VASAVI COLLEGE OF ENGINEERING
(AUTONOMOUS)
Ibrahimbagh, Hyderabad-31
Approved by A.I.C.T.E., New Delhi and
Affiliated to Osmania University, Hyderabad-07

Sponsored
by
VASAVI ACADEMY OF EDUCATION
Hyderabad

SCHEME OF INSTRUCTION AND SYLLABI UNDER CBCS FOR B.E. (EEE) VII and VIII Semesters With effect from 2020-21 (For the batch admitted in 2017-18) (R-17)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
Phones: +91-40-23146030, 23146031
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With effect from the Academic Year 2020-21

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS):: IBRAHIMBAGH, HYDERABAD – 500 031.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SCHEME OF INSTRUCTION AND EXAMINATION (R-17):: B.E. - EEE : SEVENTH SEMESTER(2020 - 21)

B.E (EEE) VII Semester								
Course Code	**Name of the Course**	**Scheme of Instruction**			**Scheme of Examination**			**Credits**
		Hours per Week			**Duration in Hrs**	**Maximum Marks**		
		L	**T**	**P/D**		**SEE**	**CIE**	
THEORY								
PC710EE	Digital Signal Processing	3	1	0	3	60	40	4
PE7XXEE	Professional Elective-I	3	0	0	3	60	40	3
PE7XXEE	Professional Elective-II	3	0	0	3	60	40	3
PE7XXEE	Professional Elective-III	3	0	0	3	60	40	3
PE7XXEE	Professional Elective-IV	3	1	0	3	60	40	4
PRACTICALS								
PC711EE	Digital Signal Processing Lab	0	0	2	3	50	30	1
PC721EE	Power Systems Lab	0	0	2	3	50	30	1
PC731EE	Integrated Circuits Lab	0	0	2	3	50	30	1
PW749EE	Project Seminar	0	0	2	Viva-Voce	-	30	1
	TOTAL	**15**	**2**	**8**		**450**	**320**	**21**
	GRAND TOTAL	**25**				**770**		
Student should acquire one online certificate course during III- VII Semester								

Professional Elective – I:

1. PE710EE - High Voltage DC Transmission
2. PE720EE - Wind and Solar Energy Systems
3. PE730EE - Programmable logic Controllers

Professional Elective – II:

1. PE740EE - Distributed Generation
2. PE750EE - Electrical Drives and Static Control
3. PE760EE - Control Systems Design

Professional Elective – III:

1. PE770EE - Power System Operation and Control
2. PE780EE - Advanced Modulation techniques for Power Converters
3. PE790EE - Digital Control Systems

Professional Elective – IV:

1. PE712EE - Electrical Machine Design
2. PE722EE - Power Quality
3. PE732EE - Advanced control systems

With effect from the Academic Year 2020-21

VASAVI COLLEGE OF ENGINEERING (Autonomous)
IBRAHIMBAGH, HYDERABAD – 500 031

Department of Electrical & Electronics Engineering
Digital Signal Processing

SYLLABUS FOR B.E. VII - SEMESTER

L:T:P (Hours/week):3:1:0	SEE Marks:60	Course Code:**PC710EE**
Credits : 4	CIE Marks:40	Duration of SEE:3Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** On completion of the course, students will be able to
1. To impart the knowledge on digital processing of a signal. 2. To introduce the analysis techniques based on discrete Fourier transforms. 3. To explain the use of circular convolution. 4. To provide a glimpse of filter design. 5. To provide a glimpse on DSP processor features and its applications.	1. Compare analog and digital processing of a signal. 2. Convert and analyze, discrete signals and systems in time and frequency domains. 3. Perform circular convolution and compare it with linear convolution. 4. Design and suggest hardware implementation of digital filter for the given specifications. 5. Explain the architecture of digital signal processor and its applications.

UNIT-I

Introduction to Digital Signal Processing: Introduction to discrete signals & systems, scheme for the digital processing of a signal, advantages of digital signal processing, representation of discrete systems using linear constant co-efficient difference equations, applications of DSP.

UNIT-II

Discrete Fourier Transform: Discrete Fourier transform, Phase and amplitude spectra, Properties of discrete Fourier transform, linear convolution of sequences using DFT, circular convolution: overlap save method and overlap add method.

Fast Fourier transform: Radix- 2 decimation in time and decimation in frequency FFT algorithms, Inverse FFT.

UNIT-III

IIR filters: Types of filters, IIR filters – design of Butterworth & Chebyshev filters, IIR filter design by impulse invariance and bilinear transformation. Realization of IIR filters using direct, canonic, cascade and parallel forms.

UNIT-IV

FIR Filters: Design and characteristics of FIR digital filters, Frequency response of linear phase filters, Window techniques – rectangular window, Hamming window, Bartlet window and Kaiser window. Realization of linear – phase FIR filters.

UNIT-V

Introduction to TMS320LF2407 DSP controller: Basic architecture features – physical memory – software tools.

General purpose input output (GPIO): Pin multiplexing and general purpose I/O overview, multiplexing – general purpose I/O control registers.

Applications of DSP: DSP based control for DC –DC buck – boost converter.

Learning Resources:

1. "Digital Signal Processing, Principles, Algorithms and Applications", John G. Proakis, 4th Edition, 2007.
2. "Digital Signal Processing, A Computer – Based Approach", Sanjit K Mitra, 3rd Edition, McGraw Hill, 2006.
3. "DSP based electro mechanical motion control", Hamid A. Tolyat, CRC press, 2003.
4. "Digital Signal Processing", Oppenheim AV, and Schafer R. W, Prentice Hall Inc., 1975.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1. No. of Internal Tests	: 2	Max. Marks for each Internal Test	:	30
2. No. of Assignments	: 3	Max. Marks for each Assignment	:	5
3. No. of Quizzes	: 3	Max. Marks for each Quiz Test	:	5

Duration of Internal Tests : 90 Minutes

With effect from the Academic Year 2020-21

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Electrical & Electronics Engineering

Digital Signal Processing Lab

SYLLABUS FOR B.E. VII - SEMESTER

L:T:P (Hours/week):0:0:2	SEE Marks:50	Course Code : **PC711EE**
Credits : 1	CIE Marks: 30	Duration of SEE : 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** On completion of the course, students will be able to
The laboratory is aimed to provide basics in software implementation of signal processing and programming to control electrical machines.	1. Demonstrate the use of software to perform convolution of signals and transform signals between different domains. 2. Design analog and digital filters. 3. Interface electrical machines with digital signal processor.

List of Experiments

1. Discrete waveform generation – square, triangular, ramp and trapezoidal.
2. Verification of linear and circular and convolution theorem.
3. Computation of DFT, IDFT using direct and FFT methods
4. Verification of sampling theorem.
5. Design of Butterworth and Chebyshev LP & HP filters.
6. Design of LPF using rectangular, Hamming and Kaiser Windows.
7. LED interfacing with digital signal processor.
8. Stepper motor control using digital signal processor.
9. D.C Motor speed control using digital signal processor.

10. 3 - ϕ Induction motor speed control using digital signal processor.
11. Brushless D.C motor speed control using digital signal processor.
12. Key – pad interfacing with digital signal processor.

From the above experiments, each student should perform at least 10 (Ten) experiments.

No. of Internal Tests:	01	Max. Marks for Internal Test:	12
Marks for assessment of each experiment			18
Duration of Internal Test: **3 Hours**			

With effect from the Academic Year 2020-21

VASAVI COLLEGE OF ENGINEERING (Autonomous)
IBRAHIMBAGH, HYDERABAD – 500 031

Department of Electrical & Electronics Engineering
Power Systems Lab

SYLLABUS FOR B.E. VII – SEMESTER

L:T:P (Hours/week):0:0:2	SEE Marks:50	Course Code : **PC721EE**
Credits : 1	CIE Marks:30	Duration of SEE : 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** On completion of the course, students will be able to
1. To allow students to practically verify several concepts and procedures learned in power systems and switchgear and protection 2. To promote teamwork among students and effective communication skills.	1. Student will be able to calculate parameters related to electric transmission line, alternators and transformers 2. Student will be able to understand the a relay operation and use them 3.Students will be able to understand insulators and their properties. 4. Communicate effectively and support constructively towards team work 5. Pursue lifelong learning for career and professional growth with ethical concern for society and environment.

List of Experiments

1. Determination of regulation and efficiency of an artificial transmission lines.
2. IDMT characteristics of Over-current relay.
3. Determination of A, B, C, D constants of short, Medium and Long lines. Drawing of circle diagrams.
4. Differential protection of single phase transformer.
5. Sequence impedance of 3-phase Alternators.

