Confidence, Concentration, Truthfulness, Cleanliness, Honesty, Humanity, Power of faith, National unity, Patriotism, Love for nature, Discipline.	6
3	Personality and Behavior Development- Soul and scientific attitude, God and scientific attitude, Positive thinking, Integrity and discipline, Punctuality, Love and kindness, Avoiding fault finding, Free from anger, Dignity of labor, Universal brotherhood and religious tolerance, True friendship, Happiness vs. suffering love for truth, Aware of self-destructive habits, Association and cooperation, Doing best, Saving nature.	6
4	Character and Competence- Science vs. God, Holy books vs. blind faith, Self-management and good health, Science of reincarnation, Equality, Nonviolence, Humility, Role of women, All religions and same message, Mind your mind, Self-control, Honesty, Studying effectively.	6
5	Human Rights- Jurisprudence of human rights nature and definition, Universal protection of human rights, Regional protection of human rights, National level protection of human rights, Human rights and vulnerable groups.	6
6	Legislative Procedures- Indian constitution, Philosophy, fundamental rights and duties, Legislature, Executive and Judiciary, Constitution and function of parliament, Composition of council of states and house of people, Speaker, Passing of bills, Vigilance, Lokpal and functionaries	7
	Ref Books: 1. Chakraborty, S.K., Values and Ethics for Organizations Theory and Practice, Oxford University Press, New Delhi, 2001. 2. Kapoor, S.K., Human rights under International Law and Indian Law, Prentice Hall of India, New Delhi, 2002. 3. Basu, D.D., Indian Constitution, Oxford University Press, New Delhi, 2002. 4. Frankena, W.K., Ethics, Prentice Hall of India, New Delhi, 1990. 5. Meron Theodor, Human Rights and International Law Legal Policy Issues, Vol. 1 and 2, Oxford University Press, New Delhi, 2000.	

EEL 506: ELECTIVE- IV: 1. ILLUMINATION ENGINEERING

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Basic electrical engineering , physics.	
Course outcome	To get the detailed information about modern lamps and their accessories. To get detailed insight of indoor and outdoor illumination system components, its controls and design aspects. To know the requirements of energy efficient lighting. To introduce the modern trends in the lighting	
Unit	Contents	Contact Hrs.
1	**Importance of Lighting in Human Life:**Optical systems of human eye ,Dependence of human activities on light, performance characteristics of human visual system, External factors of vision-visual acuity, contrast, sensitivity, time illuminance, colour, visual perception, optical radiation hazards, Good and bad effects of lighting & perfect level of illumination, Artificial lighting as substitute to natural light, Ability to control natural light, Production of light, physics of generation of light, Properties of light, Quantification & Measurement of Light.	8
2	**Light Sources:** Lamp materials: Filament, glass, ceramics, gases, phosphors and other metals and non-metals. Discharge Lamps: Theory of gas Discharge phenomena, lamp design considerations, characteristics of low and high mercury and Sodium vapour lamps, Low Vapour Pressure discharge lamps – Mercury Vapour lamp, Fluorescent Lamp, Compact Fluorescent Lamp (CFL) High Vapour Pressure discharge lamps - Mercury Vapour lamp, Sodium Vapour lamp, Metal halide Lamps, Solid Sodium Argon Neon lamps, SOX lamps, Electro luminescent lamps, Induction lamps.	6
3	**Electrical Control of Light Sources:** Ballast, igniters and dimmers for different types of lamps, **Photometric Control of Light Sources and their Quantification:** Types of Luminaries, factors to be considered for designing luminaries Types of lighting fixtures. Optical control schemes, design procedure of reflecting and refracting type of luminaries. Lighting Fixture types, use of reflectors and refractors, physical protection of lighting fixtures, types of lighting fixtures according to installation type, types of lighting fixtures according to photometric usages, luminaries standard (IEC-598-Part I).	6
4	Zonal cavity method for general lighting design, determination for zonal cavities and different shaped ceilings using COU (coefficient of utilization), beam angles and polar diagrams. Factors to be considered for design of indoor illumination scheme **Indoor illumination design for following installations:** Residential (Numerical)**,**Educational institute**,** Commercial installation**,** Hospitals**,** Industrial lighting**, Special purpose lighting schemes** Decorative lighting**,** Theatre lighting**,** Aquarium, swimming pool lighting	6
5	Factors to be considered for design of outdoor illumination scheme, **Outdoor Lighting Design:** Road classifications according to BIS, pole arrangement, terminology, lamp and luminaire selection, different design procedures, beam lumen method, point by point method, isolux diagram, problems on point by point method. **Outdoor illumination design for following installations**; Road lighting (Numerical), Flood lighting (Numerical), Stadium and sports complex, Lighting for advertisement/hoardings	6
6	**Modern trends in illumination;** LED luminary designs**,** Intelligent LED fixtures**,** Natural light conduiting**,** Organic lighting system**,** LASERS, characteristics, features and applications, non-lighting lamps**,** Optical fiber, its construction as a light guide, features and applications	7
	Ref Books: 1 H. S. Mamak, “Book on Lighting”, Publisher International lighting Academy 2. Joseph B. Murdoch, “Illumination Engineering from Edison’s Lamp to Lasers” Publisher - York, PA: Visions Communications 3. M. A. Cayless, A. M. Marsden, “Lamps and Lighting”, Publisher-Butterworth-Heinemann(ISBN978-0-415-50308-2) 4. Designing with light: Lighting Handbook., Anil Valia; Lighting System 2002	

