RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Grading System

Electrical & Electronics Engineering, VII Semester

PTEX 701 Electric Drives

Unit - I Control of D.C. motors by converters:- Introduction to Thyristor Controlled Drives, single phase semi and fully controlled converters and three semi and fully controlled converters connected to d.c. separately excited and d.c. series motors-continuous current operation, Output voltage and current waveforms, Speed and Torque expression, Speed-Torque Characteristics, Problems on converter fed d.c. motors.

Unit - II Four quadrant operation of D.C. Drives.: Introduction to Four quadrant operation, Motoring operations, Electric braking, Plugging, dynamic and regenerative braking operations. Four quadrant operation of D.C. motor by Dual converters-Closed loop operation of DC motor (Block diagram only) Control of D.C. Motors by Choppers:-Single quadrant, Two-quadrant and four quadrant chopper fed d.c. separately excited and series excited motors, Continuous current operation, Output voltage and current waveforms-Speed torques expressions-Speed torque characteristics, Problems on Chopper fed d.c. motors, Closed loop operation (Block diagram only)

Unit-III Control of Induction Motors on stator side:-Control of Induction Motor by AC Voltage controllers-Waveforms, Speed torque characteristics, Variable frequency control of induction motor by Voltage Source, Current Source inverters and cycloconverters, PWM control Comparison of VSI & CSI operations, Speed- torque Characteristics, Numerical problems on induction motor drives, Closed loop operation of induction motor drives. (Block diagram only)

Unit-IV Control of Induction Motors from rotor side:-Static rotor resistance control, Slip power recovery static Scherbius Drive, Static Kramer Drive, Their performance and speed torque characteristics advantages-application-problems.

Unit-V Control of Synchronous Motors:- Separate control & Self control of synchronous motors, Operation of self controlled synchronous motors by VSI, CSI and Cycloconverters. Load commutated CSI fed Synchronous motor, Operation, Waveform, Speed torque Characteristics, Application, Advantage, Numerical problems, Closed loop operation os synchronous motors drives. (Block diagram only)

References:

1. G.K. Dubey "Fundamentals of Electrical Drives"-. Narosa Publications
2. Gopal K. Dubey "Power semiconductor Controlled Drives"- PHI
3. S.B. Dewan, G.R. Slemon, A. Straughen "Power semiconductor Controlled Drives
4. B.K. Bose "Power Electronic control of AC Drives". PHI Learning.
5. Ned Mohan Electrical Drive Wiley India
6. V. Subramanyam "Thyristor control of Electric Drive" Tata Mc Graw Hill Pub
7. N.K. De , P.K. Sen "Electric Drives" PHI
8. S.K. Pillai, "A first course of Electrical Drive" New age International.
9. S.K. Pillai. "Analysis of Thyristor Power conditioned Motors" University Press (India)Ltd.
10. Longman P.V. Rao, "Power semiconductor Drives", BS Publications.
11. S.Shiva Nagaraju power semiconductor drive PHI learning

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Grading System

Electrical & Electronics Engineering, VII Semester

PTEX 702- Power System-II

Unit –I General - Problems associated with modern interconnected power Systems, deregulation, power systems restructuring, distributed generation, congestion, available transfer capacities, pricing of energy and transmission services.

Unit-II. Power flow studies - Formulation of static power flow equations and solutions using Gauss Seidel, Newton Raphson and FDLF methods, comparison of these methods, Economic operation of power system – Economic dispatch, Emission dispatch, line loss, ITL, economic dispatch using lagrangian multiplier method.

Unit-III MW Frequency control- Fundamental of Speed Governing, Modeling of Speed Control Mechanism, Primary ALFC, Closing of ALFC, Static & Dynamic Response to Primary ALFC, Speed Control Characteristics ,Fundamental of AGC,AGC in Isolated & Interconnected Power Systems, Modeling of the Tie line, Static & Dynamic response of two area system, Economic dispatch Control.

Unit-IV Reactive Power & Voltage control –Protection & Absorption of Reactive Power Method of Voltage Control , Static VAR systems, Different types, Application ,characteristics, characteristics of an excitation system, DC AC and static excitation system, General block diagram representation of voltage regulators.

Unit-V Power System Stability - Steady state, dynamic and transients stability, Swing equation , equal area criterion, solution of swing equation using step by step method modified Eulers method and Rnge-Kutta method, methods of improving transient stability.

References

1. I.J. Nagrath& D.P. Kothari , Modern Power System Analysis, Tata Mc Graw – Hill Publication Company Ltd 2nd edition.
2. C.L.Wadhwa,Electrical Power Systems,NewAge International(P) LimitedPublishers,2ndedition1998.
3. T.J.E. Miller , Reactive power Control in Electric Systems, John Wiley &Sons.
4. A Chakrawarti, Power System Analysis:Operation and Control PHI Learning 3rdedition
5. Elgerd O.I., “Electric Energy Systems Theory”, TMH, New Delhi, Second Edition1983.
6. PrabhaKundur, “Power system stability and control”, Mc-Graw Hill Inc, New York,1993.
7. C.W.Taylor, “Power System Voltage Stability”, Mc-Graw Hill Inc, New York,1993.

