KANNUR UNIVERSITY

FACULTY OF ENGINEERING

Curricula, Scheme of Examinations & Syllabus for Semesters VII & VIII of B.Tech. Degree Programme in Electrical & Electronics Engineering with effect from 2007 Admissions

SEVENTH SEMESTER

Code	Subject	Hours /Week			Sessional Marks	University Examination	
		L	T	P/D		Hrs	Marks
2K6EE 701	Industrial Management	3	1	-	50	3	100
2K6EE 702	Digital Signal Processing	3	1	-	50	3	100
2K6EE 703	Control Systems II	3	1	-	50	3	100
2K6EE 704	Power Systems III	3	1	-	50	3	100
2K6EE 705	Elective II	3	1	-	50	3	100
2K6EE 706(P)	Advanced Electrical Engg: Lab	-	-	3	50	3	100
2K6EE 707(P)	Software Lab	-	-	3	50	3	100
2K6EE 708(P)	Mini Project	-	-	4	50	-	-
2K6EE 709(P)	Physical Education, Health & Fitness				50		
TOTAL		**15**	**5**	**10**	**450**	**-**	**700**

Elective II

2K6 EE 705(A) – High Voltage Engineering
2K6 EE 705(B) – Electrical Machine modelling & Analysis
2K6 EE 705(C) - Switched Mode Power Converters
2K6 EE 705(D) - Biomedical Engineering
2K6 EE 705(E) – Robotics & Artificial Intelligence
2K6 EE 705(F) - Entrepreneurship

EIGHTH SEMESTER

Code	Subject	Hours/Week			Sessional Marks	University Examination	
		L	T	P/D		Hrs	Marks
2K6 EE 801	Instrumentation Systems	3	1	-	50	3	100
2K6 EE 802	Industrial Electric Drives	3	1	-	50	3	100
2K6 EE 803	Electrical Machine design	3	1	-	50	3	100
2K6 EE 804	Energy Technology	3	1	-	50	3	100
2K6 EE 805	Elective III	3	1	-	50	3	100
2K6 EE 806(P)	Seminar	-	-	4	50	-	-
*2K6 EE 807(P)	Project & Industrial Training	-	-	6	100	-	
2K6 EE 808(P)	Viva Voce	-	-	-	-	-	100
TOTAL **Aggregate marks for 8 semesters = 8400**		**15**	**5**	**10**	**400** **3000**	**-**	**600** **5400**

*25 Marks is allocated for Industrial Training

Elective III

2K6 EE 805(A) – Power System Operation & Control
2K6 EE 805(B) – Special Machines & Linear Machines
2K6 EE 805(C) - Neural Networks & Fuzzy Logic
2K6 EE 805(D) – Digital System design
2K6 EE 805(E) –Satellite Communication Systems
2K6 EE 805(F) – HVDC & FACTS

2K6 EE 701 INDUSTRIAL MANAGEMENT

3 hours lecture and 1 hour tutorial per week

Module I (12 HOURS)

Concepts of Management and Organisation - Functions of Management - Evolution of Management Thought : Taylor's Scientific Management, Fayol's Principles of Management, Douglas Mc-Gregor's Theory X and Theory Y, Mayo's Hawthorne Experiments, Hertzberg's Two Factor Theory of Motivation, Maslow's Hierarchy of Human Needs - Systems Approach to Management.

Module II (13 HOURS)

Designing Organisational Structures : Basic concepts related to Organisation - Departmentation and Decentralisation, Types of mechanistic and organic structures of organisation (Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organisation, Cellular Organisation, team structure, boundaryless organization, inverted pyramid structure, lean and flat organization structure) and their merits, demerits and suitability. Introduction to TQM-Quality Circles, ISO 9000 series procedures.

Module III (13 HOURS)

Plant location, definition, factors affecting the plant location, comparison of rural and urban sites-methods for selection of plant- Matrix approach. Plant Layout definition, objectives, types of production, types of plant layout - various data analyzing forms-travel chart.

Introduction to PERT / CPM : Project management, network modeling-probabilistic model, various types of activity times estimation-programme evaluation review techniques- Critical Path-probability of completing the project, deterministic model, critical path method (CP-critical path calculation-crashing of simple of networks.

Module IV (14 HOURS)

Work study - Definition, objectives, method study - definition, objectives, steps involved- various types of associated charts-difference between micromotion and memomotion studies. Work measurement- definition, time study, steps involved-equipment, different methods of performance rating- allowances, standard time calculation. Work Sampling - definition, steps involved, standard time calculations, differences with time study.

Introduction to Human Resource Management, Functions of HRM, Job Evaluation, different types of evaluation methods. Job description, Merit Rating.- difference with job evaluation, different methods of merit ratings, wage incentives, different types of wage incentive schemes. Marketing, marketing vs selling, marketing mix, product life cycle.

Text books

1. Amrine, Manufacturing Organization and Management, Pearson, 2nd Edition, 2004.
2. Industrial Engineering and Management O.P. Khanna Dhanpat Rai.

References

1. Stoner, Freeman, Gilbert, Management, 6th Ed, Pearson Education, New Delhi, 2005.
2. Panner Selvam, Production and Operations Management, PHI, 2004.
3. Ralph M Barnes, Motion and Time Studies, John Wiley and Sons, 2004.
4. Chase, Jacobs, Aquilano, Operations Management, TMH 10th Edition, 2003.
5. L.S.Srinath, PERT / CPM, affiliate East-West Press, New Delhi, 2000.
6. Gary Dessler, Human Resource Management, Pearson Education Asia, 2002.
7. Phillip Kotler, Marketing Management, Pearson, 2004.

Sessional work assessment	
Assignments	2x10 = 20
Tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module
Q II - 2 questions of 15marks from module I with choice to answer any one
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Q V - 2 questions of 15marks from module IV with choice to answer any one

2K6 EE 702 : DIGITAL SIGNAL PROCESSING

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Discrete Signals – Signal Representation – Standard Discrete Time Signals – Classification of Discrete Time Signals – Basic Operations on Discrete Signals – Shifting, Time Reversal, Time Scaling, Scalar Multiplication, Signal Multiplier, Addition operation.

Discrete Time System – Classifications- Static & Dynamic Systems, Time Variant & Time Invariant Systems, Causal & Non Causal Systems, Linear & Non Linear Systems, FIR and IIR Systems, Stable & Unstable Systems – Representation of arbitrary Sequence. Impulse Response and Convolution Sum, Convolution and Correlation of two Sequences - Inverse System - de convolution.

Analysis of LTI discrete systems – Solution of difference equations by direct method, natural response, forced response- Step response and determination of impulse response h(n) from second order difference equation.

Module II (12 hours)

Frequency domain representations – representations of Discrete time Fourier series(DTFS)- Discrete time Fourier transform(DTFT) and its properties – frequency response of LTI Discrete- time system - sampling – aliasing effect- sampling theorem- - Z transforms - inverse Z transforms - bilinear transformation.

Representation of discrete Fourier series (DFS) - Discrete Fourier transforms (DFT) and its properties. Inverse Discrete Fourier transforms (IDFT) - linear convolution - circular convolution - linear convolution with circular convolution using DFT - overlap - add method - overlap - save method.

Module III (14 hours)

FFT - Radix2 DIT FFT algorithm - Radix2 DIF FFT algorithm - IDFT using FFT algorithm- butterfly structure - bit reversed order - in - place computations

Structures for realization of IIR systems and FIR systems.

