ISO 9001:2015 AICTE-CII: GOLD Category Institute NAAC-'A' Grade Institute (CGPA: 3.21) NIRF-2020 Rank Band: 201-250

KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE
Opp : Yerragattu Gutta, Hasanparthy (Mandal), WARANGAL - 506 015, Telangana, INDIA.
काकतीय प्रैद्योगिकी एवं विज्ञान संस्थान, वरंगल - ५०६ ०१५ तेलंगाना, भारत
కాకతీయ సాంకేతిక విజ్ఞాన శాస్త్ర విద్యాలయం, వరంగల్ - ౫౦౬ ౦౧౫ తెలంగాణ, భారతదేశము
(An Autonomous Institute under Kakatiya University, Warangal)
(Approved by AICTE, New Delhi; Recognised by UGC under 2(f) & 12(B); Sponsored by EKASILA EDUCATION SOCIETY)
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DEPARTMENT OF

ELECTRICAL AND ELECTRONICS ENGINEERING

PG – M.Tech. (POWER ELECTRONICS)

PRR -20

SYYLABI, SCHEME OF INSTRUCTION & EVALUATION

(I Semester to IV Semester)

(Applicable from the Academic Year 2020-21)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE :: WARANGAL – 15
(An Autonomous Institute under Kakatiya University, Warangal)
SCHEME OF INSTRUCTION & EVALUATION FOR TWO YEAR POSTGRADUATE PROGRAMME

M.Tech. (POWER ELECTRONICS)

SEMESTER-I

PRR-20

S. No.	Course Category	Course Code	Course Title	Hours per Week			Credits	Evaluation Scheme								
								CIE - TA							ESE	Total Marks
								I²RE				Minor	MSE	Total		
				L	T	P		ATLP	CRP	CP	PPT					
1	PC	P20PE101	Analysis of Power Electronic Converters	3	-	-	3	8	8	8	6	10	20	60	40	100
2	PC	P20PE102	Renewable Energy Systems	3	-	-	3	8	8	8	6	10	20	60	40	100
3	PE	P20PE103	Professional Elective-I/ MOOC-I	3	-	-	3	8	8	8	6	10	20	60	40	100
4	PE	P20PE104	Professional Elective-II/ MOOC-II	3	-	-	3	8	8	8	6	10	20	60	40	100
5	PC	P20PE105	Power Converters Laboratory	-	-	4	2	-	-	-	-	-	-	60	40	100
6	PC	P20PE106	Renewable Energy Systems Laboratory	-	-	4	2	-	-	-	-	-	-	60	40	100
7	MC	P20MC107	Research Methodology & IPR	2	-	-	2	8	8	8	6	10	20	60	40	100
8	AC	P20AC108	Audit Course-I	2	-	-	1	8	8	8	6	10	20	60	40	100
			Total	**16**	**-**	**8**	**19**							480	320	800

Note:

1. *Additional Learning: Students are advised to do MOOCs to bridge the gap in the curriculum, as suggested by the Department Academic Advisory Committee (DAAC). The credits earned by the student through MOOCs will be printed in the semester grade sheet.*

[L= Lecture, T = Tutorials, P = Practicals, C = Credits, ATLP = Assignments, CRP = Course Research Paper, CP = Course Patent, PPT = Course Presentation, Minor=Minor Examination, MSE=Mid Semester Examination and ESE=End Semester Examination]

Professional Elective-I/ MOOCs-I

P20PE103A: Electrical Machine Modeling and Analysis
P20PE103B: FACTS & Custom Power Devices
P20PE103C: Electromagnetic Interference & Compatibility
P20PE103D: MOOCs

Professional Elective-II/ MOOCs-II

P20PE104A: Nonlinear Control Systems
P20PE104B: Microgrid & Distributed Generation Technologies
P20PE104C: Power Quality
P20PE104D: MOOCs

Audit Course-I

P20PE108A: English for Research Paper Writing
P20AC108B: Sanskrit for Technical Knowledge
P20AC108C: Constitution of India
P20AC108D: Pedagogy Studies

Total Contact Periods/Week: 24 **Total Credits: 19**

P20PE101ANALYSIS OF POWER ELECTRONIC CONVERTERS

Class:M. Tech. I –Semester

Specialization:Power Electronics

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on

LO1: power semiconductor switches and design of snubber circuit

LO2: non-isolated DC-DC converters&Isolated DC-DC converters

LO3: performance of single-phase & three-phase Pulse Width Modulated (PWM) inverters

LO4: operation and performance of front-end AC-DC converters

UNIT – I (9)

Overview of Switching Power Devices: Static and dynamic characteristics of switching devices: BJT, MOSFET, IGBT, GTO, qualitative treatment of wide band gap devices (GaN, SiC), design of snubber circuit

UNIT – II (9)

DC-DC Converters: Non-isolated DC-DC converters: buck, boost, buck-boost, CUK converters under continuous and discontinuous conduction operation, isolated DC-DC converters: forward fly-back, push-pull, half-bridge and full-bridge converters, relationship between input & output voltages, design of filter inductor and capacitors

UNIT – III (9)

Inverters: Single-phase and three-phase inverters, PWM techniques: single, multiple and sinusoidal PWM techniques, selective harmonic elimination, space vector modulation, current source inverter

UNIT – IV (9)

Front-End (AC-DC) Converters: Conventional methods of power factor improvements, semi-converter, extinction angle control, symmetrical angle control, active front-end converters, single phase: boost, voltage doubler and PWM rectifiers, voltage and current controlled three-phase PWM rectifiers

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Textbook:

[1] M.H. Rashid, *Power Electronics Handbook*, 4th ed., UK: Butterworth-Heinemann, 2017.

Reference Books:

[1] Ned Mohan Tore M. Undeland, *Power Electronics: Converters, Applications, and design*,3rd ed., New Jersey: John Wiley & Sons, 2007.

[2] M.H. Rashid, *Power Electronics, circuits, devices &applications,* 4th ed., Noida: Pearson Education, 2014.

[3] L.Umanand, *Power Electronics: Essentials & Applications*, New Jersey: John Wiley & Sons, 2009.

[4] Jayant Baliga B, *Fundamentals of Power Semiconductor Devices*, Germany: Springer Nature, 2008.

[5] Bin Wu, *High Power Converters and AC Drives*, 2nd ed., New Jersey: Wiley-IEEE press, 2017.
[6] Derek A Paice, *Power Electronic Converter Harmonics: Multipulse Method for Clean Power*, New Jersey: Wiley-IEEE press, 1995
[7] Robert W. Erickson and Dragan Maksimovic, *Fundamentals of Power Electronics*, 2nd ed., New York: Springer Publishing Company, 2004.

Course Learning Outcomes:

On completion of this course, students will be able to...

CO1: select an appropriate power semiconductor device for given application and design snubber circuit for power converters
CO2: design non-isolated & isolated DC-DC converters and suggest suitable topology for a given application
CO3: analyze the performance of single-phase and three-phase PWM inverters for different PWM techniques
CO4: analyze the performance of front-end AC-DC converters and power factor improvement methods

Course Articulation Matrix: P20PE101 ANALYSIS OF POWER ELECTRONIC CONVERTERS

CO		PO1	PO2	PO3	PSO 1	PSO 2
CO1	P20PE101.1	2	1	2	2	1
CO2	P20PE101.2	2	1	2	2	1
CO3	P20PE101.3	2	1	2	1	1
CO4	P20PE101.4	2	1	2	1	1
P20PE101		**2**	**1**	**2**	**1.5**	**1**

P20PE102 RENEWABLE ENERGY SYSTEMS

Class:M. Tech. I –Semester

Specialization:Power Electronics

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on …

LO1: types of renewable energy sources and principle of solar photovoltaic systems

LO2: principle of wind energy & geothermal energy systems

LO3: harnessing electrical energy from oceans, biomass and waste

LO4: working of fuel cells and types of energy storage systems

UNIT-I (9)

Introduction: Conventional and non-conventional sources of energy – brief description of different renewable energy sources, present scenario

Solar energy: Introduction to prospects of solar PV systems: photovoltaic effect and electrical equivalent circuit of a PV cell, dependence of a PV cell characteristic on temperature, solar cell output characteristics, solar maximum power point tracking (MPPT) using Perturb &Observe, incremental conductance algorithm, applications of solar PV systems- street lighting, domestic lighting, solar PV pumping systems

Introduction to off grid and grid -tied PV generation system with case study

UNIT-II (9)

Wind energy: Principles of wind power, evaluation of wind intensity, operation of a wind turbine and wind power curve, different types of wind turbine generators, topography and classification of wind turbines and applications, wind energy scenario

Geothermal Energy: Origin and types of geothermal energy, operational difficulties, liquid dominated systems

UNIT-III (9)

Energy from Oceans: Ocean temperature differences, ocean waves, energy from the waves, introduction of tidal power, basic principle of tidal power, components of tidal power plants

Bioenergy: Introduction, bio-mass conversion technologies, photo synthesis, biogas generation, biogas from power plant wastes, methods of maintaining biogas production, utilization of biogas, biogas gasification

Introduction to waste to energy

UNIT-IV (9)

Chemical energy sources: Introduction to fuel cells, principle of operation of fuel cell, classification of fuel cells, advantages, disadvantages and applications of fuel cells

Types of energy storage systems: Introduction, mechanical energy storage systems, batteries, ultra-capacitors, super conducting magnetic storage, applications

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Textbook:

[1] Rai G.D, *Non-Conventional Energy Sources*, 4th ed., New Delhi: Khanna Publishers, 2010.

[2] Felix A. Farret, M. Godoy Simoes, *Integration of Alternative Sources of Energy*, New Jersey: John Wiley & Sons, 2006.

Reference Books:

[1] B.H. Khan, *Non-conventional Energy Resources*, 2nd ed., New Delhi: McGraw Hill Education (India) Pvt. Ltd., 2006.

[2] Bansal N. K,Kaleeman, M.Miller, *Renewable Energy Sources and Conversion Technology*, New Delhi: Tata McGraw Hill Education (India) Pvt. Ltd., 2006.

[3] Duffie and Beckman, *Solar Energy Thermal Process*, New Jersey: John Wiley & Sons, 2006.

[4] REN21. 2019, *Renewables 2019 Global Status Report*, (Paris: REN21 Secretariat), ISBN 978-3-9818911-7-1.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: design and develop solar power systems and devise MPPT techniques

CO2: design and develop wind power & geothermal energy systems

CO3: harness electric power from oceans, biomass & waste

CO4: select energy storage systems and fuel cells for domestic, commercial and industrial applications

Course Articulation Matrix: P20PE102 RENEWABLE ENERGY SYSTEMS

CO		PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	P20PE102.1	2	1	1	2	1
CO2	P20PE102.2	2	1	1	2	1
CO3	P20PE102.3	2	1	1	2	1
CO4	P20PE102.4	2	1	1	2	1
P20PE102		**2**	**1**	**1**	**2**	**1**

P20PE103A ELECTRICAL MACHINE MODELLING AND ANALYSIS

Class:M. Tech. I –Semester

Specialization:Power Electronics

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on

LO1: primitive two-axis representation of an electrical machine and transfer function model of DC machines

LO2: three-phase to two-phase conversion

LO3: representation of three-phase induction motor in stator, rotor & synchronously rotating reference frames

LO4: modeling of three-phase synchronous motor in two- axis representation

UNIT – I (9)

Basic principle for Electrical Machine Analysis: Principles of electromagnetic energy conversion, general expression of stored magnetic energy, co-energy and force/torque, example using single and doubly excited system, basic concepts of rotating machines, calculation of air gap mmf and per phase machine inductance using physical machine data

Modelling and analysis of DC Machines: Basic two-pole DC machine, primitive two-axis machine, voltage and current relationship, torque equation, numerical problems

UNIT – II (9)

Reference frame theory: Linear transformation - phase transformation (a,b,c to α, β, o), active transformation (α, β, o to d, q), circuit model of a three-phase induction motor, linear transformation, phase Transformation, transformation to a reference frame, two axis models for induction motor

UNIT – III (9)

Modeling and analysis of induction machines: Voltage and current equations in stator reference frame, equation in rotor reference frame, equations in a synchronously rotating frame, torque equation, equations in state-space form

UNIT – IV (9)

Modeling and analysis of synchronous machines: Circuit model of a three-phase synchronous motor, Two axis representation of synchronous motor voltage and current equations in state - space variable form, torque equation

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Textbook:

[1] Paul C. Krause , Oleg wasynezuk, Scott D.Sudhoff, *Analysis of Electric Machinery and Drive Systems*, New Jersey: John Wiley & Sons, 2013.

Reference books:

[1] P.S.Bimbra, *Generalized Theory of Electrical Machines,* 5th ed., New Delhi: Khanna publications,1995.

[2] R. Krishnan, *Electric Motor Drives - Modelling, Analysis& control*, New Delhi: Pearson Education India Pvt. Ltd., 2002

[3] Ned Mohan, *Advanced Electric Drives, Analysis, Control and Modeling using Simulink*, New Jersey: John Wiley & Sons , 2001.

[4] Charles Kingsle, Jr., A.E. Fitzgerald, Stephen D.Umans, *Electric Machinery*, 7th ed., New Delhi: McGraw Hill Education (India) Pvt. Ltd., 2020.

Course Learning Outcomes (COs):

On completion of this course, the students will be able to…

CO1: model linear and nonlinear magnetic circuits and DC machines

CO2: apply the reference frame theory to analyze the dynamic behavior of electrical machines

CO3: determine the instantaneous torque developed by a three-phase induction motor under dynamic conditions using state space model

CO4: analyze the dynamic behaviour of a three-phase synchronous machine using the dqo model

Course Articulation Matrix: P20PE103A ELECTRICAL MACHINE MODELLING AND ANALYSIS

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20PE103A.1	2	1	2	1	2
CO2	P20PE103A.2	2	1	2	1	2
CO3	P20PE103A.3	2	1	2	1	2
CO4	P20PE103A.4	2	1	2	1	2
P20PE103A		**2**	**1**	**2**	**1**	**2**

P20PE103B FACTS & CUSTOM POWER DEVICES

Class:M. Tech. I –Semester

Specialization:Power Electronics

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop students' knowledge on /in…

LO1: power flow in transmission system

LO2: modeling & analysis of static VAr systems

LO3: fundamental principles of unified power flow controller & interline power flow controller

LO4: various custom power devices

UNIT – I (9)

Power flow in Power Systems: Steady-state and dynamic problems in AC systems, voltage regulation and reactive power flow control in power systems, control of dynamic power unbalances in power system, power flow control, constraints of maximum transmission line loading, benefits of FACTS

Transmission line compensation: Uncompensated line, shunt compensation, series compensation, phase angle control reactive power compensation, shunt and series compensation principles, reactive compensation at transmission and distribution level, static versus passive VAr Compensators

UNIT – II (9)

Static shunt compensators: SVC and STATCOM, operation and control of TSC, TCR and STATCOM, compensator control, comparison between SVC and STATCOM

Static series compensation: Static voltage and phase angle regulators - TCVR and TCPAR operation and control, applications, static series compensation – GCSC, TSSC, TCSC and static synchronous series compensators - control SSR, damping

UNIT – III (9)

Unified Power Flow Controller: Circuit arrangement, operation and control of UPFC, basic principle of P and Q control, independent real and reactive power flow control, applications, introduction to interline power flow controller, modelling and analysis of FACTS controllers

UNIT – IV (9)

Custom Power Devices: Power quality problems in distribution systems, operation and control of DSTATCOM, DVR and UPQC, Comparison of custom power devices and their applications, IEEE standards on power quality

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Textbooks:

[1] K R Padiyar, *FACTS Controllers in Power Transmission and Distribution*, New Delhi: New Age International Publishers, 2007. (Unit- I & IV)

[2] N.G. Hingorani, L. Gyugyi, *Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems*, IEEE Press Book, New Delhi: Standard Publishers and Distributors, 2001. (Unit-III & IV)

References Books:

[1] X P Zhang, C Rehtanz, B Pal, *Flexible AC Transmission Systems- Modelling and Control*, Germany: Springer Verlag, 2006.
[2] K. S. Suresh Kumar, S. Ashok, *FACTS Controllers & Applications*, E-book edition, Nalanda Digital Library, NIT Calicut,2003.
[3] G T Heydt , *Power Quality*, McGraw-Hill Professional, 2007.
[4] T J E Miller, *Static Reactive Power Compensation*, New Jersey: John Wiley and Sons, 1982.

Course Learning Outcomes:

At the end of the course the student will be able to:

CO1: develop passive & active power compensation schemes for power systems
CO2: analyze the performance of shunt & series static compensators
CO3: assess the performance of UPFC & IPFC in areas of reactive power compensation
CO4: develop control strategies for DSTATCOM, DVR and UPQC for power quality improvement

Course Articulation Matrix (CAM): P20PE103BFACTS & CUSTOM POWER DEVICES

CO		PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	P20PE103B.1	2	1	-	2	1
CO2	P20PE103B.2	2	1	1	2	1
CO3	P20PE103B.3	2	1	1	2	1
CO4	P20PE103B.4	2	1	-	2	1
P20PE103B		**2**	**1**	**1**	**2**	**1**

P20PE103C ELECTROMAGNETIC INTERFERENCE & COMPATABILITY

Class:M. Tech. I –Semester

Specialization:Power Electronics

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on …

LO1: definitions of EMI & EMC and sources of EMI
LO2: EMI from apparatus and circuits
LO3: grounding, shielding & bonding for EMC, design of EMI filters
LO4: EMI cables, connectors and components

UNIT-I (9)

Introduction: Definitions of Electro Magnetic Interference (EMI) & Electro Magnetic Compatibility (EMC), practical experiences and concerns, frequency spectrum conservation

Sources of EMI: Lightning discharge, electrostatic discharge, electromagnetic pulse

UNIT-II (9)

EMI from apparatus and circuits: Introduction, electromagnetic emission, noise from relays and switches, nonlinearities in circuits, cross-talk in transmission lines, transients in power supply lines, electromagnetic interference

UNIT-III (9)

EMC techniques: EMC technology, system grounding for EMC, cable shield grounding, cable shielding and electrical bonding

EMI filters: Characteristics of filters, power line filter design

UNIT-IV (9)

Devices for suppression of EMI: Introduction, EMI suppression cables, EMI connecters, EMC Gaskets, isolation transformers, opto-isolators, transient and surge suppression devices

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Textbooks:

[1] V. Prasad Kodali, *Engineering Electromagnetic Compatibility*, New York: IEEE Press, 2001.
[2] Henry W. Ott, *Electromagnetic Compatibility Engineering*, New York: John Wiley & Sons Inc, 2009.

Reference Books:

[1] Clayton Paul, *Introduction to Electromagnetic Compatibility*, New York: Wiley Interscience, 2006.

Course Learning Outcomes (COs):

On completion of this course, students will be able to ...