8. I.J. Nagrath, D.P.Kothari; “Power System Engineering”, Tata Mc-Graw Hills, New Delhi1994.

9. B.M.Weedy; “Electric Power System” John Wiley and Sons, 3rdedition.

10. P.S.R. Murthy, “Power System Operation and Control”, B SPubl-ication

11. A.J. wood, B.F. Wollenberg; “Power Generation, Operation and Control”; John Wiley & Sons Inc. 1984.

12. T.K. Nagsarkar, M.S. Sukhiza, -“Power System Analysis”, Oxford UniversityPress.

13. L.K. Kirchmayer, “Economic Operation of Power Systems” Wiley EasternLtd.

List of Experiments:

1. To develop a program in Matlab for information of Y-bus matrix for N bussystem.
2. Load flow solution for 3-bus system using Gauss-Seidel,Newton Raphson and FDLF methods upto 3 iteration.
3. Load flow solution for IEEE 6-bus and 30-bus system in Matlab using Newton Raphson method.
4. Assessment of transient stability of a single machine system.
5. Effect of compensation on voltage profile of IEEE 6-bussystem.
6. Study of any software tools (PSAT, EDSA, MY POWER, ETAPetc).

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Grading System

Electrical & Electronics Engineering, VII Semester

Elective I PTEX-703(A) EHVAC & HVDC Transmission

Unit-I Constitution of EHV a.c. and d.c. links, Kind of d.c. links, Limitations and Advantages of a.c. and d.c. transmission, Principal application of a.c. and d.c. transmission, Trends in EHV a.c. and d.c. transmission, Power handling capacity. Converter analysis garetz circuit, Firing angle control, Overlapping.

Unit-II FACTS devices, basic types of controller, series controller, static synchronous series compensator(SSSC), thyristor-controlled series capacitor(TCSC), thyristor controlled series reactor(TCSR), shunt controller (STATCOM), static VAR compensator(SVC), series-series controller, combined series-shunt controller, unified power flow controller(UPFC), thyristor controlled phase shifting transformer(TCPST).

Unit-III Components of EHV d.c. system, converter circuits, rectifier and inverter valves, Reactive power requirements, harmonics generation, Adverse effects, Classification, Remedial measures to suppress, filters, Ground return. Converter faults & protection harmonics misoperation, Commutation failure, Multiterminal D.C. lines.

Unit-IV Control of EHV d.c. system desired features of control, control characteristics, Constant current control, Constant extinction angle control. Ignition Angle control. Parallel operation of HVAC & DC system. Problems & advantages.

Unit-V Travelling waves on transmission systems, Their shape, Attenuation and distortion, effect of junction and termination on propagation of traveling waves. Over voltages in transmission system. Lightning, switching and temporary over voltages: Control of lighting and switching over voltages **Reference:**

1. S. Rao,- "EHV AC & DC Transmission" Khanna pub.
2. Kimbark,-" HVDC Transmission" john willy & sons pub.
3. Arrillaga,- "HVDC Transmission"2nd Edition ,IEE londan pub.
4. Padiyar, -"HVDC Transmission" 1st Edition ,New age international pub.
5. T.K. Nagsarkar,M.S. Sukhiza, -"Power System Analysis", Oxford University
6. Narain.G. Hingorani, l. Gyugyi-"Undustanding of FACTS concept and technology", john willy & sons pub.
7. P.Kundur- "H.V.D.C. Transmission" McGraw Hill

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Grading System

Electrical & Electronics Engineering, VII Semester

Elective I PTEX-703(B) Advance Power Electronics

Course Content

UNIT- 1 Introduction to various power electronics supplies. Performance parameters for power electronics supplies and their measurement. Device selection, Control circuits. Switch mode power supplies, Square wave switching, Resonant mode operation of Power supplies, Ferroresonant, Linears and the switchers.

UNIT- 2 DC to DC Converters: Analysis and design of buck, boost, buck-boost and cuk converters, two quadrant and full bridge converters. Isolated converters i.e., flyback, forward and bridge topology. Design of d.c. inductor. Concept of integrated magnetics, converter control, averaged model, state-space model.

UNIT- 3 180 mode° mode and 120°DC to Controlled AC: Controlled inversion, three phase full bridge inverters. 180 operation, harmonic analysis, PWM control of VSI, current mode control of PWM VSI, space vector modulation, three phase current sourced PWM CSI,

UNIT- 4 AC Choppers: Modeling and analysis of AC choppers, harmonics control using symmetrical and asymmetrical waveform pattern,

UNIT- 5 Soft switching DC to DC converters, zero current switching topologies, zero voltage switching topologies, generalized switching cell, ZCT and ZVT DC converters,

Text Books:

1. “Power Electronics Circuits”, Issa Batarseh, John Wiley & Sons Inc., 2004.

2. “Power Electronics: ”, L.Umanad, Wiley India.

