R19

COURSE STRUCTURE AND SYLLABUS

For

B.Tech

ELECTRICAL AND ELECTRONICS ENGINEERING

(*Applicable for batches admitted from 2019-20*)

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Permanently Affiliated to JNTUK, Kakinada, Accredited by NAAC with "A" Grade
Recognized by UGC 2(f) and 12(b) under UGC act, 1956
1-378, ADB Road, Surampalem – 533 437
Near Peddapuram, E.G.Dist, Andhra Pradesh

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

Semester – 0
3 weeks Induction Program to be conducted at the beginning of First year

Zero Semester

Induction program (mandatory)	**3 weeks duration**
Induction program for students to be offered right at the start of the first year.	• Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch and Innovations

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Precious little is done by most of the institutions, except for an orientation program lasting a couple of days. We propose a 3-week long induction program for the UG students entering the institution, right at the start. Normal classes start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.2 The time during the Induction Program is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it. The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

I Year – I Semester

S. No.	Course Category	Course Code	Course Title	L	T	P	C
1	Humanities and Social Sciences	19HE1T01	Professional Communicative English	3	--	--	3
2	Basic Sciences	19BM1T01	Linear Algebra and Differential Equations	3	--	--	3
3	Basic Sciences	19BM1T02	Numerical Methods and Multivariable Calculus	3	--	--	3
4	Basic Sciences	19BC1T02	Applied Chemistry	3	--	--	3
5	Engineering Sciences	19CS1T01	Programming for Problem Solving using C	3	--	--	3
6	Basic Sciences	19BC1L02	Applied Chemistry Laboratory	--	--	3	1.5
7	Humanities and Social Sciences	19HE1L01	Professional Communicative English Laboratory- I	--	--	3	1.5
8	Engineering Sciences	19CS1L01	Programming for Problem Solving using C Laboratory	--	--	3	1.5
9	Mandatory Courses	19HM1T07	Professional Ethics and Human Values	2	--	--	0
Total Credits							**19.5**

I Year – II Semester

S. No.	Course Category	Course Code	Course Title	L	T	P	C
1	Basic Sciences	19BM2T03	Integral Transforms and Vector Calculus	3	--	--	3
2	Basic Sciences	19BP2T02	Applied Physics	3	--	--	3
3	Engineering Sciences	19EE2T03	Electrical Circuit Analysis-I	3	--	--	3
4	Engineering Sciences	19CS2T02	Fundamentals of Computer Science	3	--	--	3
5	Engineering Sciences	19EC2T03	Basic Electronic Devices and Circuits	3	--	--	3
6	Engineering Sciences	19ME2T01	Engineering Drawing	1	--	3	2.5
7	Humanities and Social Sciences	19HE2L02	Professional Communicative English Laboratory- II	--	--	3	1.5
8	Basic Sciences	19BP2L02	Applied Physics Laboratory	--	--	3	1.5
9	Mandatory Courses	19HM2T05	Constitution of India	2	--	--	0
Total Credits							**20.5**

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

II Year – I Semester

S. No.	Course Category	Course Code	Course Title	L	T	P	C
1	Professional Core Courses	19EE3T04	Electrical Circuit Analysis-II	3	--	--	3
2	Professional Core Courses	19EE3T05	Electrical Machines-I	3	--	--	3
3	Professional Core Courses	19EE3T06	Electromagnetic Fields	3	--	--	3
4	Engineering Sciences	19ME3T03	Thermal and Hydro Prime Movers	3	--	--	3
5	Professional Core Courses	19EC3T05	Digital Electronics	3	--	--	3
6	Engineering Sciences	19EE3L04	Electrical Circuits Laboratory	--	--	3	1.5
7	Engineering Sciences	19ME3L04	Thermal and Hydro Prime Movers Laboratory	--	--	3	1.5
8	Engineering Sciences	19EE3L03	Electrical and IT Workshop	--	--	3	1.5
9	Project work, Seminar and Internship	19EE3P01	Socially Relevant Activity*	--	--	--	0.5
10	Mandatory Courses	19BE3T01	Environmental Studies	2	--	--	0
Total Credits							**20**

*** 15hours in semester**

II Year – II Semester

S. No.	Course Category	Course Code	Course Title	L	T	P	C
1	Professional Core Courses	19EE4T07	Electrical Machines-II	3	--	--	3
2	Professional Core Courses	19EE4T08	Control Systems	3	--	--	3
3	Professional Core Courses	19EE4T09	Electrical Power Generation and Distribution	3	--	--	3
4	Professional Core Courses	19EE4T10	Electrical Measurements and Instrumentation	3	--	--	3
5	Humanities and Social Sciences	19HM4T01	Managerial Economics and Financial Analysis	3	--	--	3
6	Professional Core Courses	19EC4T09	Signals and Systems	3	--	--	3
7	Professional Core Courses	19EE4L05	Electrical Machines-I Laboratory	--	--	3	1.5
8	Engineering Sciences	19EC4L02	Basic Electronic Devices and Circuits Laboratory	--	--	3	1.5
9	Mandatory Courses	19HM4T06	Essence of Indian Traditional Knowledge	2	--	--	0
Total Credits							**21**

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

III Year – I Semester

S. No.	Course Category	Course Code	Course Title	L	T	P	C
1	Professional Core Courses	19EE5T11	Electrical Power Transmission Systems	3	--	--	3
2	Professional Core Courses	19EC5T19	Advanced Microprocessors and Microcontrollers	3	--	--	3
3	Professional Core Courses	19EE5T12	Power Electronics	3	--	--	3
4	Professional Core Courses	19EC5T17	Linear and Digital IC Applications	3	--	--	3
5	Professional Core Courses	19EE5T13	Digital Control Systems	3	--	--	3
6	Professional Core Courses	19IT5T01	Data Structures	3	--	--	3
7	Professional Core Courses	19EE5L06	Electrical Machines-II Laboratory	--	--	3	1.5
8	Professional Core Courses	19EE5L07	Control Systems Laboratory	--	--	3	1.5
9	Professional Core Courses	19IT5L01	Data Structures Laboratory	--	--	3	1.5
10	Mandatory Courses	19EE5T37	MOOCS**	--	--	--	0
Total Credits							**22.5**

******Student can select the course of any discipline under MOOCS. However the agency will be decided by the respective BOS.

List of Approved MOOC providers

SWAYAM	EdX	Coursera	Udemy	Saylor Udacity

III Year – II Semester

S. No.	Course Category	Course Code	Course Title	L	T	P	C
1	Professional Core Courses	19EE6T14	DC and AC Motor Drives	3	--	--	3
2	Professional Core Courses	19EE6T15	Power System Analysis	3	--	--	3
3	Professional Core Courses	19EC6T27	Digital Signal Processing	3	--	--	3
4	Open Elective		**Open Elective-I**	3	--	--	3
5	Professional Elective		**Professional Elective–I**	3	--	--	3
6	Professional Core Courses	19EE6L08	Power Electronics Laboratory	--	--	3	1.5
7	Professional Core Courses	19EC6L10	Advanced Microprocessors and Microcontrollers Laboratory	--	--	3	1.5
8	Professional Core Courses	19EC6L07	Linear and Digital IC Applications Laboratory	--	--	3	1.5
9	Project work, Seminar and Internship	19EE6P02	Mini Project	--	--	2	1
10	Mandatory Courses	19HM6T08	IPR and Patents	2	--	--	0
Total Credits							**20.5**

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year – I Semester

S. No.	Course Category	Course Code	Course Title	L	T	P	C
1	Professional Core Courses	19EE7T20	Utilization of Electrical Energy	3	--	--	3
2	Professional Core Courses	19EE7T21	Renewable Energy Sources	3	--	--	3
3	Professional Core Courses	19EE7T22	Power System Protection	3	--	--	3
4	Open Elective		**Open Elective –II**	3	--	--	3
5	Professional Elective		**Professional Elective–II**	3	--	--	3
6	Professional Core Courses	19EE7L09	Power Systems and Simulation Laboratory	--	--	3	1.5
7	Professional Core Courses	19EE7L10	Electrical Measurements and Instrumentation Laboratory	--	--	3	1.5
Total Credits							**18**