EEL 506 ELECTIVE- IV: 2. ADVANCES IN RENEWABLE ENERGY SYSTEMS

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Introduction to Non-Conventional energy sources	
Course outcome	To know the principle of energy conversion technique from biomass, geothermal and hybrid energy systems. To understand effects of air pollution and ecosystems	
Unit	Contents	Contact Hrs.
1	Biomass Energy: Introduction, Biomass conversion technologies, Biogas generation, classification of biogas plants and their Operating system. Biomass as a source of energy, methods of obtaining energy from biomass, thermal gasification of biomass, Applications.	8
2	Geothermal Energy : Introduction, Geothermal sources , hydrothermal resources, Vapor dominated systems, Liquid dominated systems, hot water fields, Geo pressure resources, hot dry rocks, magma resources, volcanoes. Interconnection of geothermal fossil systems, geothermal energy conversion and applications	6
3	Hybrid energy systems : Need for hybrid systems, types of hybrid systems site specific examples; PV–Diesel and battery systems, PV–Gas Hybrid system, Biomass gasifier based thermal back up for Solar systems, natural convection solar driers in combination with biomass back up heater. Biogas and solar energy hybrid system, .typical applications.	6
4	Air pollution-primary, secondary, chemical and photochemical reactions, effects of CO, NO, CH and particulates, acid rain, global warming and Ozone depletion; monitoring and control of pollutants; noise pollution-sources and control measures; thermal-, heavy metals- and nuclear pollutions; industrial pollution from paper, pharmacy, distillery, tannery, fertilizer, food processing and small scale industries.	6
5	Environment impact assessment policies and auditing, conflicting worldviews and environmentally sustainable economic growth, introduction to Design For Environment (DFE), product lifecycle assessment for environment and ISO 14000; triple bottom line of economic, environment and social performance.	6
6	Ecosystem definition, concepts, structure, realm of ecology, lithosphere, hydrosphere, biosphere, atmosphere-troposphere-stratosphere; Nonrandom high quality solar energy flow/ balance to earth, greenhouse effect, matter and nutrient recycling in ecosystems; nitrogen, oxygen, carbon and water cycles, food producers, consumers and decomposers, food chains; biodiversity, threat and conservation of biodiversity.	7
	Ref Books: 1. NPTEL courses	

EEL 506 ; ELECTIVE- IV: 3. BIOMEDICAL INSTRUMENTATION

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Electrical measurement and instrumentation, physics, basic electrical engineering	
Course outcome	To know the elements body cell structure. To understand the bioelectric signal and their recording. To review different principle of construction and operation of different transducer used in biomedical applications. To understand the construction and operation principle of biedielectric signal recording systems, bais X ray components and safety assepts. the	
Unit	Contents	Contact Hrs
1	Anatomy and Physiology : Elementary ideas of cell structure, heart and circulatory system, control nervous system, Musclo-skeletal system, Respiratory system Body temperature and reproduction system. Classification of Biomedical Equipment, Diagnostic, therapeutic and clinical laboratory equipment	8
2	Bioelectric signals and their recording : Bioelectric signals (ECG, EMG, ECG, EOG & ERG) and their characteristics, Bioelectrodes, electrodes tissue interface, contact impedance, effects of high contact impedance, types of electrodes, electrodes for ECG, EEG and EMG.	6
3	Transducers for Biomedical Application : Resistive transducers - Muscle force and Stress (Strain guge), Spirometry (Potentiont), humidity, (Gamstrers), Respiration (Thermistor) Inductive Transducers - Flow measurements, muscle movement (LVDT) Capacitive Transducers - Heart sound measurement, Pulse pick up Photoelectric Transducers - Pulse transducers, Blood pressure, oxygen Analyses Piezoelectric Transducers - Pulse pickup, ultrasonic blood flowmeter Chemcial Transducer - Ag-Agfallas (Electrodes, PH electrode)	6
4	Bioldectric Signal recording machines : Physiological pre-amplifier and specialized amplifiers, ECG lead systems details of ECG, EMG, and EEG machines, Patient Monitoring system, Heart rate measurement pulse rate measurement, respiration, rate measurement, blood pressure measurement, microprocessor applications in patient monitoring, X- Ray Machine	6
5	Basic X-Ray components and circuits, types of X-ray machines e.g. general purpose, dental image intensifier system, table shooting and maintenance of X- Ray machine	6
6	Safety Aspect of Medical : Gross current, Micro Current shock, safety standards rays and considerations, safety testing instruments, biological effects of X-rays and precautions	7
	Ref Books: 1. NPTEL courses	