Quantization noise – derivation for quantization noise power – Fixed point and binary floating point number representation – comparison – over flow error – truncation error –DSP chips - architecture of fixed point DSP core (schematics only)

Module IV (13 hours)

Digital filter design techniques - design of IIR filters from analog filters - analog to digital transformation - backward - difference and forward - difference approximations - impulse invariant transformation - bilinear transformation - prewarping - analog butterworth function for various filters - design example - properties of FIR filters - design of FIR filters using windows - comparison of IIR and FIR filters - finite word length effect in DSP

Text books

1. Oppenhiem A.V. & Schafer R.W., *Discrete-Time Signal Processing*, Prentice Hall of India
2. Mitra S.K., *Digital Signal Processing - A Computer Based Approach,* Tata McGraw Hill

Reference books

1. Ziemer R.E., Tranter W.H., & Fannin D.R, *Signals And Systems-Continuous And Discrete*, Pearson Education
2. Proakins J.G. & Manolakins D.G., *Digital Signal Processing-Principles Algorithms And Applications*, Prentice Hall of India
3. Rabiner L.R. & Gold B*, Theory and Application of Digital Signal Processing*, Prentice Hall Of India
4. Ifeachor E.C., & Jervis B.W., *Digital Signal Processing-A Practical Approach,* Addison Wesley
5. *DSP Users Manual,* Texas Instruments, TMS320C54*DSP
6. *CPU And peripherals reference set Vol. 1*, DSP solutions

Sessional work assessment	
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Q V - 2 questions of 15marks from module IV with choice to answer any one

2K6 EE 703 : CONTROL SYSTEMS II

3 hours lecture and 1 hour tutorial per week

Module I (14hours)

State-space analysis of systems – Concept of state-state space and state variables-advantages over transfer function approach-state equations for typical electrical, mechanical and electromechanical systems-representation for linear time-varying and time-invariant systems- Phase variable and canonical forms-diagonalization-transfer function and state equations-matrix exponential- solution by state transition matrix-transfer function decomposition-Discrete-time state models-solution of discrete-time state equation-z transform decomposition.

Module II (10hours)

Design using conventional methods - Cascade compensation - PI, PD and PID control - lead and lag compensation using RC networks - design of lead, lag and lead-lag compensators using frequency response and root locus methods.

Module III (12 hours)

Non-linear systems - characteristics of non-linear systems - types of nonlinearities -phase plane analysis - construction –isocline method and delta method- singular points - classification of singular points.
Describing function analysis - definition - describing functions of common non-linearities –ideal relay,dead zone, saturation, combined dead zone and saturation-relay with hysteresis- stability analysis using DF - amplitude and frequency of limit cycle using DF.

Module IV (16 hours)

Liapunov methods – Sign definiteness of a function, Sylvester's criteria-stability in the sense of Liapunov - definition of stability, asymptotic stability and instability –Liapunov's second method - Liapunov stability analysis of LTIV continuous time and discrete time systems.

Controllability, observability and introduction to optimal control - concept and criteria for controllability and observability - state feed back - design via pole placement - formulation of the optimal control problem - performance measure - optimal control using second method of Liapunov - the quadratic regulator problem - solution of the reduced matrix Riccati equation

Reference books

1.Ogata K., *Modern Control Engineering*, Prentice Hall
2.Nagarath & Gopal, *Control System Engineering*, Wiley Eastern
3.Kuo B.C., *Automatic Control Systems,* Prentice Hall
4.Ogata K., *Discrete-Time Control Systems*, Prentice Hall
5.Donald E. Kirk, *Optimal Control Theory*, Prentice Hall

Sessional work assessment

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2K6 EE 704: POWER SYSTEMS-III

3 hours lecture and 1 hour tutorial per week

Module –I (13hrs)

Circuit breakers – principle of operation – air blast CB – Oil CB – SF6 CB – Vacuum CB – CB ratings –causes of over voltages – surges and traveling waves – voltage waves on loss less transmission lines – reflection and attenuation – protection against lightning –earth wires – lightning diverters – surge absorbers - arcing grounds – neutral earthing – Basic concepts of insulation levels and their selection - BIL – coordination of insulation.

Module –II(13hrs)

Protective relaying – protective zones – requirements of protective relaying – different types of relays and their applications – generalized theory of relays – protective schemes for generators, motors, transmission lines and bus bars – static relays – amplitude and phase comparators – block diagrams – protective schemes for generators, motors, transmission lines and bus bars - microprocessor based protective relaying.

Module –III(13hrs)

Industrial utilization of motors – factors governing selection of motors – Electrical considerations-matching of characteristics of load and motor – electric braking – regenerative braking – mechanical considerations-Types of enclosures- Types of transmission- heating and cooling curves- determination of rating of motor –short time , intermittent and continuous ratings -.

Electric traction - systems of traction – requirements of traction motors - speed time curve – mechanics of train movement – tractive effort for propulsion of train – power output from driving axles – specific energy consumption – methods of current collection.

Module – IV(13hrs)

Introduction to Flexible AC transmission System (FACTS) controllers- SVC, TCSC, Voltage Source Converter based controllers- Equivalent circuit, benefits and applications.

Power quality –fundamental concepts – sources, causes and effects of power quality problems– harmonics – measurement of power quality-THD- TIF – DIN – power quality standards - monitoring - mitigation techniques- passive filter design - active filter- custom power devices- distribution static compensator – dynamic voltage restorer- unified power quality conditioner.

Reference books

1. 1.Sunil S Rao, Switch Gear Protections, Khanna Publishers
2. 2.J.B. Gupta Utilization of electric power & electric traction, S K Kataria & sons
3. 3.J.B. Gupta Switchgear & Protection S K Kataria & sons
4. 4.Soni, Gupta & Bhatnagar, A Course in Electrical Power, Dhanpat Rai & Sons
5. 5.Van. C. Warrington A.R., Protective Relays Vol. 1 & 2, Chappman & Hall
6. 6.Mason C.R., Art and Science of Protective Relaying, Wiley Eastern.
7. 7.Ravindranath M. Chander, Power System Protection and Switchgear
8. 8.K R Padiyar, "FACTS controllers for transmission and distribution," New age International, New Delhi 2007.
9. 9.Haydt G.T., Electric Power Quality

Sessional work assessment

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Q V - 2 questions of 15marks from module IV with choice to answer any one

2K6 EE 705(A): HIGH VOLTAGE ENGINEERING

3 hours lecture and 1 hour tutorial per week

Module I (13 hours

Dielectrics and dielectric breakdown – electric breakdown in gas and gas mixtures- breakdown in uniform and non-uniform fields- Paschen's law-Twon-send criterion-penning effect-streamer mechanism-corona discharge-electronegative gas- breakdown in surge voltage-time lag-practical consideration in using gases for insulation purpose-breakdown in high vacuum- breakdown in liquid dielectrics-pure liquids and commercial liquids-electronic and cavitations breakdown – suspended practical mechanism-breakdown in solid dielectric-intrinsic-electromechanical-steamer and thermal breakdown-treeing phenomenon-partial discharge-breakdown of composite dielectrics

Module II (13 hours)

Generation of high voltages and currents-DC voltages-Voltage doubler- cascade-electrostatic machines-Voltage stabilization-AC voltages-cascade Transformers – series resonance circuits-impulse voltages-single stage and multistage circuits-wave shaping-tripping and control of impulse generators-synchronization with oscilloscope- generation of switching surge voltage-generation of impulse currents.

Module III (13 hours)

Measurement of high voltages and currents –DC-AC and impulse Voltages and currents – CRO – electrostatic generating and peak voltmeters, sphere gaps – factors affecting measurements- potential dividers (Capacitive and resistive)- series impedance ammeters – Ragoski coils-magnetic links-hall effect generators – PT's (magnetic and capacitive types) and CT's .