IV Year – II Semester

S. No.	Course Category	Course Code	Course Title	L	T	P	C
1	Professional Core Courses	19EE8T27	Power System Operation and Control	3	--	--	3
2	Professional Elective		**Professional Elective–III**	3	--	--	3
3	Professional Elective		**Professional Elective–IV**	3	--	--	3
4	Project work, Seminar and Internship	19EE8P03	Project Work	--	--	18	9
			Total Credits				**18**
Total Credits (19.5 + 20.5 + 20 + 21 + 22.5 + 20.5 + 18 + 18)							**160**

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

Professional Elective-I:

1.	19EE6T16	Electrical Distribution Systems
2.	19EE6T17	Artificial Intelligence Techniques
3.	19EE6T18	Electrical Machine Modeling and Analysis
4.	19EE6T19	Advanced Control Systems

Professional Elective II:

1.	19EE7T23	High Voltage Engineering
2.	19EE7T24	Energy Audit, Conservation and Management
3.	19EE7T25	Special Electrical Machines
4.	19EE7T26	HVDC Transmission

Professional Elective III:

1.	19EE8T28	Electric Power Quality
2.	19EE8T29	Hybrid Electric Vehicles
3.	19EE8T30	Electrical Machine Design
4.	19EE8T31	Advanced Power Converters

Professional Elective IV:

1.	19EE8T32	Smart Grids
2.	19EE8T33	Power System Deregulation
3.	19EE8T34	PLC and SCADA
4.	19EE8T35	FACTS

Open Elective-I:

1.	19CE6T23	Building Materials and Construction
2.	19EC6T10	Internet of Things
3.	19ME6T28	Industrial Robotics
4.	19CS6T05	Object Oriented Programming through Java
5.	19BM6T05	Complex Variables and Statistical Methods
6.	19BC6T03	Materials Chemistry and Engineering Applications

Open Elective-II:

1.	19CE7T24	Waste Water Management
2.	19EC7T30	Embedded Systems
3.	19ME7T44	Production Planning and Control
4.	19CS7T03	Python Programming
5.	19HM7T02	Management Science
6.	19BP7T03	Nuclear Science and Technology

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

I Year I Semester

PROFESSIONAL COMMUNICATIVE ENGLISH

Course Category	Humanities and Social Sciences	**Course Code**	**19HE1T01**
Course Type	Theory	**L-T-P-C**	3 – 0 – 0 – 3
Prerequisites	LSRW + Vocabulary Synonyms, antonyms, Grammar.	**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	Schumacher describes the education system by saying that it was mere training, something more than mere knowledge of facts. To develop extensive reading skill and comprehension for pleasure and profit.
2	The lesson centres on the pros and cons of the development of science and technology. To develop extensive reading skill and comprehension for pleasure and profit.
3	Depicts of the symptoms of Cultural Shock and the aftermath consequences. To develop extensive reading skill and comprehension for pleasure and profit.
4	Portrays the ways of living life in its true sense. To develop extensive reading skill and comprehension for pleasure and profit.
5	Supports the developments of technology for the betterment of human life. To develop extensive reading skill and comprehension for pleasure and profit.

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Emphasizes that the ultimate aim of education is to enhance wisdom and inspires the readers to serve their nation with their self-enrichment.
CO2	Enables the learners to promote peaceful co-existence and universal harmony in the society and empowers the learners to have initiation in innovation.
CO3	Imparts the students to manage different cultural shock due to globalization and to develop multiculturalism to appreciate diverse cultures and also motivates the learners to contribute to their nation.
CO4	Arouse the thought of life to lead in a well path by recognizing the importance of work besides enhancing their LSRW skills.
CO5	Inspires the learners at the advancement of software by the eminent personalities and motivates the readers to think and tap their innate talents.

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	-	-	-	-	2	1	-	-	1	-	3	-	-
CO2	2	1	-	-	-	1	3	1	-	1	-	1	-	-
CO3	-	-	-	-	-	1	2	-	-	1	-	-	-	-
CO4	-	-	-	-	-	1	-	1	2	-	-	-	-	-
CO5	-	-	1	2	1	-	-	-	-	1	-	-	-	-

COURSE CONTENT	
UNIT I	1. ‘The Greatest Resource- Education' from Professional Communicative English. 2. 'War' from ‘Panorama: A Course on Reading'
UNIT II	1. ' A Dilemma' from Professional Communicative English. 2. 'The Verger' from ‘Panorama: A Course on Reading'
UNIT III	1. 'Cultural Shock': Adjustments to new Cultural Environments from Professional Communicative English. 2. ' The Scarecrow' from Panorama: A Course on Reading
UNIT IV	1. ‘The Secret of Work’ from Professional Communicative English. 2. 'A Village Lost to the Nation' from Panorama: A Course on Reading
UNIT V	1. ' The Chief Software Architect' from Professional Communicative English. 2. 'Martin Luther King and Africa' from Panorama: A Course on Reading

TEXT BOOKS	
1.	PROFESSIONAL COMMUNICATIVE ENGLISH. Published by Maruthi Publishers.
2.	PANORAMA: A COURSE ON READING, Published by Oxford University Press India
REFERENCE BOOKS	
1.	ENGLISH GRAMMAR AND COMPOSITION – WREN & MARTIN
2.	LEARNER’S ENGLISH GRAMMAR AND COMPOSITION – N.D.V. Prasada Rao
WEB RESOURCES	
1.	**Online Dictionaries:** https://dictionary.cambridge.org/ https://www.oxfordlearnersdictionaries.com/
2.	**Grammar:** https://www.oxfordlearnersdictionaries.com/grammar/ https://dictionary.cambridge.org/grammar/british-grammar/
3.	**Synonyms and Antonyms:** https://www.thesaurus.com/browse/search https://www.englishclub.com/vocabulary/synonyms-antonyms.htm

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

I Year I Semester

LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS

Course Category	Basic Sciences	**Course Code**	**19BM1T01**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Basics of matrices, Differentiation, Integration	**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.
2	The skills derived from the course will help the student form a necessary base to develop analytic and design concepts.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	solve systems of linear equations, determine the rank, find the eigen values and eigenvectors, diagonalization of a matrix.	K3
CO2	identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics.	K2
CO3	solve first order differential equations and its applications	K3
CO4	solve the linear differential equations with constant coefficients by appropriate method	K3
CO5	find partial derivatives of multivariable functions and apply them to find extreme values of a function.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	-

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT I	**Solving system of linear equations, Eigen Values and Eigen vectors** Rank of a matrix by echelon form and normal form – Solving system of homogeneous and non-homogeneous linear equations – Gauss elimination method for solving system of equations – Eigenvalues and Eigen vectors and their properties.
UNIT II	**Cayley-Hamilton Theorem and Quadratic forms** Cayley-Hamilton theorem (without proof) – Finding inverse and powers of a matrix by Cayley-Hamilton theorem – Reduction to diagonal form-Quadratic forms-nature of the quadratic form - reduction of quadratic form to canonical form by orthogonal transformation.
UNIT III	**Differential equations of first order and first degree** Linear – Bernoulli – Exact – Reducible to exact. **Applications:** Newton's Law of cooling – Law of natural growth and decay – Orthogonal trajectories.
UNIT IV	**Linear differential equations of higher order** Non-homogeneous equations of higher order with constant coefficients with RHS term of the type e^{ax}, $\sin ax$, $\cos ax$, polynomials in x^n, $e^{ax}V(x)$, $x^mV(x)$ - Method of Variation of parameters.
UNIT V	**Partial differentiation** Introduction – Homogeneous function – Euler's theorem – Total derivative – Chain rule – Generalized Mean value theorem for single variable (without proof) – Taylor's and Maclaurin's series expansion of functions of two variables – Jacobian – Functional dependence. **Applications:** Maxima and Minima of functions of two variables without constraints and Lagrange's method (with constraints).