EEL 507: ELECTIVE-V. 1. ELECTRICAL MOBILITY

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Digital electronics, network analysis and synthesis	
Course outcome		
Unit	Contents	Contact Hrs
1	**Electric mobility introduction:** Introduction to electrical mobility, classification, need of electrical mobility, operating principle.	8
2	**Energy sources and storage systems:** Conventional energy sources and non-conventional energy sources, different types of energy storage schemes and energy storage devices	7
3	**Electric machines in electric mobility:** Diff. types of electrical machines used in electric mobility: induction machine , dc machine, synchronous machine,	8
4	**Power converters:** Introduction to power converters, different types of power converters, construction, working, applications, advantages, disadvantages.	7
5	**Applications, Modeling:**	8
6	**Electric vehicles and the environment;**	7
	Ref Books: 1. Nptel 2. Larminie, J.; Lowry, J. Electric vehicle technology explained [on line]. Chichester, West Sussex: J. Wiley, cop. 2003Available 3. on: <http://onlinelibrary.wiley.com/book/10.1002/0470090707>. ISBN 0470851635. 4. Miller, J. M. Propulsion systems for hybrid vehicles. 2nd ed. The Institution of Engineering and Technology, 2010. ISBN 978- 5. 1-84919-147-0. 6. Husain, I. Electric and hybrid vehicles : design fundamentals [on line]. 2nd ed. Boca Raton: CRC Press, cop. 2011 7. [Consultation: 07/03/2012]. Available on: <http://www.sciencedirect.com/science/book/9780444535658>. ISBN 8. 9781439811757. 9. Ehsani, M.; Gao, Y.; Emadi, A. Modern electric, hybrid electric, and fuel cell vehicles : fundamentals, theory and design. 2nd	

EEL 507: ELECTIVE-V 2 POWER PLANT ENGINEERING.

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Power system I, power system II, machine I and II	
Course outcome	To review basic components of power system, energy sources. To understand principle of construction and operation of different conventional power plants.	
Unit	Contents	Contact Hrs
1	Load and Energy survey, load duration curve, plant factor and plant economics, Introduction to conventional energy sources, different sources of non-conventional energy like solar, wind, tidal, geothermal biomass, MHD plants, their applications and site selection, Indian energy scenario	8
2	Thermal Power Station: Introduction, selection of sites, main parts of thermal power station and their working, simple numerical examples. Nuclear Power Plant: Review of atomic physics (atomic number, mass number, isotopes, atomic mass, unit rate of radioactivity, mass equivalent number, binding energy and mass defects), main parts of nuclear power station, types of reactors (pressurized water reactor (PWR), boiling water reactor, gas cooled reactor, liquid metal tank feeder reactor, heavy water reactor, plant layout and working, simple numerical, India's nuclear power program.	6
3	Hydroelectric Power Plant: Advantages and limitations, selection of site, hydrological cycles and hydrographs, storage and pondage, essential elements of hydroelectric plant, classification, different types of turbines and their selection, governing of hydraulic turbines, surge tanks, draft tube, layout of hydro-station, simple numerical.	6
4	Diesel Engine & Gas Power Plant: Advantage and limitations, types of diesel plants, general layout, IC engines and their performance characteristics, layout of diesel engine power plant and applications. Components of gas power plant, gas turbine fuels, turbine fuels, turbine materials, working, improvement of thermal efficiency of gas power plant and applications, simple numerical examples.	6
5	Combined working of power plants: Economics of combined working power plants, base load and peak load stations, pumped storage plants, inter- connections of power stations. Tariff: Fixed cost, running cost and their interrelation for all types of conventional power plants, depreciable cost, different types of tariffs, numerical example based on above, effect of deregulation on pricing.	6
6	Grid interface of different power plants: Concept of parallel operation of various generating sources and load sharing, need of interconnection between different power plants, concept of Grid, importance of grid, requirement of grid, types of grid (in transmission and distribution system), conditions to interface different power plants to grid.	7
	Ref Books: 1.Gupta B. R. " Power Plant Engineering".(Eurasia publications) 2.Nag P. K. " Power Plant Engineering",(Tata McGraw Hill Publications) 3.Deshpande M. V. " Elements of Electrical Power Station Design" (Wheeler publications) 4.Arora and Domkundwar, "A course in Power Plant Engineering" (Dhanpat Rai & co., 5/e) 5.R. K. Rajput, "Power Plant Engineering" 6.V. K. Mehta, "Power System", S. Chand Pub. 7.J. B. Gupta, "A course in Power System Engineering",	