CO1: describe the practical experiences & concerns associated with EMI & EMC, natural & nuclear sources of EMI
CO2: analyse the electromagnetic interference from apparatus & circuits
CO3: design filters for EMC and suggest suitable techniques for EMC
CO4: suggest suitable devices for suppression of EMI

Course Articulation Matrix: P20PE103C ELECTROMAGNETIC INTERFERENCE & COMPATABILITY						
CO		**PO1**	**PO2**	**PO3**	**PSO1**	**PSO2**
CO1	P20PE103C.1	2	1	1	2	2
CO2	P20PE103C.2	2	1	1	2	2
CO3	P20PE103C.3	2	1	1	2	2
CO4	P20PE103C.4	2	1	1	2	2
P20PE203B		**2**	**1**	**1**	**2**	**2**

P20PE104A NONLINEAR CONTROL SYSTEMS

Class:M. Tech. I –Semester

Specialization:Power Electronics

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on

LO1: behavior of linear & nonlinear systems and interpretation of nonlinear systems using describing function method

LO2: examination of nonlinear systems using phase plane analysis and linearization of nonlinear systems

LO3: implementation of Lyapunov's theory for stability analysis of nonlinear systems

LO4: issues associated with designing & the selection of nonlinear control systems

UNIT-I (9)

Introduction: Linear Vs nonlinear systems, nonlinear system behavior, nonlinear control

Describing function analysis: Fundamentals, common nonlinearities (saturation, dead-zone, on-off non-linearity, backlash, hysteresis) and their describing functions, describing function analysis of nonlinear systems, reliability of describing function method analysis, compensation and design of nonlinear system using describing function method

UNIT-II (9)

Nonlinear System Analysis: Phase portraits, singular points characterization. analysis of nonlinear systems using phase plane technique, existence of limit cycles

Linearization: Exact linearization, input-state linearization, input-output linearization

UNIT-III (9)

Stability: Fundamentals of Lyapunov theory: nonlinear systems and equilibrium points, concepts of stability, linearization and local stability, Lyapunov's direct method, invariant set theorems, Lyapunov analysis of LTI systems, Krasovskii's method, variable gradient method, physically motivated Lyapunov functions and performance analysis, control design based on Lyapunov's direct method

UNIT-IV (9)

Nonlinear Control systems design: Disturbance issues in nonlinear control, non-linear control system design problem, concept of variable-structure controller and sliding control, reaching condition and reaching mode, implementation of switching control laws, some design examples of nonlinear systems such as the ball and beam, flight control, magnetic levitation and robotic manipulator

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Textbooks:

[1] Hassan K. Khalil, *Nonlinear Systems*, 3rd ed., New Delhi: PHI Learning Pvt. Ltd., 2002. (Units -I, II, IV)

[2] Shankar Sastry, *Nonlinear Systems; Analysis, Stability and Control*, Germany: Springer Nature, 1999. (Units -I, II, III)

Reference Books:

[1] Jean- Jacques Slotine and Weiping Li, *Applied nonlinear Control*, New Delhi: PHI Learning Pvt. Ltd., 1991.

[2] Kwatny, H. G. and Blankenship, *Nonlinear Control & Analytical Mechanics*, Germany: Springer Nature, 2000.

[3] Harry G. Kwatny, Gilmer L., Blankenship, *Nonlinear Control & Analytical Mechanics: A Computational Approach*, Germany: Springer Nature, 2017.

[4] V. Lakshmikantham, S. Leela, A.A. Martynyuk *Practical Stability of Non-Linear Systems*, Singapore: World Scientific Publishing Corp. Pvt. Ltd., 1/e, 1990.

[5] A.A. Ahmed, R.B. Ahmad, Abid Yahya, Hazim H. Tahir, James Quinlan, *Variable Structure System with Sliding Mode Controller*, Procedia Engineering, Elsevier, Vol.53, 2013.

[6] Wen Yu, *Nonlinear PD regulation for ball and beam system*, International Journal of Electrical Engineering Education, Vol. 46, Issue-1, 2009.

[7] Lijun Tian, *A study of nonlinear flight control system designs*, Theses and Dissertations, Iowa State University, Digital Depository, 1999.

Course Learning Outcomes (COs):

On completion of this course, the students will be able to…

CO1: apply the describing function technique for nonlinear systems

CO2: linearize nonlinear control systems using phase plane analysis

CO3: determine the stability of nonlinear systems using Lyapunov's theory

CO4: design nonlinear control systems pertaining to flight, magnetic levitation and robotic applications

Course Articulation Matrix: P20PE104A NONLINEAR CONTROL SYSTEMS

CO		PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	P20PE104A.1	2	1	1	-	-
CO2	P20PE104A.2	2	1	1	1	1
CO3	P20PE104A.3	2	1	1	1	1
CO4	P20PE104A.4	2	1	1	1	1
P20PE104A		**2**	**1**	**1**	**1**	**1**

P20PE104BMICROGRID & DISTRIBUTED GENERATION TECHNOLOGIES

Class:M. Tech. I –Semester

Specialization:Power Electronics

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on…

LO1: various distribution generation technologies & their need in current power system

LO2: integration issues & standards of DG interconnection

LO3: different technical & economic issues of DG

LO4: microgrids & their operational aspects

UNIT-I (9)

Distributed generation (DG) technologies: Introduction and need for distributed generation (DG),reasons for growth, introduction to distributed energy resources, Combined Heat and Power (CHP) systems, solar Photo-Voltaic (PV) systems, Wind Energy Conversion Systems (WECS), small scale hydroelectric power generation, current scenario in distributed generation

UNIT-II (9)

Integration issues and standards of DG: Planning of DGs, siting and sizing of DGs optimal placement of DG sources in distribution systems, grid integration of DGs, different types of interfaces, inverter based DGs and rotating machine based interfaces, aggregation of multiple DG units, standards for interconnecting DGs to electric power systems: IEEE 1547, DG installation classes, security issues in DG implementations, grid code and islanding & non-islanding system.

UNIT-III (9)

Technical and Economic issues of DGs: Technical impacts of DGs on transmission systems, distribution systems & deregulation, impact of DGs upon protective relaying, impact of DGs upon transient and dynamic stability of existing distribution systems, steady state and dynamic analysis, economic and control aspects of DGs, market facts, issues and challenges, limitations of DGs, voltage control techniques, reactive power control, harmonics, power quality issues

UNIT-IV (9)

Microgrid: Introduction, types of microgrids: autonomous and nonautonomous grids, sizing of microgrids, modeling & analysis of microgrids with multiple DGs, microgrids with power electronic interfacing units, transients in microgrids, protection of microgrids

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Textbooks:

[1] H. Lee Willis, Walter G. Scott, *Distributed Power Generation – Planning and Evaluation*, CRC press. 2018 (Unit I, II, III)

[2] S. Chowdhury, S.P. Chowdhury and P. Crossley , *Microgrids and Active Distribution Networks*, The Institution of Engineering and Technology, London, U.K, 2009 (Unit IV)

Reference Books:

[1] Nikos Hatziargyriou, *Microgrids: Architectures and Control*, Wiley-IEEE Press, December 2013,

[2] Stephen peake, *Renewable Energy power For sustainable future*, 4th ed., UK: Oxford University Press, 2018

[3] IEEE 1547-2018 - IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces

Course Learning Outcomes (COs):

On completion of this course, the students will be able to…

CO1: integrate DG technologies to modernize the present power systems

CO2: specify the standards for DG systems

CO3: identify the issues & challenges associated with DGs

CO4: model microgrids and suggest methods for their protection

Course Articulation Matrix: P20PE104BMICROGRID & DISTRIBUTED GENERATION TECHNOLOGIES

CO		PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	P20PE104B.1	1	1	1	2	1
CO2	P20PE104B.2	1	1	1	2	1
CO3	P20PE104B.3	2	1	2	2	1
CO4	P20PE104B.4	2	1	2	2	1
P20PE104B		**1.5**	**1**	**1.5**	**2**	**1**

P20PE104C POWER QUALITY

Class:M. Tech. I –Semester

Specialization:Power Electronics

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on

LO1: power quality problems in distribution systems
LO2: voltage interruptions & voltage sags
LO3: harmonic phenomena, sources of harmonics & effects
LO4: mitigation methods for voltage interruptions & sags

UNIT–I (9)

Introduction to the Power Quality Issues: Overview, concept and definition of power quality (PQ), electric power quality phenomena, Sources of power pollution, International power quality regulations, CBEMA and ITI curves, power quality disturbances: voltage fluctuations, transients, unbalance waveform distortion, power frequency variations

Power quality terms: Voltage variations, voltage sags and short interruptions, sources of sags and interruptions, rapid voltage fluctuations, flicker, short duration outages, longer duration variations, voltage dips and voltage swells, voltage unbalance, sources, range and impact on sensitive circuits, Waveform distortion

Standards on Power Quality: Introduction to standardization, IEEE std. 519 & 1159 and IEC std. 61000-4-30 on power quality

UNIT–II (9)

Long and Short Interruptions: Introduction, causes of long and short interruptions, limits for interruption frequency and duration, overview of reliability evaluation, cost of interruptions, effect of interruption on equipment, stochastic prediction of short interruptions

Voltage Sags and its Characterization: Introduction, voltage sag magnitude and duration, three-phase unbalance, phase-angle jumps, magnitude and phase-angle jumps for three-phase unbalanced sags, load influence on voltage sags, equipment behaviour of power electronic loads, induction motors, synchronous motors, computers, consumer electronics, adjustable speed AC & DC drives

UNIT–III (9)

Waveform Distortion: Introduction, Voltage versus current distortion, harmonics versus transients, harmonic indices: Total Harmonics Distortion (THD) and Total Demand distortion (TDD), SAIFI, SAIDI, CAIDI; harmonic standards, harmonic analysis, harmonic phase sequence, triplen harmonics, interharmonics

Harmonic Sources: Introduction, harmonics generated from electrical machines such as transformers and rotating machines, arcing devices, static power conversion: phase controlled and

uncontrolled rectifiers, AC voltage regulators, cycloconverters, pulse width modulated inverters; converter fed AC and DC drives

Effects of Harmonic Distortion: Resonances, effects of harmonics on rotating machines, effect of harmonics on static power plant, power assessment with distorted waveforms, effect of harmonics on measuring instruments, harmonic interference with ripple control systems, harmonic interference with power system protection, effect of harmonics on consumer equipment, interference with communication systems

UNIT- IV (9)

Mitigation of power quality issues: Overview of mitigation methods, power system design—redundancy through switching, the system-equipment interface: voltage-source converter, series and shunt voltage controllers: DVR, DSTATCOM, combined shunt and series controllers: Unified Power Quality Conditioner (UPQC); three-phase three-wire UPQC and three-phase four-wire UPQC topologies

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Textbooks:

[1] Math H. J. Bollen, *Understanding Power Quality Problems*, Sweden: Wiley-IEEE Press, 2000. (Units-I, II).

[2] Arindam Ghosh, Gerard Ledwich, *Power Quality Enhancement Using Custom Power Devices,* 2nd ed., New York: Springer, 2012. (Units-III, IV).

Reference Books:

[1] Roger C. Dugan, Mark F. McGranaghan, Surya Santoso, H. Wayne Beaty, *Electrical Power Systems Quality*, 3rd ed., USA: McGraw Hill Professional, 2012.

[2] Simmi P Burman and Bipin Singh, *Power Quality*, 1st ed., New Delhi: S.K. Kataria & Sons, 2012.

[3] S.Chattopadhay, Madhuchanda Mitra, *Electric Power Quality*, 1st ed., New York: Springer Verlag Gmbh, 2011.

[4] Bhim Singh, Ambrish Chandra, Kamal Al-Haddad, *Power Quality problems and Mitigation Techniques,* 1st ed., New Delhi: Wiley India Pvt. Ltd., 2015.

[5] Jos Arrillaga, Neville R. Watson, S. Chen, *Power System Quality Assessment*, 2nd ed., New Zealand: John Wiley Publishing House, 2000.

[6] IEEE Transactions and Standards, USA.

Course Learning Outcomes (COs):

On completion of this course, students will be able to ...

CO1: qualify and quantify the power quality problems
CO2: quantify voltage sags and suggest methods to reduce voltage interruptions
CO3: analyze the harmonic distortions & assess their effects on the behaviour of loads
CO4: suggest methods to mitigate voltage interruptions & sags

Course Articulation Matrix: P20PE104C POWER QUALITY						
CO		**PO 1**	**PO 2**	**PO 3**	**PSO1**	**PSO 2**
CO1	P20PE104C.1	1	1	1	2	1
CO2	P20PE104C.2	1	1	1	2	1
CO3	P20PE104C.3	2	1	2	2	1
CO4	P20PE104C.4	2	1	2	2	1
P20PE104C		**1.5**	**1**	**1.5**	**2**	**1**

P20PE105 POWER CONVERTERS LABORATORY

Class:M. Tech. I –Semester

Specialization:Power Electronics

Teaching Scheme:

L	T	P	C
-	-	4	2

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This laboratory course will develop student's knowledge in/on

LO1: characteristics of power semiconductor devices

LO2: control of output voltage of DC-DC converters using duty cycle control

LO3: control of output voltage of single phase & three phase inverters using PWM techniques

LO4: control of output voltage of PWM rectifiers

LIST OF EXPERMENTS

1. Determination of MOSFET and IGBT device characteristics
2. Determination of average output voltage and plot the output voltage waveform for various duty cycles of Buck converter for given load condition
3. Determination of average output voltage and plot the output voltage waveform for various duty cycles of Boost converter for given load condition.
4. Determination of average output voltage and plot the output voltage waveform for various duty cycles of Buck-Boost converter for given load condition
5. Determine the voltage magnitude and plot the waveform of push-pull isolated DC-DC converter
6. Determination of output voltage magnitude and plot waveform of four quadrant chopper for various duty cycles for given load
7. Study of different PWM techniques for single phase inverter (single pulse width modulation, multiple pulse width modulation, sinusoidal pulse width modulation, trapezoidal modulation, staircase modulation)
8. Determination of output voltage magnitude and plot waveform of single-phase PWM inverter for a given load
9. Determination of output voltage magnitude and plot waveform of three-phase PWM inverter
10. Determination of output voltage and plot the output voltage waveform for various modulation index of single phase PWM Inverter for a given load condition using MATLAB Simulink
11. Determination of output voltage magnitude and plot waveform of single-phase semi controlled PWM rectifier
12. Determination of output voltage magnitude and plot waveform of single-phase full controlled PWM rectifier

Laboratory Manual:

[1] *Power Converters Laboratory Manual*, Department of EEE, KITSW

Reference Books:

[1] Muhammad H. Rashid, *Power Electronics, Devices, Circuits and Applications*, 4th ed., Pearson,2017
[2] William J Palam III, *Introduction to MATLAB*, 2nd ed., New Delhi: McGraw Hill Education (India) Pvt. Ltd., 2010.
[3] Steve Robert, *DC/DC Book of Knowledge*, RECOM,2015.

Course Learning Outcomes (COs):

On completion of this course, the students will be able to…

CO1: validate the characteristics of power semiconductor devices

CO2: validate the average output voltage and draw the output waveforms of DC-DC converters for different duty cycles

CO3: validate the output waveforms of single phase & three phase inverters using PWM techniques

CO4: validate the output waveforms of PWM rectifiers

Course Articulation Matrix: P20PE105 POWER CONVERTERS LABORATORY

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20PE105	2	2	2	2	-
CO2	P20PE105	2	2	2	2	-
CO3	P20PE105	2	2	2	1	-
CO4	P20PE105	2	2	2	2	1
P20PE105		**2**	**2**	**2**	**1.75**	**1**

P20PE106 RENEWABLE ENERGY SYSTEMS LABORATORY

Class:M. Tech. I –Semester

Specialization:Power Electronics

Teaching Scheme:

L	T	P	C
-	-	4	2

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This laboratory course will develop students' knowledge in/on …

LO1: measurement of solar energy radiation and obtain MPPT of solar PV system.

LO2: performance characteristics of various PV devices & its series parallel connections

LO3: modeling and simulation of solar & wind turbine System.

LO4: identifying the characteristics of fuel cell & lead acid battery

LIST OF EXPERIMENTS

1. Measurement of solar radiation using solar power meter
2. Determination of voltage, current & power output and plot the I-V and P-V curves of PV module for given irradiance and temperature
3. Determination of voltage, current & power output and plot the I-V and P-V curves of series and parallel combinations of PV modules for different temperature and radiation levels
4. Determination of voltage, current & power output of PV module for different tilt angles and shading conditions and plot the tilt – power output & characteristics
5. Determination of voltage, current & power output of grid connected PV system and plot them using MATLAB –Simulink
6. Determination of voltage, current & power output of stand-alone PV system and plot them using MATLAB –Simulink
7. Develop a MATLAB -Simulink model of a solar panel for given parameters and plot its characteristics for different values of irradiance and temperature
8. Determination of voltage, active & reactive power of the grid for a grid connected wind turbine MATLAB- Simulink model and plot them
9. Plot the load power vs turbine power characteristics by executing MATLAB- Simulink model of variable pitch wind turbine for given parameters
10. Determination of Maximum Power Point of a PV module manually by varying the duty cycle of DC-DC Converter

11. Determine and plot the fuel flow rate, utilization, stack efficiency of Fuel cell stack model using MATLAB -Simulink
12. Plot the charging and discharging characteristics of Lithium-ion battery model using MATLAB -Simulink

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Laboratory Manual:

[1] *Renewable Energy Systems Laboratory Manual*, Department of EEE, KITSW

Reference Books:

[1] Solanki, *Renewable Energy Technologies: Practical Guide For Beginners*, New Delhi: PHI Learning Pvt. Ltd., 2008.

[2] D.Mukherjee, *Fundamentals of Renewable Energy Systems*, New Delhi: New Age International publishers, 2007.

[3] Felix A. Farret, M. Godoy Simoes, *Integration of Alternative Sources of Energy*, New Jersey: John Wiley & Sons, 2006.

[4] Gilbert M. Masters, *Renewable and Efficient Electric Power Systems*, New Jersey: John Wiley & Sons, 2004.

Course Learning Outcomes (COs):

After completion of this course, students will be able to

CO1: implement MPPT for solar PV systems
CO2: analyze the performance characterstics of various PV devices & its series parallel connections
CO3: assess the performance of solar & wind turbine systems
CO4: observe the characteristics of fuel cell & lithium-ion battery

Course Articulation Matrix: P20PE106 RENEWABLE ENERGY SYSTEMS LABORATORY						
CO		**PO1**	**PO2**	**PO3**	**PSO1**	**PSO2**
CO1	P20PE106	2	2	2	2	-
CO2	P20PE106	2	2	2	2	-
CO3	P20PE106	2	2	2	2	-
CO4	P20PE106	2	2	2	2	1
P20PE106		**2**	**2**	**2**	**2**	**1**

P20MC107: RESEARCH METHODOLOGY AND IPR

Class:M. Tech. I –Semester

Specialization:SCE, DE, VE, PE, SE, DS, DC & CSP

Teaching Scheme:

L	T	P	C
2	-	-	1

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on

LO1: research methodology, approaches, principles of experimental design and research plan

LO2: sampling design, data collection, data representation and statistical analysis

LO3: layout of a research report, technical paper writing, oral presentation and intellectual property

LO4: patent rights and developments in IPR

UNIT-I (6)

Research Methodology: Meaning of research, objectives, motivation, types, approaches, research methods vs methodology, scientific method, research process, criteria for good research, literature review, research ethics, plagiarism, problems encountered by researchers in India

Defining the Research Problem and Research Design: Selecting a research problem, necessity and techniques in defining research problem, need for research design, features of good design, different research designs, basic principles of experimental design, developing a research plan

UNIT – II (6)

Sampling Design: Census and sample survey, implications, steps, criteria of selecting a sampling procedure, characteristics of a good sample design, types of sample designs, complex random sampling designs

Data Collection & Data Analysis: Collection of primary and secondary data, observation method, interview method, collection of data through questionnaires, schedules, data organization, methods of data grouping, diagrammatic and graphic representation of data, regression modeling, direct and interaction effects, anova, f-test, time series analysis, autocorrelation and autoregressive modeling

UNIT – III (6)

Interpretation and Report Writing: Interpretation technique, precaution in interpretation, significance, steps and layout of report writing, types of reports, oral presentation, mechanics of writing a research report, precautions, format of the research report, synopsis, dissertation, thesis, references/bibliography/webliography, technical paper writing/ journal/ report writing, making presentation, use of visual aids

Nature of Intellectual Property: Patents, designs, trade and copyright

Process of Patenting and Development: Technological research, innovation, patenting, development

UNIT – IV (6)

Patent Rights: Scope of patent rights, licensing and transfer of technology, patent information and databases, geographical indications

New Developments in IPR: Administration of patent system, new developments in IPR, IPR of biological systems, computer software etc. traditional knowledge case studies, IPR and IITS

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Textbooks:

[1] C.R Kothari and Gaurav Garg, "*Research Methodology, Methods & Techniques*", 4th ed., New Age International Publishers, 2019 (*Chapters 1, 2, 3, 6, 7, 11, 14*)

[2] Deborah Ebouchoux, "*Intellectual Property, The Law of Trademarks, Copyrights, Patents and Secrets*", 4th ed., Delmar, Cengage Learning, 2012 *(Chapter 1, 2, 3, 17, 18)*

[3] ***Anti-plagiarism policy of KITSW*** - A handout prepared by Dean, Research and Development, KITSW, Jan 2020.