6. Determination of positive, negative and zero-sequence reactance of three phase Transformers using sequence current excitation fault calculation.
7. Synchronous machine reactance and time constant from 3-phase S.C. set.
8. Determination of dielectric strength of insulating oils
9. Determination of voltage distribution and String efficiency of string of insulators.
10. Fault analysis of Alternator

11. Simulation of transmission line using software tool (ABCD constants, Efficiency and regulation of transmission line)
12. Simulation for determination of voltage distribution and String efficiency of string of insulators using software tool.

From the above experiments, each student should perform at least 10 (Ten) experiments.

No. of Internal Tests:	01	Max. Marks for Internal Test:	12
Marks for assessment of each experiment			18
Duration of Internal Test: **3 Hours**			

With effect from the Academic Year 2020-21

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Electrical & Electronics Engineering

Integrated Circuits Lab

SYLLABUS FOR B.E. VII - SEMESTER

L:T:P(Hours /week):0:0:2	SEE Marks :50	Course Code : **PC731EE**
Credits : 1	CIE Marks: 30	Duration of SEE : 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** On completion of the course, students will be able to
To acquire skills of designing and testing of digital and analog integrated circuits.	1. Analyze and design various applications of Op-Amp. 2. Construct and troubleshoot circuits containing linear integrated circuits. 3. Design combinational and sequential logic circuits using IC's. 4. Identify the suitable IC's in the applications of adders, counters, converters and multiplexers. 5. Compute the Triangle and square wave using op-amp and IC's.

List of Experiments:

1. Generation of Triangle and square wave using op-amp.
2. PLL (Phase locked loop).
3. Design of astable multivibrator using 555 timer.
4. Instrumentation amplifier using op-amp.
5. Active filters.
6. Design of integrator and differentiator using op-amp.
7. Multiplexer applications for logic Realization of combinational circuits.
8. Synchronous counter.

9. Asynchronous counter.
10. Study of clipping and clamping circuits using op-amps
11. Design of monostable multivibrator using IC's.
12. Boot-strap sweep circuit using op-amp.
13. Study of half adder, full adder and subtractor
14. D/A converters.
15. A/D converters.

From the above experiments, each student should perform at least 10 (Ten) experiments.

No. of Internal Tests:	01	Max. Marks for Internal Test:	12
Marks for assessment of each experiment			18
Duration of Internal Test: **3 Hours**			

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Electrical & Electronics Engineering

Project Seminar

SYLLABUS FOR B.E. VII - SEMESTER

L:T:P(Hours /week):0:0:2	SEE Marks: -	Course Code: **PW749EE**
Credits: 1	CIE Marks: 30	Duration of SEE: -

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for systematic independent study of stat of the art topics in broad area of his/her specialization.

Seminar topics may be chosen by the students with the advice from faculty members. Students are to be exposed to the following aspects of Seminar Presentation

- Literature survey.
- Organization of material.
- Preparation of OHP slides/PC presentation
- Technical writing

Each student is required to

1. Submit one page synopsis of the Seminar talk for display on notice board.
2. Give a 20 minutes presentation through OHP, PC, Slide projector, followed by 10 minutes discussion.
3. Submit a report on the seminar topic with list of references and slides used.

Seminars are to be scheduled from 3rd week to the last week of the Semester and any change in the schedule should be discouraged.
The sessional marks will be awarded to the students by at least two faculty members on the basis of an oral and a written presentation as well as involvement in the discussions.

With effect from the Academic Year 2020-21

VASAVI COLLEGE OF ENGINEERING (Autonomous)
IBRAHIMBAGH, HYDERABAD – 500 031

Department of Electrical & Electronics Engineering
High Voltage DC Transmission
(Professional Elective – I)

SYLLABUS FOR B.E. VII - SEMESTER

L:T:P (Hours /week):3:0:0	SEE Marks :60	Course Code : **PE710EE**
Credits : 3	CIE Marks: 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** On completion of the course, students will be able to
To provide the knowledge on comparison of HVAC and HVDC transmission system, the different configurations of converter and inverter circuits, desired features and combined characteristics of control rectifier and inverter circuits, protection against over voltage and over current systems, different types MTDC system and control schemes.	1. Able to classify the cost comparison of AC and DC system 2. Able to draw and explain the different configuration of converter and inverter circuits. 3. Able to draw and explain the combined characteristics, control and their applications of rectifier and inverter circuits. 4. Able to explain the protection schemes of over voltage and over current systems. 5. Able to explain the comparison between series and parallel MTDC systems.

UNIT – I:General consideration of DC and AC Transmission Systems:
Comparison of AC and DC Transmission systems. Applications of DC transmission. Economic consideration . Kinds of DC links. Components of HVDC transmission systems. Planning for HVDC Transmission. Modern Trends in DC Transmission.

UNIT – II: Converter Circuits:
Properties of Converter Circuits, converter harmonics, Different kinds of arrangements, Analysis of bridge converter with firing angle control-without overlap angle and with overlap angle, u<60^o. Equivalent circuit of rectifier - without overlap angle and with overlap angle, u < 60^o.
Inversion : operation as an inverter: equivalent circuit of inverter-without overlap angle and with overlap angle, u < 60^o

UNIT – III: Converter Control:
Introduction & basic means of control, Desired features of control, combined characteristics of rectifier and inverter. Power reversal. Individual phase control, equidistant pulse control, Basic control scheme of converters

UNIT – IV: HVDC Protection:
Converter maloperations, Short circuit current. Arc-back, Commutation failure, Bypass valves, DC reactors. DC circuit breakers. Protection against over current and over voltages, Analysis of Harmonic filters.

UNIT – V:Multi-terminal DC systems:
Application of MTDC systems, Types of MTDC systems. Comparison of series and parallel MTDC systems.

Learning Resources

1. Kimbark E.W., Direct Current Transmission Vol- I , John Wiley, 1971.
2. Padiyar K.R., HVDC Power Transmission Systems, Wiley Eastern, 1990.
3. Arrillaga J., High Voltage Direct Current Transmission, Peter Peregrinus Ltd., London, Pegramon Press, 1983

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1. No. of Internal Tests	:	2	Max. Marks for each Internal Test	:	30
2. No. of Assignments	:	3	Max. Marks for each Assignment	:	5
3. No. of Quizzes	:	3	Max. Marks for each Quiz Test	:	5

Duration of Internal Tests : 90 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)
IBRAHIMBAGH, HYDERABAD – 500 031

Department of Electrical & Electronics Engineering
Wind and Solar Energy Systems
(Professional Elective – I)

SYLLABUS FOR B.E. VII - SEMESTER

L:T:P(Hours/week):3:0:0	SEE Marks :60	Course Code : **PE720EE**
Credits : 3	CIE Marks: 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** On completion of the course, students will be able to
To provide a survey of the solar energy and wind energy resources and the technologies for harnessing these resources and control of generated power based on power electronics.	1. Energy scenario and the consequent growth of the power generation from renewable energy sources. 2. Basic physics of wind and solar power generation. 3. Power electronic interfaces for wind and solar generation. 4. Issues related to the grid-integration of solar and wind energy systems.

Unit I: Physics of Wind Power:
History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and
power-cumulative distribution functions.

Unit II: Wind generator topologies:
Review of modern wind turbine technologies,Fixed and Variable speed wind turbines,Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent- Magnet Synchronous

Generators, Power electronics converters. Generator-Converter configurations, Converter Control.

UNIT III: The Solar Resource and Solar thermal power generation:

The Solar Resource: Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability.

Solar thermal power generation : Technologies, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond,elementary analysis.

UNIT IV: Solar photovoltaic:

Technologies-Amorphous, monocrystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms, Converter Control.

UNIT V: Network Integration Issues:

Overview of grid code technical requirements. Fault ride-through for wind farms - real and

reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behavior during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems.

Learning Resources:

1. G.D. Rai, *Non-Conventional Energy Sources ,* Khanna Publishers, New Delhi, 2011.
2. B H KHAN, *Non-Conventional Energy Resources*, McGraw Hill, 2nd Edition, 2009.
3. T. Ackermann, " Wind Power in Power Systems" , John Wiley and Sons Ltd., 2005.
4. G. M. Masters, " Renewable and Efficient Electric Power Systems**",** John Wiley and Sons, 2004.
5. S. P. Sukhatme, " Solar Energy: Principles of Thermal Collection and Storage" , McGraw Hill, 1984.