TEXT BOOKS	
1.	**B.S.Grewal**, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2.	**Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India
REFERENCE BOOKS	
1.	**Micheael Greenberg**, Advanced Engineering Mathematics, 9th edition, Pearson edn
2.	**Dean G. Duffy**, Advanced engineering mathematics with MATLAB, CRC Press
3.	**Peter O'neil**, Advanced Engineering Mathematics, Cengage Learning.
4.	**Srimanta Pal, Subodh C.Bhunia**, Engineering Mathematics, Oxford University Press.
5.	**T.K.V. Iyengar et. al.,** Engineering Mathematics Volume I & III S Chand Publications.
WEB RESOURCES	
1.	**UNIT I: Solving system of linear equations, Eigen Values and Eigen vectors** https://en.wikipedia.org/wiki/System_of_linear_equations https://en.wikipedia.org/wiki/Eigenvalues_and_eigenvectors
2.	**UNIT II: Cayley-Hamilton Theorem and Quadratic forms** https://www.math.hmc.edu/calculus/tutorials/eigenstuff/ https://en.wikipedia.org/wiki/Quadratic_form
3.	**UNIT III: Differential equations of first order and first degree** https://en.wikipedia.org/wiki/Differential_equation http://um.mendelu.cz/maw-html/index.php?lang=en&form=ode https://www.khanacademy.org/math/differential-equations/first-order-differential-equations
4.	**UNIT IV: Linear differential equations of higher order** https://en.wikipedia.org/wiki/Differential_equation http://um.mendelu.cz/maw-html/index.php?lang=en&form=ode https://nptel.ac.in/courses/122107037/20
5.	**UNIT V: Partial Differentiation** https://en.wikipedia.org/wiki/Partial_derivative https://www.whitman.edu/mathematics/calculus_online/section14.03.html

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

I Year I Semester

NUMERICAL METHODS AND MULTI-VARIABLE CALCULUS

Course Category	Basic Sciences	**Course Code**	**19BM1T02**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Differentiation, Integration	**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.
2	The skills derived from the course will help the student form a necessary base to develop analytic and design concepts.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	apply Newton, Gauss and Lagrange interpolation formulae to find interpolating polynomials for the given data.	K3
CO2	find the approximate roots of transcendental equations by using different numerical methods	K2
CO3	solve initial value problems by using different numerical schemes	K3
CO4	find areas and volumes using double and triple integrals	K2
CO5	apply a range of techniques to find solutions of standard PDEs	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	-

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT I	**Interpolation** Introduction– Errors in polynomial interpolation – Finite differences – Forward differences– Backward differences –Central differences –properties – Differences of a polynomial- Newton's formulae for interpolation –Gauss formulae for interpolation- Interpolation with unequal intervals – Lagrange's interpolation formula.
UNIT II	**Solution of Algebraic and Transcendental Equations** Introduction- Bisection method – Method of false position – Secant method- Iteration method – Newton-Raphson method (One variable).
UNIT III	**Numerical Integration and solution of Ordinary Differential equations** Trapezoidal rule- Simpson's 1/3rd and 3/8th rule-Solution of ordinary differential equations by Taylor's series-Picard's method of successive approximations-Euler's method - Runge-Kutta method (second and fourth order).
UNIT IV	**Multiple integrals** Multiple integrals: Double and triple integrals – Change of variables – Change of order of integration. **Applications:** Finding Areas and Volumes.
UNIT V	**Partial Differential Equations** Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions –solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.

TEXT BOOKS	
1.	**B.S.Grewal**, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2.	**Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India
REFERENCE BOOKS	
1.	**Micheael Greenberg**, Advanced Engineering Mathematics, 9th edition, Pearson edn
2.	**Dean G. Duffy**, Advanced engineering mathematics with MATLAB, CRC Press
3.	**Peter O'neil**, Advanced Engineering Mathematics, Cengage Learning.
4.	**Srimanta Pal, Subodh C. Bhunia**, Engineering Mathematics, Oxford University Press.
5.	**T.K.V. Iyengar et. al.,** Engineering Mathematics Volume I & III S Chand Publications.
6.	**T. Amarnath,** An Elementary Course in Partial Differential Equations, Narosa Publications
WEB RESOURCES	
1.	**UNIT I: Interpolation** https://en.wikibooks.org/wiki/Introduction_to_Numerical_Methods/Interpolation
2.	**UNIT II: Solution of Algebraic and Transcendental Equations** https://en.wikibooks.org/wiki/Numerical_Methods/Equation_Solving https://www.slideshare.net/100005232690054/algebraic-and-transcendental-equations
3.	**UNIT III: Numerical Integration and solution of Ordinary Differential Equations** https://nptel.ac.in/courses/111107063/
4.	**UNIT III: Multiple Integrals** https://en.wikipedia.org/wiki/Multiple_integral http://tutorial.math.lamar.edu/Classes/CalcIII/MultipleIntegralsIntro.aspx
5.	UNIT V: **Partial Differential Equations** https://en.wikipedia.org/wiki/Partial_differential_equation

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

I Year I Semester

APPLIED CHEMISTRY

Course Category	Basic Sciences	Course Code	**19BC1T02**
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites	Intermediate Chemistry	Internal Assessment Semester End Examination Total Marks	40 60 100

COURSE OBJECTIVES	
1	To learn about Electrochemical cells, Batteries and Fuel cells
2	To know about spinels, magnetic materials and semi conductors
3	To study about Nano materials, their preparation, characterization, applications and also about principles of green chemistry and green engineering applications
4	To know about Polymers, plastics and Elastomers
5	To learn about non conventional energy sources and also Spectroscopic techniques

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	To compare different types of batteries and explain the merits of fuel cell.	K1
CO2	Discuss the use and importance of semiconductors, magnetic materials and spinels.	K4
CO3	To explain the Green methods of Synthesis and applications of Green technologies.	K3
CO4	Analyze the importance of polymers in engineering applications.	K4
CO5	List out various sources of non conventional energy**.**	K5

	PO1	**PO2**	**PO3**	**PO 4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	1	2	2	2		2				2		1	
CO2	2	2	1			1	1				1			
CO3	1	1		1	2							1		
CO4	2	2		1			1					1		
CO5	**1**	1	1				1				2	1	1	

COURSE CONTENT	
UNIT I	**ELECTROCHEMICAL ENERGY SYSTEMS 9hrs** Electrode Potential, Nernst Equation for a single electrode, EMF of the cell, Electro chemical

	Series and uses, Types of Electrodes - Hydrogen and Calomel electrode, Electrochemical Cell, Galvanic Cell vs Electrolytic Cell, Types of Ion Selective Electrodes- glass membrane electrode **Batteries**- Characteristics, classification and Important applications. Classical batteries- Dry/Lechlanche cell, Modern batteries- Zinc air, Lithium cells-Li MnO_2 cell. **Fuel cells**- Introduction, H_2-O_2 fuel cell. **Learning outcomes:** After the completion of the Unit I, the student will be able to • **Explain** the significance of electrode potentials.**(L-2)** • **Compare** different types of cells and batteries. **(L-2)** • **Classify** ion selective electrodes. (**L-2**) • **Explain** the concepts involved in the construction of lithium cells. **(L-2)** • **Apply** redox principles for construction of batteries and fuel cells. (**L-3)**
UNIT II	**SOLID STATE CHEMISTRY** Solids – Crystalline and amorphous solids- 2D and 3D close packing of atoms and ions - spinels - normal and inverse spinels, semi conductor – Elemental semi conducting materials - Non-elemental semiconducting Materials:- Stoichiometric, non stoichiometric controlled valency & Chalcogen semiconductors, Preparation of Semiconductors by Zone refining and Czocharlski crystal pulling method. Semiconducting Devices - p-n junction diode as rectifier and junction transistor. Electrical Insulators and Applications of solid, liquid and gaseous insulators. Magnetic materials- Ferro and ferri magnetism. Hall effect and its applications. **Learning Outcomes:** After the completion of the Unit II, the student will be able to • Explain 2D and 3D close packing of crystals (**L-3**) • identify different types of spinels. (**L-3**) • describe the mechanism of photo copying. (**L-2**) • explain the applications of electrical insulators. (**L-3**)
UNIT III	**NANOMATERIALS AND GREEN CHEMISTRY** **7+5 hrs** **III-A: Nano Materials:** Introduction to Nano materials, Preparation of Carbon Nano Tubes(CNTs) by Laser Ablation and Chemical Vapor Deposition Methods, Fullerenes - Preparation, Properties and Applications; Chemical synthesis of nano materials : Sol-gel method, Characterization of nano mateirals by BET & TEM (basic principles), Applications of nano materials in waste water treatment, lubricants, Medicine and sensors. **III-B: Green Chemistry:** Introduction-Principles of green chemistry, Green synthesis Methods- Phase Transfer Catalysis (PTC), Super critical fluid extraction method, Green engineering applications in environmental and power quality monitoring. **Learning outcomes:** After the completion of the Unit III, the students will be able to • **explain** the basic principles of green chemistry. **(L-3)** • **identify** different preparation methods of CNTs**. (L-3)** • **discuss** the applications in green engineering. **(L-2)**
UNIT IV	**POLYMER CHEMISTRY** **10hrs** **Polymers**: Introduction-Methods of Polymerization (Emulsion and Suspension), Conducting polymers – Mechanism of conduction in poly acetylene – applications, Bio – degradable