Module IV (13 hours)

H.V testing of materials and apparatus-acceptance-preventive and diagnostic tests-dielectric loss measurements-Schering bride-inductively coupled ratio arm bridge – loss measurement on complete equipment – partial discharge and ratio interference measurements – over voltage phenomenon and insulation co-ordination-traveling waves-line equations-wave transmission-reflection and attenuation-lighting phenomenon-switching surges-principle of insulation – co-ordination on HV and EHV systems-protection

Reference Books

1. Bewley L.V., Traveling waves on Transmission , Lines Dover Publishers
2. Kufee E & Abdulla M, High Voltage Engineering, Pergman Press
3. Naidu M S & Kamaraju V, High Voltage Engineering, Tata MC Graw Hill
4. Alston L L, H V Technology, Oxford, University Press
5. Craggs J D & Meed J M, H V Technique, Butterworths
6. Dieter Kind Wiley Lts, An Introduction to H V Experimental Technique
7. Kreuger Haywood, Discharge Detection in H V Equipment London
8. Thapar etal B, Power System Transients and High Voltage Principles, Capital pub
9. IEEE Standard Technique fo High Voltage testing, IEEE John wiley and Sons
10. Indian Standard

IS : 2070 -1962	IS : 2070 -1962
IS : 2544 -1963	IS : 2079 -1962
IS : 2099 -1962	IS : 2026 -1962
IS : 166 -1962	IS : 5959 -1970
IS : 1544 - 1964, 1970	IS : 7098 – 1973
IS : 3070 - 1965	IS : 4004 – 1967
IS : 6209 - 1971	IS : 4950 – 1968

11. British Standards
    B5:3959, B5:3070, B5:2914-1957

IEC Publications No: 99-1, Part1 -1970

Sessional work assessment

Assignments	2x10 = 20
Tests	2x15 = 30
Total marks	= 50

University examination pattern

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Q V - 2 questions of 15marks from module IV with choice to answer any one

2K6 EE 705(B): ELECTRICAL MACHINE MODELLING & ANALYSIS

3 hours lecture and 1 hour tutorial per week

Module I: Modeling and analysis of DC machines (15 hours)

Electrodynamical equations and their solution - a spring and plunger system - rotational motion system - mutually coupled coils - Lagrange's equation - application of Lagrange's equation to electromechanical systems - solution of electrodynamical equations by Euler's method and Runge-Kutta method - linearisation of the dynamic equations and small signal stability - *the primitive 4 winding commutaor machine*- the commutator primitive machine - the brush axis and its significance - self and mutually induced voltages in the stationary and commutator windings - speed e.m.f induced in commutator winding - rotational inductance coefficients - sign of speed e.m.f terms in the voltage equation - the complete voltage equation of primitive 4 winding commutator machine - the torque equation - *DC Machines* - analysis of simple DC machines using the primitive machine equations - analysis of cross-field DC machines using the primitive machine equations

Module II: Modeling and analysis of induction motors (13 hours)

The three phase induction motor - equivalent two phase machine by m.m.f equivalence - equivalent two phase machine currents from three phase machine currents - power invariant phase transformation - voltage transformation - voltage and torque equations of the equivalent two phase machine - commutator transformation and its interpretation - transformed equations - different reference frames for induction motor analysis - choice of reference frame- nonlinearities in machine equations - equations under steady state - solution of large signal transients in an induction machine - linearised equations of induction machine in current variables and flux linkage variables - small signal stability - eigen values - transfer function formulation - application of large signal and small signal equations

Module III: Modeling and analysis of synchronous machines (13 hours)

The three phase salient pole synchronous machine - three phase to two phase transformation - voltage and torque equations in stator, rotor and air-gap field reference frames - commutator transformation and transformed equations - parks transformation - suitability of reference frame Vs kind of analysis to be carried out - steady state analysis - large signal transient analysis - linearisation and eigen value analysis - general equations for small oscillations - small oscillation equations in state variable form - damping and synchronizing torques in small oscillation stability analysis - application of small oscillation models in power system dynamics

Module IV: Dynamical analysis of interconnected machines (11 hours)

Machine interconnection matrices - transformation of voltage and torque equations using interconnection matrix - large signal transient analysis using transformed equations - small signal model using transformed equations - the DC generator/DC motor system - the alternator/synchronous motor system - the Ward-Leonard system - hunting analysis of interconnected machines - selection of proper reference frames for individual machines in an interconnected system

Reference books

1.Sengupta D.P. & Lynn J.B., *Electrical Machine Dynamics,* The Macmillan Press Ltd.
2.Jones C.V., *The Unified Theory of Electrical Machines*, Butterworth
3.Woodson & Melcher, *Electromechanical Dynamics*, John Wiley & Sons
4.Kraus P.C., *Analysis of Electrical Machines*, McGraw Hill Book Company
5.Boldia I. & Nasar S.A., *Electrical Machine Dynamics*, The Macmillan Press Ltd.

Sessional work assessment	
Assignments	2x10 = 20
Tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module
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Q IV - 2 questions of 15marks from module III with choice to answer any one
Q V - 2 questions of 15marks from module IV with choice to answer any one

2K6 EE 705(C): SWITCHED MODE POWER CONVERTERS

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Switching regulators- Introduction- Circuit scheme - Basic switching regulators-Buck converters - Continuous conduction mode - Boundary between continuous and discontinuous conduction - Discontinuous conduction mode - Output voltage ripple –Numerical examples – Boost converter - Continuous conduction mode - Boundary between continuous and discontinuous conduction - Discontinuous conduction mode - Numerical examples –Buck Boost converter - Continuous conduction mode - Boundary between continuous and discontinuous conduction - Discontinuous conduction mode - Output voltage ripple - Numerical examples- Cuk dc-dc converter. Comparison between DC-DC converters – Applications.

Module II (13 hours)

Switching dc power supplies with electric isolation –Necessity of Isolation transformer – Fly back converters-– Push pull converter – Half bridge converter –Full bridge converter- -Forward converter – Dual forward converter

Some Typical circuit of single ended converter- Circuit diagram of simple buck regulator using SG 1524 and SG1525-Circuit diagram of PWM controlled off line forward converter using IC UC 1524 A – Circuit diagram of an Off line forward converter using a MOSFET

Current mode control of switching regulators - Basic diagram of a current mode control of a boost regulator-Integrated circuit implementation of current mode control scheme by using UC 1846. Forward converter using current mode control IC-Slope compensation in current mode regulator.

Module III (13 hours)

Switch mode dc-ac Inverters- Basic concepts of switch mode inverters - PWM switching scheme - Square wave switching scheme - Single phase inverters - Half bridge and full bridge inverters - SPWM with bipolar and unipolar voltage switching - Switch utilization in single phase inverters - Three phase inverters - SPWM in three phase voltage source inverters - Square wave operation in three phase inverters - Switch utilization - Ripple in the inverter output - Conduction of switches in three phase inverters - Effect of blanking time on voltage in PWM inverters - Square wave pulse switching - Programmed harmonic elimination switching - Current regulated modulation

Three phase current source inverter and its applications –Three phase voltage source inverter and its applications

Module IV (13 hours)

Resonant Pulse inverters - Classification – Series resonant inverters with unidirectional switches and with bidirectional switches – Frequency response for series and parallel loaded – Parallel resonant inverters – Voltage control of resonant inverters – Class E resonant inverter – ZVS resonant converters –ZCS resonant converters M type and L type – Comparison between ZVS & ZCS resonant converters- Two quadrant ZVS resonant converter – Resonant DC link Inverters

Multi level inverters and Multistage conversions –Multi level inverter- Concepts- General topology-Flying capacitor multilevel inverter –Principle of operation –Multi stage conversions – Control circuits voltage mode control and current mode control – Introduction about Matrix converter.