6. H. Siegfried and R. Waddington, " Grid integration of wind energy conversion systems" John Wiley and Sons Ltd., 2006.
7. G. N. Tiwari and M. K. Ghosal, " Renewable Energy Applications" , Narosa Publications, 2004.
8. J. A. Duffie and W. A. Beckman, " Solar Engineering of Thermal Processes" , John Wiley & Sons,1991.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1. No. of Internal Tests	:	2	Max. Marks for each Internal Test	:	30
2. No. of Assignments	:	3	Max. Marks for each Assignment	:	5
3. No. of Quizzes	:	3	Max. Marks for each Quiz Test	:	5

Duration of Internal Tests : 90 Minutes

With effect from the Academic Year 2020-21

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Electrical & Electronics Engineering

Programmable Logic Controllers

(Professional Elective – I)

SYLLABUS FOR B.E. VII - SEMESTER

L:T:P (Hours /week):3:0:0	SEE Marks :60	Course Code : **PE730EE**
Credits : 3	CIE Marks: 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** On completion of the course, students will be able to
1.Design,Programme and build an operational control system complete with instrumentation, analog/ digital inputs and outputs and Programmable Logic controllers. 2. Practicalities of working with PLCsinanindustrial environment and fault-findinginanautomated environment.	1.Designa PLC system, component, or process to meet a set of specifications. 2. Describe and understand how analogue and digital instrumentation connect to a PLC. 3.Understand advanced programming techniques including functional block and statement list. 4.Program, edit and test PLC programs incorporating combinational and sequential logic function, timers, counters and data handling instructions. 5.Design,understand and solve industrial problems with automation solutions

UNIT-I:

PLC Basics PLC system, I/O modules and interfacing CPU processor programming equipment programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

UNIT-II:

PLC Programming input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill-press operation. Digital logic gates programming in the Boolean algebra system,

conversion examples Ladder diagrams for process control Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

UNIT-III:

PLC Registers: Characteristics of Registers module addressing holding registers input registers, output registers. PLC Functions Timer functions and industrial applications counters counter function industrial applications, Architecture functions, Number comparison functions, number conversion functions.

UNIT-IV:

Data handling functions: SKIP, Master control Relay Jump Move FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axes and three axis Robots with PLC, Matrix functions.

UNIT-V:

Analog PLC operation: Analog modules and systems Analog signal processing multi bit data processing, analog output application examples, PID principles position indicator with PID control, PID modules, PID tuning,PID functions.

Learning Resources:

1. Programmable Logic Controllers – Principle and Applications by John.W.Webb and Ronald A Reiss Fifth edition, PHI.
2. Programmable Logic Controllers – Programming Method and Applications by JR Hackworth and F.D Hackworth – Jr- Pearson, 2004.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1.	No. of Internal Tests	: 2	Max. Marks for each Internal Test	:	30
2.	No. of Assignments	: 3	Max. Marks for each Assignment	:	5
3.	No. of Quizzes	: 3	Max. Marks for each Quiz Test	:	5

Duration of Internal Tests : 90 Minutes

With effect from the Academic Year 2020-21

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Electrical & Electronics Engineering

Distributed Generation

(Professional Elective – II)

SYLLABUS FOR B.E. VII - SEMESTER

L:T:P (Hours /week):3:0:0	SEE Marks :60	Course Code : **PE740EE**
Credits : 3	CIE Marks: 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** On completion of the course, students will be able to
To develop a conceptual introduction to various distributed generation systems, micro grids and their control	1. Describe a range of distributed energy sources including wind, PV, hydro, and energy storage systems. 2. Demonstrate the impacts that distributed energy sources are having on the control and operation of power systems including voltage control, power factor, power quality and protection coordination. 3. Analyze grid integration of different types of DGs and their effect on dynamic, steady state stability of power system. 4. Illustrate grid integration system issues and challenges with conventional and non-conventional energy sources and estimate reliability of DG based systems. 5. Model and analyze a micro grid taking into consideration the planning and operational issues of the DGs to be connected in the system.

UNIT-I:Need for Distributed generation:

Renewable sources in distributed generation and current scenario in Distributed Generation, Planning of DGs, Siting and sizing of DGs optimal placement of DG sources in distribution systems,

UNIT-II: Grid integration of DGs:
Different types of interfaces, Inverter based DGs and rotating machine based interfaces, Aggregation of multiple DG units, Energy storage elements – Batteries, ultra capacitors, flywheels.

UNIT -III :Technical impacts of DGs:
Transmission systems, Distribution systems, De-regulation – Impact of DGs upon protective relaying – Impact of DGs upon transient and dynamic stability of existing distribution systems – Steady state and Dynamic analysis.

UNIT-IV :Economic and control aspects of DGs:
Market facts, issues and challenges – Limitations of DGs – Voltage control techniques, Reactive power control, Harmonics, Power quality issues – Reliability of DG based systems

UNIT- V : Introduction to micro-grids :
Types of micro-grids – Autonomous and non-autonomous grids – Sizing of micro-grids – Modeling & analysis – Micro-grids with multiple DGs – Micro-grids with power electronic interfacing units – Transients in micro-grids – Protection of micro-grids – Case studies.

LEARNING RESOURCESS:

1. H. Lee Willis, Walter G. Scott , '*Distributed Power Generation – Planning and Evaluation*', Marcel Decker Press, 2000.
2. M.Godoy Simoes, Felix A.Farret, '*Renewable Energy Systems – Design and Analysis with Induction Generators*', CRC press.
3. Robert Lasseter, Paolo Piagi, 'Micro-*grid: A Conceptual Solution*', PESC 2004, June 2004.
4. F. Katiraei, M.R. Iravani, '*Transients of a Micro-Grid System with Multiple Distributed Energy Resources*', International Conference on Power Systems Transients (IPST'05) in Montreal, Canada on June 19-23, 2005.
5. Z. Ye, R. Walling, N. Miller, P. Du, K. Nelson, '*Facility Micro grids*', General Electric Global Research Canter, Niskayuna, New York, Subcontract report, May 2005.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1. No. of Internal Tests	: 2	Max. Marks for each Internal Test	:	30
2. No. of Assignments	: 3	Max. Marks for each Assignment	:	5
3. No. of Quizzes	: 3	Max. Marks for each Quiz Test	:	5

Duration of Internal Tests : 90 Minutes

With effect from the Academic Year 2020-21

VASAVI COLLEGE OF ENGINEERING (Autonomous)
IBRAHIMBAGH, HYDERABAD – 500 031

Department of Electrical & Electronics Engineering
Electric Drives and Static Control
(Professional Elective – II)

SYLLABUS FOR B.E. VII - SEMESTER

L:T:P (Hours /week):3:0:0	SEE Marks :60	Course Code : **PE750EE**
Credits : 3	CIE Marks: 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** On completion of the course, students will be able to
To understand and analyze the Speed control of DC motor, Induction motor, stepper motor, Brush less DC motor& Switched Reluctance Motor by using various power electronic converters and also electric braking concept	1. Describe the operation and control of electrical drives 2. Modify the speed -torque characteristics of DC motor and induction motor suitable power electronic converter. 3. Analyze the speed control of dc motor with chopper control 4. Analyze the speed control of dc motor with controlled rectifier 5. Choose an appropriate speed control for Induction motor drive to meet the requirements of application in Industry. 6. Select an appropriate speed control for stepper motor, BLDC motor and SRM drive to meet the requirements of application in Industry.

UNIT-I: Electrical Drives:
Definition and block diagram of electrical drive; Parts of electrical drives; Classification of drives; modes of operation; Multi quadrant operation of drives with an example; closed loop control of drives; important factors for selection of electrical drives; advantages of electrical drives.

UNIT-II: DC motor characteristics

Review of emf and torque equations of DC machine, review of torque-speed characteristics of separately excited dc motor, armature voltage control for varying motor speed, flux weakening for high speed operation.

Chopper fed DC drive

Review of dc chopper and duty ratio control, chopper fed dc motor for speed control, steady state operation of a chopper fed drive, armature current waveform and ripple. Review of motoring and generating modes operation of a separately excited dc machine, four quadrant operation of dc machine; single-quadrant, two-quadrant and four-quadrant choppers; steady-state operation of multi-quadrant chopper fed dc drive, regenerative braking.