	polymers. **Plastics**: Thermoplastics and thermo setting resins; Preparation, properties and applications of Polystyrene and Bakelite. **Elastomers**: Natural Rubber, Vulcanization of rubber; Synthetic Rubbers -Preparation, properties and applications of Buna-S and Thiokol. **Learning Outcomes:** ***At the end of this unit, the students will be able to*** ● **explain** different types of polymerisation mechanisms (**L-2**) ● **distinguish** between thermoplastic and thermo setting resigns **(L-4)** ● **explain** the preparation, properties and applications of Bakelite and polystyrene (**L-2**) ● **describe** the mechanism of conduction in conducting polymers (**L-2**) ● **discuss** Buna-S and Thiokol elastomers and their applications (**L-2**)
UNIT V	**Non Conventional Energy Sources & Spectroscopic Techniques** **9 hrs** Non Conventional Energy Sources : Introduction-Photo voltaic cell & Organic Photo voltaic cell - Design, Principle, advantages and disadvantages; Hydropower-Geo thermal Power - Tidal Power-Ocean thermal Energy Conversion. Spectroscopic Techniques: Electro Magnetic Spectrum- Introduction, Principles of UV and IR Spectroscopic techniques and their applications. **Learning outcomes** After the completion of the Unit V, the student will be able to • **list** different non conventional energy sources. (**L-1)** • **explain** the basic principle involved in the working of power plants. (**L-2)** • **compare** Spectroscopic techniques and their importance . **(L-2)**

TEXT BOOKS	
1.	P.C. Jain and M. Jain, Engineering Chemistry, 15/e, Dhanapat Rai & Sons, Delhi (2014).
2	Engineering Chemistry by Shikha Agarwal: Cambridge University Press,2019 edition
REFERENCE BOOKS	
1.	Sashi Chawla, A Textbook of Engineering Chemistry, Dhanapath Rai and sons, (2003)
2.	B.S Murthy and P. Shankar, A Text Book of NanoScience and NanoTechnology, University Press (2013).
3.	S.S. Dara, A Textbook of Engineering Chemistry, S.Chand & Co, (2010)
WEB RESOURCES	
1.	Electrochemical Energy Systems https://en.wikipedia.org/wiki/Electrochemical_cell
2.	Solid state chemistry https://en.wikipedia.org/wiki/Solid-state_chemistry www.engineeringenotes.com › Engineering › Electronics › Semiconductors
3.	Nanomaterials and Green Chemistry https://en.wikipedia.org/wiki/Green_chemistry https://www.acs.org/.../greenchemistry/principles
4.	Polymer Chemistry https://en.wikipedia.org/wiki/Polymer_chemistry
5.	Non Conventional Energy Sources & Spectroscopic Techniques

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

	https://en.wikipedia.org/wiki/Geothermal_power; https://en.wikipedia.org/wiki/Ocean_thermal_energy_conversion www.rsc.org/learn-chemistry/collections/spectroscopy/introduction

I Year I Semester

PROGRAMMING FOR PROBLEM SOLVING USING C

Course Category	Engineering Science	**Course Code**	**19CS1T01**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	To impart adequate knowledge on the need of programming languages and problem solving techniques.
2	To develop programming skills using the fundamentals of C Language.
3	To enable effective usage of arrays, structures, functions, pointers and dynamic memory allocation.
4	To make use of file handling functions in programming.

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Apply the fundamentals of C Programming for Problem solving.	K3
CO2	Identify the appropriate Decision statement and Loops for a given Problem.	K2
CO3	Make use of Arrays and Strings to solve the problems in C.	K3
CO4	Apply the concepts of Functions and Pointers in Problem solving.	K3
CO5	Develop solutions for problems using Structures, Unions and Files.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	1	0	0	0	0	0	0	0	1	1
CO2	3	3	3	3	1	0	0	0	0	0	0	0	1	1
CO3	3	3	3	2	1	0	0	0	0	0	0	0	2	1
CO4	2	3	3	3	1	0	0	0	0	0	0	0	2	2
CO5	3	3	3	3	1	0	0	0	0	0	0	0	2	2

COURSE CONTENT

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

UNIT I	**Introduction to Programming**–Introduction to Computer Software, Classification of Computer Software, Representation of Data – Bits and Bytes, Programming Languages – High and Low Level Languages, Generation of Programming Languages, Program Design Tools: Algorithms, Flowcharts, Pseudocode, Types of Errors, Testing & Debugging Approaches. **Introduction to C –** Structure of a C Program, Writing the First C Program, Header Files used in C Program, Compiling and Executing C Programs.
UNIT II	**Tokens in C:** Basic Data Types in C – Keywords, Identifiers, Variables, Constants, Input / Output statements in C, Operators in C, Precedence and Associativity Rules, Type Casting Types. **Decision Control**: Decision Control Statements: Conditional Branching Statements - if, if – else, nested if, if – else – if, and Switch – Case. **Basic Loop Structures**: Iterative Statements - for, while and do - while, Nested Loops, The 'Break', 'Continue', and 'goto' statements.
UNIT III	**Arrays:** Declaration and Initialization of Arrays, Accessing & Storing the elements of an Array, Operations on Arrays: Traversing, Inserting, Deleting, Searching, Two Dimensional Arrays: Declaring, Initializing, Accessing, Operations on Two Dimensional Arrays (Matrices), Applications of Arrays. **Strings:** String Fundamentals, String Input and Output, String Library Functions
UNIT IV	**Functions:** Function Declaration / Function Prototypes, Function Definition, Function Call (Call by Value), Passing Parameters to Functions, Return Statement, Storage Classes, Recursive Functions, Arrays as Function Arguments. **Pointers**: Declaring Pointer Variables, Pointer Arithmetic, Passing Arguments to Function using Pointers (Call by Reference), Pointers and Arrays, Pointer to Pointer, Dynamic Memory Allocation – Malloc, Calloc, Realloc, Free.
UNIT V	**Structures**: Introduction to Structures, Nested Structures, Array of Structures. **Unions:** Introduction, Array of Union Variables, Union inside Structure, Enumerated Data Types, Bit Fields. **Files**: Declaring, Opening, and Closing File, Reading from and Writing to Text Files.