EEL 507: ELECTIVE-V. 3. DESIGN AND ANALYSIS OF ALGORITHMS

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Numerical methods and C programming, control system I,	
Course outcome	To know fundamental characteristic of an algorithm. To understand strategy of algorithm formation, To develop different algorithm.	
Unit	Contents	Contact Hrs
1	Introduction- Fundamental characteristics of an algorithm. Basic algorithm analysis – Asymptotic analysis of complexity bounds – best, average and worst-case behaviour, standard notations for expressing algorithmic complexity. Empirical measurements of performance, time and space trade-offs in algorithms. Using recurrence relations to analyze recursive algorithms – illustrations using recursive algorithms.	8
2	Fundamental Algorithmic Strategies: Brute-Force, Greedy, Branch-and-Bound, Backtracking and Dynamic Programming methodologies as techniques for design of algorithms – Illustrations of these techniques for Problem-Solving. Heuristics – characteristics and their domains of applicability. Design of algorithms for String/ Texmatching problems, Huffman Code and Data compression problems, Subset-sum and Knapsack problems.	6
3	Graph and Tree Algorithms: Depth- and Breadth- First traversals. Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sort, Network Flow problems	6
4	Tractable and Intractable Problems: Computability.The Halting problem. Computability classes – P, NP, NP-complete and NP-hard. Cook‟s theorem. Standard NP-complete problems Reduction techniques.	6
5	Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – PSPACE.	6
6		7
	References: 1. Algorithm Design – Jon Kleinberg and Eva Tardos 2. Introduction to Algorithms – T.H. Corman et. al. 3. Fundamentals of Algorithms – E. Horowitz et al. 4. Combinatorial Optimization: Algorithms and Complexity – C.H. Papadimitriou et al	

Semester: VI

EEL 601. CONTROL SYSTEM-II

Teaching scheme:
Theory: 3 hrs
Tutorial: 1 hr
Total credit: 4

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Control system I	
Course outcome	To understand the behavior of nonlinear control system. To design and analyze PID controller. To understand and analyze state variable technique. To design and analyze suitable control system for engineering application.	
Unit	Contents	Contact Hrs
1	Non-linear Control Systems: Peculiar behavior of non-linear systems such as sub harmonics, jump resonance, limit cycle, Different types of non-linearities, Phase plane method, Singular Points, Methods of isoclines, Limit Lines & dividing lines on phase plane, Construction of phase plane, Obtaining time domain response from phase plane plots, merits & demerits. Describing function (DF) method, definition & assumptions, Derivation for describing function for different non- linearities, Stability analysis using DF method.	8
2	PID controllers: Introduction to Proportional (P), Integral (I) & Derivative (D) controller, individual effect on overall system performance, P-PI & PID control and effect on overall system performance, Numerical examples.	6
3	State Variable Technique: Concept of state & state variable, General form of state equations, formulation of state equations for the physical system, (RLC network, Armature controlled & Field controlled DC servo motor, mechanical systems).	6
4	State Variable Analysis: Different forms of state variable representations (Phase, physical & canonical form), Concept of diagonalization, Obtaining state equations from transfer function representation and vice versa, solution of state equations, State transition matrix (STM), Methods of finding STM, Power series method, Laplace transform method, Calay Hamilton method, Controllability & observability of linear system, Kalman's test.	6
5	Discrete Data Control System: Methods of representation, Z-transform, Inverse Z-transforms, Pulse transfer function of closed loop system, Response between sampling instants, Concept of stability of discrete time systems, Stability by Jury's test.	6
6	Introduction to control system design, Compensation technique-Cascade & Feedback, Compensation network (lag, lead & lag-lead), Design by reshaping of Bode plots & Root locus technique.	7
	References: 1.Ogata K., 'Modem control Engineering', Prentice Hall 2.Kuo B. C., 'Automatic Control System' Prentice Hall 3. Nagarath I. J., Gopal M., 'Control System Engineering' Willey Eastern.	