[4] Frequently Asked Questions, Office of CGPDTM, INDIA 2020

[5] Patent Office Procedures: http://www.ipindia.nic.in/writereaddata/images/pdf/ patent-office-procedures.pdf

References Books:

[1] Stuart Melville and Wayne Goddard, "*Research methodology: An Introduction for Science & Engineering Students*" 2nd ed.,JUTA, 2007.

[2] Robert P. Merges, Peter S. Menell, Mark A. Lemley, "*Intellectual Property in New Technological Age - I*", Clause 8, 2016.

[3] Dobera J Halbert, "*Resisting Intellectual Property*", Taylor & Francis Ltd.,1st ed.,2005.

[4] Ranjit Kumar, "*Research Methodology: A Step by Step Guide for beginners*", 3rd ed., Sage Publications India Pvt. Ltd, New Delhi, 2011.

[5] T. Ramappa, "*Intellectual Property Rights Under WTO*", 4th ed., .S. Chand, 2008

[6] R. Ganesan, "*Research Methodology for Engineers*", MJP Publishers, Chennai, 2011

[7] Patent application procedures: https://patentinindia.com/cost-patent-registration-india/

[8] http://www.ipindia.nic.in/history-of-indian-patent-system.htm

[9] Patent Law India: https://www.mondaq.com/india/patent/656402/patents-law-in-india--everything-you-must-know

[10] How to file patents: https://iptse.com/how-to-file-patents-understanding-the-patent-process-in-india/

[11] How Can I get a patent for my project: https://patentinindia.com/cost-patent-registration-india/

Course Learning Outcomes (COs):

On completion of this course, students will be able to

CO1: develop and formulate research problem using research methodology techniques.

CO2: utilize techniques of data modeling and analysis to solve research problem

CO3: choose an appropriate methodology to write a technical report and present a research paper

CO4: judge patent rights and adapt new developments in IPR for their patent publications

Course Articulation Matrix (CAM): **P20MC107 RESEARCH METHODOLOGY & IPR**

CO		PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	P20MC107.1	2	2	1	-	-
CO2	P20MC107.2	2	2	1	-	-
CO3	P20MC107.3	2	2	1	-	-
CO4	P20MC107.4	2	2	-	-	-
P20MC107		**2**	**2**	**1**	**-**	**-**

P20AC108A ENGLISH FOR RESEARCH PAPER WRITING

Class:M. Tech. I –Semester

Specialization:SCE, DE, VE, PE, SE, DS, DC & CSP

Teaching Scheme:

L	T	P	C
2	-	-	1

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on

LO1: planning for quality research writing with improved level of readability

LO2: constituents and attributes of a research paper

LO3: specifications for research transcription and pedagogic skills for reporting research

LO4: guidelines for publishing research papers in quality journals

UNIT-I (6)

Skills for Research Writing: Planning and preparation, word order, breaking up long sentences, structuring paragraphs and sentences, being concise and removing redundancy

Improving Level of Readability: Avoiding ambiguity and vagueness,clarifying who did what, highlighting your findings, hedging and criticizing, paraphrasing and plagiarism

UNIT-II (6)

Constituents of a Research Paper: Abstract, styles of abstract, keywords, characteristics of poor abstract, assessing quality of abstract, introduction- outline in introduction, assessing quality of introduction, review of literature, ways of referring to authors in literature

Attributes of a Research paper: Methodology, use of tenses and articles in methodology, results, styles of reporting results, discussion, styles of writing discussions, conclusions, impact of writing conclusions, assessing quality of conclusions, final check-do's and don'ts

UNIT-III (6)

Specifications for Research Transcription: Structuring phrasing and summarizing oftitle and abstract, structuring phrasing and summarizing of introduction, critical review of literature, limitations of previous work and demonstration of innovation in proposed research

Pedagogic skills for reporting research: Structuring and justifying the methodology, structuring, reporting, interpreting and summarizing results, structuring, comparing, interpreting and summarizing discussions, styles of writing discussions, structuring, differentiating and summarizing of conclusions

UNIT-IV (6)

Quality Assurance and Corroboration of Research: Indexing and harnessing useful phrases, adapting final check for readability, clarity in logical order of argumentation, checking for journal guidelines, consistency, accuracy, acknowledgements and spell-check

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Textbook:

[1] Adrian Wallwork, *English for Writing Research Papers*, 2nd ed., Germany: Springer Nature, 2016.

Reference Books:

[1] Goldbort R, *Writing for Science,* 2nd ed., London: Yale University Press, 2006.

[2] Day R, *How to Write and Publish a Scientific Paper*, 8th ed., Cambridge: Cambridge University Press, 2016.

[3] Adrian Wallwork , English for Academic Research ,Grammar, Usage and Style, 2nd ed., Germany: Springer Nature,2012.

Course Learning Outcomes (COs):

On completion of this course, students will be able to...

CO1: develop essential skills for research writing with improved level of readability.

CO2: organize the constituents of research paper and derive conclusions with a final check of Do's & Don'ts

CO3: justify, interpret, compare and summarize results for proposed methodologies in research paper

CO4: adopt quality assurance methods like final check for readability, consistency & accuracy of a research paper

Course Articulation Matrix: P20AC108A ENGLISH FOR RESEARCH PAPER WRITING

CO		PO1	PO2	PO3	PSO 1	PSO 2
CO1	P20AC108A.1	1	2	2	-	-
CO2	P20AC108A.2	1	2	2	-	-
CO3	P20AC108A.3	1	2	2	-	-
CO4	P20AC108A.4	1	2	2	-	-
P20AC108A		**1**	**2**	**2**	**-**	**-**

P20AC108B SANSKRIT FOR TECHNICAL KNOWLEDGE

Class:M. Tech. I –Semester

Specialization:SCE, DE, VE, PE, SE, DS, DC & CSP

Teaching Scheme:

L	T	P	C
2	-	-	1

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on

LO1: proficiency in illustrious Sanskrit, the scientific language in the world
LO2: the depth of grammar in Sanskrit
LO3: deeper insight into tenses used in Sanskrit
LO4: concepts related to various technical fields

UNIT-I (6)

Introduction: Alphabets, vowels, consonants, Māheśvara sutras, combined alphabets, verbs, basic words

UNIT-II (6)

Study of grammar I: Singular/dual/plural, nominative case, accusative case, instrumental case, dative case, ablative case, genitive case, locative case

UNIT-III (6)

Study of grammar II: Nouns and adjectives, indeclinable, present tense, past tense, future tense, order and request, prefixes, number word, combinations ablative case, genitive case, locative case and cases

UNIT-IV (6)

Technical concepts related to various fields: Technical concepts of Mathematics, Chemistry, Electrical science, Mechanics & Mechanical Science, Metallurgy, Aeronautics, Marine science, measurement of time, astronomy, architecture, botany, agriculture, hygiene & health

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Textbook:

[2] Dr.Vishwas, *Abhyaspustakam*, 1st ed. New Delhi: Samskrita-Bharti Publication, 2014.

[3] Suresh Soni, *India's Glorious Scientific Tradition*, 1st ed., New Delhi: Ocean books (P) Ltd, 2008 (Unit IV).

Reference Books:

[4] Vempati Kutumbshastri, *Teach Yourself Sanskrit*, 1st ed., New Delhi: Prathama Deeksha Rashtriya Sanskrit Sansthanam, 2012.

Course Learning Outcomes (COs):

On completion of this course, students will be able to...

CO1: understand to read & write basic Sanskrit language
CO2: identify the usage of grammar in the ancient Indian language
CO3: make use of tenses in Sanskrit language

CO4: analyze the ancient Sanskrit literature on science & technology

Course Articulation Matrix (CAM): P20AC108B SANSKRIT FOR TECHNICAL KNOWLEDGE						
CO		**PO1**	**PO2**	**PO3**	**PSO 1**	**PSO 2**
CO1	P20AC108B.1	2	1	1	-	-
CO2	P20AC108B.2	2	1	1	-	-
CO3	P20AC108B.3	2	1	1	-	-
CO4	P20AC108B.4	2	1	1	-	-
P20AC108B		**2**	**1**	**1**	**-**	**-**

P20AC108C CONSTITUTION OF INDIA

Class:M. Tech. I –Semester

Specialization:SCE, DE, VE, PE, SE, DS, DC & CSP

Teaching Scheme:

L	T	P	C
2	-	-	1

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives:

This course will develop students' knowledge in/on

LO1: state policy and parliamentary form of government, council of ministers

LO2: necessity of act of information technology and its powers, cyber security and its laws

LO3: consumer protection act, rights of consumer-deficiency in service

LO4: crimes against women, different legislations, process of investigation and right to information act

UNIT – I (6)

Constitutional Law: Constitution meaning and significance, constitutional history, status of fundamental rights, role of fundamental duties, implementation of the directive principles of the state policy, parliamentary form of government, president, prime minister, council of ministers, federal structure in constitution, relations between central and state, amendment of constitution – procedure and kinds of amendments.

UNIT –II (6)

Law of information technology: Evolution, genesis and necessity of information technology act, features and various authorities under it act, their powers, impact of other related enactments, e-commerce laws in India, digital and electronic signatures in Indian laws, e-contracts and its validity in India, cyber tribunals, definition and necessity of cyber security, computer and cyber security, e-mail security, database security, operating system security, advance computers, network and mobile security techniques, sensitive personal data and information in cyber laws, cybercrimes, hacking, phishing –stalking, cyber terrorism.

UNIT– III (6)

Corporate Law: Definition and essentials of valid contract, corporate incorporation and management, directors of company, company secretary, corporate governors, different system of corporate governors, corporate governance and social responsibility, emerging trends, corporate and social environment responsibility, competition law, objectives competition commission of India, consumer protection act, consumerism, rights of consumer, deficiency in service, unfair trade practices, e-contracts etc.

UNIT - IV (6)

Criminal Law: Definition of crime, crimes against women including cybercrimes, criminal justice systems, protection for women for atrocities, different legislations like constitution, Indian penal code, human rights, domestic violence, equality in rights, dowry prohibition, prevention of child marriage, prevention of sexual harassment against woman at work place, protection of children some sexual harassment – investigation – compliant , process of investigation – fir, panchanama, closure report, charge sheet etc. , procedure of search

Right to Information Act: Freedom of information, Indian constitution and right to information, legislating the right to information, salient features of the right to information act 2005 , public authority under RTI act , nature of RTI, exemptions and limitations , composition, powers and functions of the information commissions , right to information and implementation issues

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Textbooks:

[1] M.P.Jain, *Indian Constitutional Law, Vol.1*, Wadhwa & Co, Nagpur, 2003.
[2] Vakul Sharma, *Information Technology – Law and Practice,* Universal Law Publishing, 3rd Ed. 2011.
[3] Gower and Davies, *Principles of Modern Company Law,* Sweet and Maxwell Publishing, 10th Ed.
[4] Ratan Lal and Dhiraj Lal, *Indian Penal Code*, Wadhwa & Co., 36th Ed. 2000.
[5] O.P.Srivastava, *Principles of Criminal Law,* Eastern Book Company, 6th Ed. 2016.
[6] KM Shrivastava, *The Right to Information: A Global Perspective*, Lancer Publisher, New Delhi (2013).

Reference Books:

[1] H.M.Seervai, *Constitutional Law of India, Vol.3,* N.M.Tripathi , 4th Ed., 1997.
[2] G.C.V.Subba Rao, *Indian Constitutional Law*, S.Gogia& Co., Hyderabad.
[3] Dr.S.R.Myneni, *Information Technology Law (Cyber Laws),* Asia Law House, Hyderabad, 1st Ed. 2018.
[4] J.M. Thomson: *Palmer's Company Law, Vol.4, 21st Ed.* Wildy & Sons Ltd.
[5] P.S.Achutan Pillai, *PSA Pillai'sCriminal Law*, Butterworth Co., 2000.
[6] K.D.Gour: *Criminal Law*, *Cases and Materials*, 9th Ed. LexisNexis, 2019.
[7] Sairam Bhat, *Right to Informationand Good Governance*, National Law School of India University, 2016.
[8] Dheera Khandelwal and KK Khandelwal, *A Commentary and Digest on the Right to Information Act, 2005,* 2nd Ed., 2014.

Course Learning Outcomes (COs):

On completion of this course, students will be able to...

CO1: develop the knowledge in state policy and parliamentary form of government
CO2: make use of information technology act and cyber security
CO3: utilize the consumer protection act and rights consumer
CO4: perceive the legislations and understand the process of investigation and right to information act

Course Articulation Matrix (CAM): P20AC108C CONSTITUTION OF INDIA

CO		PO1	PO2	PO3	PSO 1	PSO 2
CO1	P20AC108C.1	1	1	1	-	-
CO2	P20AC108C.2	1	1	1	-	-
CO3	P20AC108C.3	1	1	1	-	-
CO4	P20AC108C.4	1	1	1	-	-
P20AC108B		**1**	**1**	**1**	**-**	**-**

P20AC108D PEDAGOGY STUDIES

Class:M. Tech. I –Semester

Specialization(s):SCE, DE, VE, PE, SE, DS, DC & CSP

Teaching Scheme:

L	T	P	C
2	-	-	1

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on

LO1: terminology of pedagogy studies, role of curriculum, relation between teaching and learning

LO2: effectiveness of pedagogical practices and teaching strategies

LO3: student centered approaches of learning

LO4: factors supporting effective pedagogy, research gaps and future directions of potential areas

UNIT-I (6)

Methodology: Aims and rationale, policy background, cconceptual framework and terminology, theories of learning- behaviourism, constructivism, social constructivism, critical theory, difference between curriculum and syllabus, curriculum, importance of curriculum for students and teachers, role played by the curriculum.

Teaching- Learning Process: Introduction, concept of pedagogy, principles of teaching, maxims of teaching, phases of learning, relationship between teaching and learning, factors of teaching and learning in classroom situation, difference between teaching and learning.

UNIT-II (6)

Overview of pedagogical practices in developing countries: Overview and aims, pedagogy approaches, pedagogy as practice, pedagogy as ideas, pedagogy and equity, curriculum, teacher education - initial teacher education, continuing professional development, training unqualified teachers,effectiveness of pedagogical practices, pedagogic theory and pedagogical strategies, teachers' attitudes and beliefs.

Strategies of Teaching: Features, characteristics, advantages and limitations of lecture method, demonstration method, experimental method and discussion method.

UNIT-III (6)

Student Centred Approaches: Features, characteristics, advantages and limitations of constructivist approach of learning, discovery method of learning, enquiry method, project-based learning (PBL), activity based learning (ABL).

Practical Approaches: Features of experiential learning and teacher's role, peer tutoring, field visits and process of organizing, e-learning tools, strengths and weaknesses.

UNIT-IV (6)

Role of teacher education, school curriculum, guidance materials in supporting effective pedagogy: Professional development, alignment with classroom practices and follow-up support, peer support, support from the head teacher and the community, curriculum and assessment, barriers to learning:limited resources and large class sizes.

Research gaps and future directions: Research design, contexts, pedagogy, teacher education, curriculum and assessment, dissemination and research impact.

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Textbooks:

[1] Dr. S. K. Bhatia, Dr. Sonia Jindal, *A Textbook of curriculum, pedagogy and evaluation*, 1st ed., New Delhi: Paragon International Publishers, 2016.

[2] Jo Westbrook, Naureen Durrani, Rhona Brown, David Orr, John Pryor, Janet Boddy, Francesca Salvi, *Pedagogy, Curriculum. Teaching Practices and Teacher Education in Developing Countries*, Education Rigorous Literature Review, Center for International Education, University of Sussex, December 2013.

Reference books:

[1] Ackers J, Hardman F, *Classroom interaction in Kenyan primary schools*, Compare, 31 (2): 245-261, 2001.

[2] Agrawal M, *Curricular reform in schools: The importance of evaluation*, Journal of Curriculum Studies, 36 (3): 361-379, 2004.

[3] Akyeampong K, *Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1.* London: DFID, 2003.

[4] Akyeampong K, Lussier K, Pryor J, Westbrook J, *Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count?* International Journal Educational Development, 33 (3): 272–282, 2013.

[5] Alexander RJ, *Culture and pedagogy: International comparisons in primary education.* Oxford and Boston: Blackwell, 2001.

[6] Chavan M, *Read India: A mass scale, rapid, 'learning to read' campaign,* 2003.

[7] www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Learning Outcomes (COs):

On completion of this course, the students will be able to…

CO1: *describe the significance of curriculum, relationship between teaching and learning*

CO2: *justify the effectiveness of pedagogical practicesof teaching and compare the lecture, demonstration, experimental and discussion methods of teaching strategies*

CO3: *analyze the role of student centered approaches in learning of a student and identify suitable approaches for the improvement*

CO4: *exemplify the role of professional development, curriculum, assessment for effective pedagogy and identify the research gaps in allied areas*

Course Articulation Matrix: P20AC108D PEDAGOGY STUDIES

CO		PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	P20AC108D.1	-	1	-	-	-
CO2	P20AC108D.2	1	1	1	-	-
CO3	P20AC108D.3	1	1	1	-	-
CO4	P20AC108D.4	1	1	1	-	-
P20AC108D		**1**	**1**	**1**	**-**	**-**

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE :: WARANGAL – 15
(An Autonomous Institute under Kakatiya University, Warangal)
SCHEME OF INSTRUCTION & EVALUATION FOR TWO YEAR POSTGRADUATE PROGRAMME

PRR-20

M.Tech. (POWER ELECTRONICS)

SEMESTER-II

S. No.	Course Category	Course Code	Course Title	Hours per Week			Credits	Evaluation Scheme								
								CIE - TA							ESE	Total Marks
								I²RE				Minor	MSE	Total		
				L	T	P		ATLP	CRP	CP	PPT					
1	PC	P20PE201	Advanced Power Electronics	3	-	-	3	8	8	8	6	10	20	60	40	100
2	PC	P20PE202	Power Electronic Control of DC & AC Drives	3	-	-	3	8	8	8	6	10	20	60	40	100
3	PE	P20PE203	Professional Elective-III/ MOOC-III	3	-	-	3	8	8	8	6	10	20	60	40	100
4	PE	P20PE204	Professional Elective-IV/ MOOC-IV	3	-	-	3	8	8	8	6	10	20	60	40	100
5	PC	P20PE205	Advanced Power Electronics Simulation Laboratory	-	-	4	2	-	-	-	-	-	-	60	40	100
6	PC	P20PE206	Electric Drives Laboratory	-	-	4	2	-	-	-	-	-	-	60	40	100
7	PROJ	P20PE207	Mini Project with Seminar	-	-	4	2	-	-	-	-	-	-	100	-	100
8	AC	P20AC208	Audit Course-II	2	-	-	1	8	8	8	6	10	20	60	40	100
			Total	**14**	**-**	**12**	**19**							**520**	**280**	**800**

Note:

1. *The students shall undergo mandatory Industrial training/ Internship for at least 6 to 8 weeks during summer vacation at Industry/R&D organization. Internship evaluation will be done during the III semester.*
2. *Additional Learning: Students are advised to do MOOCs to bridge the gap in the curriculum, as suggested by the Department Academic Advisory Committee (DAAC). The credits earned by the student through MOOCs will be printed in the semester grade sheet.*

[L= Lecture, T = Tutorials, P = Practicals, C = Credits, ATLP = Assignments, CRP = Course Research Paper, CP = Course Patent, PPT = Course Presentation, Minor=Minor Examination, MSE=Mid Semester Examination and ESE=End Semester Examination]

