SHRI VENKATESHWARA UNIVERSITY

EVALUATION SCHEME & SYLLABUS

M.TECH Power System

(Two Years Post Graduation Programme)
II SEMESTER

(w.e.f. 2019-20)

SCHOOL OF ENGINEERING & TECHNOLOGY

M.TECH
Power System
SEMESTER-II

Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	MPS 201	Digital Protection of Power System	3	0	0	20	10	30		70		100	3
2	MPS 202	Power System Dynamics-II	3	0	0	20	10	30		70		100	3
3	MPS-031	Restructured Power Systems	3	0	0	20	10	30		70		100	3
4	MPS-043	Power Quality	3	0	0	20	10	30		70		100	3
5	MPS-221	Mini Project	0	0	4				50		50	100	2
6	MPS-211	Power Quality Lab	0	0	4				25		25	50	2
7	MPS-212	Power Electronics Applications to Power Systems Lab	0	0	4				25		25	50	2
8	AUD102	Disaster Management	2	0	0	20	10	30		70		100	
		Total										700	18

Code	Course Name	L-T-P	Cr.
WPS -401	Digital Protection of Power System	3-0-0	3

Course Objectives:-Students will be able to:

- Study of numerical relays
- Developing mathematical approach towards protection
- Study of algorithms for numerical protection

Unit No.	Content
1	Evolution of digital relays from electromechanical relays. Performance and operational characteristics of digital protection.
2	Mathematical background to protection algorithms. Finite difference techniques.
3	Interpolation formulae. Forward, backward and central difference interpolation. Numerical differentiation. Curve fitting and smoothing. Least squares method. Fourier analysis. Fourier series and Fourier transform. Walsh function analysis.
4	Basic elements of digital protection. Signal conditioning: transducers, surge protection, analog filtering, analog multiplexers. Conversion subsystem: the sampling theorem, signal aliasing. Error, sample and hold circuits, multiplexers, analog to digital conversion. Digital filtering concepts. The digital relay as a unit consisting of hardware and software.
5	Sinusoidal wave based algorithms. Sample and first derivative (Mann and Morrison) algorithm. Fourier and Walsh based algorithms.
6	Fourier Algorithm: Full cycle window algorithm, fractional cycle window algorithm. Walsh function based algorithm. Least Squares based algorithms. Differential equation based algorithms. Traveling Wave based Techniques. Digital Differential Protection of Transformers. Digital Line Differential Protection. Recent Advances in Digital Protection of Power Systems.

Suggested reading:

- A.G. Phadke and J. S. Thorp, "Computer Relaying for Power Systems", Wiley/Research studies Press, 2009.

- A.T. Johns and S. K. Salman, "Digital Protection of Power Systems", IEEE Press,1999.
- Gerhard Zeigler, "Numerical Distance Protection", Siemens Publicis Corporate Publishing, 2006.

- S.R. Bhide "Digital Power System Protection" PHI Learning Pvt.Ltd.2014.

Course Outcomes: Students will be able to:

- Learn the importance of Digital Relays

- Apply Mathematical approach towards protection

Learn to develop various Protection algorithms

Code	Course Name	L-T-P	Cr.
WPS -301	Power System Dynamics-II	3-0-0	3

Course Objectives:-Students will be able to:

- Study of power system dynamics

- Interpretation of power system dynamic phenomena
- Study of various forms of stability.

Unit No.	Content
1	Basic Concepts of Dynamic Systems and Stability Definition Small Signal Stability (Low Frequency Oscillations) of Unregulated and Regulated System
2	Effect of Damper, Flux Linkage Variation and AVR
3	Large Signal Rotor Angle Stability Dynamic Equivalents And Coherency Direct Method of Stability Assessment Stability Enhancing Techniques Mitigation Using Power System Stabilizer
4	Asynchronous Operation and Resynchronization Multi-Machine Stability
5	Dynamic Analysis of Voltage Stability Voltage Collapse
6	Frequency Stability Automatic Generation Control Primary and Secondary Control Sub-Synchronous Resonance and Counter Measures

Suggested reading:

- P. Kundur, “Power System Stability and Control”, McGraw Hill Inc, 1994
- J. Machowski, Bialek, Bumby, “Power System Dynamics and Stability”, John Wiley & Sons, 1997
- L. Leonard Grigsby (Ed.); “Power System Stability and Control”, Second edition, CRC Press, 2007
- V. Ajjarapu, “Computational Techniques for voltage stability assessment & control”; Springer, 2006.

Course Outcomes:- Students will be able to:

- Gain valuable insights into the phenomena of power system including obscure ones.

- Understand the power system stability problem.
- Analyze the stability problems and implement modern control strategies.
- Simulate small signal and large signal stability problems.