UNIT-III:

Controlled rectifier fed DC drives

Single phase fully controlled rectifier control of dc separately excited motor; single phase half controlled rectifier control of dc separately excited motor; three phase fully controlled rectifier control of dc separately excited motor; dual converter control of dc separately excited dc motor.

Closed-loop control of DC Drive

Control structure of DC drive, inner current loop and outer speed loop, dynamic model of dc motor – dynamic equations and transfer functions.

UNIT-IV:

Induction motor characteristics

Review of induction motor equivalent circuit and torque-speed characteristic, variation of torque-speed curve with (i) applied voltage, (ii) applied frequency and (iii) applied voltage and frequency, typical torque-speed curves of fan and pump loads, operating point, constant flux operation, flux weakening operation.

Induction motor control:

Speed control of 3-phase induction motor with A.C voltage regulators, Voltage source inverters, Current source inverter and Cyclo-converters; v/f control ac drive; Static rotor resistance control; slip power recovery schemes: Static Krammer drive and Scherbius drive.

UNIT-V: Brushless dc (BLDC) MOTOR DRIVES: Construction and operation of BLDC motor; BLDC motor drive for servo applications; features and applications.

Stepper motors: Construction and classification of stepper motor; operation of variable reluctance stepper motor with suitable configuration; Calculation of step angle; operation of Permanent magnet stepper motor; features and applications.

Switched reluctance motor: Construction and operation of switched reluctance motor; converter circuits; Features and applications.

Learning Resources:

1. GK.Dubey, Fundamentals of Electric Drives, Narosa Public House, Delhi, 2001.
2. M.D. Singh and K.B.Khanchandani, Power Electronics, Tata McGraw Hill PublishingCompany Ltd., 2000.
3. Bimal.K.Bose, Modern Power Electronics and AC Drives, Pearson Education Asia,
2002.
4. S.K.Pillai, A First Course in Electrical Drives, New Age International, 2000.
5. G. K. Dubey, "Power Semiconductor Controlled Drives", Prentice Hall, 1989.
6. W. Leonhard, "Control of Electric Drives", Springer Science & Business Media, 2001.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1. No. of Internal Tests	: 2	Max. Marks for each Internal Test	:	30
2. No. of Assignments	: 3	Max. Marks for each Assignment	:	5
3. No. of Quizzes	: 3	Max. Marks for each Quiz Test	:	5

Duration of Internal Tests : 90 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)
IBRAHIMBAGH, HYDERABAD – 500 031

Department of Electrical & Electronics Engineering
Control Systems Design
(Professional Elective – II)

SYLLABUS FOR B.E. VII - SEMESTER

L:T:P (Hours /week):3:0:0	SEE Marks :60	Course Code : **PE760EE**
Credits : 3	CIE Marks: 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** On completion of the course, students will be able to
Understand and design controllers for various systems using state space approach and also design controllers using P, PI and PID approaches.	1. Understand various design specifications. 2.Design controllers to satisfy the desired design specifications using simple controller structures (P, PI, PID, compensators). 3. Design controllers using the state-space approach.

UNIT-I: Design Specifications :
Introduction to design problem and philosophy. Introduction to time domain and frequency domain design specification and its physical relevance. Effect of gain on transient and steady state response. Effect of addition of pole on system performance. Effect of addition of zero on system response.

UNIT-II: Design of Classical Control System in the time domain :
Introduction to compensator. Design of Lag, lead lag-lead compensator in time domain.
Feedback and Feed forward compensator design. Feedback compensation. Realization of compensators.

UNIT-III: Design of Classical Control System in frequency domain :

Compensator design in frequency domain to improve steady state and transient response. Feedback and Feed forward compensator design using bode diagram.

UNIT-IV: Design of PID controllers :

Design of P, PI, PD and PID controllers in time domain and frequency domain for first, second and third order systems. Control loop with auxiliary feedback – Feed forward control.

UNIT-V: Control System Design in state space :

Review of state space representation. Concept of controllability & observability, effect of pole zero cancellation on the controllability & observability of the system, pole placement design through state feedback. Ackerman's Formula for feedback gain design. Design ofObserver. Reduced order observer. Separation Principle.

Learning Resources :

1. N. Nise, " Control system Engineering" , John Wiley, 2000.
2. I. J. Nagrath and M. Gopal, " Control system engineering" , Wiley, 2000.
3. M. Gopal, " Digital Control Engineering" , Wiley Eastern, 1988.
4. K. Ogata, " Modern Control Engineering" , Prentice Hall, 2010.
5. B. C. Kuo, " Automatic Control system" , Prentice Hall, 1995.
6. J. J. D'Azzo and C. H. Houpis, " Linear control system analysis and design (conventional and modern)" , McGraw Hill, 1995.
7. R. T. Stefani and G. H. Hostetter, " Design of feedback Control Systems" , SaundersCollege Pub, 1994.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1. No. of Internal Tests	: 2	Max. Marks for each Internal Test	: 30
2. No. of Assignments	: 3	Max. Marks for each Assignment	: 5
3. No. of Quizzes	: 3	Max. Marks for each Quiz Test	: 5

Duration of Internal Tests : 90 Minutes

With effect from the Academic Year 2020-21

VASAVI COLLEGE OF ENGINEERING (Autonomous)
IBRAHIMBAGH, HYDERABAD – 500 031

Department of Electrical & Electronics Engineering
Power System Operation and Control
(Professional Elective – III)

SYLLABUS FOR B.E. VII - SEMESTER

L:T:P (Hours /week):3:0:0	SEE Marks :60	Course Code : **PE770EE**
Credits : 3	CIE Marks: 40	Duration of SEE: 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** On completion of the course, students will be able to
1. To provide knowledge on obtaining solution for load dispatch problems. 2. To provide knowledge on modelling and analysis of power system under steady and dynamic conditions.	1. Draw the fuel cost characteristics, input-output characteristics and heat rate characteristics of generating units. 2. Solve the load dispatch problem and Unit Commitment problems using iterative technique satisfying equality and inequality constraints for optimal solution. 3. Compute steady state error for changes in load demand and design controllers to minimize the error for single area and two area systems. 4. Compute steady state and transient stability limit of given network for different fault types and conditions. 5. Choose and model the Controller for Reactive Power Compensation in a system to improve System Voltage.

UNIT – I:Interconnection of power systems:
Importance of interconnection of Power Systems

Economic Operation of Power System: Input output curves – Heat rates and incremental cost curves – Equal incremental cost criterion and economic operation neglecting transmission losses. Transmission loss coefficients, Economic operation including Transmission losses.

UNIT – II: Unit Commitment:
Spinning Reserve, Constraints in unit commitment-thermal unit constraints, hydro constraints and fuel constraints, Unit commitment solution methods-Priority list methods, Dynamic programming method and Lagrangian relaxation method

UNIT – III: Load Frequency Control:
Governor Characteristics – Regulation of two generators in parallel – concept of control area – incremental power balance of a control area - single area control. Flat frequency control – Flat tie line frequency control – Tie line bias control. Advantages of pool operation – Development of model for two area control. Automatic Voltage Regulator.

UNIT – IV: Power System Stability:
Definitions of Steady State Stability and Transient Stability, Steady state stability of a synchronous machine connected to infinite bus, calculation of steady state stability limit, synchronous machine models with and without saliency, Equal area criterion, Application of equal area criterion, Swing equation, Step by step solution of Swing equation, factors effecting transient stability, auto Reclosures, mathematical formulation of voltage stability problem.

UNIT-V:Power factor control and voltage control:
Causes and disadvantages of low power factor, methods of power factor improvement-Static capacitors, Synchronous condensers and phase advancers. Advantages of power factor improvement.
Necessity of voltage control, methods of voltage control-excitation control, tap changing transformers and booster transformers Reactive Power Control: Reactive power generation by synchronous generators, FACTS Controllers-TCSC, STATCOM, UPFC.