Professional Elective-III/ MOOCs-III

P20PE203A:	Artificial Intelligence Applications in Power Engineering
P20PE203B:	Optimal Control Theory
P20PE203C:	Modeling and Simulation of Power Electronic Systems
P20PE203D:	MOOCs

Professional Elective-IV/ MOOCs-IV

P20PE204A:	Electric and Hybrid Electrical Vehicles
P20PE204B:	Microcontroller & DSP based Systems
P20PE204C:	Energy Auditing & Management
P20PE204D:	MOOCs

Audit Course-II

P20AC208A:	Stress Management by Yoga
P20AC208B:	Value Education
P20AC208C:	Personality Development through Life Enlightenment Skills
P20AC208D:	Disaster Management

Total Contact Periods/Week: 26 **Total Credits: 19**

P20PE201 ADVANCED POWER ELECTRONICS

Class:M. Tech. II –Semester

Specialization:Power Electronics

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop students 'knowledge in/on

LO1: modeling and current controlling of DC-DC Converters

LO2: design of DC-DC converter components such as transformer, inductor, capacitor, input filter & thermal design

LO3: converter topologies & the switching strategies which result in zero- voltage and/or zero-current switchings

LO4: emerging topologies & control strategies of MLI

UNIT-I (9)

Modeling of DC-DC Converters: Basic AC modelling approach, state space averaging, circuit averaging and averaged switch modeling, canonical circuit modeling, converter transfer functions for buck, boost and buck-boost, SEPIC topologies

Current mode control: Introduction, types, advantages and disadvantages, slope compensation, determination of duty cycle and transfer functions for buck, boost and buck-boost converters

UNIT-II (9)

Design of DC-DC Converters: Introduction to isolated DC-DC converters, forward converter, fly back converter, full bridge & half bridge converters, feed-back loop stabilization with current mode control, right plane zero, design of transformer, design of inductor and current transformer, selection of filter capacitors, selection of ratings for devices, input filter design, thermal design, introduction to phase shifted DC-DC converters, applications of DC-DC converters,

UNIT-III (9)

Resonant Converters: Introduction, Basic resonant circuit concepts, classification - load resonant converters, resonant switch converters, zero voltage switching clamped voltage converters, resonant DC link inverters, high frequency link integral half cycle converters, phase modulated resonant converters, applications of resonant converters

UNIT-IV (9)

Multi-level Inverters: Need for multi-level inverters, concept of multi-level, topologies for multi-level, diode clamped, flying capacitor and cascaded H-bridge multilevel inverter configurations, features and relative comparison of these configurations, applications of multi-level inverters

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Textbooks:

[1] Erickson and Maksimovic, *Fundamentals of Power Electronics*, 2nd ed., Amsterdam: Kluwer academic publishers, 2004. (Unit-I & Unit-II)

[2] NedMohan, T. M. Undeland, William P. Robbins, *Power Electronics Converters, Applications & Design* 2nd ed., New Jersey: John Wiley & Sons, 2006. (Unit-III)

[3] M.H.Rashid, *Power Electronics-Circuits, Devices & Applications,*4th ed., Noida: Pearson Education, 2014. (Unit-IV)

Reference Books:

[1] L. Umanand and SR Bhat, *Design of Magnetic Components for Switched Mode Power Converters*, New Delhi: New Age International Publishers, 2009.

[2] Abraham I. Pressman, *Switching Power Supply Design Third Edition,* New Delhi:McGraw Hill International, 2009.

Course Learning Outcomes (COs):

On completion of this course the student will be able to

CO1: develop dynamic models for DC-DC converters and determine their transfer functions

CO2: design power converter components for DC-DC converters

CO3: apply the concepts of ZCS & ZVS to increase the efficiency of power conversion

CO4: apply multilevel inverters for industrial applications

Course Articulation Matrix (CAM): P20PE201 ADVANCED POWER ELECTONICS

CO		PO 1	PO 2	PO3	PSO 1	PSO 2
CO1	P20PE201.1	2	1	1	1	1
CO2	P20PE201.2	2	1	2	2	2
CO3	P20PE201.3	2	1	2	2	2
CO4	P20PE201.4	1	1	2	2	2
P20PE201		**1.75**	**1**	**1.75**	**1.75**	**1.75**

P20PE202POWER ELECTRONIC CONTROL OF DC & AC DRIVES

Class:M. Tech. II –Semester

Specialization:Power Electronics

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on

LO1: fundamentals and control of rectifier & chopper fed electric drives
LO2: scalar, vector & direct torque control of induction motor drives
LO3: control concepts of sinusoidal SPM, synchronous reluctance & wound rotor synchronous motor drives
LO4: closed loop control of sinusoidal IPM & trapezoidal SPM synchronous motor drives

UNIT-I (9)

Introduction to Electrical Drives: Types of motor torques, types and components of load torques

Chopper controlled DC Drives: Multi quadrant control of DC motor drive, closed loop control of DC motor drives, analysis of steady state and dynamic performance, applications of DC drives

UNIT-II (9)

Induction motor drives: Introduction,analysis of induction motor fed from non-sinusoidal supply voltage, stator voltage control – voltage fed inverter control and current fed inverter control, V/f controlled induction motors, vector or field oriented control –indirect vector control and direct vector control, direct torque and flux control, applications of IM drives

UNIT-III (9)

Sinusoidal Surface mounted Permanent Magnet (SPM) machine drives: Introduction, sinusoidal SPM machine drives – Volt/hertz control, self-control model, absolute position encoder and vector control – field weakening mode

Sinusoidal Interior Permanent Magnet(IPM) machine drives: Current vector control with maximum torque per ampere control, field weakening control and vector control with stator flux orientation

UNIT-IV (9)

Switched Reluctance Motor (SRM) drives: construction, operating principle, expression for torque, characteristics, power converters for SRM drives, applications

BLDC (Trapezoidal SPM machine) drives: Drive operator with inverter, torque speed curve, machine dynamic model, drive control – closed loop control speed control with feedback mode and closed loop current control with freewheeling mode, torque pulsation and extended speed operation

Textbooks:

[1] G. K. Dubey, *Fundamentals of electric Drives*, 2nd ed., New Delhi: Narosa Publishing House, 2011.(Unit-I).

[2] B K. Bose,*Modern Power Electronics and AC Drives*, New Delhi: PHI Learning Pvt. Ltd., 2001. (Units-II, III, IV).

Reference Books:

[1] Paul Krause, Oleg Wasynczuk, Scott Sudhoff, Steven Pekarek, *Analysis of Electric Machinery and Drive Systems*, 3rd ed., IEEE Press, 2013.

[2] R. Krishnan, *Electric motor drives modeling, Analysis and control,* New Delhi: PHI Learning Pvt. Ltd., 2001.

[3] Shepherd, Hulley, Liang, *Power Electronics and motor control*, 2nd ed., Cambridge: Cambridge University Press, 1996.

[4] M.H. Rashid, *Power electronic circuits, Devices and applications*, 4th ed., New Delhi: PHI Learning Pvt. Ltd., 2017.

[5] Dubey G.K., *Power Semiconductor controlled drives*, New Jersey: Prentice Hall Inc, A division of Simon and Schester England cliffs, 1989.

[6] Murphy J.M.D, Turnbull, F.G, *Thyristor control of AC motor*, Oxford: Elsevier Pergamon press, 1988.

[7] NedMohan, Advanced Electric Drives: Analysis, Control, and Modeling Using MATLAB / Simulink, New York: Wiley publications, 2014.

Course Learning Outcomes (COs):

On completion of this course, the students will be able to

CO1: design DC motor drives for industrial applications

CO2: design scalar, vector & direct torque control techniques for induction motor drives

CO3: design controllers for PMSM drives

CO4: design controllers for BLDC & SRM drives

Course Articulation Matrix: P20PE202 POWER ELECTRONIC CONTROL OF DC & AC DRIVES						
CO		**PO1**	**PO2**	**PO3**	**PSO1**	**PSO2**
CO1	P20PE202.1	2	1	2	2	1
CO2	P20PE202.2	2	1	2	2	1
CO3	P20PE202.3	2	1	2	2	1
CO4	P20PE202.4	2	1	2	2	1
P20PE202		**2**	**1**	**2**	**2**	**1**

P20PE203AARTIFICIAL INTELLIGENCE APPLICATIONS IN POWER ENGINEERING

Class: M. Tech. II –Semester

Specialization: Power Electronics

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on

LO1: the function & architecture of biological & artificial neural networks

LO2: the perceptron models based on Backpropagation algorithm, fuzzy and crisp sets

LO3: fitness functions, operators, convergence of genetic algorithm

LO4: applications of Artificial Intelligence (AI) techniques in power engineering

UNIT-I (9)

Biological Neural Networks: Introduction, biological neuron, architecture, characteristics

Artificial Neural Networks: Introduction, models of neuron network, architectures, knowledge representation, artificial intelligence and neural networks, learning process, error correction learning, Hebbian learning, competitive learning, Boltzmann learning, supervised learning, unsupervised learning, reinforcement learning, learning tasks.

UNIT-II (9)

ANN Paradigms: Introduction to perceptron, multi-layer perceptrons, Back Propagation Algorithm (BPA), error minimization using BPA algorithm, Self–Organizing Map (SOM), radial basis function network, Functional Link Network (FLN), Hopfield network

FuzzyLogic: Introduction, fuzzyversuscrisp,fuzzysets, membershipfunctions, basicfuzzy set operations, properties of fuzzy sets, fuzzy cartesian product, operations on fuzzy relations, fuzzy logic theory– block representation, fuzzy quantifiers, fuzzy inference system - fuzzy rule base, defuzzification methods

UNIT-III (9)

Genetic Algorithms: Introduction, encoding, fitness function, reproduction operators, genetic modeling, genetic operators, crossover, single site crossover, two point crossover, multi point crossover, uniform crossover, matrix crossover, crossover rate, inversion & deletion, mutation operator, mutation, mutation rate, bit-wise operators, generational cycle, convergence of genetic algorithm

UNIT-IV (9)

AI Applications: Applications of neural networks in power electronics and motor drives, fuzzy logic in power electronic converters for smart power systems, genetic algorithm for improved performance of boost converters, genetic algorithm in power system optimization with FACTS devices, AI techniques for speed control of DC and AC motors

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Textbooks:

[1] S. Rajasekaran and G.A.Vijayalakshmi Pai, *Neural Networks, Fuzzy Logic & Genetic Algorithms – Synthesis and Applications,* New Delhi: PHI Learning Pvt. Ltd., 2003. (For Units-I, II & III)

[2] P.Joshi, P.Kulkarni, *Artificial Intelligence: Building Intelligent Systems,* New Delhi: PHI Learning Pvt. Ltd., 2015 (For Units-I & IV)

Reference Books/Articles:

[1] Mohammad H. Hassoun,*FundamentalsofArtificialNeuralNetworks,*New Delhi: PHI Learning Pvt. Ltd.,1998.

[2] James A. Anderson,*IntroductiontoNeuralNetworks,*New Delhi: PHI Learning Pvt. Ltd.,1998.

[3] David E. Goldberg, *Genetic Algorithms- in Search, Optimization, and Machine Learning,*Boston: Addison-Wesley Publishing Company Inc.,1989.

[4] Bimal K. Bose, *Neural Network Applications in Power Electronics and Motor Drives – An Introduction andPerspective*, IEEE Transactions on Industrial Electronics, Vol. 54, Issue-1, 2007.

[5] Harold R. Chamorro and Gustavo A. Ramos, *Fuzzy Logic in Power Electronic Converters for Smart Power Systems,* open access peer-reviewed chapter, Chapter-8, 2012.

[6] Kumaraguru Prabhakar, Fangxing Li, *Application of genetic algorithm for the improved performance ofboost converters*, IFAC Proeedings Volumes, Elsevier, Vol. 45, Issue 21, 2012.

[7] Nadil Amin, Abu Qauser Marowan, Bashudeb Chandra Ghosh, *Application of Genetic Algorithm inPower System Optimization with Multi-type FACTS*, International Journal of Scientific and ResearchPublications, Volume 7, Issue 5, May 2017.

Course Learning Outcomes (COs):

On completion of this course, the students will be able to…

CO1: implement supervised & unsupervised learning mechanisms for ANN and compare biological & artificial neural networks

CO2: minimize the error with backpropagation algorithm and apply fuzzy logic to solve engineering problems

CO3: implement genetic algorithm using fitness functions, crossover and mutation

CO4: apply AI techniques to solve problems associated with power systems, electrical machines & power electronics

Course Articulation Matrix: P20PE203AARITIFICIAL INTELLIGENCE APPLICATIONS IN POWER ENGINEERING

CO		PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	P20PE203A.1	-	1	-	-	-
CO2	P20PE203A.2	2	1	1	-	-
CO3	P20PE203A.3	2	1	1	-	-
CO4	P20PE203A.4	2	1	2	2	2
P20PE203A		**2**	**1**	**1.33**	**2**	**2**

P20PE203B OPTIMAL CONTROL THEORY

Class:M. Tech. II –Semester

Specialization:Power Electronics

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on

LO1: fundamental concepts of optimal control
LO2: extremal of functionals involving independent functions
LO3: necessary & boundary conditions for optimal control
LO4: dynamic programming methods for solving control problems

UNIT-I (9)

Performance Measures for optimal control problems: optimal control problem formulation, general form of performance measure, fundamental concepts and theorems of calculus of variations, function and functional, extremal of functionals of a single function

UNIT-II (9)

Calculus of Variations: Euler - Lagrange equation and solution, functionals involving several independent functions, various boundary condition equations, Piecewise-smooth extremals

UNIT-III (9)

Variational Approach to control problems: Necessary conditions for optimal control using Hamiltonian, different boundary condition equations for solving the optimal control problem, linear regulator problem, Pontryagin's minimum principle, state inequality constraints, minimum time problems, minimum control effort problems

UNIT-IV(9)

Dynamic programming: Principle of optimality, application of the principle of optimality to decision making, recurrence relation of dynamic programming, computational procedure for solving control problems, characteristics of dynamic programming solution, Hamilton-Jacobi-Bellman equation, continuous linear regulator problems

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Textbook:

[1] Donald E. Kirk, *Optimal Control Theory, An introduction*, New York: Dover Publications Inc., 2004.

Reference Books:

[1] A.P.Sage, *Optimum Systems Control*,2nd ed., Prentice Hall, 1977.
[2] Jay C. Hsu, A. U. Meyer, *Modern Control, Principles and Applications*, New York: McGraw-Hill Inc., 1968.
[3] K.K.D.Young, *Design of Variable Structure Model Following Control Systems*, IEEE Transactions on Automatic Control, Vol. 23, pp 1079-1085, 1978.

Course Learning Outcomes (COs):

On completion of this course, the students will be able to…

CO1: analyze problem formulation, performance measures & mathematical treatment of optimal control problems
CO2: apply Euler-Lagrange equation to find the solutions for extremal of functionals
CO3: apply necessary & boundary conditions to solve optimal control problems
CO4: apply dynamic programming for solving optimal control problems

Course Articulation Matrix (CAM): P20PE203B OPTIMAL CONTROL THEORY						
CO		**PO 1**	**PO 2**	**PO 3**	**PSO 1**	**PSO 2**
CO1	P20PE203B.1	2	1	1	-	1
CO2	P20PE203B.2	2	1	1	-	1
CO3	P20PE203B.3	1	1	1	-	1
CO4	P20PE203B.4	1	1	1	-	1
P20PE203B		**1.5**	**1**	**1**	**-**	**1**

P20PE203C MODELING & SIMULATION OF POWER ELECTRONIC SYSTEM

Class:M. Tech. II –Semester

Specialization:Power Electronics

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on

CO1: power electronic converters & drives with appropriate time steps.
CO2: modeling & simulation of power electronic converter circuits
CO3: identification of different control methods for modeling of drives
CO4: behavior of power converters with state space analysis

UNIT-I (9)

Introduction: Challenges in computer simulation, simulation process, mechanics of simulation, solution techniques for time domain analysis, equation solver, circuit-oriented simulators

UNIT-II (9)

Modelling and Simulation of power converters: Introduction to MATLAB and Simulink, operation of single/three phase bilateral bridges in rectifier mode, control principles, control of the DC Side Voltage, voltage control loop, the inner current control loop, single phase and three phase boost type APFC and control, three phase utility inter phases and control, simulation of rectifiers, choppers and inverter circuits along with PWM techniques

UNIT-III (9)

Modelling and Simulation of Electric Drives: Modelling of power electronic converters with transportation delay, concept of control gain, linearization of rectifiers with inverse cosine control, principal of vector control, modeling and simulation of vector controlled three phase induction motor with a three level inverter drive, state space model of three phase induction motor, modeling of multilevel converters and its applications to drives

UNIT-IV (9)

Modelling, Simulation of Switching converters with State space Averaging: State space representation of power electronic converters (with buck converter as a state ,space representative example),trapezoidal integration, M & N method for simulating power electronic converters(with buck converter as a representative example), state space averaging techniques, modeling and linearization of converter transfer function, simulation and design of power electronic converters using state space averaged models.

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Textbooks:

[1] M. B. Patil, V. Ramnarayanan, V. T. Ranganathan, *Simulation of power electronic converters*, New Delhi: Narosa Publishing House, 2010

[2] Ned Mohan Tore M. Undeland, *Power Electronics: Converters, Applications, and design*, 3rd ed., New Jersey: John Wiley & Sons, 2007.

[3] M.H. Rashid, *Power electronic circuits, Devices and applications*, 4th ed., New Delhi: PHI Learning Pvt. Ltd., 2017.

[4] G.K. Dubey, S. R. Doradla, A. W. Joshi, R. M.K. Joshi, *Thyristorised Power Controllers*, New York, Wiley Eastern Ltd., 1986.

Reference Books:

[1] IETE Press Book, *Power Electronics*, New York: McGraw Hill Higher Education, 2003
[2] Cyril W Lander, *Power Electronics*, New York: McGraw Hill Higher Education, 1987.
[3] B K. Bose,*Modern Power Electronics and AC Drives*, New Delhi: PHI Learning Pvt. Ltd., 2001.
[4] Abraham Pressman, Keith Billings, Taylor Morey, *Switching Power Supply Design*, 3rd ed., New York: McGraw Hill Publishing Company., 2009.
[5] Daniel M Mitchell DC-DC Switching Regulator Analysis, New York:McGraw Hill Higher Education, 1988

Course Learning Outcomes (COs):

On completion of this course, the students will be able to…

CO1: specify the timestep requirements to simulate dynamic models pertaining to power converters and drives
CO2: assess the performance of PWM techniques for power electronic converters
CO3: design control strategies for electric drives
CO4: analyze the performance of DC-DC converters using the state-space averaging techniques

Course Articulation Matrix: P20PE203C MODELING & SIMULATION OF POWER ELECTRONICS SYSTEM

CO		PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	P20PE203C.1	2	1	2	2	2
CO2	P20PE203C.2	2	1	2	2	2
CO3	P20PE203C.3	2	1	2	2	2
CO4	P20PE203C.4	2	1	2	2	2
P20PE203C		2	1	2	2	2

P20PE204A ELECTRIC AND HYBRID ELECTRICAL VEHICLES

Class:M. Tech. II –Semester

Specialization:Power Electronics

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on

LO1: characteristics, tractive effort, composite fuel economy of HEVs, PHEVs and FCVs

LO2: architectures of PHEVs & SHEVs, effects of adding PHEVs on existing power grid and applications of electric vehicles in ground and non-ground military

LO3: operation of power electronic converters & motors used for hybrid vehicles

LO4: mathematical modelling of batteries, DC machines, DC-DC converters & HEV dynamics

UNIT – I (9)

Introduction: A brief history of HEVs, architectures of HEVs, state of the art of HEVs, challenges and key technology of HEVs.