Reference books

1.Ned Mohan et.al, *Power Electronics*, John Wiley and Sons
2.P.C.Sen ,Modern Power Electronics , S.Chand & Company
3.Muhammed H.Rashid, Power Electronics- Third edition, Pearson education .
4.Keith H Billings, *Handbook of Switched Mode Power Supplies*, McGraw Hill Publishing Company

Sessional work assessment

Assignments	2x10 = 20
Tests	2x15 = 30
Total marks	= 50

University examination pattern

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Q V - 2 questions of 15marks from module IV with choice to answer any one

2K6 EE 705(D): BIOMEDICAL ENGINEERING

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Electrical activity of excitable cells - SD curve - functional organization of the peripheral nervous system - electrocardiogram (in detail with all lead systems) - electroencephalogram - electromyogram - electroneurogram - electrode - electrolyte interface - polarisation - polarisable and non polarisable electrodes - surface electrodes - needle electrodes - micro electrodes - practical hints for using electrodes - 'skin -electrode' equivalent circuit - characteristics of 'bio - amplifiers'

Module II (13 hours)

Blood pressure - direct measurements - harmonic analysis of blood pressure waveform - systems for measuring venous pressure - heart sounds - phonocardiography - cardiac catheterisation - indirect blood pressure measurement - electromagnetic blood flow meters - ultrasonic blood flow meters - impedance plethysmography - photo plethysmography - 'indicator-dilution' method for blood flow determination - spirometry - measurement of various respiratory parameters - respiratory plethysmography - chamber plethysmography

Module III (13 hours)

Measurement of gas flow rate - cardiac pacemakers and other electric stimulators - defbrillators and cardio converters - blood pumps - hemodialysis - ventilators - infant incubators - drug delivery devices - lithotripsy - therapeutic applications of laser

Module IV (13 hours)

Physiological effects of electricity - important susceptibility parameters - macro shock hazards - micro shock hazards - protection against shock - electrical isolation - electrical safety analyzers - measurement of pH, PCO_2 and PO_2

Reference books

1.John G. Webster, *Medical Instrumentation - Application and Design,* John Wiley and Sons
2.Hand Book of Biomedical Instrumentation, Khandpur, TMH
3.Raja Rao C. & Guha S.K., *Principles of Medical Electronics & Biomedical Instrumentation,* Universities Press
4.Geddes & Baker, *Principles of Applied Biomedical Instrumentation*, Wiley, Latest edition
5.Wiley, *Encyclopedia of Medical Devices and Instrumentation*, Latest edition
6.Bronzino, *Hand book of Biomedical Engineering,* IEEE Press book

Sessional work assessment	
Assignments	2x10 = 20
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Total marks	= 50

University examination pattern

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Q V - 2 questions of 15marks from module IV with choice to answer any one

2K6 EE 705 (E): ROBOTICS & ARTIFICIAL INTELLIGENCE

3 hours lecture and 1 hour tutorial per week

Module I (12 Hours)

Introduction to robotics – Classification of Robots – Direct Kinematics –The Arm Equation- A Five –Axis articulated Robot(Rhino XR-3) – Inverse Kinematic Problem – Inverse Kinematics of a Five axis articulated robot – Workspace Analysis – Continuous- Path Motion .

Module II (12 Hours)

Robot control: The control problem – State equation – Constant solutions – Linear feedback systems - Single-axis PID control – PD-Gravity control – Computed-Torque control – Variable-Structure control – Impedance control . Robot applications – Industrial automation – General layout.

Module III (14 hours)

Artificial Intelligence- Definition - history and applications - propositional calculus -predicate calculus - inference rules - structures and strategies for state space search - heuristic search algorithms - heuristics in games - complexity issues - control and implementation of state space search - production systems - planning - the blackboard architecture

Module IV (14 hours)

Languages and programming techniques for AI - overview of LISP - search - higher order functions and procedural abstractions - search strategies - pattern matching - recursion - interpreters - logic programming in LISP - streams and delayed evaluation - network representations and inheritance - CLOS.

Reference books

1. Robert J.Schilling, "Fundamentals of Robotics – Analysis & Control", Prentice Hall of India Pvt. Ltd., 2006.
2.Introduction to Robotics (Mechanics & Control), John J. Craig, Pearson Education Asia 2002.
3.Saeed B.Niku, "Introduction to Robotics – Analysis, Systems, Applications", Prentice Hall of India Pvt. Ltd., 2003.
4.Luger G.F. & Stubblefield W.A., Artificial Intelligence, 3/e, Addison Wesley
5.Nils J Nilsson, Artificial Intelligence - A New Synthesis, Harcourt Asia Pte. Ltd.
6.Elain Rich & Kevin Knight, Artificial Intelligence, 2/e, Tata McGraw Hill
7.Steven L Tanimotto, The Elements of Artificial Intelligence, Computer Science Press
Winston P.H., LISP, Addison Wesley

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University examination pattern

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Q V - 2 questions of 15marks from module IV with choice to answer any one

2K6 EE 705 (F): ENTREPRENEURSHIP

3 hours lecture and 1 hour tutorial per week

Module I (12 hours)

Entrepreneur- Functions and classifications of entrepreneurs - Characteristics of entrepreneur - Nature and importance of entrepreneur - Entrepreneur vs. professional manager - Women entrepreneurs.

Module II (13 hours)

Concept of Entrepreneurship - Enterpreneurship and environment-Policies governing entrepreneurs-entrepreneurial development programmes - Institutions for - entrepreneurship development, -Entrepreneurship development in other countries.

Module III (13 hours)

Entrepreneurial motivation theories-entrepreneurial competencies-Developing competencies-Role of entrepreneur-Assistance programmes for small scale units-Role of SSI sector in the economy-SSI units-failure ,causes and preventive measures-

Module IV (14 hours)

Concept and classification of project- identification- project formulation - project report - project design - project appraisal - profitability appraisal - project planning - social cost benefit analysis - financial analysis and project financing. Role of financial institutions -Bank finance to entrepreneurs-Role of development financial institutions

Reference books

1. Harold Koontz & Heinz Weihrich, *Essentials of Management*, McGraw Hill International
2. Robert D Hirich & Michael P Peters Irwin, *Entrepreneurship*, McGraw Hill
3. Rao T.V. & Deshpande M.V., Prayag Metha, Manohar S Nadakarni, *Developing Entrepreneurship A Hand Book,* Learning Systems
4. Donald Kurado & Richard M Hodgelts, *Entrepreneurship A Contemporary Approach,* The Dryden Press
5. Dr Patel V.G., *Seven Business Crisis*, Tata McGraw Hill
6. Jeffry A Timmons, *New Venture Creation - Entrepreneurship for 21st Century,* McGraw Hill International, 5th Edition
7. Patel J.B., Noid S.S., *A Manual on Business Opportunity Identification*, *Selections*, EDII
8. Rao C.R., *Finance for Small Scale Industries*
9. Pandey G.W., *A Complete Guide to Successful Entrepreneurship,* Vikas Publishing

Sessional work assessment	
Assignments	2x10 = 20
Tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module
Q II - 2 questions of 15marks from module I with choice to answer any one
Q III - 2 questions of 15marks from module II with choice to answer any one
Q IV - 2 questions of 15marks from module III with choice to answer any one
Q V - 2 questions of 15marks from module IV with choice to answer any one

2K6 EE 706(P): ADVANCED ELECTRICAL ENGINEERING LAB

3 hours practical per week

(Twelve experiments from the following topics listed will be scheduled for the laboratory depending on the availability of equipment, components etc.)

