PROGRAMME: B.E. Electrical and Electronics Engineering, V Semester

Course: EX501 Utilization of Electrical Energy

CATEGORY OF COURSE	COURSE TITLE	COURSE CODE	CREDITS - 4C			THEORY PAPERS
Departmental Core DC-9	Utilisation of Electrical Energy	EX501	L	T	P	Max.Marks-100
			3	1	0	Min.Marks-35
						Duration-3hrs.

COURSE CONTENTS

Unit-I

Illumination Engineering

Nature of light, units, sensitivity of the eye, luminous efficiency, glare. Production of Light; Incandescent lamps, arc lamps gas discharge lamps- fluorescent lamps- polar curves, effect of voltage variation on efficiency and life of lamps, Distribution and control of light, lighting calculations, solid angle, inverse square and cosine laws, methods of calculations, factory lighting, flood lighting and street lighting, Direct diffused and mixed reflection & transmission factor, refractors, light fittings.

Unit-II

Heating, Welding And Electrolysis

Electrical heating-advantages, methods and applications, resistance heating, design of heating elements, efficiency and losses control. Induction heating: core type furnaces, core less furnaces and high frequency eddy current heating, dielectric heating: principle and special applications, arc furnaces: direct arc furnaces, Indirect arc furnaces, electrodes, design of heating elements, power supply and control.

Different methods of electrical welding, resistance welding, arc welding, energy storage welding, laser welding, electro beam welding, and electrical equipment for them.

Arc furnaces transformer and welding transformers. Review of electrolytic principles, laws of electrolysis, electroplating, anodizing-electro-cleaning, extraction of refinery metals, power supply for electrolytic process, current and energy efficiency.

Unit-III

Traction

Special features of Traction motors, selection of Traction Motor, Different system of electric traction and their Advantages and disadvantages, Mechanics of train movement: simplified speed time curves for different services, average and schedule speed, tractive effort, specific energy consumption, factors affecting specific energy consumption, acceleration and braking retardation, adhesive weight and coefficient of adhesion,

Unit-IV

Electric Drives

Individual and collective drives- electrical braking, plugging, rheostatic and regenerative braking load equalization use of fly wheel criteria for selection of motors for various industrial drives, calculation of electrical loads for refrigeration and air-conditioning, intermittent loading and temperature rise curve.

Unit-V

Introduction to Electric and Hybrid Vehicles

Configuration and performance of electrical vehicles, traction motor haracteristics, tractive effort, transmission requirement, vehicle performance and energy consumption.

References:

- Open Shaw ,Taylor, .Utilization of electrical energy., Orient Longmans, 1962.
- H. Pratap, Art and Science of Utilization of Electrical Energy.
- Gupta, J.B., Utilization of Elect. Energy ,Katariya and sons, New Delhi.
- Garg, G.C., Utilization of Elect. Power and Elect. Traction.
- N V Suryanarayan, Utilization of Elect. Power including Electric Drives and Elect. Traction, New Age International.
- Hancok N N, Electric Power Utilisation, Wheeler Pub.
- Mehrdad,Ehsani,Yimin Gao,Sabastien.E. Gay,Ali Emadi, "Modern electric, hybrid electric and fuel cell vehicles", CRC Press.

PROGRAMME: BE Electrical and Electronics Engg.-V Semester

Course: EX502 Microprocessors & Microcontrollers

CATEGORY OF COURSE	COURSE TITLE	COURSE CODE	CREDITS-6C			THEORY PAPERS
Departmental Core DC-10	Microprocessors & Microcontrollers	EX502	L	T	P	Max.Marks-100 Min.Marks-35 Duration-3hrs.
			3	1	2	

COURSE CONTENTS

UNIT 1:

Microprocessor 8086

Introduction to 16-bit 8086 microprocessors, architecture of 8086, Pin Configuration, interrupts, minimum mode and maximum mode, timing diagram, Memory interfacing, Comparative study of Salient features of 8086, 80286 and 80386.

UNIT 2:

Microprocessor 8086 programming

Instruction set of 8086, Addressing mode, Assembler directives & operations, assembly and machine language programming, subroutine call and returns, Concept of stack, Stack structure of 8086, timings and delays,

UNIT 3:

Input-Output interfacing: Memory Mapped I/O and Peripherals I/O. PPI 8255 Architecture and modes of operation, Interfacing to 16-bit microprocessor and programming, DMA controller (8257) Architecture, Programmable interval timer 8254, USART 8251, 8 bit ADC/DAC interfacing and programming.

UNIT 4:

Microcontroller 8051

Intel family of 8 bit microcontrollers, Architecture of 8051, Pin description, I/O configuration, interrupts; Interrupt structure and interrupt priorities, Port structure and operation, Accessing internal & external memories and different mode of operations, Memory organization, Addressing mode, instruction set of 8051 and programming.