TEXT BOOKS	
1.	Programming in C, Reema Thareja, 2nd Edition, Oxford University Press.
2.	The C programming Language, Dennis Richie and Brian Kernighan, Pearson Education
REFERENCE BOOKS	
1.	Programming in C – Ashok N.Kamthane, Amit Ashok Kamthane, 3rd Edition, Pearson.
2.	C Programming-A Problem Solving Approach, Forouzan, Gilberg, Cengage.
3.	Programming in C (A Practical Approach) – Ajay Mittal, First Edition, Pearson.
WEB RESOURCES	
1.	http://nptel.ac.in/courses/106104128/
2.	http://students.iitk.ac.in/programmingclub/course/#notes
3.	http://c-faq.com/~scs/cclass/cclass.html
4.	http://www.youtube.com/watch?v=b00HsZvg-V0&feature=relmfu
5.	http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-087-practical-programming-in-c-january-iap-2010/

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

I Year I Semester

APPLIED CHEMISTRY LABORATORY

Course Category	Basic Science	**Course Code**	**19BC1L02**
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Basic Chemistry	**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Students will learn to estimate the given amount of dissolved compounds in water by using volumetric analysis and preparation of polymers and nano particles	K3
CO2	Students will be able to learn compelxometric titrations to determine the concentration of different metal ions present in water and determine the % moisture in a coal sample.	K3
CO3	Students will be able to identify the accurate value of conductivity of given solutions. and to estimate the viscosity and surface tension of given solutions.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	2	0	0	0	0	0	0	0	0	0	0	0
CO2	2	1	0	1	0	0	0	0	0	0	0	0	0	0
CO3	2	1	0	0	0	0	0	0	0	0	0	0	0	0

COURSE CONTENT(Any 10 of the following listed 14 experiments)	
1.	Estimation of HCI using standard Na_2CO_3 solutions

2.	Determination of alkalinity of a sample containing Na_2CO_3 and NaOH
3.	Estimation of $KMnO_4$ using standard Oxalic acid solution.
4.	Estimation of Ferrous iron using standard $K_2Cr_2O_7$ solution
5.	Determination of Temporary and permanent Hardness water using standard EDTA solution.
6.	Determination of % moisture content in a coal sample.
7.	Determination of Mg^{2+} present in an antacid
8.	Conductometric Titrations between strong acid and strong base
9.	Conductometric Titrations between strong acid and weak base
10.	Estimation of Vitamin – C
11.	Preparation of Phenol - Formaldehyde Resin
12.	Determination of viscosity of a liquid
13.	Determination of surface tension of a liquid
14.	Preparation of Nano particles.(Cu/Zn)

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

I Year I Semester

PROFESSIONAL COMMUNICATIVE ENGLISH LABORATORY – I

Course Category	Humanities and Social Sciences	**Course Code**	**19HE1L01**
Course Type	Theory	**L-T-P-C**	0 – 0 – 3 – 1.5
Prerequisites	LSRW + Vocabulary Synonyms, antonyms, Grammar.	**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

CO	Course Outcomes Description	COGNITIVE LEVEL
CO1	Interpret and responding appropriately in various day to day contexts and will be able to use speech sounds effectively.	K2
CO2	Apply stress, intonation and pronunciation in conversations and learn formal communicative expressions.	K3
CO3	Attain the collection of dialogues and acclimate them to their real life situations with proper intonation.	K2

K1- Remembering, K2- Understanding, K3-Applying, K-4 Analyzing, K5- Evaluating, K6- Creating

CO	PO1	PO2	PO3	PO4	PO 5	PO6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	-	-	-	-	-	-	-	-	-	2	-	-	-	-

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

PRESCRIBED LAB MANUAL FOR SEMESTER I:

'**STRENGTHEN YOUR STEPS**: A Multimodal Course in Communication Skills' Published by Maruthi Publications.

Objectives:
To enable the students to learn the communication skills; listening, speaking, reading and writing.
Outcome:
The course enables the learner to acquire communication skills which will help the students to become successful in the competitive world.

The course content along with the study material is divided into six units.

UNIT 1:
Hello, I'm ……
Consonant Sounds

UNIT 2:
I would love to …. But,
Vowel Sounds

UNIT 3:
With your Permission, I would like to
Syllable and Accent

UNIT 4:
Why don't we……

Pronunciation and Rhythm

UNIT 5:
Could you please ……

Tones

UNIT-6: Dialogues

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

I Year I Semester

PROGRAMMING FOR PROBLEM SOLVING USING C LABORATORY

Course Category	Engineering Science	**Course Code**	**19CS1L01**
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	To learn various steps in program development using Raptor.
2	To write C programs using basic concepts in C like operators, control statements etc.,
3	To design modular, reusable and readable C programs using concepts like Arrays, Functions and Pointers.
4	To write programs using Structures and Unions.
5.	To write programs to perform file operations.

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Translate given algorithms to a working programs.	K2
CO2	Design programs using Pointers to access Arrays, Strings and Functions.	K3
CO3	Develop programs using Structures, Unions and File operations.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	2	0	0	0	0	0	0	0	2	2
CO2	3	3	3	3	2	0	0	0	0	0	0	0	2	2
CO3	3	3	3	3	2	0	0	0	0	0	0	0	2	2

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

<table>
<tr><th colspan="2">COURSE CONTENT</th></tr>
<tr><td>1.</td><td>Construct flowcharts using Raptor Tool to
a) calculate the maximum, minimum and average of three numbers
b) calculate area of a triangle given three sides using Heron’s formula.</td></tr>
<tr><td>2.</td><td>Construct flowcharts using Raptor Tool to
a) calculate simple interest for various parameters specified by the user.
b) swapping of two numbers with and without using the third variable.</td></tr>
<tr><td>3.</td><td>Write a C Program to Perform Addition, Subtraction, Multiplication and Division of two numbers.</td></tr>
<tr><td>4.</td><td>Write a C Program to find the Grade of a student by taking input of percentage using all Relational Operators (>, >=, <, <=, ==, !=)
<table>
<tr><th>Theory (%)</th><th>Letter Grade</th><th>Level</th></tr>
<tr><td>≥ 90</td><td>O</td><td>Outstanding</td></tr>
<tr><td>≥ 80 to < 90</td><td>S</td><td>Excellent</td></tr>
<tr><td>≥ 70 to < 80</td><td>A</td><td>Very Good</td></tr>
<tr><td>≥ 60 to < 70</td><td>B</td><td>Good</td></tr>
<tr><td>≥ 50 to < 60</td><td>C</td><td>Fair</td></tr>
<tr><td>≥ 40 to < 50</td><td>D</td><td>Satisfactory</td></tr>
<tr><td><40</td><td>F</td><td>Fail</td></tr>
</table></td></tr>
<tr><td>5.</td><td>Write a C Program to swap two given input numbers
a) With using a temporary variable. b) Without using a temporary variable.</td></tr>
<tr><td>6.</td><td>Write a C Program to implement arithmetic operations using two operands and one operator using
a) if – else – if condition. b) Switch – Case statement.</td></tr>
<tr><td>7.</td><td>Write a C Program to print the following patterns
a) Floyd’s Triangle. b) Pascal Triangle.</td></tr>
<tr><td>8.</td><td>Write a C Program
a) To find the sum of its individual digits for a given positive number.
b) To check whether the given number is Prime or not.</td></tr>
<tr><td>9.</td><td>Write a C Program
a) To check whether the given number is a Palindrome or not.</td></tr>
</table>

	b) To check whether the given number is an Armstrong or not
10.	Write a C Program using Functions to find both the largest and smallest number in an given array numbers.
11.	Write C programs to perform swapping of two numbers by passing a value and reference.
12.	Write a C Program for two Matrices by checking the compatibility a) Addition. b) Multiplication.
13.	Write a C program on Strings to implement the following operations without string handling functions a) Concatenation of two given input strings. b)Length of a string. c) Reverse of a given string.
14.	Write C programs that use both recursive and non-recursive functions for the following i) To find the factorial of a given integer. ii) To find the GCD (greatest common divisor) of two given integers. iii) To find Fibonacci sequence
15.	Write a C program using Pointers to work on a) Matrix Addition. b) Transpose of a Matrix.
16.	Write a C program to read and print the details of an Employee (Name, Date of the Birth, Designation, Salary) using Structures.
17.	Write a C program a) to read and print the student details (Name, Register number, Address, Intermediate %) using Union. b) to display the name of the colour using Enum data type
18.	Write a C Program to a) Copy one file to another. b)Count the number of characters, words and lines in a file.