EEL602 PRINCIPLES OF ELECTRICAL MACHINE DESIGN

Teaching scheme:
Theory: 3 hrs
Tutorial: 1 hr
Total credit: 4

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Machine I and II,	
Course outcome	To understand principles of electric machine design. To design different components of electric machine. To design Transformer To understand CAD and use it for transformer design	
Unit	Contents	Contact Hrs
1	Principles and design of Electrical machines: Design of Electrical machines along with their parts and special features, rating, Specifications, Standards, Performance and other criteria to be considered, Brief study of magnetic, electric, dielectric and other materials, Introduction to machine design.	8
2	Design of Electrical Apparatus: Detailed design of heating coils, starters and regulators. Design of Electrical Devices Field coils, Chokes and lifting magnets.	6
3	AC and DC Winding: Types of dc windings, Pitches, Choice and design of simple/ duplex lap and wave winding, Concept of multiplex windings and reasons for choosing them, Single and double layer single phase AC winding with integral and fractional slots, Single and double layer integral and fractional slot windings of three phase. AC winding factors, Tests for fault finding in windings, Numerical examples.	6
4	Heating, Cooling and Ventilation: Study of different modes of heat generation, Temperature rise and heat dissipation, Heating and Cooling cycles, heating and cooling time constants, their estimation, dependence and applications, Methods of cooling / ventilation of electrical apparatus, Thermal resistance, radiated heat quantity of cooling medium (Coolant) Numerical.	6
5	Design of Transformer: Design of distribution and power transformers, Types, Classification and specifications, Design and main dimensions of core, yoke, winding, tank (with or without cooling tubes) and cooling tubes, Estimation of leakage reactance, resistance of winding, No load current, Losses, Voltage regulation and efficiency, Mechanical force developed during short circuits, Their estimation and measures to counteract them, Testing of transformers as per I.S.S., Numerical examples.	6
6	Computer aided Design of Electrical machine: Introduction, advantages various approaches of Computer Aided Designing, Computer Aided Designing of transformer, Winding of rotating Electrical Machines. Optimization of Design.	7
	References: 1. Siskind – Electrical Machine Design (Mcgraw Hill). 2. Sawhaney. A. K– A Course in Electrical Machine Design (Dhanpat Rai). 3. Deshpande. M. V- A Course in Electrical Machine Design (Prentice Hall Of India).(Design And Testing Of Electrical Machines). 4. Sen .S. K– Computer aided design of Electrical Machines	

EEL603 POWER ELECTRONICS

Teaching scheme:
Theory: 3 hrs
Tutorial: 1 hr
Total credit: 4

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Electronic Devices And Circuits	
Course outcome	To review principle of construction, operation and characteristics of basic semiconductor devices. To understand and analyze performance of controlled and uncontrolled converters. To understand and analyze performance of DC to DC converters. Dc to AC converters. To understand and analyze performance of AC voltage controllers.	
Unit	Contents	Contact Hrs
1	Power semiconductor devices & their characteristics : Characteristics and operation of power diodes, Thyristors, power transistors (BJTs, MOSFETs, IGBTs, SITs), Ratings of power semiconductor devices, typical applications of power semiconductor devices, Introduction to types of power electronic circuits: diode rectifiers, AC-DC converters, AC-AC converters, DC-DC converters, DC-AC converters	8
2	Turn on and Turn off circuits for power semiconductor devices; BJT base drive requirements and drive circuit, MOSFET & IGBT gate drive circuits, Isolation of gate/base drives: Pulse transformers, optocouplers Thyristor firing schemes, Gate drive ICs	6
3	Diode Rectifiers and AC-DC converters : Diode Rectifiers: Single phase half wave, full wave rectifiers with R and RL load, Three phase bridge rectifier with R and RL load, Effect of source inductance Controlled Rectifiers : Principle of phase controlled rectification, single phase semi and full converter with R and RL load, power factor improvement in controlled rectifiers, three phase semi and full converter with R and RL load.	6
4	AC voltage controllers (AC-AC converters) : Principle of on-off control, principle of phase control in single phase and three phase circuits, Cycloconverters: single phase cycloconverter operation, three phase cycloconverter operation.	6
5	DC-DC converters : Classification of DC-DC converters, Buck converter, Boost converter, Buck-Boost converter, Cuk converter	6
6	DC-AC converters : Principle of operation and performance parameters, single phase bridge inverter, Three phase inverters: 180 degree and 120 degree conduction modes of operation	7
	References: 1.RashidM. H – Power Electronics circuits, devices and applications-(New Delhi Pearson Education). 2.Murthi.V. R- Power Electonics Devices, circuits and Industrial Applications.(Oxford). 3. Bimbhra.P. S- Power Electronics.(Khanna Publication).	

EEL604: Elective-VI: 1. INDUSTRIAL AUTOMATION AND CONTROL

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Control system I, industrial automation	
Course outcome	To understand construction and working principle of different industrial measurement systems. To understand new trends in industrial process control.	
Unit	Contents	Contact Hrs
1	Introduction to Industrial Automation and Control: Architecture of Industrial Automation Systems. Introduction to sensors and measurement systems.	8
2	measurement: Temperature measurement, Pressure and Force measurements, Displacement and speed measurement, Flow measurement techniques, Measurement of level, humidity, pH etc, Signal Conditioning and Processing, Estimation of errors and Calibration	6
3	Process Control: Introduction to Process Control P I D Control, Controller Tuning. Implementation of PID Controllers. Special Control Structures: Feed forward and Ratio Control. Predictive Control, Control of Systems with Inverse Response, Cascade Control, Overriding Control, Selective Control, Split Range Control.	6
4	Sequence Control: Introduction to Sequence Control PLCs and Relay Ladder Logic Sequence Control, Scan Cycle, RLL Syntax Sequence Control, Structured Design Approach Sequence Control, Advanced RLL Programming Sequence Control : The Hardware environment	6
5	Control of Machine tools: Introduction to CNC Machines Control of Machine Tools, Analysis of a control loop, Introduction to Actuators, Flow Control Valves. Hydraulic Actuator Systems,: Principles, Components and Symbols, Hydraulic Actuator Systems: Pumps and Motors, Proportional and Servo Valves.	6
6	Pneumatic Control Systems: System Components Pneumatic Control Systems, Controllers and Integrated Control Systems. Networking of Sensors, Actuators and Controllers: The Fieldbus, The Fieldbus Communication Protocol, Introduction to Production Control Systems	7
	References NPTEL course	