UNIT 5:

8051 Interfacing, Applications and serial communication

8051 interfacing to ADC and DAC, Stepper motor interfacing, Timer/ counter functions, 8051 based thyristor firing circuit, 8051 connections to RS-232, 8051 Serial communication , Serial communication modes, Serial communication programming, Serial port programming in C.

BOOKS:

1. Hall Douglas V.,Microprocessor and interfacing, Revised second edition 2006, Macmillan, McGraw Hill .
2. A.K. Ray & K.M.Bhurchandi, Advanced Microprocessors and peripherals- Architecture, Programming and Interfacing, Tata McGraw – Hill, 2009 TMH reprint..
3. Kenneth J. Ayala**,** The 8086 microprocessor: programming and interfacing the PC, Indian -edition , CENGAGE Learning.

4. Muhammad Ali Mazidi and Janice Gillespie Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson education, 2005.
5. Kenneth J. Ayala**,** The 8051 Microcontroller Architecture, III edition, CENGAGE Learning.
6. V.Udayashankara and M.S.Mallikarjunaswamy, 8051 Microcontroller: Hardware, Software & Applications, Tata McGraw – Hill, 2009.
7. McKinlay, The 8051 Microcontroller and Embedded Systems – using assembly and C, PHI, 2006 / Pearson, 2006.

PROGRAMME: B.E. Electrical & Electronics Engg. V Semester

COURSE: EX 503 ELECTRICAL MACHINE -II

CATEGORY OF COURSE	COURSE TITLE	COURSE CODE	Credits-6C			Theory Papers
			L	T	P	
Departmental Core DC-11	Electrical Machine - II	EX 503	3	1	2	Max.Marks-100 Min.Marks-35 Duration-3hrs.

COURSE CONTENTS

Unit-I

Synchronous generators, Construction features, Types of prime movers, Excitation system and brushes excitation, Polyphase distributive winding, Integral slot & Fractional slot winding, emf equation, Generation of harmonics and their elimination.

Factor affecting size of synchronous generators, armature reaction, leakage reactive, synchronous reactance and impedance, Equivalent circuit of alternator, relation between generated voltage and terminal voltage, determination of equivalent circuit parameters, Short circuit ratio and its effect on performance, phasor diagram, Synchronous generator under load, Effect of excitation variation, Regulation curve, Regulation by synchronous impedance method, mmf method, Zpf and ASA method, Effect of AVR power and Torque relation.

Unit-II

Salient pole machine, Two reaction theory equivalent circuit model and phasor diagram, Determination of X_d and X_q by slip test, regulation of salient pole alternator, Power angle equation and characteristic

Synchronizing of alternator with infinite busbar, Synchronizing power, Parallel operation and load sharing operation on infinite bus bar, Effect of varying excitation and mechanical torque, Effect of synchronizing current, Hunting of alternator, synchroncopes and phase sequence indicator.

Unit-III

Synchronous motors, Construction, Starting and Stopping of synchronous motor, Pull in torque, Motor under load power and torque, reluctance torque, Effect of excitation Effect of armature reaction, Power factor adjustment V curves, inverted V curves, synchronous motors as power factor correcting device, synchronous motors as frequency changer, Super synchronous motors, Hunting & damper winding efficiency and losses.

Analysis under sudden short circuit, Transient parameters of synchronous machine, Various transient & sub transient reactances, Time constants, expression of transient and sub transient reactance in terms of self & mutual inductances of various winding, Analysis of three phase short circuit oscillograph and determination of transient parameters from oscillogram.

Unit-IV

Generalized theory of electrical Machines, Basic for development of generalized approach for analysis of electrical machines, Kron's Primitive machine, Concept of rotational & Transformer voltage, Pseudo stationery coil, Voltage and flux linkages, equation of electrical machines, based on coupled circuit approach. Expression for Self & Mutual inductance of various windings with respect to rotor position, Park's and Inverse park's transformation.
Formulation of equations based on generalized approach for various machines,

Unit-V

Single phase and special motors.
Permanent magnet motors, P.M.synchronous motors Introduction to shaded pole motors, Repulsion motor, Universal motors, Hysteresis motor, Reluctance motor, Stepper motor, AC-series motor, Linear induction motors, DC & AC servo motors, Magnetic levitation vehicles, Brush less dc motors.

List of Experiments:

1. Determination of equivalent Circuit parameter of a single phase induction motor. Prediction of torque speed characteristic. Verification from load test.
2. V and invested V-curves of a three phase synchronous motor. Comparison with predicted characteristics
3. Regulation of 3 phase alternator by (1) Zero power factor and (2) A.S.A method (3) MMF and (4) Potiers method & results
4. Determination of X_d and Xq of a salient pole synchronous machine.
5. Measurement of phase sequence impedance of a 3 phase alternator.
6. Study of torque step rate characteristics of stepper motor, Discrimination of operating torque.
7. Load characteristics of universal motor. Operating on DC and AC supply, comparison of performance.
8. Synchronization of 3 phase alternator.
9. No loads short circuit test & legend current test on alternator.
10. Standard short circuit test & determination of X_d, X_d' and—$X_d''$and machine time constant.