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

I Year I Semester

PROFESSIONAL ETHICS AND HUMAN VALUES

Course Category	Mandatory Courses	**Course Code**	19HM1T07
Course Type	Theory	**L-T-P-C**	2 -0 -0 - 0
Prerequisites	NA	**Total Marks (Internal Assessment)**	100

Course Outcomes		**Blooms Taxonomy Level**	
On successful completion of the course, the student will be able to			
CO 1	Understand different concepts in Professional Ethics and Human Values.	Understanding	K1
CO 2	Apply ethical principles to resolve the problems that arise in work place.	Applying	K3
CO 3	Make use of Engineers rights to fulfill their responsibilities.	Applying	K3
CO 4	Understand the responsibility of an engineer in designing safety.	Understanding	K2
CO 5	Analyze the social media accounts in order to create and maintain a positive digital footprint.	Analyzing	K4

Contribution of Course Outcomes towards achievement of Program													
Outcomes: 1 – Low, 2 - Medium, 3 – High													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	0	0	2	0	0	3	2	3	0	2	0	1	0	0
CO2	0	0	2	0	0	2	2	3	0	1	0	2	0	0
CO3	0	0	2	0	0	3	2	3	0	2	0	1	0	0
CO4	0	0	2	0	0	3	2	3	0	2	0	1	0	0
CO5	0	0	2	0	0	2	2	3	0	1	0	1	0	0

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT I	**Professional Ethics and Human values:** Ethics -History of Ethics-Types of Ethics, Professional Ethics and its forms - Morals, Values – Integrity –Civic Virtue –Respect for others – Living Peacefully – Caring – Sharing – Honesty –Courage – Value time –Co-operation – Loyalty- Collegiality-Commitment – Empathy – Self-confidence – Spirituality- Character.
UNIT II	**Engineering & Organization Ethics:** Engineering Ethics-Meaning & Purpose of Engineering Ethics- Consensus and Controversy – Work Place Ethics and Business Ethics –Ethics in HRM, Finance & Marketing – Ethical Theories-Meaning & Uses of Ethical Theories-Theories of moral Development-Kohlberg's Theory – Gilligan's Argument –Heinz's Dilemma.
UNIT III	**Engineers Responsibilities and Rights:** Key Characteristics of Engineering Professionals – Professional Roles to be played by an Engineer - Ethical egoism-Collective bargaining-Confidentiality- Acceptance of Bribes/Gifts when is a Gift and a Bribe-examples of Gifts v/s Bribes-Whistle Blowing and its types-when should it be attempted-preventing whistle blowing.
UNIT IV	**Engineers' Responsibility for Safety and Risk:** Concept of Safety-Types of Safety, Risk-Types of Risks, Voluntary v/s Involuntary Risk-Short term v/s Long term Consequences- Expected Probability- Reversible Effects-Threshold Levels for Risk- Delayed v/s Immediate Risk- Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents.
UNIT V	**Ethical issues in Social Media:** Social Media- Various Social Media Platforms: Google, Facebook, YouTube, Instagram - Social Media set-up and Uses-Ethical use of Social media-Effects of Social Media on Public-Social Media (vs) News- Social Media Fame and Reputation-Trolling, Harassing, and Hating on Social Media-Legal Aspects of Social Media.

Reference Books	
1.	"Engineering Ethics includes Human Values" by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd-2009.
2.	"Professional Ethics and Morals" by Prof.A.R.Aryasri, Dharanikota Suyodhana- Maruthi Publications.
3.	"Professional Ethics and Human Values" by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran-Laxmi Publications
4.	"Professional Ethics and Human Values" by Prof.D.R.Kiran-
5.	"Indian Culture, Values and Professional Ethics" by PSR Murthy-BS Publication
6.	"Ethics in Engineering" by Mike W. Martin and Roland Schinzinger -Tata McGraw- Hill -2003
7.	"Engineering Ethics" by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.

WEB RESOURCES (Suggested)	
1.	https://study.com/academy/lesson/ethical-issues-in-internet-social-media-marketing.html
2.	https://www.tutorialspoint.com/engineering_ethics/engineering_ethics_rights_of_engineers
3.	https://link.springer.com/article/10.1007/s11948-997-0039-x

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

I Year II Semester

INTEGRAL TRANSFORMS AND VECTOR CALCULUS

Course Category	Basic Sciences	**Course Code**	**19BM2T03**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	NIL	**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.
2	The skills derived from the course will help the student form a necessary base to develop analytic and design concepts.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	examine the properties of Laplace transformation	K3
CO2	solve ordinary differential equations by using Laplace transformation technique	K2
CO3	expand a periodic function as a Fourier series and find Fourier transform of a given function.	K3
CO4	understand vector differential properties of scalar and vector point functions and their applications.	K2
CO5	apply Green's, Stokes and Divergence theorem to evaluate line, surface and volume integrals.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT I	**Laplace transforms:** Laplace transforms of standard functions – Properties - Periodic functions - Unit step function – Dirac's delta function.
UNIT II	**Inverse Laplace transforms:** Inverse Laplace transforms – Properties – Convolution theorem (without proof). **Applications:** Solving ordinary differential equations (initial value problems) using Laplace transforms.
UNIT III	**Fourier Analysis:** Introduction- Periodic functions – Dirichlet's conditions - Fourier series of a function, even and odd functions –Change of interval – Half-range sine and cosine series. Fourier integral theorem (without proof) – Fourier sine and cosine integrals – sine and cosine transforms – Inverse transforms.
UNIT IV	**Vector Differentiation:** Gradient - Directional derivative - Divergence – Curl – Laplacian and second order operators – Vector identities.
UNIT V	**Vector Integration:** Line integral – Work done – Potential function – Area, Surface and volume integrals - Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof) and related problems.

TEXT BOOKS	
1.	**B.S.Grewal**, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2.	**Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India
REFERENCE BOOKS	
1.	**Micheael Greenberg**, Advanced Engineering Mathematics, 9th edition, Pearson edn
2.	**Dean G. Duffy**, Advanced engineering mathematics with MATLAB, CRC Press
3.	**Peter O'neil**, Advanced Engineering Mathematics, Cengage Learning.
4.	**Srimanta Pal, Subodh C.Bhunia**, Engineering Mathematics, Oxford University Press.
5.	**T.K.V. Iyengar et. al.,** Engineering Mathematics Volume I & III S Chand Publications.
6.	**Murray R Speigel,** Schaum's Outline of Vector Analysis, Schaum's Outline.
7.	**Shanti Narayan**, Integral Calculus – Vol. 1 & II
WEB RESOURCES	
1.	**UNIT I: Laplace transforms** https://en.wikipedia.org/wiki/Laplace_transform https://web.stanford.edu/~boyd/ee102/laplace.pdf
2.	**UNIT II: Inverse Laplace transforms** https://www.intmath.com/laplace-transformation/7-inverse-laplace-transform.php
3.	**Unit – III: Fourier Series** https://www.mathsisfun.com/calculus/fourier-series.html https://lpsa.swarthmore.edu/Fourier/Xforms/FXformIntro.html
4.	**UNIT IV: Vector Differentiation** https://en.wikipedia.org/wiki/Vector_calculus
5.	**UNIT V: Vector Integration** https://en.wikipedia.org/wiki/Divergence_theorem http://tutorial.math.lamar.edu/Classes/CalcIII/StokesTheorem.aspx

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

I Year II Semester

APPLIED PHYSICS

Course Category	BASIC SCIENCES	**Course Code**	**19BP2T02**
Course Type	Theory	**L-T-P-C**	3 - 0 - 0-3
Prerequisites	Intermediate Physics	**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	Impart Knowledge of Physical Optics phenomena like Interference and Diffraction required to design instruments with higher resolution.
2	Understand the physics of Semiconductors and their working mechanism for their utility in Engineering applications.
3	Impart the knowledge of Dielectric materials with characteristic utility in appliances.