Concept of Hybridization of the Automobile: Vehicle basics, basics of EV, basics of HEV, basics of Plug□in Hybrid Electric Vehicle (PHEV), basics of Fuel Cell Vehicles (FCVs)

HEV Fundamentals: Vehicle model, vehicle performance, EV powertrain component sizing, series hybrid vehicle, parallel hybrid vehicle, wheel slip dynamics

UNIT –II (9)

Introduction to PHEVs: PHEV architectures, equivalent electric range of blended PHEVs, fuel economy of PHEVs, power management of PHEVs, HEV to PHEV conversions, vehicle□to□grid technology

Special Hybrid Vehicles: Applications of hydraulic hybrid vehicles, off□road HEVs, diesel HEVs, electric or hybrid ships, aircraft and locomotives, other industrial utility application vehicles

HEV Applications for Military Vehicles: Ground vehicle applications, non□ground□vehicle military applications

UNIT– III (9)

Power Electronics in HEVs: Rectifiers used in HEVs, non□isolated bidirectional DC–DC converter, voltage source inverter, current source inverter, isolated bidirectional DC–DC converter, PWM rectifier in HEVs, EV and PHEV battery chargers

Electric Machines and Drives in HEVs: Operation of permanent magnet motor drives, switched reluctance motors, doubly salient permanent magnet machines, design and sizing of traction motors

UNIT - IV (9)

Battery Modelling: characterization of batteries, electric circuit model for batteries and ultracapacitors. modelling of Nickel Metal Hydride (NiMH) battery, modelling of Lithium□Ion

(Li□Ion) battery, parameter estimation for battery models, example case of using battery model in an EV system.

Modelling and Simulation of Electric and Hybrid Vehicles: Fundamentals of vehicle system modelling, modelling of DC machine, DC–DC boost converter & vehicle dynamics, PHEV modelling using MATLAB

*****

Textbook:

[1] C. Mi, M. A. Masrur and D. W. Gao, "*Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives*", New Jersey: John Wiley & Sons, 2017.

Reference Books:

[1] S. Onori, L. Serrao and G. Rizzoni, "*Hybrid Electric Vehicles: Energy Management Strategies*", Germany: Springer Nature, 2015.

[2] M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "*Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design*", Florida: CRC Press, 2004.

[3] T. Denton, "*Electric and Hybrid Vehicles*", UK: Routledge, 2016.

Course Learning Outcomes (COs):

On completion of this course, students will be able to ...

CO1: determine the tractive effort, composite fuel economy of HEVs, PHEVs

CO2: analyze the architecture of PHEVs & SHEVs & effects of adding PHEVs on existing power grid

CO3: analyze the operation of power electronic converters & motors used for hybrid vehicles

CO4: develop the mathematical models for batteries, tractive motors, DC-DC converters & HEV

Course Articulation Matrix (CAM): P20PE204A ELECTRIC AND HYBRID ELECTRICAL VEHICLES

CO		PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	P20PE204A.1	1	1	-	2	1
CO2	P20PE204A.2	2	1	1	2	2
CO3	P20PE204A.3	2	1	1	2	2
CO4	P20PE204A.4	1	1	-	2	1
P20PE204A		**1.5**	**1**	**1**	**2**	**1.5**

P20PE204B MICROCONTROLLER & DSP BASED SYSTEMS

Class:M. Tech. II –Semester

Specialization:Power Electronics

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on …

LO1: architecture,addressing modes & instruction set of 8051 microcontroller

LO2: assembly language programming using 8051 microcontroller

LO3: interfacing 8051 microcontroller with I/O devices & stepper motor

LO4: programming with DSP processor and features of FPGA controller

UNIT – I (9)

Microcontrollers: Intel 8051- architecture, registers, memories, addressing modes, instruction set, arithmetic instructions, logical instructions, single bit instructions, I/O ports, serial communication, timers, interrupts, programming

UNIT –II (9)

8051 Peripherals and Programming: Interfacing I/O devices- serial communication, timer/counter programming interrupt programming, assembly language programming, addressing, operations, stack & subroutines, interrupts-DMA

UNIT– III (9)

Applications: Interfacing LCD display, keyboard, generation of gate signals using microcontrollers for converters and inverters, control of PMDC motor, control of stepper motor

UNIT - IV (9)

Digital Signal Processor (DSP): Architecture,computational building blocks, address generation unit, program control and sequencing, VLIW architecture, pipelining, TMS320F2833X processor – features, applications, detailed description with functional block diagram and applications, programming for control applications

Introduction to FPGA controller,Spartan-6 family: XC6SLX9, features and application

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Textbooks:

[1] Kenneth J. Ayala, *The 8051 microcontroller,* Cengage Learning, 2007. *(for Units I, II and III)*

[2] B. Venkataramani and M. Bhaskar, *Digital Signal Processors, Architecture, Programming and Applications*", 2nd ed., New Delhi: McGraw Hill Education (India) Pvt. Ltd., 2017.*(for Unit IV)*

[3] TMS320F2833X Users guide—Texas Instruments *(for Unit IV)*

Reference Books:

[1] Muhammed Ali Mazidi, *The 8051 Microcontrollers and Embedded systems using Assembly and C,* 2nd ed., New Delhi: Pearson Education India Pvt. Ltd., 2006

[2] Douglas V. Hall, SSSP Rao, *Microprocessors & Interfacing,* 3rd ed., New Delhi: McGraw Hill Education (India) Pvt. Ltd., 2017.
[3] Phil Lapsley, Jeff Bier, *DSP Processor Fundamentals, Architectures & Features*, Wiley- IEEE Press, 2000

Course Learning Outcomes (COs):

On completion of this course, students will be able to ...

CO1: develop assembly language programs on 8051 microcontroller to perform arithmetic operations, data manipulations & code conversions
CO2: implement PWM schemes using timers & interrupts of 8051 microcontroller
CO3: interface I/O devices & power converter with 8051 microcontroller
CO4: employ DSP controllers & FPGAs for power electronic applications

Course Articulation Matrix (CAM): P20PE204B MICROCONTROLLER & DSP BASED SYSTEMS

CO		PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	P20PE204B.1	1	1	1	1	1
CO2	P20PE204B.2	2	1	2	2	2
CO3	P20PE204B.3	2	1	2	2	2
CO4	P20PE204B.4	1	1	1	1	1
P20PE204B		**1.5**	**1**	**1.5**	**1.5**	**1.5**

P20PE204C ENERGY AUDITING AND MANAGEMENT

Class:M. Tech. II –Semester

Specialization:Power Electronics

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on

LO1: energy audit and demand side management (DSM) techniques
LO2: equipment and domain of energy conservation and audit in power system
LO3: instruments used for energy audit and energy management
LO4: energy conservation in electrical equipment

UNIT–I (9)

E**nergy audit and demand side management (DSM) in power utilities:** Energy scenario & conservation -demand forecasting techniques, integrated optimal strategy for reduction of T&D Losses, DSM techniques and methodologies, loss reduction in primary and secondary distribution system and capacitors, energy management, role of energy managers, energy audit, metering

UNIT–II (9)

Energy audit: Energy audit concepts, basic elements and measurements, mass and energy balances, scope of energy auditing in industries

Energy audit of Electrical Equipment: Evaluation of energy conserving opportunities and environmental management-preparation and presentation of energy audit reports, case studies for induction motors, transformers, cables, lighting, AC systems, pumps, capacitor banks and potential energy savings

UNIT–III (9)

Instrumentation: Evaluation and instrumentation techniques for renewable energy systems (solar thermal, photovoltaic and wind energy), energy management devices, microcontroller-based systems

UNIT- IV (9)

Energy conservation: Energy conservation in HVAC systems and thermal power plants, solar systems, fan and lighting systems - different light sources and luminous efficacy, energy conservation in electrical devices and systems, economic evaluation of energy conservation measures, electric motors and transformers, inverters and UPS, voltage stabilizers

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Textbooks:

[1] Chakrabarti Amlan, *Energy Engineering and Management*, 2nd ed., New Delhi: PHI Learning, 2019. (Units-I, IV).

[2] Rajiv Shankar, *Energy Auditing in Electrical Utilities,* 1st ed., New Delhi: Viva Books Publisher, 2014.

(Units-II, III).

Reference Books:

[1] Wayne C. Turner, *Energy Management Handbook*, 4th ed., New Jersey: Prentice Hall PTR Publishers, 2001.

[2] B.K. Hodge, Robert Taylor, *Analysis and Design of Energy Systems,* 3rd ed., London: Pearson Publishers, 1999.

Course Learning Outcomes (COs):

On completion of this course, students will be able to ...

CO1: describe the need &significance of energy audit & management

CO2: prepare energy audit report of electrical equipment

CO3: describe the evaluation & instrumentation techniques for renewable energy systems

CO4: evaluate energy conservation in electrical devices and systems

Course Articulation Matrix: P20PE204C ENERGY AUDITING AND MANAGEMENT

CO		PO 1	PO 2	PO 3	PSO1	PSO 2
CO1	P20PE204C.1	1	2	1	2	1
CO2	P20PE204C.2	1	2	1	2	1
CO3	P20PE204C.3	2	2	2	2	1
CO4	P20PE204C.4	2	2	2	2	1
P20PE204C		**1.5**	**2**	**1.5**	**2**	**1**

P20PE205 ADVANCED POWER ELECTRONIC SIMULATION LABORATORY

Class: M. Tech. II –Semester

Specialization:Power Electronics

Teaching Scheme:

L	T	P	C
-	-	4	2

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This laboratory course will develop students' knowledge in/on

LO1: performance of power electronic converters for various duty cycles through simulation

LO2: simulation of DC-DC converter with suitable output filter

LO3: simulation study of the performance of resonant converters

LO4: simulation analysis of multilevel inverters using pulse width modulation technique

LIST OF EXPERIMENTS

1. Determination of output voltage magnitude and plot waveforms of DC-DC Boost converter for different duty cycle using MATLAB-Simulink/Pspice/LTspice
2. Determination of output voltage magnitude and plot waveforms of DC-DC Buck-Boost converter for different the duty cycle using MATLAB-Simulink/Pspice/LTspice
3. Develop a small signal model of Buck and Boost converters for desired output and plot waveforms using MATLAB-Simulink for different the duty cycle
4. Determination of output voltage and current magnitude and plot waveforms of flyback converter, half bridge converter and full bridge converters with duty cycle variation using MATLAB-Simulink
5. Deign of components of output filter (L&C) of Buck converter and plot the voltage and current waveforms across the filter and loads using MATLAB-Simulink
6. Determination of output voltage and current magnitude and plot waveforms of series load resonant converter by varying switching frequency through simulation using MATLAB-Simulink
7. Determination of output voltage and current magnitude and plot waveforms of Zero Voltage Switching resonant converter by varying switching frequency using MATLAB-Simulink
8. Determination of output voltage and current magnitude and plot waveforms of zero current switching resonant converter by varying switching frequency using MATLAB-Simulink
9. Determination of output voltage magnitude & frequency and plot waveform of 3-level inverter with sinusoidal and carrier PWM techniques (PD, POD, APOD) for given R and RL loads using MATLAB-Simulink
10. Design and analysis of 5-level NPC multilevel Inverter using pulse width modulation using MATLAB-Simulink

11. Design and analysis of 5-level Cascaded H-bridge Multilevel Inverter using PWM using MATLAB-Simulink
12. Design and analysis of 5-level Flying Capacitor Multilevel Inverter using PWM using MATLAB-Simulink

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Laboratory Manual:

[1] *Advanced Power Electronic Simulation Laboratory Manual*, Department of EEE, KITSW.

Reference Book:

[1] M. H. Rashid, Power Electronics: Circuits, Devices & Applications, 4th ed., Noida: Pearson Education, 2017.

Course Learning Outcomes (COs):

On completion of this course, the students will be able to…

CO1: quantify the performance of DC-DC converters
CO2: assess the filtering requirements for DC-DC converters
CO3: analyse resonant converters and assess their performance
CO4: determine the THD of output voltage & current waveforms of multilevel inverters using PWM

Course Articulation Matrix: P20PE205 ADVANCED POWER ELECTRONIC SIMULATION LABORATORY

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20PE205.1	2	2	2	2	1
CO2	P20PE205.2	2	2	2	2	1
CO3	P20PE205.3	2	2	2	2	1
CO4	P20PE205.4	2	2	2	2	1
P20PE205		2	2	2	2	1

P20PE206 ELECTRIC DRIVES LABORATORY

Class:M. Tech. II –Semester

Specialization:Power Electronics

Teaching Scheme:

L	T	P	C
-	-	4	2

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This laboratory course will develop student's knowledge in/on

LO1: speed control of DC motors using DC-DC converters

LO2: speed control of induction motor drives using stator & rotor control methods

LO3: speed control of SPM, IPM, SRM & BLDC drives

LO4: simulation of DC & AC drives

LIST OF EXPERMENTS

1. Plot the voltage vs speed characteristics for motoring and braking modes of DC motor fed by four quadrant chopper
2. Control the speed and current drawn by PMDC motor using Buck Converter in Open loop and closed loop modes by varying load
3. Control the speed of an induction motor excited by single phase AC voltage controller using firing angle control
4. Control the speed of wound rotor induction motor drive using rotor resistance method and plot the rotor speed vs resistance characteristics.
5. Control the speed of three phase voltage source inverter fed induction motor in open and closed loop operations
6. Control the speed of single phase VSI fed induction motor drive using TMS320F28335 DSP processor
7. Control the speed of three phase VSI fed BLDC motor drive by varying load
8. Control the speed of Sinusoidal Surface mounted Permanent Magnet (SPM) machine drive fed by PWM inverter
9. Control the speed of Sinusoidal Interior Permanent Magnet (IPM) machine drive fed by PWM inverter
10. Control the speed of Switched Reluctance Motor (SRM) drive fed by PWM inverter
11. Develop a MATLAB Simulink model of chopper fed DC drive and plot the speed, armature current and torque waveforms for different firing angles
12. Develop a MATLAB Simulink model of VSI controlled induction motor drive and determine the output voltage and speed for different values of modulation index and frequency of VSI

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Laboratory Manual:

[1] *Electric Drives Laboratory Manual*, Department of EEE, KITSW

Reference Book:

[1] G. K. Dubey, Fundamentals of electric Drives, 2nd ed., New Delhi: Narosa Publishing House, 2011

Course Learning Outcomes (COs):

Upon completion of this course, the student will be able to…

CO1: control the speed of DC drive using DC-DC converters

CO2: control the speed of induction motors using stator & rotor control techniques

CO3: control the speed of SPM, IPM, SRM & BLDC motor drives

CO4: develop MATLAB Simulink models to control speed of DC & AC drives and validate the speed characteristics

Course Articulation Matrix: P20PE206 ELECTRIC DRIVES LABORATORY

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20PE206.1	2	2	2	2	1
CO2	P20PE206.2	2	2	2	2	1
CO3	P20PE206.3	2	2	2	2	1
CO4	P20PE206.4	2	2	2	2	1
P20PE206		2	2	2	2	1

P20PE207 MINI PROJECT WITH SEMINAR

Class:M. Tech. II –Semester

Specialization:Power Electronics

Teaching Scheme:

L	T	P	C
-	-	4	2

Examination Scheme:

Continuous Internal Evaluation	100
End Semester Examination	-

Course LearningObjectives (LOs):

This course will develop students' knowledge on /in…

LO1: implementing a project independently by applying knowledge to practice
LO2: literature review and well-documented report writing
LO3: creating PPTs and effective technical presentation skills
LO4: writing technical paper in scientific journal style & format and creating video pitch

Continuous Internal Evaluation (CIE) for Mini Project with Seminar:

1) The *Post Graduate Mini Project Evaluation Committee (PGMPEC)*shall be constituted with HoD as a Chairman, M.Tech. Coordinator as a Convener and three to five other faculty members representing various specializations in that particular programme as members.
2) Student has to take up independent mini project on innovative ideas, innovative solutions to common problems using their knowledge relevant to courses offered in their program of study, which would supplement and complement the program assigned to each student.
3) *PGMPEC* shall allot a faculty supervisor to each student for guiding on
   (a) Selection of topic
   (b) Literature survey and work to be carried out
   (c) Preparing a report in proper format
   (d) Right conduct of research and academic activity to promote academic integrity
   (e) Use of anti-plagiarism software to detect plagiarism in the report and submission of Mini project report within acceptable plagiarism levels
   (f) Effective mini project oral presentation before the PGMPEC

   There shall be only Continuous Internal Evaluation (CIE) forseminar
4) The CIE for mini project is as follows:

Assessment	**Weightage**
Mini project Supervisor Assessment	**20%**
PGMPEC Assessment: *(i) Registration presentation* ***(10%)*** *(ii) Working model / process / software package / system developed* ***(20%)*** *(iii) Mini project report* ***(20%)*** *(iv) Mini project paper* ***(10%)*** *(v) Mini project video pitch* ***(10%)*** (vi) *Final presentation (with PPT) and viva-voce* ***(10%)***	**80 %**
Total Weightage:	**100%**

Note: It is mandatory for the student to

(i) appear for final presentation (with PPT) and viva-voce to qualify for course evaluation

(ii) write mini project paper in given journal format

(ii) create a good video pitch to present mini project

(a) **Mini Project Topic**: The topic should be interesting and conducive to discussion. Topics may be found by looking through recent issues of peer reviewed Journals/Technical Magazines on the topics of potential interest

(b) **Working Model**: Each student is requested to develop a working model/ process/ software package /system on the chosen work and demonstrate before the *PGMPEC*as per the dates specified by *PGMPEC*

(c) **Mini Project Report:** Each student is required to submit a well-documented mini project report as per the format specified by*PGMPEC*

(d) **Anti-Plagiarism Check:** The mini project report should clear plagiarism check as per the Anti-Plagiarism policy of the institute

(e) **Presentation:** Each student should prepare PPT with informative slides and make an effective oral presentation before the *PGMPEC*as per the schedule notified by thedepartment

(f) **Video Pitch:** Each student should create a pitch video, which is a video presentation on his / her mini project. Video pitch should be no longer than 5 minutes by keeping the pitch concise and to the point, which shall also include key points about his / her business idea / plan (*if any*) and social impact

5) The student has to register for the Mini project as supplementary examination in the following cases:

i) he/she is absent for oral presentation and viva-voce

ii) he/she fails to submit the report in prescribed format

iii) he/she fails to fulfill the requirements of Mini project evaluation as per specified guidelines

6) (a) The CoE shall send a list of students registered for supplementary to the HoD concerned

(b) The PGMPEC, duly constituted by the HoD, shall conduct Mini project evaluation and send the award list to the CoE within the stipulated time

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: apply knowledge to practice to design and conduct experiments and utilize modern tools for developing working models / process / system leading to innovation and entrepreneurship

CO2: demonstrate the competencies to perform literature survey, identify gaps, analyze the problem and prepare a well-documented Mini project report

CO3: make an effective oral presentation through informative PPTs, showing knowledge on the subject and sensitivity towards social impact of the Mini project

CO4: write a "Mini project paper" in scientific journal style and format from the prepared Mini project report and create a video pitch on Mini project

Course Articulation Matrix (CAM): P20PE207MINI PROJECT WITH SEMINAR						
CO		PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	P20PE207.1	2	-	2	2	2
CO2	P20PE207.2	2	-	2	2	2
CO3	P20PE207.3	-	2	-	1	1
CO4	P20PE207.4	-	2	-	1	1
P20PE207		**2**	**2**	**2**	**1.5**	**1.5**

P20AC208A STRESS MANAGEMENT BY YOGA

Class:M. Tech. II –Semester

Specialization:SCE, DE, VE, PE, SE, DS, DC & CSP

Teaching Scheme:

L	T	P	C
2	-	-	1

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives:

This course will develop students' knowledge in/on

LO1: awareness about different types of stress
LO2: yoga in the management of stress
LO3: positive health and overall wellbeing
LO4: prevention of stress related health problems by yoga practice

UNIT – I (6)

Stress: Definition of stress, types of stress - acute and chronic; stressors; definition of yoga from various sources, types of yoga – karma yoga, gnana yoga, bhakti yoga and raja yoga; concept of Bhagavat gita; yoga versus exercise; basics of physiology and psychology; brain and its parts – central nervous system (CNS), peripheral nervous system (PNS), hypothalamic pituitary adrenal (HPA) axis; sympathetic and parasympathetic nervous systems; fight and flight mechanism; relationship between stress and yoga.