References:

1. M.G. Say,Performance & design of AC machines, CBS publishers & distributors, Delhi, 3rd edition
2. A.E. Clayton & N.N. Nancock, The Performance & design of DC machines CBS publications & distributors,Delhi, 3rd edition
3. Nagrath I.J.& Kothari D. P., Electric Machines, Tata McGraw Hill , New Delhi, 2nd edition
4. Bharat Heavy Electricals Ltd, Transformers, Tata McGraw Hill
5. Syed A. Nasar,Electric Machines & Power Systems, Volume I , Tata McGraw Hill, New Delhi
6. A. E. Fitzerald & C. Kingsley & S.D. Umans , Electric Machinery Tata McGraw Hill ,New Delhi ,5th edition
7. P.S. Bhimbra, Generalized theory of Electrical Machines, Khanna publishers, Delhi, 5th edition.
8. Bhimbra. P.S., Electrical Machines, Khanna Pub.
9. Irving L. Kosow, Electric Machinery and Transformers, PHI.
10. Thedore Wildi, Electrical Machines Drives and Power Systems, Pearson Education, Asia.
11. Electrical Machines- Ashfaq Hussain. Dhanpat Rai Publication.
12. Langsdorf, Theory of Alternating Currents Machines, TMH.

PROGRAMME : BE Electrical & Electronics Engineering-V Semester

Course: EX504 Power Electronics Devices & Circuits

CATEGORY OF COURSE	COURSE TITLE	COURSE CODE	CREDITS -6 C			THEORY PAPERS
Departmental Core DC-12	Power Electronics Devices & Circuits	EX504	L	T	P	Max.Marks-100 Min.Marks-35 Duration-3hrs.
			3	1	2	

COURSE CONTENTS

Unit-I

Advantages and application of power electronic devices characteristics, Symbol & application of power diodes, power transistors, GTO, Triac, Diac, Power MOSFET, IGBT, LASCR, Fast recovery diode, schottey diode MCTs.
Principle of operation of SCR, Two transistor analogy, brief idea of construction of SCR, Static characteristics of SCR, Condition of turn on & off of SCR Gate characteristics, Method for turning on of SCR, Turnoff methods, different commutation techniques (Class A,B,C,D,E, & F Commutation) firing of SCR, Use of pubic transformer and opto isolator in firing, Resistance firing Ckt, Resistance capacitance firing circuit, UJT firing cut, and ramp triggering, firing for 3-Φ circuit.

SCR rating & protection of SCR over voltage, Over current, Suprior firing, Design of snubber circuit and protection of gate of SCR, heating, cooling & mounting of SCR series and parallel operation of SCR, String efficiency & problem associated with series and parallel operation of SCR

Unit-II

Operation and analysis of single phase (Half wave & Full Wave) and multiphase (Three Phase) uncontrolled and controlled rectifier circuit with resistive, resistive & inductive load (continuous & non continuous conduction, Fw small & very large inductive loads) and RLE loads. Estimation of average load voltage and load current for above rectifier cirucits active and reactive power input. Effect of free wheeling diode and source inductance on performance of these rectifier circuits . Comparison of mid point & Bridge rectifier circuits.

Unit-III

Series and parallel inverter, Voltage source & current source inverter, Single phase and three phase bridge inverter, Self cumulated inverters,, Mc- murray & MC murray bed ford inverters, Voltage control of single phase and three phase bridge inverter, Harmonics & their reduction techniques.

Unit-IV

Principle of chopper operation, Various control strategies in chopper, Step up & step-up/step down choppers, chopper configuration (Type A,B, C,D, & E), Steady state analysis of chopper circuits, Current & voltage commutation of chopper circuits Jones & Morgens chopper

Unit-V

Single phase (mid point & bridge configuration) and three phase cyclo convertor configuration and operating principles.

AC voltage controllers (using SCRs & Traics) single phase full wave controller with R and RL load, Estimation of RMS load voltage, RMS load current and input power factor, three phase AC voltage controller (Without analysis)

Dual converter

Switched mode voltage regulator buck, Boost, Buch & Boost, Ck regulators.