1. Determination of transfer function of DC motor (a) armature control (b) field control
2. Study and experiments on (a) DC servo motor (b) AC servo motor
3. Experiments on synchros (a) characteristics (b) data transmission (b) error detection (d) differential synchro
4. Magnetic amplifier - characteristics and control circuits.
5. Determination of transfer function of the amplidyne and load characteristics
6. Closed loop voltage voltage regulation of DC Generator using Amplidyne
7. Design and experimental determination of frequency response determination of lag, lead and lag-lead networks
8. Study and experiments using PID Controller.
9. Determination of relay characteristics
10. Experiments on Sphere Gaps
11. Study and experiments using Power , Energy and Harmonic Analyser.
12. Study of 8085 & 8086 Microprocessors and implementation of simple programs.
13. 8085 Microprocessor based generation of Non – Linear functions using proper interfacing and display devices.
14. 8086 Microprocessor based generation of Non – Linear functions using proper interfacing and display devices.
15. DC Motor interfacing and relay interfacing using 8085 & 8086 Microprocessor kits .
16. Study of 8051 Microcontroller and implementation of simple programs.
17. Generation of Sine wave , Square wave, sawtooth wave and triangular wave using 8051 Microcontroller
18. Familiarisation of DSP Kits

Sessional work assessment	
Laboratory practicals and record	= 35
Test	= 15
Total marks	= 50

2K6 EE 707(P): SOFTWARE LAB

3 hours practical per week

(12 Experiments should be done in the lab classes and recorded, covering at least one experiment per Module. The remaining should be practiced)

Module I: C Programming

1. Simple programs (Factorial computation, displaying Pascals triangle, palindrome checking , fibonacci sequence, checking for prime numbers etc.)
2. Programs using decision and statements in C (Eg. Bubble sorting, quick sorting programs etc)
3. Functions – Pass by value, pass by reference, passing arrays
4. File Handling programs (Eg: Plotting a curves after reading from a file and writing to a file)
5. Matrix manipulations – multiplication, inverse, determinants, transpose.

Module II: Numerical Analysis using C

1. Solution of differential equations – Eulers & Ranga Kutta- Comparison
2. Solution of linear equations – Gauss elimination, Gauss Jordan & Gauss- Siedel-Comparison
3. Solution of numerical integration – Trapezoidal & Simpsons -Comparison

Modulte III : MATLAB Programming:

1. Familiarization of basic MATLAB commands
2. Time domain response of a second order system for step input and obtain performance parameters.
3. Conversion of transfer function of a system into state space form and vice-versa.
4. Root locus diagram of an open loop transfer function and determine range of gain 'k' for stability.
5. Bode diagram of an open loop transfer function.
6. To draw a Nyquist plot of an open loop transfer functions and examine the stability of the closed loop system.
7. Design of a lag, lead and lag lead compensator for given specifications.

Module IV: MATLAB/SIMULINK Experiments :

1. Single phase and three phase diode bridge rectifiers
2. Single phase half wave controlled converter with R and RL load.
2. Single phase fully controlled converter with R and RL load
3. Three phase fully controlled converter with R and RL load.
4. Single phase AC voltage controller with R and RL load.
5. Buck, boost and buck boost converters for a given switching frequency
6. Cyclo converters
7. Sine PWM DC-AC Converter

Module V : Pspice/Electronic workbench/SEQUEL or any Circuit simulation software

1. Determination of node voltages and branch currents in a resistive network.
2. Thevenin's equivalent circuit of a resistive network.
3. Transient response of (a) series R-L-C circuit for step voltage input, (b) parallel R-L-C circuit for step current input.
4. Transient response of a series R-L-C circuit for alternating square voltage waveform.
5. Frequency response of a series R-L-C circuit for sinusoidal voltage input.
6. Transient response of output voltage in a single phase half wave rectifier circuit using capacitance filter.
7. Single phase and three phase diode bridge rectifiers
8. Single phase and three phase SCR bridge rectifiers

Module VI: Power system simulation (using any power flow analysis package)

1. Power flow analysis using Gauss Siedel /Newton Raphson's/ Fast Decoupled Method.
2. Developing a Single line Diagram of a Power System.
3. Fault analysis with a single line diagram. Obtaining the sub-transient fault currents for (a) Symmetrical Faults, (b) Line to Ground Fault, (c) Line to Line Faults etc.

Sessional work assessment	
Laboratory practicals and record	= 35
Test	= 15
Total marks	= 50

2K6 EE 708(P): MINI PROJECT

4 hours per week

The project work can be a modelling/design project, experimental project or computer simulation projects in the topics of Electrical & Electronics Engineering interest. It can be allotted as a group project with groups consisting of three to five students

The assessment of all the mini projects shall be done by a committee consisting of three or four faculty members specialised in the various fields of Electrical & Electronics Engineering - the students will present their project work before the committee - the group average marks for the various projects will be fixed by the committee - the guides will award the marks for the individual students in a project maintaining the group average - each group will prepare the project report and submit to the department through the guide - the Head of the department will certify the copies and shall retain one copy in the departmental library

Sessional work assessment	
Presentation	: 30
Report	: 20
Total marks	: 50

2K6 EE 709(P): PHYSICAL EDUCATION, HEALTH & FITNESS

Introductory Lectures:

Unit 1: Health and fitness: Modern concept of health and fitness, meaning, scope, need and importance of health, fitness and wellness.

Unit II: Exercise and fitness: Means and methods of developing fitness. Importance of physical activities and exercises in developing and maintaining good health, Physical fitness and well being.

Unit III : Sports and Physical education: Meaning and scope, role and importance of sports and games in the development of physical fitness and personality. Social values of sports. Rules of major games.

Practical Sessions:

(All classes will be conducted after the normal working hours of the college)

50 sessions of minimum 1 hour duration each are envisaged (including Theory and Practical). The student can opt for one of the following activities in line with the specific programme / schedule announced by the faculty.

Athletics, Badminton, Basketball, Cricket, Football, General fitness, Hockey, Kabadi, Table Tennis, Ball Badminton, Archery, Volley ball, Yoga (not all activities may be offered in a particular semester. More disciplines will be offered based on the availability of infrastructure and expertise).

In addition, health and fitness assessment such as height, Weight, Resting Pulse rate and blood Pressure will be carried out.

Objective :

a) Basically to inculcate awareness of health, general fitness and attitude to voluntary physical involvement.
b) To promote learning of basic skills in sports activities and secondarily to pave the way for mastering some of the skills through continued future involvement.

Scheme of assessment:

The student will be continuously assessed on his performance on the field of play. There will not be minimum mark for pass or fail. Total 50 marks will be given assessing their attendance, regularity, punctuality and performance for 50 hours of activity from 1st semester to 7th semester.

2K6 EE 801: INSTRUMENTATION SYSTEMS

3 hours lecture and 1 hour tutorial per week

Module I: (14 hours) **Transducers**

Definition-different types of transducers-criteria for selection-general characteristics-dynamic characteristics-calibration-transducers for measurement of displacement-velocity-acceleration-speed- angular rotation–altitude-flow-liquid level-force-torque-humidity and moisture-pressure-strain and temperature-Hall effect transducers and applications

Module II: (12 Hours) **Signal conditioning, data transmission and Telemetry**

Signal conditioning-instrumentation amplifiers-different amplifiers-filters-low pass-high pass-band pass and band rejection filters-transducer bridges- null type and deflection bridges-AC bridges using push pull transducers-Data transmission and telemetry-methods of data transmission-general telemetry systems-sampling process-principles of time division and frequency division multiplexing-Modulation-AM,FM,PM,PAM,FWM,PPM and PCM as applied to telemetry.

Module III: (14 Hours) **Display methods, Recorders Experimental and Statistical analysis**

Display methods and devices-different types of display –display system building blocks. Recorders-galvanometric recorders-pen driving system-servo recorders-magnetic recorders-digital recorders-Experiments and statistical analysis-performance of experiment-the record of experiment-accuracy and precision-classification of errors-the characteristics of experimental data-description of dispensed data-type of probability distribution-probability error-combination of variances-combined error-guarantee errors.