UNIT –II (6)

Ashtanga Yoga: Do's and don'ts in life; yamas – ahimsa, satya, asteya, bramhacharya and aparigraha; niyama – shaucha, santosha, tapa, svadhyaya, ishvarapranidhana; asana; pranayama; pratyahara; dharana; dhyana; samadhi.

UNIT– III (6)

Asana and Stress: Definition of asana from patanjali; origin of various names of asanas; various yoga poses and their benefits for mind and body; sequence of performing asanas - standing, sitting, lying down on stomach, lying down on back and inverted postures; activation of annamaya kosha; effect on various chakras, systems and glands thereby controlling the stress levels through the practice of asanas.

UNIT - IV (6)

Pranayama: Anulom and vilom pranayama, nadi shudhi pranayama, kapalabhati pranayama, bhramari pranayama, nadanusandhana pranayama.

Meditation Techniques: Om meditation; cyclic meditation; instant relaxation technique (IRT); quick relaxation technique (QRT); deep relaxation technique (DRT)

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Textbooks:

[1] *Yogic Asanas for Group Training - Part-I*, Nagpur: Janardhan Swami Yogabhyasi Mandal.

[2] Swami Vivekananda, *Rajayoga or Conquering the Internal Nature*, Kolkata: Advaita Ashrama (PublicationDepartment).

Reference Book:

[1] Nagendra H.R and Nagaratna R, *Yoga Perspective in Stress Management*, Bangalore: Swami Vivekananda Yoga Prakashan.

Course Learning Outcomes (COs):

On completion of this course, students will be able to ...

CO1: differentiate yoga and exercise

CO2: explain eight steps of Ashtanga yoga

CO3: describe different yogasanas, and their benefits for mind and body

CO4: discuss the benefits of pranayama and meditation as an effective tool for stress management

Course Articulation Matrix (CAM): P20AC208A STRESS MANAGEMENT BY YOGA						
CO		**PO1**	**PO2**	**PO3**	**PSO1**	**PSO2**
CO1	P20AC208A.1	1	1	-	-	-
CO2	P20AC208A.2	1	1	-	-	-
CO3	P20AC208A.3	1	1	-	-	-
CO4	P20AC208A.4	1	1	-	-	-
P20AC208A		**1**	**1**	**-**	**-**	**-**

P20AC208B VALUE EDUCATION

Class:M. Tech. II –Semester

Specialization:SCE, DE, VE, PE, SE, DS, DC & CSP

Teaching Scheme:

L	T	P	C
2	-	-	1

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop students' knowledge on /in…

LO1: value of education and self-development
LO2: importance of cultivation of values
LO3: personality and behavior development
LO4: character and competence

UNIT – I (6)

Values and self-development: Social values and individual attitudes; work ethics; indian vision of humanism; moral and non-moral valuation; standards and principles; value judgments.

UNIT – II (6)

Importance of cultivation of values: Sense of duty, devotion, self-reliance, confidence, concentration, truthfulness, cleanliness, honesty, humanity, discipline, power of faith; national unity, patriotism; love for nature

UNIT – III (6)

Personality and behavior development: Soul and scientific attitude; positive thinking; integrity, discipline and punctuality; love and kindness; avoid fault thinking, free from anger; dignity of labor

Universal brotherhood and religious tolerance: True friendship, love for truth, happiness vs suffering; aware of self-destructive habits; association and cooperation; doing best for saving nature.

UNIT – IV (6)

Character and competence: Holy books vs blind faith; self-management and good health; science of reincarnation; equality, non-violence, humility, role of women; all religions and same message; mind your mind, self-control, honesty, studying effectively.

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Textbook:

[1] S. K. Chakroborty, *Values and Ethics for organizations: Theory and practice*, New Delhi: Oxford University Press, 2000.

Reference Books:

[1] D. N. Grose, *A text book of Value Education*, New Delhi: Dominant Publishers and Distributors, 2005.
[2] Yogesh Kumar Singh and Ruchika Nath, *Value Education*, New Delhi: A. P. H. Publishing

Corporation, 2005.
[3] S. P. Ruhela, *Human Values and Education*, New Delhi: Sterling Publishers Pvt. Ltd., 1986.
[4] V. Narayan Karan Reddy, *Man, Education and Values,* New Delhi: B. R. Publishing Corporation, 1979.
[5] Bharatwaj Tilak Raj, *Education of Human Values,* New Delhi, 2nd ed., Mittal Publications, 2001.

Course Learning Outcomes (COs):
On completion of this course, students will be able to…
CO1: illustrate social & moral values and inculcate Indian vision of humanism
CO2: develop sense of duty, national unity and love for nature
CO3: utilize positive thinking and develop universal brotherhood
CO4: build character & competence through holy books

Course Articulation Matrix (CAM):P20AC208B VALUE EDUCATION

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20AC208B.1	-	1	-	-	-
CO2	P20AC208B.2	-	2	-	-	-
CO3	P20AC208B.3	-	1	-	-	-
CO4	P20AC208B.4	-	2	-	-	-
P20AC208B		-	1.5	-	-	-

P20AC208CPERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Class:M. Tech. II –Semester

Specialization:SCE, DE, VE, PE, SE, DS, DC & CSP

Teaching Scheme:

L	T	P	C
2	-	-	1

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop students' knowledge on/in…

LO1: holistic development of personality

LO2: accomplishmentof day-to-day responsibilities and to achieve the highest goal

LO3: basic knowledge to maintain a stable mind, pleasing personality and determination

LO4: personality building towards becoming a role model

UNIT – I (6)

Holistic development of personality: Neetisatakam - verses-19, 20, 21, 22(wisdom), verses-29, 31, 32 (pride& heroism), verses-26, 28, 63, 65(virtue), verses-52, 53, 59(don'ts), verses-71, 73, 75, 78(do's).

UNIT – II (6)

Approach to day to day work and duties: Shrimad bhagwad geeta - chapter2-verses 41, 47, 48 chapter3-verses 13, 21, 27, 35; shrimad bhagwad geeta - chapter6-verses 5, 13, 17, 23, 35, chapter18-verses 45, 46, 48.

UNIT – III (6)

Statements of basic knowledge: Shrimad bhagwad geeta - chapter2-verses 56, 62, 68 chapter12-verses 13, 14, 15, 16, 17, 18.

UNIT – IV (6)

Personality of role model: Shrimad bhagwad geeta - chapter 2-verses 17, chapter 3-verses 36, 37, 42 chapter 4-verses 18, 38, 39, chapter 18-verses 37, 38, 63.

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Textbook:

[1] Swami Swarupananda, *Shrimad Bhagavad Geeta*, Advaita Ashram(Publication Department),Kolkata:Printed in Sharada Press, Car Street, Mangalore.

Reference Books:

[1] Prof. Satyavrata Siddhantalankar, *Bhagavad Geeta* , New Delhi: Oriented Publishing

[2] P.Gopinath, *Bhartrihari's Three Satakam (Niti-sringar-vairagya),* New Delhi: Rashtriya Sanskrit Sansthanam

[3] Maharaja Bhadrihari , *Nithishatakam Translated by P.Jwala Dutta Sharma*, Dharm Diwakar Press, Moradabad, 1909, 1st ed. *world.com/section_personality_development.html*

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: build an holistic personality

CO2: develop himself to accomplish his responsibilities and achieve his highest goal in life

CO3: perceive basic knowledge to maintain stable mind, pleasing personality and determination

CO4: originate himself to become a role model thus leading mankind to peace and prosperity

Course Articulation Matrix (CAM): P20AC208CPERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTEMENT SKILLS

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20AC208C.1	2	1	1	-	-
CO2	P20AC208C.2	2	1	1	-	-
CO3	P20AC208C.3	2	1	1	-	-
CO4	P20AC208C.4	2	1	1	-	-
P20AC208C		**2**	**1**	**1**	**-**	-

P20AC208D: DISASTER MANAGEMENT

Class:M. Tech. II –Semester

Specialization:SCE, DE, VE, PE, SE, DS, DC & CSP

Teaching Scheme:

L	T	P	C
2	-	-	1

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on

LO1: disaster management cycle and relation between disaster & development
LO2: risk / vulnerability assessment and reduction strategies
LO3: management strategies, approaches, frameworks and governance
LO4: disaster mitigation aspects and recovery strategies

UNIT – I (6)

Introduction to Disaster: Concepts of hazard, vulnerability & risks; natural and manmade disasters- earthquake, cyclone, floods , volcanoes; famine, displaced populations, industrial & transport accidents; slow and rapid onset disasters - famine, draught , epidemics , air crash, tidal waves & tsunami

Mitigation and Management techniques of Disaster: Basic principles of disasters management, disaster management cycle, political, social, economic impacts of disasters, gender and social issues during disasters, principles of psychosocial issues and recovery during emergency situations, Impact of disaster on development, different stake holders in disaster relief, refugee operations during disasters, human resettlement and rehabilitation issues during and after disasters, intersectoral coordination during disasters, models in disasters

UNIT –II (6)

Disaster Risk and Vulnerability: Introduction to disaster risk and vulnerability, risk analysis techniques, process of risk assessment, analytical systems for risk assessment, natural hazard/ risk assessment, understanding climate risk, mapping of risk assessment, decision making for risk reduction, problems in risk assessment, strategies for risk reduction, community-based risk reduction; observation and perception of vulnerability, vulnerability identification, vulnerability types and dimensions, vulnerability and social and economic factors

Preparedness and Response: Disaster preparedness significance & measures, institutional mechanism for disaster preparedness, disaster preparedness policy & programmes, concept and significance of disaster preparedness plan, community based disaster preparedness plan, prediction, early warnings and safety measures of disaster, resource mobilization, post disaster reliefs & logistics management, emergency support functions and coordination mechanism

UNIT– III (6)

Disaster Management and Governance: Institutional arrangements, disaster management strategies & approaches, Community Based Disaster Preparedness (CBDP) - components, teams, preparedness, linkages with development programmes

Disaster Response in India: Legal framework, National disaster management Act, 2005, institutions for disaster management – NDMA, NIDM, role of government agencies, NCMC committee, crisis management group, need, media, community resilience, social & economic problems, funding mechanism

UNIT - IV (6)

Disaster Risk Mitigation: Background, strengthening, Sendai framework and strengthening disaster risk governance, responsibility matrix.

Disaster Recovery: Scope, approach, recovery process, steps involved in recovery process, early, mid& long-term recovery, reconstruction, coordination–central, state, & private sectors and voluntary organizations, rehabilitation–economical and psychological

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Textbooks:

[1] Manual on *Natural Disaster Management in India*, M C Gupta, NIDM, New Delhi, 2016*(Chapters 1-5,7,9 &10)*

[2] N. G. Dhawan, A. S. Khan, *Disaster Management and Preparedness*, 1st ed., New Delhi: CBS Publication, 2014.*(Chapters 1,2,3,4,6,7,8 &10)*

Reference Books:

[1] Ashok Kumar and Vipul Anekant, *Challenges to internal security of India*, Tata McGraw hill,2020

[2] Larry R. Collins, *Disaster management and Preparedness*, CRC Press, 2004

[3] Tony Moore and Raj Lanka, *Hand book of Disaster and Emergency Management*, 3rd ed., Elsevier, 2006.

[4] R. K. Dave, *Disaster Management in India: Challenges and Strategies*, Prowess Publishing, 2018

[5] M. M. Sulphey, *Disaster Management*, 1st ed., Prentice Hall of India, 2016.

[6] M. Pandey, *Disaster Management*, 1st ed., Wiley India, 2014.

[7] R. B. Singh, *Natural Hazards and Disaster Management: Vulnerability and Mitigation*, Noida: Rawat Publications, 2006

Course Learning Outcomes (COs):

On completion of this course, students will be able to ...

CO1: categorize disasters, analyse the phases of disaster management cycle and relation between disaster & development

CO2: perform risk / vulnerability assessment and devise response & preparedness strategies for risk / vulnerability reduction

CO3: identify the role of government and private agencies involved in disaster assistance

CO4: analyse the mitigation measures and recovery strategies to inculcate a culture of resilience

Course Articulation Matrix (CAM): P20AC208D DISASTER MANAGEMENT

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20AC208D.1	2	1	1	-	-
CO2	P20AC208D.2	2	1	1	-	-
CO3	P20AC208D.3	1	1	-	-	-
CO4	P20AC208D.4	2	1	-	-	-
P20AC208D		**1.75**	**1**	**1**	-	-

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE :: WARANGAL – 15
(An Autonomous Institute under Kakatiya University, Warangal)
SCHEME OF INSTRUCTION & EVALUATION FOR TWO YEAR POSTGRADUATE PROGRAMME

M.Tech. (POWER ELECTRONICS)

SEMESTER-III

PRR-20

S. No.	Course Category	Course Code	Course Title	Hours per Week			Credits	Evaluation Scheme								
								CIE - TA							ESE	Total Marks
								I²RE				Minor	MSE	Total		
				L	T	P		ATLP	CRP	CP	PPT					
1	PE	P20PE301	Professional Elective-V/ MOOC-V	3	-	-	3	8	8	8	6	10	30	60	40	100
2	OE	P20OE302	Open Elective-I/ MOOC-VI	3	-	-	3	8	8	8	6	10	30	60	40	100
3	PROJ	P20PE303	Dissertation *Phase-I* /Industrial Project (*to be continued in IV – semester also as Dissertation Phase-II*)	-	-	18	9	-	-	-	-	-	-	100	-	100
4	PROJ	P20PE304	Internship Evaluation	-	-	2	-	-	-	-	-	-	-	100	-	100
			Total	**6**	**-**	**20**	**15**							**320**	**120**	**400**

Note:

1. *Additional Learning: Students are advised to do MOOCs to bridge the gap in the curriculum, as suggested by the Department Academic Advisory Committee (DAAC). The credits earned by the student through MOOCs will be printed in the semester grade sheet.*

[L= Lecture, T = Tutorials, P = Practicals, C = Credits, ATLP = Assignments, CRP = Course Research Paper, CP = Course Patent, PPT = Course Presentation, Minor=Minor Examination, MSE=Mid Semester Examination and ESE=End Semester Examination]

Professional Elective-V/ MOOCs-V

P20PE301A: Smart Electric Grid
P20PE301B: Advanced Control Strategies for Power Converters and Drives
P20PE301C: Machine Learning
P20PE301D: MOOCs

Open Elective-I/ MOOCs-VI

P20OE302A: Business Analytics
P20OE302B: Industrial Safety
P20OE302C: Operations Research
P20OE302D: Cost Management of Engineering Projects
P20OE302E: Composite Materials
P20OE302F: Waste to Energy
P20OE302H: MOOCs

Total Contact Periods/Week: 26 **Total Credits: 15**

P20PE301A SMART ELECTRIC GRID

Class: M. Tech. III –Semester

Specialization: Power Electronics

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on

LO1: functions of smart grid & its architecture
LO2: tools & techniques for smart grid
LO3: communication technologies in smart grid
LO4: control of smart power grid system

UNIT-I (9)

Introduction to smart grid: Working definitions of smart grid and associated concepts, smart grid functions, traditional power grid and smart grid, new technologies for smart grid, advantages, Indian smart grid, key challenges for smart grid

Smart grid architecture: Components and architecture of smart grid design, review of the proposed architectures for smart grid, fundamental components of smart grid designs, transmission automation, distribution automation, renewable integration

UNIT-II (9)

Tools and techniques for smart grid: Computational techniques, static and dynamic optimization techniques, computational intelligence techniques, evolutionary algorithms, artificial intelligence techniques

UNIT-III (9)

Communication technologies in smart grid: Introduction to communication technology, protocols of communication, wide area measurement systems (WAMS), goals and benefits, components of WAMS, synchrophasor measurement units (PMUs), benefits of using PMU over SCADA, phasor data concentrator (PDC), communication standards and protocols

UNIT-IV (9)

Control of smart power grid system: Load Frequency Control (LFC) in micro grid system, voltage control in micro grid system, reactive power control in smart grid, case studies and test beds for the smart grids

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Textbooks:

[1] Stuart Borlase, *Smart Grids, Infrastructure, Technology and Solutions*, Boca Raton (FL): *CRC Press*,2013.

[2] Gil Masters, *Renewable and Efficient Electric Power System*, Second Edition, New Jersey: Wiley-Electrical & Electronics Engineering Press,2004.

Reference Books:

[1] A.G. Phadke and J.S. Thorp, *Synchronized Phasor Measurements andtheir Applications*, USA: Springer Edition, 2010.

[2] A.B.M Shawakat and Ali, *Smart Grids: Opportunities, Developments, and Trends*, London: Springer-Verlag, 2013.

[3] James Momoh, *Smart Grid: Fundamentals of Design and Analysis*, New Jersey: Wiley-IEEE Press, 2012.

Course Learning Outcomes (COs):

After completion of this course, students will be able to…

CO1: *analyze the features of smart electric grid & its architecture*

CO2: apply the evolutionary algorithms & techniques for SEGs

CO3: analyze communication technologies for SEGs

CO4: *devise strategies to control frequency, voltage and reactive power in SEGs*

Course Articulation Matrix: P20PE301A SMART ELECTRIC GRID

CO		PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	P20PE301A.1	2	1	1	2	1
CO2	P20PE301A.2	2	1	1	2	1
CO3	P20PE301A.3	2	1	1	2	1
CO4	P20PE301A.4	2	1	1	2	1
P20PE301A		**2**	**1**	**1**	**2**	**1**

P20PE301B ADVANCED CONTROL STRATEGIES FOR POWER CONVERTERS AND DRIVES

Class:M. Tech. III –Semester

Specialization:Power Electronics

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives:

This course will develop students' knowledge in/on

LO1: classical control and predictive control methods for power electronics & drives
LO2: model predictive control for three phase inverter & neutral point clamped inverter
LO3: model predictive control for induction & permanent magnet synchronous motors.
LO4: design & implementation issues of model predictive controllers

UNIT – I (9)

Classical Control Methods for Power Converters and Drives: Introduction, classification of power converters, control of power converters and drives, control requirements and challenges, classical current control methods- hysteresis current control, linear control with pulse width modulation, classical electrical drive control methods- field oriented control, direct torque control, importance of predictive control in power electronic applications

UNIT – II (9)

Model Predictive Control for Three-Phase Inverter: Introduction, converter model, load model, discrete-time model for prediction, implementation of the predictive control strategy, comparison to a classical control scheme.

Model Predictive Control for Three-Phase Neutral Point Clamped Inverter-Introduction, system model, linear current control method with pulse width modulation, predictive current control method- reduction of the switching frequency, capacitor voltage balance.

UNIT – III (9)

Model Predictive Control for Induction Machines: Introduction, dynamic model of an induction machine, field-oriented control of an induction machine fed by a matrix converter using predictive current control, predictive torque control of an induction machine fed by a voltage source inverter.

Model Predictive Control for Permanent Magnet Synchronous Motors: Machine modeling, field-oriented control using predictive current control- discrete-time model, control scheme, predictive speed control- discrete-time model control scheme, and rotor speed estimation.

UNIT – IV (9)

Design and Implementation Issues of Model Predictive Control: Cost function selection- actuation constraints -minimization of the switching frequency, minimization of the switching losses, hard constraints, weighting factor design- cost function classification, weighting factors adjustment,

delay compensation- effect of delay due to calculation time, delay compensation method, effect of model parameter errors on model predictive control

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Textbook:

[1] Tobias Geyer, *Model Predictive Control of High Power Converters and Industrial Drives*, New Jersey: John Wiley & Sons, Ltd, 2017.

