SHRI VENKATESHWARA UNIVERSITY

EVALUATION SCHEME & SYLLABUS

M.TECH Power System Part Time

(Two Years Post Graduation Programme)
IV SEMESTER

(w.e.f. 2019-20)

SCHOOL OF ENGINEERING & TECHNOLOGY

M.TECH
Power System
Part Time
SEMESTER-IV

Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	WPS-401	Digital Protection of Power System	3	0	0	20	10	30		70		100	3
2	WPS-411	Power Electronics Applications to Power Systems Lab	3	0	0							50	3
3	WPS-043	Power Quality	2	0	0	20	10	30		70		100	2
	WPS-421	MINI PROJECT	0	0	4				50		50	100	2
		Total										350	10

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 -421	Mini Project	0-0-4	2

Code	Course Name	L-T-P	Cr.
WPS -411	Power Electronics Applications to Power Systems Lab	0-0-4	2

S. No.	Experiment
1	Write A Program For Best First Search
2	Write A Program to Generate the output for A* Algorithm.
3	Write a Program To Show the Tic Tac Toe Game for 0 and X.
4	Write A Program For Expert System By Using Forward Chaining.
5	Comparing the Search Methods
6	Implement the Greedy Search Algorithm
7	Implement the min-max Algorithm
8	Adding a Heuristic

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 measures and standards-THD-TIF-DIN-C message weights-flicker factor transient phenomena-occurrence of power quality problems power acceptability curves-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-harmonic distortion of fluorescent lamps-effect of power system harmonics on power 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 and effect of harmonics on system equipment and loads.
- To develop analytical modeling skills needed for modeling and analysis of harmonics 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 techniques for harmonics.