Module IV: (12 Hours) **Instrumentation systems**

Basic Measuring system-Analog and digital data acquisition systems-generalized input-output configuration of measuring systems-dynamic characteristics-mathematical model-the concept transfer function (with special reference to measuring system)-procedure for developing transfer function-response to various type of inputs-classification of instruments based on their order & dynamic and frequency response studies-process control systems for temperature, level and pressure.

Reference Books

1.Sawhney A.K., A Course in Electrical and Electronic Measurement and Instrumentation, Dhanpat Rai and Sons

2. William David Cooper, Electronic Instrumentation and Measurement Techniques, prentice Hall

3. Ernet O. Doblin, Measurement System Application and Design, Mc Graw Hill International Edition

4. Klaassan K.B., Electronic Measurement and Instrumentation, Cambridge University Press

5. J B Gupta, Electronic & Electrical Measurements and Instrumentation , S K Kataria & Sons

6.Earnest C Doblin, Measurement System Application and Design, McGraw Hill

Sessional work assessment	
Assignments	2x10 = 20
Tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module
Q II - 2 questions of 15marks from module I with choice to answer any one
Q III - 2 questions of 15marks from module II with choice to answer any one
Q IV - 2 questions of 15marks from module III with choice to answer any one
Q V - 2 questions of 15marks from module IV with choice to answer any one

2K6 EE 802 : INDUSTRIAL ELECTRIC DRIVES

3 hours lecture and 1 hour tutorial per week

Module I (12 hours)

Electric drives - Block diagram of an electric drive - Parts of electric drives – Choice of electric drives – Speed torque conventions and multi quadrant operations-Drive parameters- Components of load torque - Steady state stability - Load equalization – Numerical examples

Control of electrical drives - Closed loop control of drives - Multi motor drives- current limit control - Speed sensing - Current sensing - Phase locked loop speed control-Closed loop position control –Necessity of solar powered dives and battery powered drives- Advantages of electric drives.

Module II (14 hours)

Dc motor drives – Methods of speed control- combined armature voltage and field flux control – Rectifier control of DC motors – Single phase half control and fully control – Three phase half control and fully control speed torque characteristics of single phase fully controlled rectifier drive – Numerical examples – Chopper control of DC drive –Principle of operation and control technique – TRC & CLC - Closed loop speed control schemes – Drive with current limit control –Closed loop armature control with field weakening.

Module III (14 hours)

Induction motor drives – Speed torque curves for variable frequency control of induction motor-torque and power capabilities – Fixed frequency variable voltage operation – Variable frequency operation - AC voltage controller circuits – Single quadrant closed loop speed control – Four quadrant closed loop speed control variable frequency control - VSI fed induction motor drive - Operation with field weakening - CSI controlled induction motor drives – Cycloconverter control drives - Slip power recovery schemes - Rotor frequency control - Single phase induction motor drives - Open loop and closed loop variable frequency PWM inverter drive with dynamic braking – Closed loop slip speed controlled PWM inverter drive with regenerative braking - Block diagram and flow charts.

Module IV (12 hours)

Synchronous motor drives –Speed control – Speed torque curves with variable frequency control - VSI and CSI fed drives - Variable frequency control - Self controlled synchronous motor drives – Closed loop speed control of self controlled synchronous motor drive fed from VSI and CSI block diagrams - Brushless dc motor drives - Microprocessor controlled dc and ac drives –Block diagrams and flow charts.

Reference books

1. Dubey G.K, *Fundamentals of Electric Drives*, Narosa Publications
2. Dubey G.K., *Power Semiconductor Controlled Drives*, Prentice Hall
3. Vedam Subramaniam, Thyristor Control of Electric Drives
4. Sen P.C, *Thyristor DC Drives*, John Wiley & Sons
5. Bose B.K et al, *Microcomputer Control of Power Electronics and Drives*, IEE Press

Sessional work assessment	
Assignments	2x10 = 20
Tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module
Q II - 2 questions of 15marks from module I with choice to answer any one
Q III - 2 questions of 15marks from module II with choice to answer any one
Q IV - 2 questions of 15marks from module III with choice to answer any one
Q V - 2 questions of 15marks from module IV with choice to answer any one

2K6 EE 803 : ELECTRICAL MACHINE DESIGN

3 hours lecture and 1 hour tutorial per week

Module I (14 hours)

DC machines - output equation - main dimensions - choice of specific electric and magnetic loadings - choice of speed and number of poles - design of armature conductors, slots and winding - design of air-gap and field system, - Carter's coefficient - real and apparent flux density - design examples

Module II (14 hours)

Transformers - single phase and three phase power transformers - output equation - main dimensions - choice of specific electric and magnetic loadings- design of core, LV winding, HV winding, tank and cooling tubes - design examples - temperature rise calculations - continuous and intermittent rating.

Module III (12 hours)

Alternators - salient pole and turbo alternators - output equation - main dimensions - choice of specific electric and magnetic loadings - choice of speed and number of poles - design of armature conductors, slots and winding - design of air-gap, field system and damper winding - design examples

Module IV (12 hours)

Induction machines - output equation - main dimensions - choice of specific electric and magnetic loadings - design of stator and rotor windings, stator and rotor slots and air-gap of slip ring and squirrel cage motors - calculation of rotor bar and end ring currents in cage rotor - design examples

Reference books

1. Clayton & Hancock, *Performance and Design of DC Machines*, ELBS.
2. Sawhney AK& A Chakrabarti, A course in *Electrical Machine Design*, Dhanpath Rai &Sons.
3. Say M.G., *Performance and Design of AC Machines*, Pitman, ELBS
4. Agarwal AK, Principles of Electrical machine design, SK Kataria & Sons

Sessional work assessment

Assignments	2x10 = 20
Tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module
Q II - 2 questions of 15marks from module I with choice to answer any one
Q III - 2 questions of 15marks from module II with choice to answer any one
Q IV - 2 questions of 15marks from module III with choice to answer any one
Q V - 2 questions of 15marks from module IV with choice to answer any one

2K6EE 804: ENERGY TECHNOLOGY

3 hours lecture and 1 hour tutorial per week

Module I (12 Hours)

Energy Conservation & Energy Audit: Need for Energy Conservation- Energy Shortage and Environmental aspects- Global & Indian Energy Scenario – Carbon Credit.

Energy audit - Need of Energy auditing-Steps of Energy auditing-Conduct Energy auditing- Energy Auditing in Motors,Transformers & Lighting Systems- Industrial distribution losses – Energy Saving Estimation.

Audit Instruments – Power, Energy & Harmonic Analyser – Thermal Imagers.

Module – II(12Hours)

Energy Saving Systems: Energy Efficient Technologies in Electrical systems – Energy Efficient Motors –Soft Starters- – LED Lighting.

Maximum Demand Controllers – Automatic Power Factor Controllers – Variable impedance type and voltage source converter based power factor correction- SVC and TCSC- STATCOM- harmonic elimination.

Module – III(14 Hours)

Recent Trends in Renewable Energy Technology:

Solar radiation and its measurement- solar radiation geometry-Photovoltaic conversion - Conceptual description of photovoltaic effect - Electrical characteristics of silicon PV cells and modules - Solar cell materials and prospects – Organic solar cells – Application of PV systems- Solar Thermal Power Generation.

Wind and small hydro power - Wind turbines - Horizontal axis and vertical axis wind turbines - Power and energy from wind turbines – Bits limit-Wind characteristics- variation of wind power with elevation- stand alone and grid connected power generation- reactive power, voltage regulation and frequency control- components of small hydro power- case study of a micro hydro project.

Module – IV(14 Hours)

Generators for renewable power generation: Induction generators and permanent magnet generators- self excited generators and doubly fed induction generators- microprocessor based control system for wind farms.

Economics of Energy Conservation: Financial analysis – Fixed and variable costs – Interest charges – Simple pay back period – Discounted cash flow methods-Net present value method-Internal Rate of return method – profitability Index-case study of financial evaluation of renewable energy systems.