Learning Resources:

1. D.P.Kothari and I.J.Nagrath, Modern Power Systems Analysis, 3rd Eddition, Tata McGraw Hill, 2004
2. John, J,Grangier, William D.Stevenson Jr., Power Systems Analysis, 3rd Eddition, Tata McGraw Hill, 2003
3. C.L.Wadhwa, Electric Power Systems. 3rd Edition, New age International (P) Ltd., 2002
4. Haadi Sadat, Power Systems Analysis, Tata McGraw Hill

5. Elgard, Electrical Energy Systems Theory
6. J.Wood and B.F.Wollenberg, Power Generation, Operation and Control, 2nd ed, vol 3. New York: John Wiley & Sons Inc, 1996.
7. Chakravarthy, Power Systems Operation and Control
8. S.Sivanagaraju and S.Satyanarayana, Electric power Transmission and Distribution,2009, Pearson Education

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1. No. of Internal Tests	:	2	Max. Marks for each Internal Test	:	30
2. No. of Assignments	:	3	Max. Marks for each Assignment	:	5
3. No. of Quizzes	:	3	Max. Marks for each Quiz Test	:	5

Duration of Internal Tests : 90 Minutes

With effect from the Academic Year 2020-21

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Electrical & Electronics Engineering

Advanced Modulation techniques for Power Converters

(Professional Elective – III)

SYLLABUS FOR B.E. VII - SEMESTER

L:T:P (Hours /week):3:0:0	SEE Marks :60	Course Code : **PE780EE**
Credits : 3	CIE Marks: 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** On completion of the course, students will be able to
To know the modulation techniques employed for power electronic converters and design multi-level inverters with different topologies.	1: Understand the basic converter topologies and multilevel inverter topologies 2: Apply fundamentals of PWM schemes with different analysis for inverters 3: Analyze modulation of single phase and three VSIs. 4: Design multi level inverters with carrier based PWM

UNIT-I Introduction to Power Electronic Converters:

Basic Converter Topologies, Voltage Source/Stiff Inverters, Switching Function Representation of Three-Phase Converters, Output Voltage Control, Current Source/Stiff Inverters, Concept of a Space Vector, Three-Level Inverters, Multilevel Inverter Topologies.

UNIT-II Modulation of One Inverter Phase Leg:

Fundamental Concepts of PWM, Evaluation of PWM Schemes, Double Fourier Integral Analysis of a Two Level Pulse Width Modulated Waveform, Naturally Sampled Pulse Width Modulation, PWM Analysis by Duty Cycle Variation, Regular Sampled Pulse Width Modulation, Direct

Modulation, Integer versus Non-Integer Frequency Ratios, Review of PWM Variations

UNIT-III Modulation of Single-Phase Voltage Source Inverters:
Topology of a Single-Phase Inverter, Three-Level Modulation of a Single-Phase Inverter, Analytic Calculation of Harmonic Losses, Sideband Modulation, Switched Pulse Position, Switched Pulse Sequence

UNIT-IV Modulation of Three-Phase Voltage Source Inverters:
Topology of a Three-Phase Inverter (VSI), Three-Phase Modulation with Sinusoidal References, Third-Harmonic Reference Injection, Analytic Calculation of Harmonic Losses, Discontinuous Modulation Strategies, Triplen Carrier Ratios and Sub-harmonics.

UNIT-V Carrier-Based PWM of Multilevel Inverters:
PWM of Cascaded Single-Phase H-Bridges, Overmodulation of Cascaded H-Bridges, PWM Alternatives for Diode-Clamped Multilevel Inverters, Three-Level Naturally Sampled PD PWM, Three-Level Naturally Sampled APOD/ POD PWM, Overmodulation of Three-Level Inverters, Five-Level PWM for Diode-Clamped Inverters, PWM of Higher Level Inverters.

Learning Resources:

1. D. Grahame Holmes and Thomas A. Lipo, "Pulse width modulation for power converters principles and practice", IEEE Series on Power Engineering, A JOHN WILEY & SONS, INC., PUBLICATION

The break-up of CIE: Internal Tests+ Assignments + Quizzes

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2. No. of Assignments	: 3	Max. Marks for each Assignment	: 5
3. No. of Quizzes	: 3	Max. Marks for each Quiz Test	: 5

Duration of Internal Tests : 90 Minutes

With effect from the Academic Year 2020-21

VASAVI COLLEGE OF ENGINEERING (Autonomous)
IBRAHIMBAGH, HYDERABAD – 500 031

Department of Electrical & Electronics Engineering
Digital Control Systems
(Professional Elective – III)

SYLLABUS FOR B.E. VII - SEMESTER

L:T:P (Hours /week):3:0:0	SEE Marks :60	Course Code :**PE790EE**
Credits : 3	CIE Marks: 40	Duration of SEE: 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** On completion of the course, students will be able to
Understand digital control systems concepts and also analyze and design digital control systems	1. Obtain discrete representation of LTI systems. 2. Analyse stability of open loop and closed loop discrete-time systems. 3. Design and analyse digital controllers. 4. Design state feedback and output feedback controllers.

UNIT-I: Discrete Representation of Continuous Systems:
Basics of Digital Control Systems. Discrete representation of continuous systems. Sampleand hold circuit. Mathematical Modelling of sample and hold circuit. Effects of Sampling andQuantization. Choice of sampling frequency. ZOH equivalent.

UNIT-II: Discrete System Analysis:
Z-Transform and Inverse Z Transform for analyzing discrete time systems. Pulse Transfer function. Pulse transfer function of closed loop systems. Mapping from s-plane to z plane.
Solution of Discrete time systems. Time response of discrete time system.

UNIT-III: Stability of Discrete Time System :
Stability analysis by Jury test. Stability analysis using bilinear transformation. Design of digital control system with dead beat response. Practical issues with dead beat response design.

UNIT-IV: State Space Approach for discrete time systems:
State space models of discrete systems, State space analysis. Lyapunov Stability. Controllability, reach-ability, Reconstructibility and observability analysis. Effect of polezero cancellation on the controllability & observability.

UNIT-V:Design of Digital Control System:
Design of Discrete PID Controller, Design of discrete state feedback controller. Design of set
point tracker. Design of Discrete Observer for LTI System. Design of Discrete compensator.

Learning Resources :

1. K. Ogata, " Digital Control Engineering" , Prentice Hall, Englewood Cliffs, 1995.
2. M. Gopal, " Digital Control Engineering" , Wiley Eastern, 1988.
3. G. F. Franklin, J. D. Powell and M. L. Workman, " Digital Control of DynamicSystems" , Addison-Wesley, 1998.
4. B.C. Kuo, " Digital Control System" , Holt, Rinehart and Winston, 1980.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1. No. of Internal Tests	: 2	Max. Marks for each Internal Test	: 30
2. No. of Assignments	: 3	Max. Marks for each Assignment	: 5
3. No. of Quizzes	: 3	Max. Marks for each Quiz Test	: 5

Duration of Internal Tests : 90 Minutes

With effect from the Academic Year 2020-21

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Electrical & Electronics Engineering

Electrical Machine Design

(Professional Elective – IV)

SYLLABUS FOR B.E. VII - SEMESTER

L:T:P (Hours /week):3:1:0	SEE Marks :60	Course Code : **PE712EE**
Credits : 4	CIE Marks: 40	Duration of SEE: 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** On completion of the course, students will be able to
To impart the fundamentals of electric machine design such that the students can apply these concepts for designing the machines**.**	1. Choose materials for conducting, magnetic, insulating parts of the machine based on machine design requirements using the knowledge of properties of materials. 2. Design the thermal circuit for the permissible temperature rise and develop different methods to limit temperature to the maximum permissible value using different cooling methodologies. 3. Design AC machines, transformer,3 phase Induction machines in compliance with the given specifications applying the fundamentals 4. Demonstrate the use of computer in machine design to simplify the design process 5. Interpret the design of PMSMs, BLDCs, SRM and claw-pole machines.

Unit I:

Introduction

Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, types of cooling, types of enclosures, heat flow, temperature rise, rating of machines.

Unit II:

Transformers

Sizing of a transformer, main dimensions, kVA output for single- and three-phase transformers, window space factor, overall dimensions, operating characteristics, regulation, no load current, temperature rise in Sizing of a transformer, main dimensions, kVA output for single- and three-phase transformers, window space factor, overall dimensions, operating characteristics, regulation, no load current, temperature rise in transformers, design of cooling tank, methods for cooling of transformers.

Unit III:

Induction Motors

Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor, magnetic leakage calculations, leakage reactance of poly phase machines, magnetizing current, short circuit current, circle diagram, operating characteristics.

Unit IV:

Synchronous Machines

Sizing of a synchronous machine, main dimensions, design of salient pole machines, short circuit ratio, shape of pole face, armature design, armature parameters, estimation of air
gap length, design of rotor, design of damper winding, determination of full load field mmf, design of field winding, design of turbo alternators, rotor design.

Unit V:

Computer aided Design (CAD):

Limitations (assumptions) of traditional designs, need for CAD analysis, synthesis and hybrid methods, design optimization methods, variables, constraints and objective function, problem formulation. Introduction to

FEM based machine design. Introduction to **c**omplex structures of modern machines-PMSMs, BLDCs, SRM and claw-pole machines.