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	Analyze the optical applications using the concepts of Interference and diffraction.	Analyze (K4)
CO2	Apply the concepts of quantum mechanics for calculation of free quantum particle energies.	Applying (K3)
CO3	Apply the basics of Laser Mechanism and fiber optics for the communications systems.	Applying(K3)
CO4	Understand the electrical conductivities in semiconductors and study the types of semiconductors using Hall Effect.	Understanding (K2)
CO5	Understand the polarization phenomenon in dielectric materials and Dielectric Materials to study dependence on temperature and frequency response.	Understanding(K2)

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO 1	2	2	0	1	1	0	0	0	0	0	0	0	0	0
CO 2	2	2	0	1	0	0	0	0	0	0	0	0	0	0
CO 3	2	2	1	0	0	0	0	0	0	0	0	0	0	0
CO4	3	2	2	0	0	0	0	0	0	0	0	1	0	0
CO 5	2	1	0	0	0	0	0	0	0	0	0	0	1	0

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT I	**WAVE OPTICS** **(10 hrs)** **INTERFERENCE** Introduction-Principle of Superposition – Coherent Sources – Interference in parallel and non - parallel thin films (reflection geometry), Newton's rings & Applications. **DIFFRACTION** Introduction- Differences between Interference and Diffraction, Differences between Fresnel and Fraunhoffer diffraction Fraunhoffer diffraction in single slit (Qualitative), Fraunhoffer diffraction Double slit(Qualitative), Grating equation (analytical Treatment)- Rayleigh criterion of resolution and Resolving power of grating,
UNIT II	**QUANTUM MECHANICS (8hrs)** Introduction – Matter waves – de Broglie's hypothesis – Davisson-Germer experiment – G.P.Thomson experiment – Heisenberg's Uncertainty Principle –interpretation of wave function – Schrödinger Time Independent and Time Dependent wave equations – Particle in a potential box
UNIT III	**LASERS (11 hrs)** Introduction-Characteristics–Spontaneous and Stimulated emission of radiation – population inversion - Pumping Mechanisms - Ruby laser – Helium Neon laser – Semiconductor laser– Applications **FIBER OPTICS:** Introduction- Structure of Optical Fiber – Total Internal Reflection-Numerical Aperture and Acceptance Angle-classification of Optical fibers- optical fiber communication system- Advantages of Optical fibers- Applications.
UNIT IV	**SEMICONDUCTOR PHYSICS (8 hrs)** Introduction–Intrinsic semi conductors - density of charge carriers- Electrical conductivity – Fermi level – extrinsic semiconductors - p-type &n-type - Density of charge carriers -Hall effect- Hall coefficient - Applications of Hall effect
UNIT V	**DIELECTRICS (11 hrs)** Introduction - Dielectic polarization– Dielectric Polarizability, Susceptibility and Dielectric constant-types of polarizations- Electronic Ionic and Orientational polarizations (qualitative) – Lorentz Internal field – Claussius-Mossoti equation -Applications of dielectrics. **MAGNETICS PROPERTIES** Inroduction-Magnetic dipole moment-Magnetization-Magnetic susceptibility and permeability- Origin of permanent magnetic moment -Classification of Magnetic materials(Analytical)--Hysteresis-soft and hard magnetic materials & applications

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

TEXT BOOKS	
1.	"A Text book of Engineering Physics"by M.N.Avadhanulu, P.G.Kshirsagar -S.Chand Publications,
2.	"Engineering Physics" by M.R.Srinivasan, New Age international publishers.
3.	"Solid State Physics" by SO Pilai., - New age International Publishers
REFERENCE BOOKS	
1.	Kettles Introduction to Solid state Physics-Charles Kittel,Wiley India Edition
2.	Solid State Physics ,AJ Dekker, I Edition,Macmillan Publishers India Private Limited
WEB RESOURCES	
1.	https://youtu.be/NVllY3LlNqc https://youtu.be/1TRdOjVpm-0 https://youtu.be/0tHcWDNCJ-o
2.	https://study.com/academy/lesson/the-de-broglie-hypothesis-definition-significance.html https://www.youtube.com/watch?v=uPvWlwOhCTo
3.	https://www.youtube.com/watch?v=fdS12EaXH3A http://folk.uio.no/ravi/cutn/cmp/band1.pdf
4.	https://www.electronics-tutorials.ws/diode/diode_1.html https://youtu.be/3csUvwZdsOg https://www.youtube.com/watch?v=_40dpUzzfhA
5.	https://youtu.be/TuvLv6SBO5s https://youtu.be/u0Qf9jVh2kc

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

I Year II Semester

ELECTRICAL CIRCUIT ANALYSIS-I

Course Category	Engineering Sciences	**Course Code**	**19EE2T03**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	**NA**	**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	To Study the concepts of electrical networks and magnetic coupled circuits
2	To Understand the concepts of single phase AC system and components in electrical wiring
3	To Study the concepts of R,L,C circuits, resonance in series, parallel circuits and locus diagrams
4	To Understand various forms of powers of R, L, C network with sinusoidal excitation
5	To Solve electrical networks with respect to resonance concepts.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Analyze various electrical networks in presence of active and passive elements.	Analyzing	K4
CO2	Solve magnetic circuits with various dot conventions.	Applying	K3
CO3	Analyze different periodic waveforms and get explore on the basic techniques for wiring.	Analyzing	K4
CO4	Understand various forms of powers of R, L, C network with sinusoidal excitation	Understanding	K2
CO5	Solve electrical networks with respect to resonance concepts.	Applying	K3

Contribution of Course Outcomes towards achievement of Program

Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	1	0	0	0	2	0	0	0	0	0	1	2	2
CO2	3	2	0	0	0	0	0	0	0	0	0	0	0	2
CO3	3	3	0	0	0	0	0	0	0	0	0	0	1	2
CO4	3	2	2	0	0	0	0	0	0	0	0	0	2	1
CO5	3	2	0	0	0	0	0	0	0	0	0	0	0	2

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT I	**Introduction to Electrical Circuits:** Passive components and their V-I relations. Sources (dependent and independent) -Kirchhoff's laws, Network reduction techniques (series, parallel, series - parallel, star-to-delta and delta- to-star transformation). source transformation technique, nodal analysis and mesh analysis to DC networks with dependent and independent voltage and current sources.
UNIT II	**Magnetic Circuits:** Basic definition of MMF, flux and reluctance. Analogy between electrical and magnetic circuits. Faraday's laws of electromagnetic induction Concept of self and mutual inductance. Dot convention - coefficient of coupling and composite magnetic circuit. Analysis of series and parallel magnetic circuits**.**
UNIT III	**Single Phase A.C Systems and Components of Electrical Wiring:** Periodic waveforms (determination of rms, average value and form factor).Concept of phase angle and phase difference – Waveforms and phasor diagrams for lagging, leading networks. Basic components in electrical wiring, Types of wiring, Connection diagrams of SPST, Staircase, Godown, ceiling fan and Tube light connection, Purpose of earthing.
UNIT IV	**Analysis of AC Networks-I:** Complex and polar forms of representations, Steady state analysis of R, L and C circuits. Power Factor and its significance, real, reactive power and apparent power, waveform of instantaneous power and complex power
UNIT V	**Analysis of AC Networks-II:** Extension of node and mesh analysis to AC networks, Series and parallel resonance, Selectivity, band width and Quality factor, Introduction to locus diagrams.