References

1. Guide Book for National Certification Examination for Energy Managers & Energy Auditors – Bureau of Energy Efficiency, Ministry of Power, Govt of India.
2. Renewable energy sources and emerging technologies, DP Kothari, KC Singal and Rakesh Ranjan, Prentice Hall, New Delhi-2009.
3. Financial evaluation of renewable energy Technologies, TC Kandpal and H P Garg, Mac millan India, Delhi-2003.
4. Non –Conventional sources of energy-G.D Rai, Khanna Publishers, 2000
5. Solar Energy Utilization-G.D.Rai, Khanna Publishers, 2000
6. Renewable and novel energy sources-S.L Sab, MI Publishers, 1995.
7. Energy Technology-S Rao and B B Parulekar, Khanna Publisher, 1999.
8. Renewable energy sources and their environmental impact-S.A Abbasi and Naseema Abbasi, Prentice-Hall of India, 2001

Sessional work assessment	
Assignments	2x10 = 20
Tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module
Q II - 2 questions of 15marks from module I with choice to answer any one
Q III - 2 questions of 15marks from module II with choice to answer any one
Q IV - 2 questions of 15marks from module III with choice to answer any one
Q V - 2 questions of 15marks from module IV with choice to answer any one

2K6 EE805 (A) POWER SYSTEM OPERATION & CONTROL

3 hours lecture and 1 hour tutorial per week

Module –I (14 hrs)

Unit commitment – constraints in unit commitment - unit commitment solution- priority list method – dynamic programming solution – hydro thermal coordination – long range and short range hydro scheduling – dynamic programming solution to the hydro thermal scheduling.

Module –II (14 hrs)

Power system security – factors affecting power system security – contingency analysis- calculation of sensitivity factors – correcting the generation dispatch – sensitivity methods – linear programming method

Module –III (14 hrs)

An introduction to state estimation of power systems – static state estimation – role & formulation -least squares estimation - weighted LSE - non linear measurements –tracking state estimation of power systems – treatment of bad data – network observability and pseudo measurements - applications of power system state estimation –block diagram of a typical power system control centre real time control of power systems – SCADA

Module IV (10 hrs)

Load forecasting- methodology – estimation of periodic components – time series approach – - estimation of stochastic components- econometric models – reactive load forecast.

References

1) Allen J. Wood, B.F. Wollenburg Power Generation Operation and Control, John Wiley & sons
2) D.P. Nagrath & Kothari Modern Power System Analysis
3) A.K.Mahalanabis, "Computer Aided Power system analysis and control", Tata McGraw Hill 1991
4) O.I. Elgerd: "Electric Energy Systems Theory", McGraw Hill, 2nd Edition, 1982,Dec

Sessional work assessment

Two tests	2 x 15 = 30
Two assignments	2 x 10 = 20
Total	= 50

University examination pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module
Q II - 2 questions of 15marks from module I with choice to answer any one
Q III - 2 questions of 15marks from module II with choice to answer any one
Q IV - 2 questions of 15marks from module III with choice to answer any one
Q V - 2 questions of 15marks from module IV with choice to answer any one

2K6 EE 805 (B) : SPECIAL MACHINES & LINEAR MACHINES

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Servo motors - symmetrical components applied to two - phase servo motors - equivalent circuit and performance based on symmetrical components - servo motor torque - speed curves

Module II (13 hours)

Stepper motors - construction features - method of operation - drive - amplifiers and transistor logic - half stepping and the required switching sequence - the reluctance type stepper motor - ratings and other characteristics

Module III (13 hours)

Reluctance motors - general - types of synchronous motors - reluctance - motors - definitions - construction - polyphase and split phase reluctance motors - capacitor type reluctance motors - hysteresis motors - construction - polyphase - capacitor type and shaded pole hysteresis motors - universal motors - universal motors - application and torque - characteristics - essential parts of universal motors

Module IV (13 hours)

Linear machines - basic difference between LEMS and rotating - machine - classification of LEMS, linear motors and levitation machines - linear induction motors - linear synchronous motors - DC linear motors - linear levitation machines

Reference books

1. Vincent Del Toro, Electric Machines and Power Systems, Prentice Hall
2. Veinott, Fractional Horsepower Electric Motors, McGraw Hill
3. Nasar S.A., Boldea I., Linear Motion Electric Machine, John Wiley & Sons

Sessional work assessment	
Assignments	2x10 = 20
Tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module
Q II - 2 questions of 15marks from module I with choice to answer any one
Q III - 2 questions of 15marks from module II with choice to answer any one
Q IV - 2 questions of 15marks from module III with choice to answer any one
Q V - 2 questions of 15marks from module IV with choice to answer any one

2K6 EE 805 (C) : NEURAL NETWORKS & FUZZY LOGIC

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Introduction to artificial neural networks - biological neurons - Mc Culloch and Pitts modals of neuron - types of activation function - network architectures - knowledge representation - learning process - error-correction learning - supervised learning - unsupervised learning - single unit mappings and the perceptron - perceptron convergence theorem (with out proof) - method of steepest descent - least mean square algorithms - adaline/medaline units - multilayer perceptrons - derivation of the back-propagation algorithm

Module II (13 hours)

Radial basis and recurrent neural networks - RBF network structure - covers theorem and the separability of patterns - RBF learning strategies - K-means and LMS algorithms - comparison of RBF and MLP networks - recurrent networks - Hopfield networks - energy function - spurious states - error performance - simulated annealing - the Boltzman machine - Boltzman learning rule - the mean field theory machine - MFT learning algorithm - applications of neural network - the XOR problem - traveling salesman problem - image compression using MLPs - character retrieval using Hopfield networks

Module III (13 hours)

Fuzzy logic - fuzzy sets - properties - operations on fuzzy sets - fuzzy relations - operations on fuzzy relations - the extension principle - fuzzy measures - membership functions - fuzzification and defuzzification methods - fuzzy controllers - Mamdani and Sugeno types - design parameters - choice of membership functions - fuzzification and defuzzification methods - applications

Module IV (13 hours)

Introduction to genetic algorithm and hybrid systems - genetic algorithms - natural evolution - properties - classification - GA features - coding - selection - reproduction - cross over and mutation operators basic GA and structure

Introduction to Hybrid systems - concept of neuro-fuzzy and neuro-genetic systems

Reference books

1. Simon Haykins, "*Neural Network a - Comprehensive Foundation"*, Macmillan College, Proc, Con, Inc
2. Zurada J.M., "*Introduction to Artificial Neural Systems,* Jaico Publishers
3. Driankov D., Hellendoorn H. & Reinfrank M., "*An Introduction to Fuzzy Control*", Norosa Publishing House
4. Thimothy J. Ross, *"Fuzzy Logic with Engineering Applications"*, McGraw Hill
5. Bart Kosko. *"Neural Network and Fuzzy Systems"*, Prentice Hall, Inc., Englewood Cliffs
6. David E. Goldberg, *"Genetic Algorithms in Search Optimisation and Machine Learning"*, Addison Wesley
7. Suran Goonatilake & Sukhdev Khebbal (Eds.), *"Intelligent Hybrid Systems*", John Wiley & Sons

Sessional work assessment	
Assignments	2x10 = 20
Tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module
Q II - 2 questions of 15marks from module I with choice to answer any one
Q III - 2 questions of 15marks from module II with choice to answer any one
Q IV - 2 questions of 15marks from module III with choice to answer any one
Q V - 2 questions of 15marks from module IV with choice to answer any one

2K6 EE 805 (D) : DIGITAL SYSTEM DESIGN

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Finite state machine design - the concept of state machine - timing in state machine - FSM design procedure - ASM notation - Moore and Mealy machine design - examples of Moore and Mealy machines - finite state machine word problems