Learning Resources:

1. A. K. Sawhney, "A Course in Electrical Machine Design", Dhanpat Rai and Sons, 1970.
2. M.G. Say, "Theory & Performance & Design of A.C. Machines", ELBS London.
3. S. K. Sen, "Principles of Electrical Machine Design with computer programmes", Oxford and IBH Publishing, 2006.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1.	No. of Internal Tests	: 2	Max. Marks for each Internal Test	:	30
2.	No. of Assignments	: 3	Max. Marks for each Assignment	:	5
3.	No. of Quizzes	: 3	Max. Marks for each Quiz Test	:	5

Duration of Internal Tests: 90 Minutes

With effect from the Academic Year 2020-21

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Electrical & Electronics Engineering

Power Quality

(Professional Elective – IV)

SYLLABUS FOR B.E. VII - SEMESTER

L:T:P (Hours /week):3:1:0	SEE Marks :60	Course Code : **PE722EE**
Credits : 4	CIE Marks: 40	Duration of SEE: 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** On completion of the course, students will be able to
1. To know different terms of power quality. 2. To Illustrate of voltage power quality issue - short and long interruption 3. To construct study of characterization of voltage sag magnitude and three phase unbalanced voltage sag. 4. To know the behavior of power electronics loads; induction motors, synchronous motor etc by the power quality issues 5. To prepare mitigation of power quality issues by the VSI converters.	1. Know the severity of power quality problems in distribution system. 2. Understand the concept of voltage sag transformation from up-stream (higher voltages) to down-stream (lower voltage) 3. Compute the concept of improving the power quality to sensitive load by various mitigating custom power devices

UNIT-I: Introduction:

Introduction of the Power Quality (PQ) problem, Terms Used in PQ: Voltage Sag, Swell, Surges, Harmonics, over voltages, spikes, Voltage fluctuations, Transients, Interruption, overview of power quality phenomenon, Remedies to improve power quality, power quality monitoring. Power Quality Data: Data collection, Data analysis, Database Structure, Creating PQ databases, Processing PQ data.

UNIT-II: Voltage sag -characterization:
Voltage sag -definition, causes of voltage sag, voltage sag magnitude, monitoring, theoretical calculation of voltage sag magnitude, voltage sag calculation in non-radial systems, meshed systems, voltage sag duration. Three phase faults, phase angle jumps, magnitude and phase angle jumps for three phase unbalanced sags, load influence on voltage sags.

UNIT-III: PQ considerations in Industrial Power Systems:
Adjustable speed drive (ASD) systems and applications, mitigation of harmonics. Characterization of voltage sags experienced by three-phase ASD systems: Types of sags and phase -angle jumps. Effects of momentary voltage dips on the operation of induction and synchronous motors. Voltage sag coordination for reliable plant operation.

UNIT-IV: Effects of Harmonics on Power Quality:
Harmonic analysis of industrial customers, technical barriers in ASDs. Methods of evaluation of harmonic levels in industrial distribution systems. Harmonic effects on transformers. Impact of distribution system capacitor banks on PQ. Guidelines for limiting voltage harmonics.

UNIT-V: Power Quality Monitoring:
Introduction, site surveys, Transducers, IEC-measurement techniques for Harmonics, Flicker, IEC Flicker meter.

Learning Resources:

1. Math HJ Bollen, "Understanding Power Quality Problems ", IEEE I Press.
2. C. Sankaran, "Power Quality" CRC Press.
3. R.Sastry Vedam, M.Sarma, "Power Quality- Var Compensation in Power Systems ", CRC Press, 2009.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1.	No. of Internal Tests	: 2	Max. Marks for each Internal Test	:	30
2.	No. of Assignments	: 3	Max. Marks for each Assignment	:	5
3.	No. of Quizzes	: 3	Max. Marks for each Quiz Test	:	5

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)
IBRAHIMBAGH, HYDERABAD – 500 031

Department of Electrical & Electronics Engineering
Advanced Control Systems
(Professional Elective – IV)

SYLLABUS FOR B.E. VII - SEMESTER

L:T:P(Hours /week):3:1:0	SEE Marks :60	Course Code : **PE732EE**
Credits : 4	CIE Marks: 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** On completion of the course, students will be able to
Understand advanced control systems concepts and also analyze the stability of advanced control systems	1.assess the controllability and observability of analog and discrete control systems. 2.Analyse non-linear systems. 3. Analyse stability using lyapunov's stability criterion. 4. formulate and analyze optimal control problem

UNIT-I: Review of state space representation of continuous time systems and their solutions:
State models for discrete time systems described as difference equations and transfer functions. Transfer function from state model, state transition matrix and solution of state equation for discrete time systems.

UNIT-II: Controllability and Observability:
Concepts of controllability and observability, controllability tests for continuous time, discrete time , time invariant systems. Observability tests for continuous time and discrete time, time invariant systems, controllability and observability modes in state. Jordon's canonical form, controllable andobservable companion forms for single input single output systems, pole placement by state feed back.

UNIT-III: Nonlinear systems:
Behaviour of non-linear systems, Jump resonance, sub harmonic oscillation, limit cycles, common physical, non – linearities, singular points, phase plane, method, construction of phase plane trajecties, isocline method, delta method, computation of time.

UNIT- IV: Stability:
Lvapunov's stability criteria, Theorems, The direct method of Liapunov for linear systems, Methods of constructing Liapunov function Krasovski's Method, variable gradient method.

UNIT-V: Optimal Control:
Formulation of optimal control problem, calculus of variations, Minimisation of functionals . Formulation of variational calculus using Hamiltonian method.

LEARNING RESOURCESS:

1. Gopal M. Modern, Control System Theory, Wiley Eastern Ltd. 2004.
2. Schulz DG , Melsa JL , State functions of linear control systems, Mc Graw Hill.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1.	No. of Internal Tests	: 2	Max. Marks for each Internal Test	:	30
2.	No. of Assignments	: 3	Max. Marks for each Assignment	:	5
3.	No. of Quizzes	: 3	Max. Marks for each Quiz Test	:	5

Duration of Internal Tests: 90 Minutes

With effect from the Academic Year 2020-21

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS) :: IBRAHIMBAGH, HYDERABAD – 500 031.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SCHEME OF INSTRUCTION AND EXAMINATION (R-17) :: B.E. - EEE : EIGHTH SEMESTER (2020 - 21)

B.E (EEE) VIII Semester								
Course Code	**Name of the Course**	**Scheme of Instruction**			**Scheme of Examination**			**Credits**
		Hours per Week			**Duration in Hrs**	**Maximum Marks**		
		L	**T**	**P/D**		**SEE**	**CIE**	
THEORY								
PE8XXEE	Professional Elective-V	3	0	0	3	60	40	3
PE8XXEE	Professional Elective-VI	3	0	0	3	60	40	3
PRACTICALS								
PW819EE	Project Work / Internship	0	0	18	Viva-voce	50	50	9
	TOTAL	**6**	**0**	**18**		**170**	**130**	**15**
	GRAND TOTAL	**24**				**300**		
Student should acquire one online certificate course during III- VII Semester								

Professional Elective – V:

1. PE810EE - Electrical Power Distribution Engineering
2. PE820EE - Switched mode power conversion
3. PE830EE - SCADA system and application

Professional Elective – VI:

1. PE840EE - Renewable Energy Sources
2. PE850EE - Electric and Hybrid Vehicles
3. PE860EE - Mathematical Methods in Control Systems

VASAVI COLLEGE OF ENGINEERING (Autonomous)
IBRAHIMBAGH, HYDERABAD – 500 031

Department of Electrical & Electronics Engineering
Electrical Power Distribution Engineering
(Professional Elective-V)

SYLLABUS FOR B.E. VIII - SEMESTER

L:T:P (Hours /week):3:0:0	SEE Marks: 60	Course Code: **PE810EE**
Credits: 3	CIE Marks: 40	Duration of SEE: 3Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** On completion of the course, students will be able to
1. To provide knowledge on structure of Electrical Distribution System 2. To provide knowledge on performance of Electrical distribution system. 3. To provide knowledge on Distribution Automation.	1.Computecontribution factor, coincidence factor, load factor and loss factors based on the characteristics of loads. 2. Design primary and secondary system of Distribution Network based on the factors effecting them 3. Choose the optimal size and location of capacitors for improvement of Power Factor and Voltage Profile using algorithms. 4. Compute fault currents for different faults in distribution systems and choose the protective schemes and co-ordinate the protective devices 5. List the procedures for Distribution automation using different Communication systems and Automated devices.