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EEL604: Elective-VI: 2. DESIGN OF EXPERIMENTS FOR ENGINEERS AND MANAGERS

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite		
Course outcome	To understand experimental design principles. To understand different experimental design used in industry. To deign computer experiments to use with engineering problems.	
Unit	Contents	Contact Hrs
1	Introduction to experimental design principles, simple comparative experiments, introduction to R language and its applications in DOE problems	8
2	Single factor experiments, randomized blocks, Latin square designs and extensions, introduction to R language Introduction to factorial designs, two levels, 2k factorial designs, confounding and blocking in factorial designs, applications to manufacturing problems.	6
3	Fractional factorial designs, two-level, three-level and mixed-level factorials and fractional factorials, applications to quality control problems. Regression models including multiple regression models and its application to transportation scheduling problems	6
4	Response surface methodology, parameter optimization, robust parameter design and its application to control of processes with high variability	6
5	Random and mixed effects models, nested and split plot and strip plot designs and its application to semiconductor manufacturing problem. Repeated measures design, analysis of covariance and its applications in comparing alternatives	6
6	Design of computer experiments and the applications in industrial engineering problems	7
	References NPTEL course	

EEL604: ELECTIVE-VI: 3. ARTIFICIAL NEURAL NETWORK.

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite		
Course outcome	To review basic principles of neuron structure. To understand building blocks artificial neural network. To understand different networks of ANN To develop different algorithm for learning. To study and understand Fuzzy neural networks.	
Unit	Contents	Contact Hrs
1	Introduction and ANN Structure : Biological neurons and artificial neurons. Model of an ANN. Activation functions used in ANNs. Typical classes of network architectures. Mathematical Foundations and Learning mechanisms : Re-visiting vector and matrix algebra. State-space concepts. Concepts of optimization. Error-correction learning. Memory-based learning. Hebbian learning. Competitive learning.	8
2	Single layer perceptrons : Structure and learning of perceptrons. Pattern classifier - introduction and Bayes' classifiers. Perceptron as a pattern classifier. Perceptron convergence. Limitations of a perceptrons.	6
3	Feedforward ANN : Structures of Multi-layer feedforward networks. Back propagation algorithm. Back propagation - training and convergence. Functional approximation with back propagation. Practical and design issues of back propagation learning.	6
4	Radial Basis Function Networks : Pattern separability and interpolation. Regularization Theory.Regularization and RBF networks.RBF network design and training. Approximation properties of RBF	6
5	Competitive Learning and Self organizing ANN : General clustering procedures. Learning Vector Quantization (LVQ). Competitive learning algorithms and architectures. Self organizing feature maps. Properties of feature maps.	6
6	Fuzzy Neural Networks : Neuro-fuzzy systems. Background of fuzzy sets and logic. Design of fuzzy stems. Design of fuzzy ANNs	7
	References NPTEL course	

ELECTIVE-VII 1. SWITCH GEAR AND PROTECTION

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Power system I and II, control system I and II, machine I and II	
Course outcome	To understand principles of protective relaying. To understand principle of construction, operation and selection of different type of circuit breaker used in power system. To understand different protection schemes used in power system operation	
Unit	Contents	Contact Hrs
1	Switchgear and protection: Different types of switchgear, modes of classification, ratings and specifications. Protective Relaying: Need of protective relaying in power system, General idea about protective zone, Primary and backup protection, Desirable qualities of protective relaying, Classification of relays, Principle of working and characteristics of attracted armature, balanced beam, induction, disc and cup type relays, induction relays, Setting characteristics of over current; directional, differential, percentage differential and distance (impedance, reactance, mho) relays, introduction to static relays, advantages & disadvantages.	8
2	Circuit interruption: Principles of circuit interruption, arc phenomenon, A.C. and D. C. circuit breaker, Restricting and recovery voltage. Arc quenching methods. Capacitive, inductive current breaking, resistance switching, Auto reclosing Circuit Breakers: Construction, working and application of Air blast, Bulk oil, Minimum oil, SF6 and vacuum circuit breakers, Circuit breaker ratings, Rewritable and H. R. C. fuses, their characteristics and applications..	6
3	Digital And Numerical Protection: Introduction, working principle , Diff. methods of Digital and Numerical protection,	6
4	Bus bar: Feeder and Transmission line protection. Bus bar protection, Frame leakage protection circulating current protection and Transmission line protection using over current relays. Principles of distance relaying, choice between impedance, reactance and mho types, pilot wire and carrier pilot protection.	6
5	Protection of Alternators and Transformers: Alternators – Stator fault, stator inter turn protection. Unbalanced load, protection (Negative phase sequence [NPS] protection) Transformer – Use of Buccholz relay, differential protection, connection of C. T. and calculation of C.T. ratio needed for differential relaying, balanced and unbalanced restricted earth fault protection, frame leakage protection. Generator-Transformer unit protection	6
6	Insulation co-ordination and over current protection: Definitions (Dry flashover voltage FOV), WEF FOV, Impulse FOV, insulation, coordinating insulation and protective devices. Basic impulse insulation (BIL), Determination of line insulation. Insulation levels of substation equipment. Lightning arrester selection and location. Modern surge diverters and Necessity of power system earthing, Method of earthing the neutral, Peterson coil, earthing of transformer.	7
	References: 1. Patara Basu & Chaudhary – Power System Protection.(New Delhi Oxford And IBH). 2. Sunil S. Rao – Switchgear & Protection.(Tata Mcgraw Hill). 3. Madhavrao .T. S– Static relay.	