Module II (13 hours)

Asynchonous design - asynchronous ASM - asynchronous system - design principles - problem of asynchronous circuits - hazards - critical races - examples

Module III (13 hours)

Designing with programmable devices - programmable LSI techniques - PLA - logic cell array and atifuse FPGAs - designing with FPGAs - large PAL structures - MAX and XC7000 EPLDs - RAM based FPGAs - FLEX8000/10K families - selecting and using FPGAs

Module IV (13 hours)

Hardware description languages - introduction to VHDL - behavioral modeling - transport vs inertial delay - simulation deltas - sequential processing - process statement - signal assignment vs variable assignment - sequential statements - data types - subprograms and packages - predefined attributes - configurations - subprogram overloading - VHDL synthesis - design examples

Text books

1. David J. Comer, "*Digital Logic and State Machine Design*", Saunders College publishing
2. Randy H. Katz, "*Contemporary Logic Design*", Benjamin/Cummings Publishing Co.
3. Geoff Bostock, "*FPGAs and Programmable LSI*", Butterworth Heinemann
4. Douglas L. Perry, "*VHDL*", McGraw Hill
5. Charles S. Roth, "*Fundamentals of Logic Design*", Jaico Publishing House

Reference books

1. Zoran Salacic, "*Digital System Design and Prototyping Using Field Programmable Logic*", Kluwer Academic Publishers
2. Stephen Brown & Zvonoko Vranesic, "*Fundamentals of Digital Logic with VHDL Design*", McGraw Hill
3. Bhasker J., "*A VHDL Primer*", Addison Wesley 3rd Ed.
4. Navabi Z., "*VHDL: Analysis and Modeling of Digital Systems*", McGraw Hill

Sessional work assessment

Assignments	2x10 = 20
Tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module.
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one.
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one.
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one.
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

2K6 EE 805(E) : SATELLITE COMMUNICATION SYSTEMS

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Satellite orbits - solar day and sidereal day - orbital parameters - satellite trajectory - period, velocity and position of a satellite - geostationary satellites - non-geostationary constellations - launching of geostationary satellites - Hohmann transfer - effect of earth's shape - other heavenly bodies - atmospheric drag and radiation pressure on the satellite's orbit

Module II (13 hours)

Communication satellites - spacecraft subsystems - payload - repeater, antenna, attitude and control systems - telemetry, tracking and command - power sub system and thermal control

Earth stations - antenna and feed systems - satellite tracking system - amplifiers - fixed and mobile satellite service earth stations

Module III (13 hours)

Communication link design - frequency bands used - antenna parameters - transmission equations - noise considerations - link design - very small aperture terminals (VSAT) - VSAT design issues

Module IV (13 hours)

Multiple access techniques - frequency division multiple access - time division multiple access - code division multiple access - access protocols for data traffic

Reference books

1. Richharia M., *Satellite Communication Systems*, Second Ed., Macmillan Press Ltd.
2. Robert M Gagliardi, *Satellite Communication*
3. Tri T Ha, *Digital Satellite Communication,* MGH

Sessional work assessment	
Assignments	2x10 = 20
Tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module.
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one.
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one.
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one.
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

2K6 EE 805(F): HVDC & FACTS

3 hours lecture and 1 hour tutorial per week

MODULE I (14 hrs)

Basics of power transmission networks- Control of power flow in AC systems . Flexible AC transmission system (FACTS) controllers - Basic Types of FACTS Controllers.-Equivalent circuit of FACTS Controllers- Benefits of FACTS controllers,

Analysis of uncompensated AC line- Passive reactive power compensation - Series capacitor connected at midpoint of line- Shunt capacitor connected at midpoint of line Comparison- STATCOM at midpoint of line – SSSC at midpoint of line- Comparison –Some examples

MODULE II (13 hrs)

Configuration of SVC- Operation and control of TSC, TCR - SVC controller - Operation and control of STATCOM-Twelve and Twenty four pulse STATCOM - Comparison between SVC and STATCOM.

Static series compensation: Operation and control of TCSC - SSR and its damping-. Static voltage and phase angle regulators- TCVR and TCPAR- Operation and control of SSSC- Operation and Control. of UPFC.

MODULE III (12 hrs)

DC power transmission- Introduction- comparison of AC and DC transmission- Need for HVDC -Application of DC transmission-Description of DC transmission system- Planning for DC transmission, Thyristor valves, Valve firing- HVDC converters – Pulse number- choice of converter configuration. Graetz circuit- simplified analysis. Converter bridge characteristics

MODULE IV (13 hrs)

Converter and HVDC system control- Principle of DC link control-Converter control characteristics- modification, System control hierarchy, Firing angle control-IPC-EPC, Current and extinction angle control, Starting and Stopping of DC link-Start up of DC link, Power control, Higher level controllers-Converter faults and protection- Smoothing reactors- Protection of DC line –DC breakers-characteristics and types- applications , Monopolar operation

REFERENCES:

1. K R Padiyar, "FACTS controllers in power transmission and distribution ," New Age International publishers,New Delhi 2007
2. N.G. Hingorani & L. Gyugyi, "Understanding FACTS: Concepts and technology of flexible AC transmission systems " IEEE Press, 2000
3. T.J.E Miller, "Reactive Power Control in Electric Systems", John Wiley & Sons,1986
4. K R Padiyar, "HVDC Power transmission systems, Technology and System Interactions," New Age International publishers, NewDelhi, 1999.
5. Ned Mohan et.al, "Power Electronics-converters, application and applications" John Wiley and Sons, New York, 2001.

Sessional work assessment	
Assignments	2x10 = 20
Tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module.
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one.
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one.
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one.
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

2K6 EE 806(P) : SEMINAR

4 hours per week

Individual students should be asked to choose a topic in a field of their interest but in Electrical & Electronics Engineering, preferably from outside the B.Tech syllabus and give a seminar on that topic for about thirty minutes - a committee consisting of at least three faculty members (preferably specialized in different fields of Electrical & Electronics Engineering) shall assess the presentation of the seminars and award the marks to the students based on the merits of the topic of presentation - each student shall submit two copies of a write up of his seminar talk - one copy shall be returned to the student after duly certifying it by the Head of the Department and the other will be kept in the departmental library.

Sessional work assessment	
Presentation	: 30
Report	: 20
Total marks	: 50

2K6 EE 807(P) : PROJECT& INDUSTRIAL TRAINING

6 hours per week

The project work can be a Modelling and Simulation, Design or Experimental, in the field of Electrical & Electronics Engineering. It can be allotted as a group project with groups consisting of three to five students. Each group will prepare the project report and submit to the department through the guide - the Head of the Department will certify the copies and shall retain one copy in the departmental library

All students shall undergo an industrial training programme either by attending training program for a minimum of five days in a registered industry/Govt. establishment/Research institute or by visiting at least five reputed industries/Engineering establishments. They have to submit a report of the industrial training program.

The assessment of all the projects shall be done by a committee consisting of three or four faculty members specialised in the various fields of Electrical & Electronics Engineering - the students will present their project work before the committee - the group average marks for the various projects will be fixed by the committee - the guides will award the marks for the individual students in a project maintaining the group average

A maximum of 25 marks will be awarded for the industrial training

Sessional work assessment

Project work	: 75
Industrial Training	: 25
Total marks	: 100

2K6 EE 808(P) : VIVA VOCE

There is only University examination for Viva Voce. Examiners will be appointed by the university for conducting the viva voce. The viva voce exam will be based on the subjects studied for the B.Tech course, mini project, project & Industrial training and seminar reports of the student - the relative weightages would be as follows

Sessional work assessment	
Subjects	: 30
Mini project	: 20
Project & Industrial Training	: 30
Seminar	: 20
Total marks	: 100