UNIT – I:Load Modeling and Characteristics:
Introduction, Load characteristics, Diversified demand, non- coincident demand, coincidence factor contributions factor problems, Load modeling.

Distribution System:
Sub transmission system and Substation Bus Schemes.

UNIT – II: Distribution feeders:
Design considerations of Primary Systems: Radial type Primary feeder, Loop type primary feeder, Primary Network, Factors affecting feeder voltages, feeder loading, Tie Lines. Application of ABCD parameters to feeder circuits.
Design practice of secondary distribution systems-Secondary Voltage levels, Present design practice, Secondary banking, Secondary networks, Secondary mains, Spot Networks.(Theoretical aspects only).

UNIT – III: Voltage drop and power loss calculation:
3-phase , non-3-phase primary lines, single phase two wire laterals with ungrounded neutral, single phase two wire ungrounded laterals. Application of capacitors to distribution systems, Effect of series and shunt capacitors, power factor correction, Economic justification for capacitors, Best capacitor location.

Unit IV: Distribution system Protection:
Objectives-protection schemes- Circuit Breakers-Sectionalizers-Coordination of protective devices-objectives-types of coordination-classification of faults-fault calculations(Theoretical aspects only)

UNIT – V:Distribution Automation:
Project planning, Communication, SCADA, Consumer Information Service (CIS), Automatic Meter Reading (AMR)

LEARNING RESOURCESS:

1. Turan Gonen, Electric Power distribution Engineering, McGraw Hill Book Co., International Student Edition, 1986.
2. Electric Power Distribution and Automation by S.Sivanagaraju and V.Sankar, DhanpatRai and Co.
3. A.S.Pabla, Electric Power Distribution, Tata McGraw Hill publishing Ltd., 1997
4. Kamalesh Das, Electric Power Systems for Industrial Plants" Jaico Publishing House, 2007.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

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2. No. of Assignments	: 3	Max. Marks for each Assignment	:	5
3. No. of Quizzes	: 3	Max. Marks for each Quiz Test	:	5

Duration of Internal Tests: 90 Minutes

With effect from the Academic Year 2020-21

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Electrical & Electronics Engineering

Switched Mode Power Conversion

(Professional Elective-V)

SYLLABUS FOR B.E. VIII - SEMESTER

L:T:P (Hours /week):3:0:0	SEE Marks :60	Course Code : **PE820EE**
Credits : 3	CIE Marks: 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** On completion of the course, students will be able to
To apply the basic concepts of power electronics for designing converters and implement practical circuits for UPS, SMPS etc.	1. Design converter system for electrical applications 2. Design SMPS for small power applications. 3. Choose suitable control scheme for converters. 4. Design appropriate filter to get harmonic free power supply. 5. Choose appropriate filter for reduction of EMI.

UNIT – I: Basic Converter Circuits:

Buck Regulator, Buck- Boost Regulator, Boost Regulator, Cuk Converters and Resonant Converters. Choice of switching frequency.

UNIT – II: Isolated SMPS:

Fly back Converter, Forward Converter, Half-Bridge and Full Bridge Converters, Push-Pull Converter and SMPS with multiple outputs. Choice of switching frequency.

UNIT – III: Control Aspects:

PWM Controllers, Isolation in feedback loop, Power Supplies with multiple output.

UNIT – IV: Design Considerations:

Selection of output filter capacitor, Selection of energy storage inductor, Design of High Frequency Inductor and High frequency Transformer, Selection of switches. Snubber circuit design.

UNIT – V: Electro Magnetic Interference (EMI):

EMI Filter Components, Conducted EMI suppression, Radiated EMI suppression, Measurement.

LEARNING RESOURCES:

1. Switched Mode Power Supplies, Design and Construction, H. W. Whittington, B. W.Flynn and D. E. MacPherson, Universities Press, 2009 Edition.
2. Mohan N. Undeland . T & Robbins W, Power Electronics Converters, Application andDesign. John Wiley, 3rd edition, 2002
3. Umanand L., Bhat S.R., Design of magnetic components for switched Mode PowerConverters. , Wiley Eastern Ltd.,1992
4. Robert. W. Erickson, D. Maksimovic .Fundamentals of Power Electronics., SpringerInternational Edition, 2005
5. Course Material on Switched Mode Power Conversion, V. Ramanarayanan.
6. Krein P.T .Elements of Power Electronics., Oxford University Press
7. M.H.Rashid, Power Electronics. Prentice-Hall of India

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1. No. of Internal Tests	: 2	Max. Marks for each Internal Test	:	30
2. No. of Assignments	: 3	Max. Marks for each Assignment	:	5
3. No. of Quizzes	: 3	Max. Marks for each Quiz Test	:	5

Duration of Internal Tests: 90 Minutes

With effect from the Academic Year 2020-21

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Electrical & Electronics Engineering

SCADA System and Application

(Professional Elective-V)

SYLLABUS FOR B.E. VIII - SEMESTER

L:T:P (Hours /week):3:0:0	SEE Marks :60	Course Code : **PE830EE**
Credits : 3	CIE Marks: 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** On completion of the course, students will be able to
1. To understand what is meant by SCADA and its functions. 2. To know SCADA communication. 3. To get an insight into its application.	1. Describe the basic tasks of Supervisory Control Systems (SCADA) as well as their typical applications. 2. Acquire knowledge about SCADA architecture, various advantages and disadvantages of each system. 3. Knowledge about single unified standard architecture IEC 61850. 4. To learn about SCADA system components: remote terminal units, PLCs, intelligent electronic devices, HMI systems, SCADA server. 5. Learn and understand about SCADA applications in transmission and distribution sector, industries etc.

Unit – I:Introduction to SCADA:

Data acquisition systems, Evolution of SCADA,
Communication technologies. Monitoring and supervisory functions, SCADA applications in Utility Automation, Industries SCADA

Unit – II: Industries SCADA System Components:

Schemes- Remote Terminal Unit (RTU), Intelligent Electronic Devices (IED), Programmable Logic Controller (PLC), Communication Network, SCADA Server, SCADA/HMI Systems

Unit – III:SCADA Architecture:

Various SCADA architectures, advantages and disadvantages of each system - single unified standard architecture –IEC 61850.

Unit – IV:SCADA Communication:

various industrial communication technologies -wired and wireless methods and fiber optics. open standard communication protocols.

Unit – V: SCADAApplications:

Utility applications- Transmission and Distribution sector-operations, monitoring, analysis and improvement. Industries - oil, gas and water.

Case studies, Implementation, Simulation Exercise

Learning Resources:

1. Stuart A. Boyer: "SCADA-Supervisory Control and Data Acquisition", Instrument Society of AmericaPublications, USA,2004.
2. Gordon Clarke, Deon Reynders: "Practical Modern SCADA Protocols: DNP3, 60870.5 and RelatedSystems", Newnes Publications, Oxford, UK,2004.
3. William T. Shaw, "Cybersecurity for SCADA systems", PennWell Books, 2006.
4. David Bailey, Edwin Wright, "Practical SCADA for industry", Newnes, 2003.
5. Wiebe, "A guide to utility automation: AMR, SCADA, and IT systems for electricpower",PennWell 1999.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1. No. of Internal Tests	: 2	Max. Marks for each Internal Test	:	30
2. No. of Assignments	: 3	Max. Marks for each Assignment	:	5
3. No. of Quizzes	: 3	Max. Marks for each Quiz Test	:	5

Duration of Internal Tests: 90 Minutes

With effect from the Academic Year 2020-21

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Electrical & Electronics Engineering

Renewable Energy Sources

(Professional Elective-VI)

SYLLABUS FOR B.E. VIII - SEMESTER

L:T:P (Hours /week):3:0:0	SEE Marks :60	Course Code :**PE840EE**
Credits : 3	CIE Marks: 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** On completion of the course, students will be able to
To provide a survey of the most important renewable energy resources and the technologies for harnessing these resources within the framework of a broad range of simple to state- of -the-art energy systems.	1. Demonstrate the generation of electricity from various Non-Conventional sources of energy, have a working knowledge on types of fuel cells. 2. Estimate the solar energy, Utilization of it, Principles involved in solar energy collection and conversion of it to electricity generation. 3. Explore the concepts involved in wind energy conversion system by studying its components, types and performance. 4.Illustrate geothermal energy and ocean energy and explain the operational methods of their utilization. 5. Acquire the knowledge on harnessing biomass as a source of energy and analyze photosynthetic efficiency.