References:

1 M.H. Rashid, Power Electronics Circuits, Devices and Applications, Pearson
2 Education, Singapore, 1993.
3 M Ramsmoorthy, An Introduction to transistor and their application, Affiliated East-West Press.
4 P.C. Sen, Power Electonics, TMH.
5 M.D. Singh, K.B. Khanchandani, Power Electronics, TMH, Delhi, 2001.
6 Chakravarti A., Fundamental of Power Electronics and Drives, Dhanpat Ray & Co.,
7 Dr. P.S. Bhimbhra, Power Electonics, Khanna Pub.
8 Vedam Subramanyam, Power Electronics New Age International Revised II ed. 2006.
9 Randall Shaffer, Fundaments of Power Electronics With MATLAB Cengage Leaening 2008.

PROGRAMME: B.E Electrical & Electronics Engg., V Semester

Course: EX 505 Power System-I

CATEGORY OF COURSE	COURSE TITLE	COURSE CODE	CREDIT-6C			THEORY PAPER
Departmental Core DC-13	Power System-I	EX-505	*L*	T	P	**Max.Marks-100**
			3	1	2	Min.Marks-35 Duration-3hrs.

Course Contents

Unit-I

An overview of Electrical Energy Generation

General background, structure and components of power network. Power generation – Introduction to conventional, non-conventional & distributed generation, Effect of transmission voltage on power system economy. Selection of size of feeder. Comparison of isolated versus interconnected power system. Problems associated with modern large interconnected power system. Power Plant Economics - Load curves, base load, peak load, load factor, demand factor, diversity factor, capacity factor, utilization factor, cost of electricity, capital cost, fuel and operation cost.

UNIT-II

Transmission Line Components & Under Ground Cabling

Inductance resistance and capacitance of transmission line, Calculation of inductance for 1-Φ and 3-Φ, Single and double circuit line, Concept of GMR and GMD, Symmetrical & asymmetrical conduction configuration, Calculation of capacitance for 2 wire and 3 wire systems, Effect of ground or capacitance, Capacitance calculation for symmetrical and asymmetrical 1-phase and three phase, Single and double circuit line, Charging current, Transposition of line, Composite conductor, Skin and proximity effect, bundle conductor.

Underground Cable

Comparison of cables and overhead transmission lines, Classification of cables, requirement of cable construction, capacitance of single and multi-core cable, economic core diameter, dielectric stress in cable, Grading of cables, ionisation of Heating of cables, Phenomena of dielectric losses and sheath loss in cables, Thermal resistance of cables.

UNIT-III

Transmission systems & performance of transmission line

Various systems of transmission, effect of system voltage, comparison of conductor materials required for various overhead systems.

Short, Medium & long transmission line and their representation, Nominal T, Nominal Л, Equivalent T and equivalent Л, network models, ABCD constants for symmetrical & asymmetrical network, Mathematical solution to estimate regulation & efficiency of all types of lines.

Surge Impedance, loading, Interpretation of long line equation and its equivalent equation. Tuned power lines. Power flow through transmission line, Circle diagram, Method of voltage control, Static & rotating VAR generator, transformer control.

UNIT-IV

Insulator & Mechanical design Mechanical DesignTypes of conductors used in overhead transmission line, Types of line supports and towers, Distribution of conductors over transmission towers, Spacing between conductors, Length of span and sag- tension calculation for transmission line, Wind & ice loading, support of line at two different levels, string chart, Sag template, Stringing of conductor, Vibration and Vibration dampers.InsulatorMaterials used for transmission line insulations, Types of insulator for overhead transmission line failure of insulator, Voltage distribution of suspension insulator, String efficiency, Shielding and grading.

Unit-V

Voltage control & Distribution system

Ac single phase, 3 phase, 3wire & 4 wire distribution, Kelvin's law for most economical size of conductor Substation layout showing substation equipment, bus bar single bus bar and sectionalized bus bar, main and transfer for bus bar system, sectionalized double bus bar system, ring mains.

References:

1. William Stevenson, Elements of Power System Analysis, McGraw Hill.
2. C.L. Wadhwa, Electrical Power System Analysis, New Age International.
3. D.P. Kothari, I.J. Nagrath, Modern Power System Analysis TMH, III Ed. Reprint 2008.
4. D.P. Kothari, I.J. Nagrath, Power System Engineering TMH II Ed. Reprint 2009.
5. John Grainger and William Stevenson, Power system Analysis, McGraw Hill.
6. Ashfaq Husain, Electrical Power Systems, Vikas Publishing House.
7. T. Wildi, Electrical Machines, Drives and Power Systems, Pearson Education.
8. C.L. Wadhwa, Generation, Distribution and Utilization of Electrical Energy", New Age International.
9. Turar Goren, Electrical power Transmission system Engineering, John Wiley & Sons.
10. Power Systems Design- M.V. Deshpandey

SUGGESTED LIST OF EXPERIMENTS

1. Electrical design of transmission line.
2. Mechanical design of transmission line.
3. Drawing of Tower structure.
4. Drawing of insulators.