Reference Books:

[1] Jose Rodriguez and Patricio Cortes Universidad, *Predictive Control of Power Converters and Electrical Drives*, New Jersey: John Wiley & Sons, 2012.

Course Learning Outcomes:

On completion of this course, students will be able to...

CO1: compare classical control methods & model predictive control methods

CO2: apply the knowledge of model predictive control for power converters

CO3: apply model predictive control for the speed/torque control of induction & synchronous motors

CO4: *analyze the issues associated with design & implementation of model predictive controllers*

Course Articulation Matrix: P20PE301B ADVANCED CONTROL STRATEGIES FOR POWER CONVERTERS AND DRIVES

CO		PO1	PO2	PO3	PSO 1	PSO 2
CO1	P20PE301B.1	1	2	2	1	1
CO2	P20PE301B.2	2	1	2	2	1
CO3	P20PE301B.3	2	1	2	2	1
CO4	P20PE301B.4	2	2	2	2	2
P20PE301B		**1.75**	**1.5**	**2**	**1.75**	**1.25**

P20PE301C MACHINE LEARNING

Class:M. Tech. III –Semester

Specialization:Power Electronics

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on…

LO1: supervised learning paradigms of machine learning, & advanced classification techniques

LO2: unsupervised learning paradigms of machine learning, and dimensionality reduction analysis

LO3: machine learning model evaluation & selection, and deep learning techniques

LO4: recent advances in machine learning for energy, power electronics, power transmission lines& internet of things

UNIT- I (9)

Supervised learning: Techniques, regression and classification, basic methods , Bayesian inference and learning, Bayes theorem, inference, Naïve Bayes, linear methods, simple linear regression, multiple linear regression, logistic regression, support vector machines (SVM) , Kernal function – Kernal SVM, gaussian process, ensemble methods – bagging, boosting and gradient boosting, stacking and decision Trees, random forests

UNIT-II (9)

Unsupervised learning: Clustering, k-means and Kernel k-means techniques, Gaussian Mixture Model (GMM), Expectation Maximization (EM), Variational Auto Encoder (VAE), dimensionality reduction: Singular Value Decomposition (SVD), Principal Components Analysis (PCA), Kernel PCA, Independent Component Analysis (ICA), factor analysis

UNIT-III (9)

Machine learning model evaluation & selection: Model evaluation, model selection, and algorithm selection in machine learning, introduction to statistical learning theory

Data representation learning: Traditional feature learning, global feature learning, manifold learning, deep learning: convolutional neural network, convolutional layer, pooling layer, normalization layer, fully connected layer, deep belief networks, recurrent neural networks, long short term memory networks.

UNIT-IV (9)

Recent developments in machine learning (ML): ML for energy systems reliability management, ML based modeling of power electronic converters, ML techniques to classify power transmission line fault types and locations, and ML applications to internet of things (IoT)

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Textbooks:

[1] V.K. Jain, *Machine Learning*, New Delhi: Khanna Book Publishing Co., 2019. (Unit I & II)

[2] Kevin P. Murphy, *Machine Learning: A Probabilistic Perspective*, Cambridge: MIT Press, 2012. (Unit I, II & III)

Reference Books:

[1] Ian Goodfelow, Yoshua Bengio, and Aaron Courville, *Deep Learning*, Cambridge : MIT Press, 2016

[2] Christopher Bishop, *Pattern Recognition and Machine Learning*, Germany: Springer Nature, 2007

[3] E. Alpaydin: *Machine Learning*, Cambridge : MIT Press, 2010

[4] Tom M. Mitchell, *Machine Learning*, New Delhi: McGraw Hill (India) Pvt. Ltd. ISBN 0070428077, 1997

[5] Trevor Hastie, Robert Tibshirani, Jerome Friedman, *The Elements of Statistical Learning*, Germany: Springer Nature, 2009

[6] Vinod Chandra S.S., *Artificial Intelligence & Machine Learning*, New Delhi: PHI Learning Pvt. Ltd., 2014.

[7] Tom M. Mitchell, Jaime G. Carbonell, Ryszard S. Michalski, "*Machine Learning: A Guide to Current Research*", Kluwer Academic Publishers, 2011

Reference Articles:

[1] Raschka S, "*Model Evaluation, Model Selection, and Algorithm Selection in Machine Learning*", 2018, University of Wisconsin–Madison (Unit III)

[2] Bousquet O., Boucheron S., Lugosi G. (2004) *Introduction to Statistical Learning Theory*. In: Bousquet O., von Luxburg U., Rätsch G. (eds) Advanced Lectures on Machine Learning. ML 2003. Lecture Notes in Computer Science, vol 3176. Springer, Berlin, Heidelberg (Unit III)

[3] L. Duchesne, E. Karangelos and L. Wehenkel, "*Recent Developments in Machine Learning for Energy Systems Reliability Management*," in *Proceedings of the IEEE*, vol. 108, no. 9, pp. 1656-1676, Sept. 2020, doi: 10.1109/JPROC.2020.2988715(Unit IV)

[4] H. S. Krishnamoorthy and T. Narayanan Aayer, "*Machine Learning based Modeling of Power Electronic Converters,"2019 IEEE Energy Conversion Congress and Exposition (ECCE),* Baltimore, MD, USA, 2019, pp. 666-672, doi: 10.1109/ECCE.2019.8912608 (Unit IV)

[5] A.N. Hasan, P. S. P. Eboule and B. Twala, "*The use of machine learning techniques to classify power transmission line fault types and locations*,"*2017 International Conference on Optimization of Electrical and Electronic Equipment (OPTIM) & 2017 Intl Aegean Conference on Electrical Machines and Power Electronics (ACEMP),* Brasov, 2017, pp. 221-226, doi: 10.1109/OPTIM.2017.7974974 (Unit IV)

[6] Yue Xu, "*Recent Machine Learning Applications to Internet of Things (IoT)*", [Online] https://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_ml.pdf(Unit IV)

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: analyze supervised learning techniques & paradigms mathematically

CO2: analyze unsupervised learning techniques & paradigms mathematically

CO3: compare and choose appropriate model/algorithm according to the properties of the given inputs & outputs

CO4: extract features that can be used for a particular machine learning approach in various energy, power electronics, power transmission lines&IoT applications

Course Articulation Matrix (CAM): P20PE301C MACHINE LEARNING

CO		PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	P20PE301C.1	2	1	1	1	2
CO2	P20PE301C.2	2	1	1	1	2
CO3	P20PE301C.3	2	1	1	1	2
CO4	P20PE301C.4	2	1	2	1	2
P20PE301C		**2**	**1**	**1.25**	**1**	**2**

P20OE302A BUSINESS ANALYTICS

Class: M. Tech., III –Semester

Specialization: SCE, DE, VE, PE, SE, DS, DC & CSP

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on

LO1: fundamental concepts of business analytics and descriptive analytics
LO2: data collection and data visualization methods
LO3: text analysis and simulation methods in business analytics
LO4: social media, web and health care analytics

UNIT-I (9)

Introduction to Business Analytics: Introduction to business analytics, why analytics, business analytics: the science of data-driven decision making, business context, technology data science, descriptive analytics, predictive analytics, prescriptive analytics descriptive, predictive, and prescriptive analytics techniques, big data analytics, web and social media analytics, machine learning algorithms, framework for data-driven decision making, analytics capability building, roadmap for analytics capability building, challenges in data-driven decision making and future

Descriptive Analytics: Introduction to descriptive analytics, data types and scale, structured and unstructured data, cross-sectional, time series, and panel data, types of data measurement scales, population and sample, measures of central tendency, percentile, decile, and quartile, measures of variation

UNIT-II (9)

Data Collection: Introduction, the value of data, data collection preliminaries, data collection methods, data types, problem formulation preliminaries, challenges in data collection, data collation, validation and presentation, data collection in the retailing industry

Data Visualization: Introduction, motivating example, methods of data visualization, software and data visualization

UNIT-III (9)

Text Analytics: Introduction, motivating text analysis, methods of text analysis, natural language processing

Simulation: Introduction, motivating examples, simulation modeling method and case studies

UNIT-IV (9)

Applications of Business Analytics: Introduction, what is social media and web analytics, display advertising in real time, A/B experiments for measuring value of digital media and handling e-retailing challenges, strategies for mobile devices, the future of social media analytics

Health Care Analytics: Introduction, methods of health care analytics

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Textbooks:

[1] U Dinesh Kumar, *Business Analytics: The Science of Data-Driven Decision Making*, 1st ed., 2017. (Units-I)

[2] Bhimasankam Pochiraju, Sridhar S, *Essentials of Business Analytics: A Textbook*,1st ed. Springer Nature Switzerland, 2019. (Units-II, III, IV).

Reference Books:

[1] R N Prasad, Seema Acharya, *Fundamentals of Business analytics: Big Data*, 2nd ed. Wiley Publications, 2017.

[2] Foster Provest, Tom Fawcett, *Data Science for Business*, 1st ed. USA: O'Reilly, 2013.

Course Learning Outcomes (COs):

On completion of this course, the students will be able to

CO1: describe the concepts of business analytics and descriptive analytics

CO2: apply the data collection and data visualization methods in business analytics

CO3: categorize text analysis and simulation methods in business analytics

CO4: apply social media & web analytics and health care analytics in real world problems

Course Articulation Matrix: P20OE302A BUSINESS ANALYTICS							
CO		**PO1**	**PO2**	**PO3**	**PSO1**	**PSO2**	**PSO3**
CO1	P20OE302A.1	-	-	-	-	-	-
CO2	P20OE302A.2	1	1	-	-	-	-
CO3	P20OE302A.3	1	1	-	-	-	-
CO4	P20OE302A.4	2	2	-	-	-	-
P20OE302A		**1.33**	**1.33**	-	-	-	-

P20OE302B INDUSTRIAL SAFETY

Class: M. Tech. III –Semester

Specialization(s): SCE, DE, VE, PE, SE, DS, DC & CSP

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on

LO1: need for safety in industries

LO2: fundamentals of maintenance engineering

LO3: causes for wear& corrosion and method of lubrication

LO4: faults tracing in equipment and importance of preventative maintenance

UNIT –I (9)

Industrial Safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948; for health and safety, washrooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels etc., safety color codes, fire prevention and firefighting, equipment and methods.

UNIT –II (9)

Fundamentals of Maintenance Engineering: Definition and aim of maintenance engineering, primary and secondary functions and responsibility of maintenance department, types of maintenance, types and applications of tools used for maintenance, maintenance cost & its relation with replacement economy, service life of equipment.

UNIT –III (9)

Prevention of Wear and Corrosion: Wear- types, causes, effects, wear reduction methods, lubricants; types and applications, lubrication methods, general sketch, working and applications- screw down grease cup, pressure grease gun, splash lubrication, gravity lubrication, wick feed lubrication, side feed lubrication, ring lubrication, definition, principle and factors affecting the corrosion, types of corrosion, corrosion prevention methods.

UNIT –IV(9)

Fault tracing and Preventative maintenance : Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment - machine tool, pump, air compressor, internal combustion engine, boiler, electrical motors, types of faults in machine tools and their general causes, periodic and preventative maintenance; advantages of preventative maintenance, Repair cycle importance.

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Textbooks:

[1] John Ridley and John Channing., *Safety at work*, 6th ed., UK: Elsevier Butterworth-Heinemann,2003.[Unit 1& Unit 2] chapter [2,3,5,6,7,8]

[2] Amit Gupta., *Industrial Safety and environment*, Laxmi Publications (P) LTD., New Delhi., 2006., 1973., [Unit3 & Unit 4] chapters [10,11,12,13,14,15,16,17]

Reference Books:

[1] R. Keith Mobley Editor, Lindley R. Higgins Darrin J. Wikoff., *Maintenance Engineering Handbook*, 7th ed., New York: Mc Graw Hill International, 2008

[2] Mohammed Ben–Daya.,UdayKumar., Prabhakar Murthy D.N., *Introduction to Maintenance Engineering*, New Delhi: Wiley India Pvt. Ltd., 2016.

Course Learning Outcomes (COs):

Upon completion of this course, students will be able to….

CO1: summarize the principles of industrial safety and maintenance

CO2: describe the functions of maintenance department and list the types of maintenance & tools used for maintenance

CO3: identify the causes for wear ,tear& corrosion and suitable lubrication method for a given application

CO4: describe the significance of decision-tree and apply it for problems in equipment to detect and classify the faults and need of preventative maintenance

Course Articulation Matrix (CAM) : P20OE302B INDUSTRIAL SAFERTY

COs		PO1	PO2	PO3	PSO 1	PSO 2
CO1	P20OE302B.1	1	1	1	-	-
CO2	P20OE302B.2	1	1	1	-	-
CO3	P20OE30B.3	1	1	1	-	-
CO4	P20OE302B.4	1	1	1	-	-
P20OE302B		**1**	**1**	**1**	**-**	-

P20OE302C OPERATIONS RESEARCH

Class:M. Tech. III –Semester

Specialization(s):SCE, DE, VE, PE, SE, DS, DC & CSP

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on

LO1: linear programming problems
LO2: non linear optimization problem
LO3: sequencing, scheduling and network model
LO4: decision making theory and queuing models

UNIT – I (9)

Linear Programming Problem (LPP): Mathematical formulation of LPP, solution of linear programming problems-simplex method, artificial variable technique, duality in LPP and dual simplex method; sensitivity analysis.

UNIT –II (9)

Non-Linear Programming Problem (NLPP): Classification of NLPP, unconstrained optimization techniques- iterative methods - random search methods, steepest decent method, conjugate gradient method, Fibonacci method and golden section method.

Constrained Optimization Techniques-- Lagrange's method and Kuhn-Tuckermethod.

UNIT– III (9)

Sequencing and Scheduling: Sequencing and scheduling of n jobs one, two and three machine problems, scheduling of *'n'* jobs through k machines problem.

Project Network: Network construction-CPM and PERT; resource analysis in network problems.

UNIT - IV (9)

Decision Analysis and Game Theory: Introduction, decisions under uncertainty- Laplace criterion, max-min criterion, savage criterion and Hurwitz criterion; game theory-introduction, two person zero sum games and the maximin-minimax principle; mixed strategy games- graphical method and linear programming method, dominance property.

Queuing Theory-Elements and operating characteristics of a queuing system, Poisson queuing systems, study of single server queuing model with infinite capacity.

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Textbooks:

[1] Kanti swarup, P.K.Gupta, Man Mohan, *Operations Research,* 16th edn., New Delhi: S. Chand & Sons, 2013. (Chapters: 2, 4, 5, 6, 12, 16, 17, 21, 25, 27)

[2] S.S. Rao,*Optimization Techniques*, 3rd edn., New Delhi: New Age International, 2013. (Chapters: 6)

Reference Book(s):

[1] H.A. Taha, *Operations Research an Introduction,* 6th Edn., New Delhi: Prentice Hall of India, 2006
[2] N.D Vohra, *Quantitative Techniques in Management*, 3rd edn, New Delhi: TMH, 2010

Course Learning Outcomes (COs):

On completion of this course, students will be able to ...

CO1: model engineering real time problems and solve them using various LPP techniques
CO1: optimize the engineering problems using NLPP methods
CO2: apply the tools and techniques to solve sequencing and scheduling problems and project network models
CO3: analyze conflicting situations using game theory and solve various queuing model parameters

Course Articulation Matrix (CAM): P20OE302C OPERATIONS RESEARCH

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20OE302C.1	2	1	1	-	-
CO2	P20OE302C.2	2	1	1	-	-
CO3	P20OE302C.3	2	1	1	-	-
CO4	P20OE302C.4	2	1	1	-	-
P20OE302C		**2**	**1**	**1**	-	-

P20OE302D COST MANAGEMENT OF ENGINEERING PROJECTS

Class:M. Tech. III –Semester

Specialization(s):SCE, DE, VE, PE, SE, DS, DC & CSP

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on

LO1: cost concepts, objectives of costing system, project management
LO2: standard costing, cost control and reduction
LO3: cost behavior, profit planning and types of budgets
LO4: quantitative techniques for cost management

UNIT-I (9)

Overview of Cost Accounting: Cost concepts in decision making, objectives of a costing system, different costs of projects - relevant cost, differential cost, incremental cost, opportunity cost, activity-based costing

Project: Meaning, types of projects, benefits of project management, project life cycle

UNIT-II (9)

Standard Costing: Meaning, advantages and limitations, standard costing in manufacturing and process industries, standard costing and standardized costing, standard cost and estimated cost

Cost Control and Reduction: Cost control meaning, distinction between cost control and cost reduction, advantages and disadvantages of cost control and cost reduction, cost control techniques, essential for success of cost controls and cost reduction programme, areas of cost reduction, tools and techniques of cost reduction

UNIT-III (9)

Cost Behavior and Profit Planning: Marginal cost, absorption cost, break-even analysis, cost-volume-profit (CVP) analysis, profit-volume (PV) ratio, sales ratio, margin of safety

Budgets: Budgetary control, flexible budget, performance based budgets, zero based budgets

UNIT-IV (9)

Quantitative Techniques for Cost Management: linear programming problems (LPP includes graphic method and simplex method), transportation problems, assignment problems

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Textbooks:

[1] S.P. Jain, K.L.Narang, *Advanced Cost Accounting*, New Delhi: Kalyani Publishers, 2014 (Chapter 7, 10,11 13, 14, 16 &27)

[2] N.D. Vohra, *Quantitative Techniques in Management*, 3rd ed. New Delhi: Tata McGraw Hill Book Co. Ltd. 2007 (Chapter 2,3, 5 and 6)

Reference Books:

[1] Ashish K. Bhattacharya, *Principles & Practices of Cost Accounting*, 3rd ed. New Delhi: Prentice Hall India Learning Private Limited, 2004.

[2] Harold Kerzner, *Project Management: A systems approach to Planning, Scheduling and Controlling,* 10th ed.New Delhi: John Wiley & Sons Inc., 2009.
[3] V K Kapoor, *Operations Research,* New Delhi: Sultan Chand & Sons, 2013.
[4] Charles T. Horngren and George Foster, *Cost Accounting A Managerial Emphasis*, New Delhi: Prentice Hall of India, 1991.

Course Learning Outcomes (COs):

Upon completion of this course, the student will be able to…

CO1: interpret overview of cost accounting and project management
CO2: distinguish standard costing in manufacturing and process industries, estimate cost control and reduction
CO3: estimate cost behavior, profit planning and budget
CO4: apply quantitative techniques for linear programming, transportation and assignment problems

Course Articulation Matrix (CAM): P20OE302DCOST MANAGEMENT OF ENGINEERING PROJECTS

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20OE302D.1	1	1	1	-	-
CO2	P20OE302D.2	1	1	1	-	-
CO3	P20OE302D.3	2	1	1	-	-
CO4	P20OE302D.4	2	1	1	-	-
P20OE302D		**1.5**	**1**	**1**	-	-

P20OE302E COMPOSITE MATERIALS

Class:M. Tech. III –Semester

Specialization(s):SCE, DE, VE, PE, SE, DS, DC & CSP

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on…

LO1: composite material properties and applications
LO2: properties and applications of fibers and rule of mixture
LO3: manufacturing and applications of metal matrix, ceramic matrix and carbon-carbon composites
LO4: polymer matrix composites, manufacturing and applications

UNIT- I (9)

Composite Materials: Definition, classification, characteristics, advantages, applications, functional requirements of reinforcement and matrix, effect of reinforcement on composite performance - size, shape, distribution and volume fraction.

UNIT-II (9)

Reinforcements: Preparation - layup, curing, fibers-glass, carbon, Kevlar, boron, properties and applications- fibers, whiskers, particle reinforcements, mechanical behavior of composites, rule of mixtures, inverse rule of mixtures, isostrain and isostress conditions.

UNIT-III (9)

Manufacturing of Metal Matrix Composites: Casting – solid state diffusion technique, cladding – hot isostatic pressing, properties and applications.