UNIT-I: Fuel cells:

Types of Non- conventional energy sources , Fuel Cells : Principle of operation with special reference to H_2-O_2 Cell - Classification and Block diagram of fuel cell systems - Ion exchange membrane cell - Molten carbonate cells - Solid oxide electrolyte cells - Regenerative system-

Regenerative Fuel Cell – Work output and Emf of fuel cell- Advantages and disadvantages of Fuel Cells — Polarization - Conversion efficiency and Applications of Fuel Cells.

UNIT-II: **Solar Energy:**
Solar Radiation and its Measurements: Solar constant-Solar radiation at the earth's surface-Solar radiation geometry-Solar radiation data- Solar radiation measurements.
Solar Energy Collectors: Flat plate collectors- Concentrating Collectors: Focusing and Non-Focusing- Solar pond.
Solar Photovoltaics: p-n junctions- Solar cells- PV systems: Standalone and Grid interactive solar systems.
Applications of Solar Energy: Solar thermal electric conversion- Solar water heating- Solar cooking.

UNIT-III: Wind Energy:
Principles of wind energy conversion :Nature of wind - Power in the Wind-Forces on blades-Basic components of WECS -Classification of WECS - Advantages and disadvantages of WECS -Wind energy collectors – Performance of wind machines- wind energy generators - Wind electric generating and control systems - Site selection considerations - Environmental aspects- Applications of Wind energy.

UNIT-IV: **Energy from the Ocean and Geothermal Energy:**
Ocean thermal electric conversion (OTEC): Open cycle- Closed cycle - Hybrid cycle systems.
Energy from tides: Basic principle of tidal power- Components of tidal power plants- Operation methods of utilization of tidal energy- Advantages and limitations of tidal power generation.
Ocean waves: Wave energy conversion devices-Advantages and limitations of wave energy**.**
Geothermal Energy: Nature of geothermal fields-Geothermal Sources.

UNIT-V:Energy from Biomass:
Biomass conversion technologies / processes - Photosynthesis - Photosynthetic efficiency - Biogas generation - Selection of site for Biogas plant - Classification of Biogas plants - Details of commonly used Biogas plants in India - Advantages and disadvantages of Biogas generation - Thermal gasification of biomass.

Learning Resources:

1. G.D. Rai, Non-Conventional Energy Sources , Khanna Publishers, New Delhi, 2011.
2. B H KHAN, Non-Conventional Energy Resources, McGraw Hill, 2nd Edition, 2009.
3. Ashok Desai V, Non-Conventional Energy, Wiley Eastern Ltd, 1990.
4. Mittal K.M, Non-Conventional Energy Systems, Wheeler Publishing Co. Ltd, 1997.
5. Ramesh R, Kurnar K.U, Renewable Energy Technologies, Narosa Publishing House, New Delhi, 1997.

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1. No. of Internal Tests	: 2	Max. Marks for each Internal Test	:	30
2. No. of Assignments	: 3	Max. Marks for each Assignment	:	5
3. No. of Quizzes	: 3	Max. Marks for each Quiz Test	:	5

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)
IBRAHIMBAGH, HYDERABAD – 500 031

Department of Electrical & Electronics Engineering
Electric and Hybrid Vehicles
(Professional Elective-VI)

SYLLABUS FOR B.E. VIII - SEMESTER

L:T:P (Hours /week):3:0:0	SEE Marks :60	Course Code : **PE850EE**
Credits : 3	CIE Marks: 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** On completion of the course, students will be able to
Acquire knowledge about fundamental concepts, principles, analysis and design of hybrid and electric vehicles and learn electric drive in vehicles / traction.	At the end of this course, students will demonstrate the ability to: 1. Understand the models to describe the conventional & hybrid vehicles and their performance. 2. Identify different drive trains 3. Select various types of propulsion units and their control depending upon the application 4. Understand the different possible ways of energy storage. 5. Adopt different strategies related to energy storage systems & charging topologies.

Unit I: Introduction:

Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance.

Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

Unit-II: Drive Trains:

Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.
Electric Drive Trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

Unit-III: Electric Propulsion Unit:
Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

Unit-IV: Energy Storage:

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage andits analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.
Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems

Unit-V:Energy Management Strategies:

Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.
Charging Topologies: AC, DC, Wireless; Vehicle to Grid(V2G)
Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

Learning Resources :

1. C. Mi, M. A. Masrur and D. W. Gao, “Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives”, John Wiley & Sons, 2011.
2. S. Onori, L. Serrao and G. Rizzoni, “Hybrid Electric Vehicles: Energy ManagementStrategies”, Springer, 2015.
3. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, “Modern Electric, Hybrid Electric, and FuelCell Vehicles: Fundamentals, Theory, and Design”, CRC Press, 2004.
4. T. Denton, “Electric and Hybrid Vehicles”, Routledge, 2016.
5. John M. Miller, Propulsion Systems for Hybrid Vehicles, IET 2nd Edition, 2010

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2.	No. of Assignments	: 3	Max. Marks for each Assignment	:	5
3.	No. of Quizzes	: 3	Max. Marks for each Quiz Test	:	5

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)
IBRAHIMBAGH, HYDERABAD – 500 031

Department of Electrical & Electronics Engineering
Mathematical Methods in Control Systems
(Professional Elective-VI)

SYLLABUS FOR B.E. VIII - SEMESTER

L:T:P (Hours /week):3:0:0	SEE Marks :60	Course Code : **PE860EE**
Credits : 3	CIE Marks: 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** On completion of the course, students will be able to
1. To give the students an understanding of foundational concepts in linear algebra and random processes for use in control systems 2. To understand Probability, Random variables.	1. Apply matrix properties and functions to a given problem 2. Use eigen values and eigen vectors 3. Find out responses of linear systems to any given input signal

Unit – I:
Linear Spaces – Vectors and Matrices
Transformations, Norms
Matrix Factorization

Unit – II:
Eigen value, Eigenvectors and Applications
SVD and Applications
Projections and Least Square Solutions

Unit – III:
Probability, Random variables
Probability distribution and density functions, Joint density and conditional distribution
Functions of random variables and random vectors

Unit – IV:
Characteristic functions and correlation matrices

Unit – V:
Random Processes and properties

Learning Resources:

1. G. Strang, "Introduction to Linear Algebra", 4 th Edition, Wellesley-Cambridge Press, 2009
2. Papoulis & Pillai, "Probability, random variable and stochastic processes", Mcgraw Hill, 2002
3. H. Stark & J.W. Woods, "Probability and random processes with application to signal processing", Pearson Education Asia, 2002
4. J A Gubner: "Probability and Random processes for Electrical and Computer engineers", Cambridge Univ. Press. 2006

The break-up of CIE: Internal Tests+ Assignments + Quizzes

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2. No. of Assignments	: 3	Max. Marks for each Assignment	:	5
3. No. of Quizzes	: 3	Max. Marks for each Quiz Test	:	5

Duration of Internal Tests: 90 Minutes

With effect from the Academic Year 2020-21

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Electrical & Electronics Engineering

Project

SYLLABUS FOR B.E. VIII - SEMESTER

L:T:P (Hours /week):0:0:18	SEE Marks: 50	Course Code: **PW819EE**
Credits: 9	CIE Marks: 50	Duration of SEE: -

'Solving the real life problem' should be the focus of U.G. project. Faculty members should prepare the project brief well in advance which should be made available to the students at the Departmental library. The project may be classified as hardware, software, modeling , simulation. It should involve one or many elements of techniques such as analysis, design, synthesis.

The Department will appoint a project co-ordinator who will coordinate the following

- Grouping of students (a maximum of three in a group)
- Allotment of projects and project guides
- Project monitoring at regular intervals.

All project allotment are to be completed by 4th week of IV year 1st semester so that students get sufficient time for completion of the project.

All projects will be monitored at least twice in a semester through students presentation. Sessional marks should be based on the grades/marks, awarded by a monitoring committee of faculty members and marks given by the supervisor.

Efforts be made that some of the projects are carried out in Industries with the help of Industry co-ordinators. Problems can also be invited from the industries to be worked out through UG project.

Common norms will be established for final documentation of the project report by the respective Department.

* Excellent /Very good/Good/Satisfactory/Unsatisfactory.

Note: Three periods of contact load will be assigned to each project guide.