ELECTIVE-VII 2. COMPUTER AIDED ANALYSIS AND DESIGN

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Numerical methods and C programming, control system I and II	
Course outcome	To study different computer aided tools in engineering application. To understand the functionality of different engineering software. To apply different software in engineering design.	
Unit	Contents	Contact Hrs
1	Introduction to computer aided tools for analysis and design- software and hardware	8
2	PSPICE /PSIM / MATLAB-SIMULINK/ (description as per choice/ availability)	6
3	MATHEMATICA/ PSIM / LABVIEW / DSPACE(description as per choice/ availability)	6
4	Modelling of Electrical/Electronic components and systems, Time and Frequency domain analysis, parameter variations, response representation storage/import/export.	6
5	Optimization methods: parametric optimization and functional optimization. Design issues of Electrical/Electronic components and systems.	6
6	Applications for control systems, power systems and electrical machines	7
	Text/Reference Books: 1. L.P.Singh, „Advanced Power System Analysis and Dynamics", New Age International. 2. M.Gopal, „Control Systems: Principles and Design", TMH 3. Vlado Ostovic „Computer-Aided Analysis of Electric Machines: A Mathematical Approach", Prentice Hall. 4. Singiresu S. Rao, „ Engineering optimization: theory and practice", John Wiley & Sons. 5. Paul W. Tuinenga, "SPICE: A guide to circuit Simulation and Analysis Using PSPICE", Prentice Hall, 1992. 6. M.H. Rashid, "SPICE for Circuits and Electronics Using PSPICE" Prentice Hall of India, 2000	

ELECTIVE-VII 3. MECHATRONICS

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Digital electronics, basic mechanical engineering	
Course outcome	To understand concept of mechatronics. To understand sensor and transducer construction and operation. To understand microprocessor architecture and operation. To understand principle of construction and operation of PLC To design a robo for engineering application.	
Unit	Contents	Contact Hrs
1	Introduction to Mechatronics and its Systems; Evolution, Scope, Measurement Systems, Control Systems, open and close loop systems, sequential controllers, microprocessor based controllers, mechatronics approach. Basics of Digital Technology Number System, Boolean algebra, Logic Functions, Karnaugh Maps, Timing Diagrams, Flip-Flops, Applications	8
2	Sensors and transducers -Introduction, performance terminology-Displacement, Position and Proximity, Velocity and motion, force, Fluid Pressure-Temperature sensors Light Sensors-Selection of Sensors-Signal Processing Pneumatic and Hydraulic actuation systems: actuation systems, Pneumatic and hydraulic systems, directional control valves, pressure control valves, cylinders, process control valves, rotary actuators.	6
3	Mechanical actuation systems -Mechanical systems, types of motion, kinematics chains, cams, gear trains, ratchet and pawl, belt and chain drives, bearings, mechanical aspects of motor selection.	6
4	Microprocessors-Introduction, Architecture, Pin Configuration, Instruction set, Programming of Microprocessors using 8085 instructions-Interfacing input and output devices-Interfacing D/A converters and A/D converters, Applications, Temperature control, Stepper motor control, Traffic light controller	6
5	Programmable Logic Controller- Introduction, Basic structure, Input/ Output Processing, Programming, Mnemonics, Timers, Internal relays and counters, Data handling, Analog Input/Output, Selection of a PLC.	6
6	Robotics- Introduction, types of robots, Robotic control, Robot drive systems Robot end effectors, selection parameters of a robot, applications.	7
	Text/Reference Books: 1. Bolton W., "Mechatronics", Longman, Second Edition, 2004. 2. Histand Michael B.& Alciatore David G., "Introduction to Mechatronics & Measurement Systems", McGraw Hill, 2003. 3. HMT Ltd., "Mechatronics", Tata McGraw Hill Publishing Co. Ltd., 1998. 4. Nitaigour Premchand Mahalik, "Mechatronics Principles, Concepts * Applications", TMH 2003	

ELECTIVE- VIII. 1. RURAL TECHNOLOGY AND COMMUNITY DEVELOPMENT.