Manufacturing of Ceramic Matrix Composites: Liquid metal infiltration – liquid phase sintering, properties and applications.

Manufacturing of Carbon/carbon Composites: Knitting, braiding, weaving; properties and applications.

UNIT-IV (9)

Manufacturing of Polymer Matrix Composites: Preparation of molding compounds and prepregs, manufacturing of polymer matrix composites - hand layup, autoclave, filament winding, compression molding and reaction injection molding, properties and applications.

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Textbook:

[1] Chawla K.K., *Composite Materials*, 4th ed., New York: Springer, Verlag, 2019. (*Chapters 1, 2, 5, 6, 7 & 8*)

Reference Books:

[1] Agarwal, B.D. and Broutman, L. J., *Analysis and Performance of Fiber Composites*, 4th ed., USA: John Wiley & Sons, 2017.
[2] Strong A.B., *Fundamentals of Composite Manufacturing*, 2nded., SME, 2007.
[3] Sharma S.C., *Composite materials*, 1sted., New Delhi: Narosa Publications, 2000.

[4] Mathews F.L. and Rawlings R.D., *Composite materials: Engineering and Science*‖, 1st ed., England: Chapman and Hall, 1994.
[5] Krishnan K., Chawla *Composite Materials Science and Engineering*, India: Springer Private Limited, 2009.
[6] P.K. Mallick, *Fiber Reinforced Composite materials, Manufacturing and Design*, New York: CRC Press, Taylor and Francis Group, 2010.

Course Learning Outcomes (COs):
On completion of this course, students will be able to…
CO1: *classify composite materials and explain their applications*
CO2: *outline properties and applications of reinforcements.*
CO3: *categorize manufacturing methods for metal matrix composite, ceramic matrix composite, carbon/carbon composite and their properties.*
CO4: *compare manufacturing methods of polymer matrix composites.*

Course Articulation Matrix (CAM) P20OE302E COMPOSITE MATERIALS

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	20OE302E.1	1	1	1	-	-
CO2	20OE302E 2	1	1	1	-	-
CO3	20OE302E.3	1	1	1	-	-
CO4	20OE302E.4	1	1	1	-	-
P20OE302E		**1**	**1**	**1**	**-**	-

P20OE302F WASTE TO ENERGY

Class:M. Tech. III –Semester

Specialization(s):SCE, DE, VE, PE, SE, DS, DC & CSP

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop students' knowledge on/in…

LO1: concept of waste to energy
LO2: production of energy form waste.
LO3: technologies for waste to energy.
LO4: standards for waste to energy plants and carbon credits.

UNIT – I (9)

Introduction: Principles of waste management and waste utilization, waste management hierarchy and 3R principle of reduce, reuse and recycle, waste as a resource and alternate energy source

Waste Sources and Characterization: Waste production in different sectors such as domestic, industry and agriculture, classification of waste – agro based, forest residues, domestic waste, industrial waste (hazardous and non-hazardous), characterization of waste for energy utilization

UNIT – II (9)

Technologies for Waste to Energy: Biochemical conversion – energy production from organic waste through anaerobic digestion and fermentation, thermo-chemical conversion – combustion, incineration and heat recovery, pyrolysis, gasification, plasma arc technology

Waste to Energy Options: Landfill gas, collection and recovery, refuse derived fuel (RDF) – fluff, briquettes, pellet, alternate fuel resource (AFR) – production and use in cement plants, thermal power plants and industrial boilers, conversion of wastes to fuel resources for other useful energy applications, energy from plastic wastes – non-recyclable plastic waste for energy recovery, energy recovery from wastes and optimization of its use, benchmarking and standardization, energy analysis

UNIT – III (9)

Energy production: Waste activities – collection, segregation, transportation and storage requirements, location and siting of 'waste to energy' plants, industry specific applications – in-house use – sugar, distillery, pharmaceuticals, pulp and paper, refinery and petrochemical industry

Centralized and Decentralized Waste to Energy Plants: Centralized and decentralized energy production, distribution and use, comparison of centralized and decentralized systems and its operations

UNIT-IV (9)

Waste to Energy & Environmental Implications: Environmental standards for waste to energy plant operations and gas clean-up, savings on non-renewable fuel resources

Carbon Credits: carbon foot print calculations and carbon credits transfer mechanisms

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Textbooks:

[1] *Waste to Resources: A Waste Management Handbook*, NewDelhi: TERI Press,2014. (Unit – I, III & IV)

[2] Sunil Pandey, *Industrial and Urban Waste Management in India*, New Delhi: TERI Press, 2015 (Unit –II)

Reference Books:

[1] Banwari Lal and Patwardhan ,*Wealth from Waste: Trends and Technologies*, New Delhi :TERI Press, 2014.

[2] S.N Mukhopadhyay, *Fundamentals of waste and Environmental Engineering*, New Delhi: TERI Press, 2016.

[3] Gazette Notification on Waste Management Rules 2016.

[4] CPCB Guidelines for Co-processing in Cement/Power/Steel Industry.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: outline the operations of waste sources and alternate energy sources

CO2: adopt waste to energy technologies

CO3: list the stages of waste to energy production

CO4: appraise environmental standards and estimate carbon foot print

Course Articulation Matrix: P20OE302F WASTE TO ENERGY

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20OE302F.1	1	1	1	-	-
CO2	P20OE302F.2	1	1	1	-	-
CO3	P20OE302F.3	1	1	1	-	-
CO4	P20OE302F.4	1	1	1	-	-
P20OE302F		1	1	1	-	-

P20PE303 DISSERTATION PHASE-I /INDUSTRIAL PROJECT

Class:M. Tech. III –Semester

Specialization: Power Electronics

Teaching Scheme:

L	T	P	C
-	-	18	9

Examination Scheme:

Continuous Internal Evaluation	100
End Semester Examination	-

Course LearningObjectives (LOs):

This course will develop students' knowledge on /in…

LO1: selecting problem-based Dissertation title in one of the areas of specialization
LO2: literature review and well-documented report writing
LO3: effective technical presentation skills with creating PPTs and speaking with technical knowledge
LO4: creating video pitch

Registration Presentation: The Registration Dissertation Presentation shall include a brief report and presentation focusing the identified topic, literature review, time schedule indicating the main tasks, and expected outcome.

Progress Presentation-I: At the end of first stage (third semester), student shall be required to submit a preliminary report of work done for evaluation to the project coordinator and present the same before the *Department Post Graduate Review Committee* (DPGRC).

Evaluation for Dissertation / Industrial Project:

Dissertation work shall be normally conducted in two stages: Dissertation *Phase-I* in third semester and Dissertation *Phase-II* in fourth semester.

Dissertation *Phase-I*:

(i) The Department *Post Graduate Review Committee (DPGRC)* shall be constituted with HoD as a Chairman, M.Tech. Coordinator as a Convener and three to five other faculty members representing various specializations in that particular programme as members.

(ii) (a) Student shall take up independent Dissertation Phase-I on innovative ideas, innovative solutions to common problems using their knowledge relevant to courses offered in their programme of study, which would supplement and complement the program assigned to each student

(or)

(b) Student shall take up industrial project (in any industry) relevant to the courses offered in their programme of study, which would supplement and complement the program assigned to each student

(iii) DPGRC shall allot a faculty supervisor to each student for guiding on
(a) Selection of topic
(b) Literature survey and 50% work to be carried out during phase-I
(c) Preparing a report in proper format
(d) Effective oral presentation on dissertation phase-I before the DPGRC
(e) Right conduct of research and academic activity to promote academic integrity
(f) Use of anti-plagiarism software to detect plagiarism in the report and submission of dissertation report within acceptable plagiarism levels

(iv) In case of students with industrial projects, internal guide shall be there to track the progress from time to time

(v) There shall be only Continuous Internal Evaluation (CIE) for Dissertation Phase-I

(vi) CIE for the Dissertation Phase-I in third semester is as follows:

Assessment	Weightage
Dissertation Phase-I Supervisor Assessment	**50%**
DPGRC Assessment: *(i) Registration Presentation* ***(10%)*** *(ii) Progress Report on Phase-I* ***(10%)*** *(iii) Video pitch on Phase-I* ***(10%)*** *(iv) Progress Presentation -I and viva voce* ***(20%)***	**50%**
Total Weightage:	**100%**

Note: It is mandatory for the student to
(i) appear for progress presentation -I and viva voceto qualify for course evaluation
(ii) create a good video pitch on dissertation phase-I

(a) **Dissertation Topic:** The topic should be interesting and conducive to discussion. Topics may be found by looking through recent issues of peer reviewed Journals/Technical Magazines on the topics of potential interest
(b) **Working Model:** Each student is required to develop a working model/ process/software package/system, on the chosen work and demonstrate before the DPGRC as per the dates specified by DPGRC at the end of dissertation phase-II
(c) **Progress Report:** Each student is required to submit a well-documented progress report on dissertation phase-I as per format specified by DPGRC

(vii) The student has to register for the Dissertation Phase-I as supplementary examination in the following cases:
(a) he/she is absent for oral presentation and viva-voce
(b) he/she fails to submit the report in prescribed format
(c) he/she fails to fulfill the requirements of Dissertation Phase-I evaluation as per specified guidelines

(viii) (a) The CoE shall send a list of students registered for supplementary to the HoD concerned
(b) The DPGRC, duly constituted by the HoD, shall conduct Dissertation Phase-I evaluation and send the award list to the CoE within the stipulated time

Course Learning Outcomes (COs):
On completion of this course, students will be able to…
CO1: select current topics in their specialization and allied areas from peer reviewed journals / technical magazines/ conference proceedings
CO2: demonstrate the skills for performing literature survey, identify gaps, analyze the technical content and prepare a well-documented Dissertation report
CO3: create informative PPTs with effective oral presentation, showing knowledge on the subject and sensitivity towards social impact of the Dissertation
CO4: demonstrate Dissertation through effective video pitch

Course Articulation Matrix (CAM): P20PE303DISSERTATION PHASE-I /INDUSTRIAL PROJECT

CO		PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	P20PE303.1	2	-	2	2	2
CO2	P20PE303.2	2	-	2	2	2
CO3	P20PE303.3	-	2	-	1	1
CO4	P20PE303.4	-	2	-	1	1
P20PE303		**2**	**2**	**2**	**1.5**	**1.5**

P20PE304 INTERNSHIP EVALUATION

Class:M. Tech. III –Semester

Specialization: Power Electronics

Teaching Scheme:

L	T	P	C
-	-	2	-

Examination Scheme:

Continuous Internal Evaluation	100
End Semester Examination	-

Course LearningObjectives (LOs):

This course will develop students' knowledge on /in…

LO1: selection of internship in one of the areas of course specialization

LO2: practical and real time subject application

LO3: writing well-documented report

LO4: effective technical presentation skills with creating PPTs

Guidelines for Internship:

(1) The students shall undergo 6-8 weeks internship during summer/winter vacation at industry/R&D organization / Academic Institutes like IITs & NITs.

(2) The students preferably shall undergo internship at one organization only. In case of any difficulty, the stipulated period of internship shall be completed at different organizations with minimum of two weeks internship at every stage.

(3) The internship evaluation shall be done in the III semester of study and hence the students shall complete the prescribed period of internship before start of III semester (from end of I semester to commencement of III semester).

(4) The internship evaluation shall be done by *Department Post Graduate Evaluation Committee (DPGRC)*.

Evaluation for Internship:

There shall be only Continuous Internal Evaluation (CIE) for Internship Evaluation

(i) CIE for the Internship in third semester is as follows:

Assessment	Weightage
Internship Supervisor's Evaluation: *a) Completion of Internship Assignment* ***(10%)*** *b) Quality of work in completing the Internship Assignment* ***(10%)*** c) *Attendance, punctuality and work hours* ***(10%)***	***30%***
DPGRC Assessment: *a) Duration (8 /6 weeks)* ***(15% / 10%)*** *b) Internship Report* ***(35%)*** *c) Oral Presentation (with PPT) and viva voce* ***(20%)***	***70%***
Total Weightage:	***100%***

Note: It is mandatory for the student to

(i) appear for oral presentation (with PPT) and viva voceto qualify for course evaluation

(a) Internship Report: Each student is required to submit a well-documented internship report as per format specified by DPGRC

(b) Anti-Plagiarism Check: The internship report should clear plagiarism check as per the Anti-Plagiarism policy of the institute

(c) Presentation: Each student should prepare PPT with informative slides and make an effective oral presentation before the DPGRCas per the schedule notified by thedepartment

(ii) The student has to register for the Internship as supplementary examination in the following cases:

(a) he/she is absent for oral presentation and viva-voce
(b) he/she fails to submit the report in prescribed format
(c) he/she fails to fulfill the requirements of Internship evaluation as per specified guidelines

(iii) (a) The CoE shall send a list of students registered for supplementary to the HoD concerned

(b) The DPGRC, duly constituted by the HoD, shall conduct Internship evaluation and send the award list to the CoE within the stipulated time

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: learn new concepts and apply them to the solution of engineering problems
CO2: function effectively on multidisciplinary teams and interface with other areas of organization
CO3: clearly communicate their ideas in writing and prepare a well-documented internship report
CO4: create informative PPTs and clearly communicate their ideas orally demonstrating technical knowledge

Course Articulation Matrix (CAM): P20PE304INTERNSHIP EVALUATION

CO		PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	P20PE304.1	2	-	2	2	2
CO2	P20PE304.2	2	-	2	2	2
CO3	P20PE304.3	-	2	-	1	1
CO4	P20PE304.4	-	2	-	1	1
P20PE303		**2**	**2**	**2**	**1.5**	**1.5**

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE :: WARANGAL – 15
(An Autonomous Institute under Kakatiya University, Warangal)
SCHEME OF INSTRUCTION & EVALUATION FOR TWO YEAR POSTGRADUATE PROGRAMME

PRR-20

M.Tech. (POWER ELECTRONICS)

SEMESTER-IV

S. No.	Course Category	Course Code	Course Title	Hours per Week			Credits	Evaluation Scheme								
								CIE - TA							ESE	Total Marks
								I²RE				Minor	MSE	Total		
				L	T	P		ATLP	CRP	CP	PPT					
1	PROJ	P20PE401	Dissertation *Phase-II*	-	-	30	15	-	-	-	-	-	-	60	40	100
Total				**-**	**-**	**30**	**15**	**60**							**40**	**100**

[L= Lecture, T = Tutorials, P = Practicals, C = Credits, ATLP = Assignments, CRP = Course Research Paper, CP = Course Patent, PPT = Course Presentation, Minor=Minor Examination, MSE=Mid Semester Examination and ESE=End Semester Examination]

Total Contact Periods/Week: 30 **Total Credits: 15**

P20PE401 DISSERTATION PHASE-II

Class:M. Tech. IV –Semester

Specialization: Power Electronics

Teaching Scheme:

L	T	P	C
-	-	30	15

Examination Scheme:

Continuous Internal Evaluation	60
End Semester Examination	40

Course Learning Objectives (LOs):

This course will develop students' knowledge on/in…

CO1: recognize and formulate a problem to analyze, synthesize, evaluate, simulate and create a their project
CO2: design an innovative product by applying current knowledge and adopt to emerging applications of engineering and technology
CO3: creating PPTs and effective technical presentation and knowledge skills
CO4: writing technical paper in scientific journal style & format

Progress Presentation -II shall be conducted during the 5th /6th week of IV semester.
Progress Presentation -III shall be conducted during the 12th /13th week of IV semester.

Evaluation for Dissertation Work:

Dissertation *Phase-II*:

(i) Student has to continue the Dissertation work in 4th semester as Dissertation Phase-II

(ii) There shall be Continuous Internal Evaluation (CIE) for 60 marks and End Semester Examination for 40 marks.

(iii) The evaluation for Dissertation Phase-II is as follows:

Assessment	Weightage
Dissertation Supervisor Assessment (10%) *DPGRC* Assessment: *(i) Progress Presentation -II (10%)* *(ii) Progress Presentation -III (10%)* *(iii) Working model/process/software package/system developed (10%)* *(iv) Dissertation Video pitch (10%)* *(v) Dissertation Paper (10%)*	**60%**
End Semester Examination: *(i) Dissertation Report (20%)* *(ii) Oral presentation with PPT and viva-voce (20%)*	**40%**
Total Weightage	**100%**

Note: It is mandatory for the student to

(i) appear for oral presentation (with PPT) and viva-voce to qualify for course evaluation

(ii) write dissertation paper in given journal format

(ii) create a good video pitch on dissertation phase-I & II

(a) **Working Model:** Each student is required to develop a working model/ process/system on the chosen work and demonstrate before the DPGRC as per the dates specified by DPGRC at the end of dissertation phase-II

(b) **Dissertation Report:** Each student is required to submit a well-documented dissertation report as per the format specified by DPGRC

(c) **Anti-Plagiarism Check:** The dissertation report should clear plagiarism check as per the Anti-Plagiarism policy of the institute

(d) **Presentation:** Each student should prepare PPT with informative slides and make an effective oral presentation before the DPGRC as per the schedule notified by the department

(e) **Video Pitch:** Each student should create a pitch video, which is a video presentation on his / her dissertation Phase-I & II. Video pitch should be no longer than 5 minutes by keeping the pitch concise and to the point, which shall also include key points about his / her business idea / plan (if any) and social impact

(iv) **Dissertation Synopsis Presentation (DSP):**

(a) Students, with the consent of supervisor, shall apply to the DPGRC for conduct of dissertation synopsis presentation (DSP). This shall normally happen when the supervisor feels that the student has done significant work to qualify for M.Tech. dissertation.

(b) Those students who clear DSP shall only be allowed to submit the dissertation report for end semester examination

(v) **Dissertation Report:**

After clearing DSP, student shall be required to submit two bound copies of dissertation report, one for the department and other for the Dissertation Supervisor. The Dissertation report shall be evaluated by the DPGRC and external examination shall be conducted on a pre-notified date.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: apply knowledge to practice to design & conduct experiments and utilize modern tools for developing working models / process / system leading to innovation and entrepreneurship

CO2: design the hardware/software to demonstrate the principle of working to correlate the analytical simulation and experimental results

CO3: create informative PPT and demonstrate communication skills through effective oral presentation showing knowledge on the subject and sensitivity towards social impact of the Dissertation

CO4: write a "Dissertation paper" in scientific journal style and format from the prepared Dissertation report and create a video pitch on Dissertation

Course Articulation Matrix (CAM): P20PE401DISSERTATION PHASE-II

CO		PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	P20PE401.1	2	-	2	2	2
CO2	P20PE401.2	2	-	2	2	2
CO3	P20PE401.3	-	2	-	1	1
CO4	P20PE401.4	-	2	-	1	1
P20PE401		**2**	**2**	**2**	**1.5**	**1.5**

COURSE CREDIT STRUCTURE COURSE WEIGHTAGE

Semester	PRR-20 Curriculum	As per Model Curriculum
I	19	18
II	19	18
III	15	16
IV	15	16
Total:	**68**	**68**

Courses	% Weightage of Courses
Professional Theory	42.85 % (9/21)
Professional Lab	38.1 % (8/21)
Other	19.05 % (4/21)
Total:	**100 % (21/21)**

SEMESTER vs COURSE CATEGORY WEIGHTAGE

Number of Courses / Number of Credits (*Course Category wise*)

Semester	MC	PC	PE	OE	PROJ	AC	TOTAL
I	1/2	4/10	2/6	-	-	1/1	**8/19**
II	-	4/10	2/6	-	1/2	1/1	**8/19**
III	-	-	1/3	1/3	2/9	-	**4/15**
IV	-	-	-	-	1/15	-	**1/15**
Total	**1/2**	**8/20**	**5/15**	**1/3**	**4/26**	**2/2**	**21/68**
% Weightage of Course Category	**2.94 % (2/68)**	**29.41 % (20/68)**	**22.05 % (15/68)**	**4.41 % (3/68)**	**38.23 % (26/68)**	**2.94 % (2/68)**	**100 % (68/68)**