Code	Course Name	L-T-P	Cr.
WPS-031	Restructured Power Systems	3-0-0	3

Course Objectives: -Students will be able to:

- Understand what is meant by restructuring of the electricity market
- Understand the need behind requirement for deregulation of the electricitymarket
- Understand the money, power & information flow in a deregulated powersystem

Unit No.	Content
1	Fundamentals of restructured system Market architecture Load elasticity Social welfare maximization
2	OPF: Role in vertically integrated systems and in restructured marketscongestion management
3	Optimal bidding Risk assessment Hedging Transmission pricing Tracing of power
4	Ancillary services Standard market design Distributed generation in restructured markets
5	Developments in India IT applications in restructured markets
6	Working of restructured power systems PJM, Recent trends in Restructuring

Suggested reading:

- Lorrin Philipson, H. Lee Willis, “Understanding electric utilities and de-regulation”, Marcel Dekker Pub. 1998.
- Steven Stoft, “Power system economics: designing markets for electricity”, JohnWiley and Sons, 2002.
- Kankar Bhattacharya, Jaap E. Daadler, Math H.J. Boolen, “Operation of restructured power systems”, Kluwer Academic Pub., 2001.
- Mohammad Shahidehpour, Muwaffaq Alomoush, “Restructured electrical power systems: operation, trading and volatility”, Marcel Dekker.

Course Outcomes: -Students will be able to:

- Describe various types of regulations in power systems.
- Identify the need of regulation and deregulation.
- Define and describe the Technical and Non-technical issues in Deregulated Power Industry.
- Identify and give examples of existing electricity markets.
- Classify different market mechanisms and summarize the role of various entities inthe market

Code	Course Name	L-T-P	Cr.
WPS -043	Power Quality	3-0-0	3

Course Objectives: -Students will be able to:

- Understand the different power quality issues to be addressed.
- Understand the recommended practices by various standard bodies like IEEE,IEC , etc on voltage& frequency, harmonics.
- Understanding STATIC VAR Compensators

Unit No.	Content
1	Introduction-power quality-voltage quality-overview of power quality Phenomena classification of power quality issues-power quality measuresand standards-THD-TIF-DIN-C message weights-flicker factor transient phenomena-occurrence of power quality problems power acceptabilitycurves-IEEE guides, standards and recommended practices.

2	Harmonics-individual and total harmonic distortion RMS value of a harmonic waveform- Triplex harmonics-important harmonic introducing devices-SMPS Three phase power converters arcing devices saturable devices-harmonicdistortion of fluorescent lamps-effect of power system harmonics onpower system equipment and loads.
3	Modeling of networks and components under non-sinusoidal conditions transmission and distribution systems. Shunt capacitors-transformers-electric machines-ground systems loads that cause power quality problems power quality problems created by drives and its impact on drive.
4	Power factor improvement- Passive Compensation Passive Filtering , Harmonic Resonance Impedance Scan Analysis- Active Power Factor Corrected Single Phase Front End, Control Methods for Single Phase APFC Three Phase APFC and Control Techniques, PFC Based on Bilateral Single Phase and Three Phase Converter
5	Static VAR compensators-SVC and STATCOM Active Harmonic Filtering-Shunt Injection

	Filter for single phase, three-phase three-wire and three-phase fourwire Systems d-q domain control of three phase shunt active filters uninterruptible power supplies constant voltage transformers series active power filtering techniques for harmonic cancellation and isolation.
6	Dynamic Voltage Restorers for sag, swell and flicker problems. Grounding and wiring introduction. NEC grounding requirements-reasons for grounding typical grounding and wiring problems solutions to grounding and wiring problems

Suggested reading:

- G.T. Heydt, "Electric power quality", McGraw-Hill Professional, 2007
- Math H. Bollen, "Understanding Power Quality Problems", IEEE Press, 2000
- J. Arrillaga, "Power System Quality Assessment", John wiley, 2000
- J. Arrillaga, B.C. Smith, N.R. Watson & A. R.Wood ,"Power system Harmonic Analysis", Wiley,1997

Course Outcomes: Students will be able to:

- Acquire knowledge about the harmonics, harmonic introducing devices andeffect of harmonics on system equipment and loads.
- To develop analytical modeling skills needed for modeling and analysis ofharmonics in networks and components
- To introduce the student to active power factor correction based on static VAR compensators and its control techniques
- To introduce the student to series and shunt active power filtering techniquesfor harmonics.

Code	Course Name	L-T-P	Cr.
AUD -102	Disaster Management	2-0-0	0

Course Objectives: -Students will be able to:
learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.

Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple

perspectives. Develop an understanding of standards ofhumanitarian response and practical relevance in specific types of disasters and conflictsituations.

Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

Unit No.	Heading	Content
1	**Introduction**	Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.
2	**Repercussions Of Disasters And Hazards**	Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.
3	**Disaster Prone Areas In India**	Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics

4	**Disaster Preparedness And Management**	Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.
5	**Risk Assessment**	Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival
6	**Disaster Mitigation**	Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

SUGGESTED READINGS:

R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies"'New Royal book Company.

Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", PrenticeHall Of India, New Delhi.

Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep&Deep Publication Pvt. Ltd., New Delhi.