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Communication skills	
Course outcome	To analysis data, information and knowledge. To understand concepts of marketing. To identify projects and work for community development To understand and analyze business model.	
Unit	Contents	Contact Hrs
1	Data Analysis and Measures of Central Tendency- Meaning, nature, scope and limitations of statistics, collection of statistical data, classification, tabulation and diagrammatic representation of data, Measures of central tendency : Statistical averages Mean, Median, Mode.	8
2	Data, Information and Knowledge; concept of information, need of information (professional, educational, research), qualities of information, value of information, difference between data and information, properties of the needed information. Information and Management; planning, organizing, co-ordinating and controlling,	6
3	Concepts of marketing; difference between marketing selling and retailing; marketing mix, market-segmentation, marketing planning. Strategy and Approaches; modern concept of marketing.	6
4	Community development; concept, definition, meaning, need, history, principles, objectives and scope. Community Building: Coming of Age, Regenerating Community, Community Model	6
5	Consensus Organizing Model, What's Behind Building Healthy Communities? Participatory Democracy, The Role of various NGOs in Community Development.	6
6	The Role of Business and Government in Community Development Initiatives How to Form a Non-profit Corporation Fund Raising and Grant Writing.	7
	References; NPTEL	

ELECTIVE- VIII. 2. PROJECT MANAGEMENT

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Communication skills.	
Course outcome	To understand concepts of project management. To develop a project plan. To understand the project implementation strategy. To analyze post project affects.	
Unit	Contents	Contact Hrs
1	Introduction to Project management: Characteristics of projects, Definition and objectives of Project Management, Stages of Project Management, Project Planning Process, Establishing Project organization.	8
2	Work definition: Defining work content, Time Estimation Method, Project Cost Estimation and budgeting, Project Risk Management,	6
3	Project scheduling and Planning Tools: Work Breakdown structure, LRC, Gantt charts, CPM/PERT Networks	6
4	Developing Project Plan (Baseline), Project cash flow analysis, Project scheduling with resource constraints: Resource Levelling and Resource Allocation. Time Cost Trade off: Crashing Heuristic.	6
5	Project Implementation: Project Monitoring and Control with PERT/Cost, Computers applications in Project Management, Contract Management, Project Procurement Management	6
6	Post-Project Analysis	7
	Text/Reference Books: 1. Shtub, Bard and Globerson, Project Management: Engineering, Technology, and Implementation, Prentice Hall, India 2. Lock, Gower, Project Management Handbook. 3. Cleland and King, VNR Project Management Handbook. 4. Wiest and Levy, Management guide to PERT/CPM, Prentice Hall. Ibdia 5. Horald Kerzner, Project Management: A Systemic Approach to Planning, Scheduling and Controlling, CBS Publishers, 2002. 6. S. Choudhury, Project Scheduling and Monitoring in Practice. 7. P. K. Joy, Total Project Management: The Indian Context, Macmillan India Ltd.	

ELECTIVE- VIII. 3. KNOWLEDGE MANAGEMENT

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Communication skills	
Course outcome	To understand different components knowledge management. To conduct knowledge audit and knowledge management practices in organization.	
Unit	Contents	Contact Hrs
1	Introduction: Definition, evolution, need, drivers, scope, approaches in Organizations, strategies in organizations, components and functions, understanding knowledge; Learning organization: five components of learning organization, knowledge sources, and documentation	8
2	Essentials of Knowledge Management; knowledge creation process, knowledge management techniques, systems and tools	6
3	Organizational knowledge management; architecture and implementation strategies, building the knowledge corporation and implementing knowledge management in organization	6
4	Knowledge management system life cycle, managing knowledge workers,	6
5	knowledge audit, and knowledge management practices in organizations, few case studies.	6
6	Futuristic KM: Knowledge Engineering, Theory of Computation, Data Structure	7
	Reference Books : 1. Knowledge Management – a resource book – A Thohothathri Raman, Excel, 2004. 2. Knowledge Management- Elias M. Awad Hasan M. Ghazri, Pearson Education 3. The KM Toolkit – Orchestrating IT, Strategy & Knowledge Platforms, Amrit Tiwana, Pearson, PHI, II Edn. 4. The Fifth Discipline Field Book – Strategies & Tools For Building A learning Organization – PeterSenge et al. Nicholas Brealey 1994 5. Knowledge Management – Sudhir Warier, Vikas publications 6. Leading with Knowledge, Madanmohan Rao, Tata Mc-Graw Hill	