3. “Power Electronics: Converters, Applications, and Design”, Ned Mohan, John Wiley & Sons Inc., 2001. 4. “Power Electronics: Devices and Circuits”, Jagannathan, PHI Learning 2012

Reference Books:

1. “Power Electronic Systems Theory and Design”, Jai P Agrawal, Pearson Education Asia, 2001.

2. “Switching Power Supply Design”, A I Pressman, McGraw Hill Publication, 1991. 3. “Handbook of Power Electronics”, M H Rashid

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Grading System

Electrical & Electronics Engineering, VII Semester

Elective II PTEX-704(A) Renewable Energy Sources

Course Content

Unit - I

Renewable Energy Systems Energy Sources, Comparison of Conventional and non-conventional, renewable and non-renewable sources. Statistics of world resources and data on different sources globally and in Indian context. Significance of renewable sources and their exploitation. Energy planning, Energy efficiency and management.

Unit – II

Wind Energy System Wind Energy, Wind Mills, Grid connected systems. System configuration, working principles, limitations. Effects of wind speed and grid conditions. Grid independent systems - wind-battery, wind diesel, wind-hydro biomass etc. wind operated pumps, controller for energy balance.Small Hydro System Grid connected system, system configuration, working principles, limitations. Effect of hydro potential and grid condition. Synchronous versus Induction Generator for stand alone systems. Use of electronic load controllers and self excited induction generators.Wave Energy System: System configuration: grid connected and hybrid systems.

Unit - III

Solar Radiation Extraterrestrial solar radiation, terrestrial solar radiation, Solar thermal conversion, Solar Photo tonic System Solar cell, Solar cell materials, efficiency, Characteristics of PV panels under varying insulation. PV operated lighting and water pumps, characteristics of motors and pumps connected to PV panels. Biomass Energy System: System configuration, Biomass engine driven generators, feeding loads in stand-alone or hybrid modes, Biomass energy and their characteristics.

Unit – IV

Energy from oceans Ocean temperature difference, Principles of OTEC, plant operations, Geothermal Energy Electric Energy from gaseous cells, Magneto-hydro generated energy, Non hazardous energy from nuclear wastes, Possibilities of other modern non-conventional energy sources.

Unit – V

Electric Energy Conservation Energy efficient motors and other equipment. Energy saving in Power Electronic controlled drives. Electricity saving in pumps, air-conditioning, power plants, process industries, illumination etc. Methods of Energy Audit. Measurements systems; efficiency measurements. energy regulation, typical case studies, various measuring devices analog and digital, use of thyristers.

References:

1. John Twidell & Toney Weir, Renewable Energy Resources, E & F N Spon.

2.El-Wakil, Power Plant Technology, McGraw Hill.

3.Rai G D, Non-conventional Energy Resources, Khanna.

4.F Howard E. Jordan, "Energy-Efficient Electric Motor & their Application-II", Plenum Press, New York, USA.

5.Anna Mani, "Wind Energy Resource Survey in India-III", Allied Publishers Ltd., New Delhi,

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Grading System

Electrical & Electronics Engineering, VII Semester

Elective II PTEX-704(B) Reliability Engineering

Course Content

UNIT-I

Introduction to reliability and indices. Review of probality theory. Density and distribution function of continuous and discrete random variable.

UNIT-II

Component reliability, hazard function, failure laws, exponential failure law, wear in period and its importance. Safety and reliability, replacement, methods of reliability improvement.

UNIT-III

Reliability evaluation of series, parallel, and series–parallel network. Complex network reliability evaluation using event, space, decomposition, tie-set, cut-set and, Satand by system and load sharing system,multi state models.

UNIT-IV

Markov process, State diagram, Availability and unavailability function. Evaluation of time dependent and limiting state probabilities. MTTF calculation. Concept of frequency and durations. State enumeration method for evaluating failure frequency, MUT, MDT,frequency balance approach.

UNIT-V

Reliability testing, estimation of reliability function, failure function and MTTF from grouped and ungrouped datas , censoring and accelerations ,parametric methods.

TEXT BOOKS

1 Introduction to reliability engineering –E.E.Lewis, John Wiely and Sons, 1987

2 Reliability and maintainability engineering, C.E. Ebeling, TMH, 2006

Reference books

1Reliability Engineering : Probability Models and maintanance methods –Joel A.Nochlas,Taylor and Prancis 2005

2 Reliability evaluation of engineering system: concept and techniques-R. Billinton, R.N.Allon, Pitman, 1984

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Grading System

Electrical & Electronics Engineering, VII Semester

PTEX 705 Minor Project II

The Minor Project II Work provides students an opportunity to do something on their own and under the supervision of a guide. Each student shall work on an approved project, which may involve fabrication, design or investigation of a technical problem that may take design, experimental or analytical character or combine element of these areas. The project work involves sufficient work so that students get acquainted with different aspects of manufacture, design or analysis. The students also have to keep in mind that in final semester they would be required to implement whatever has been planned in the Major Project in this semester. It is possible that a work, which involves greater efforts and time may be taken up at this stage and finally completed in final semester, but partial completion report should be submitted in this semester and also evaluated by an external examiner. At the end of semester, all students are required to submit a synopsis.