TEXT BOOKS	
1.	Engineering Circuit Analysis by William Hayt and Jack E.Kemmerley and Steven M.Durbin, Tata McGraw Hill Company, 9th Edition
2.	Network Analysis by M.E.Van Valkenburg; Pearson publications Revised Third Edition
3.	Fundamentals of Electrical Circuits by Charles K.Alexander and Matthew N.O.Sadiku, Tata McGraw Hill Education (India) 6th Edition.
4.	Electrical Wiring ,Estimating & costing by S.L.Uppal Khanna Publishers
REFERENCE BOOKS	
1.	Network Theory by N C Jagan & C Lakshminarayana, BS Publications.
2.	Linear Circuit Analysis by De Carlo, Lin, Oxford publications Second Edition
3.	Electric Circuits by David A. Bell, Oxford publications
4.	Circuit Theory(Analysis and Synthesis) by A Chakrabarthi, Dhanpat Rai & Co. Revised Sixth Edition
5.	A course in Electrical Installation, Estimation & costing by J.B.Gupta by katson books.
WEB RESOURCES (Suggested)	
1.	http://pdf-ebooks-for-free.blogspot.in/2015/01/network-theory-by-alaxender-and-sadiku.html
2.	https://nptel.ac.in/courses/108102042/3
3.	https://lecturenotes.in/notes/28-notes-for-network-theory-nt-by-verified-writer

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

I Year II Semester

FUNDAMENTALS OF COMPUTER SCIENCE

Course Category	Engineering Science	**Course Code**	**19CS2T02**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	To understand the concept of Computer Hardware and Software.
2	To learn the concepts of Memory Management and I/O Management.
3	To understand different Network Topologies.

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Identify the internal organization of digital computer.	K2
CO2	Distinguish types of memories and memory mapping.	K2
CO3	Illustrate various data representation techniques.	K2
CO4	Summarize the functionalities of Operating System.	K2
CO5	Categorize different Network Topologies.	K2

Contribution of Course Outcomes towards achievement of Program

Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	1	1	0	0	0	0	0	0	0	0	0	1	0
CO2	3	1	2	0	0	0	0	0	0	0	0	0	1	0
CO3	3	1	0	0	0	0	0	0	0	0	0	0	1	0
CO4	3	1	2	0	0	0	0	0	0	0	0	0	1	0
CO5	3	1	1	0	0	0	0	0	0	0	0	0	1	0

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT I	**Introduction to Computer :** Digital and analog Computers, Characteristics of computers, History of computers, Generations of Computers, Classification of Computers, Application of Computers. **The Computer system Hardware:** CPU-ALU,CU,MU ,Instruction format, Instruction set, Inside a computer Cabinet.
UNITII	**Computer Memory:** Memory representation ,Memory Hierarchy, CPU Registers, Cache Memory, Primary Memory, Secondary Memory, Storage Devices-Magnetic Disk Type, Optical Disk Type. **Input and Output Devices:** Input output Unit, Input Devices, Output Devices, I/O Port, Working of I/O System
UNITIII	**Data Representation:** Number System- Decimal, Binary, Octal, Hexadecimal, Conversion of Decimal to Binary ,Octal ,Hexadecimal, Conversion of Binary, Octal ,Hexadecimal to Decimal Number System. **User Computer Interface:** Types of Software - System software and application software. System software-Operating System, Device Drivers , System Utility.
UNITIV	**Operating System:** Objectives of Operating System,Types of OS, Functions of OS, Processing Management-CPU Scheduling, Process synchronization, Memory Management-Memory allocation, Virtual Memory, File management, Device management.
UNITV	**Data Communications and computer Networks:** Data Transmission Media- Twisted pair, Coaxial Pair, Optical Fiber, Radio Transmission, Computer Network: Network Types-LAN, WAN, MAN, LAN Topologies- Bus ,Ring, Star Topologies. Network Devices –Network Interface card, Bridge, Hub, Switch, Router, Gateway. **The Internet and Internet Services:** The internet Architecture, Internet Connections-Dial-up Access, DSL(Digital subscriber Line), ISDN(Integrated Service Digital Network), Cable Model, World wide Web, Web Browsers, URL.

TEXT BOOKS	
1.	Computer Fundamentals by Anitha Goel, Pearson education
2.	Norton Peter, “Introduction to Computers”, 4th Ed., TMH
REFERENCE BOOKS	
1.	Computer Fundamentals By PK Sinha, 6th Editions, BPB publications
2.	Fundamentals of Computers by E. Balagurusamy, McGrawHill editions
WEB RESOURCES	
1.	https://www.tutorialspoint.com/computer_fundamentals
2.	https://www.javatpoint.com/computer-fundamentals-tutorial
3.	https://www.wisdomjobs.com/e-university/computer-fundamentals-tutorial-392.html.
4.	https://nptel.ac.in/courses/106103068/29

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

I Year II Semester

BASIC ELECTRONIC DEVICES AND CIRCUITS

Course Category	Engineering Science	**Course Code**	**19EC2T03**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	To learn the basics concepts of semiconductor physics, the construction details, operation and characteristics of various Semiconductor diodes
2	To understand the operation and analysis of rectifiers with and without filters.
3	To study the characteristics of bipolar junction transistors in different configurations and characteristics of different types of FET.
4	To understand the concepts of transistor amplifiers, FET amplifiers and Feedback amplifiers.
5	To understand the concepts of various oscillator circuits.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the concepts various semiconductor devices.	K2
CO2	Design rectifiers and filter circuits for the given specifications.	K3
CO3	Understand the concepts of BJT and FET for various configurations.	K2
CO4	Design amplifiers using BJT and FET with & without feedback.	K3
CO5	Understand the concepts of various types of Oscillators.	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	3	2	2								1	3	2
CO2	3	3	2	2								1	3	2
CO3	3	3	2	2								1	3	2
CO4	3	3	2	2								1	3	2
CO5	3	3	2	2								1	3	2

COURSE CONTENT	
UNIT I	**SEMICONDUCTOR DEVICES** **PN Junction Diode:** Introduction to Semiconductor Physics-Classification of Materials,

	Charge densities in semiconductors, Fermi Level in intrinsic and Extrinsic semiconductors.Open circuited PN junction, Biased PN junction, DiodeEquation, Volt-Ampere Characteristics, Temperaturedependence of V-I characteristics, Diode Resistance and Diode Capacitance. **Special Purpose Electronic Devices:** Breakdown Mechanisms in Semiconductor Diodes, Zener Diode Characteristics, Principle of Operation and Characteristics of Tunnel Diode (with the help of Energy Band Diagram), Varactor Diode, LED, Photo Diode.
UNIT II	**RECTIFIERS AND FILTERS** **Rectifiers:** Introduction**,** half wave rectifier, full wave rectifier, bridge rectifier circuit diagrams operation, input and output waveforms, derivations of I_{dc}, I_{RMS}, efficiency, ripple factor, TUF, PIV, voltage regulation, Zener diode as a voltage regulator. **Filters:** Series Inductor filter, Shunt Capacitor filter, L- section filter, Π- section filter, Multiple L- section Filter, derivation for ripple factor in each case.
UNIT III	**TRANSISTOR CHARACTERISTICS** BJT: Introduction, transistor current components, transistor equation, transistor configurations, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations. SCR, UJT, FET, MOSFET, DIAC, TRIAC: Introduction, construction, V-I characteristics.
UNIT IV	**AMPLIFIERS:** Analysis of BJT CE & CC amplifiers, FET amplifier, Concept of Negative feedback & its characteristics, Feedback Amplifiers using BJT- classification, Calculation of transfer gain(A_{vf}), Input resistance (R_{if}), output resistance(R_{of}) and bandwidth.
UNIT V	**OSCILLATORS:** Oscillator principle, conditions for oscillations, types of oscillators – RC phase shift, Wein bridge, generalized analysis of LC Oscillators, Hartley and Colpitt's oscillators using BJT and FET, Frequency and amplitude stability of oscillators.

TEXT BOOKS	
1.	Electronic Devices and Circuits – J. Millman, C.C.Halkias, and Satyabrata Jit, McGraw Hill Education. 4e, 2015,
2.	Electronic Devices and Circuits – Mohammad Rashid, Cengage Learning, 2013
3.	Semiconductor Physics and Devices-Donald A. Neamen, Third Edition , McGraw-Hill Higher-Education
4.	Electronic Devices and Circuits – David A. Bell, 5 Ed, Oxford.
REFERENCE BOOKS	
1.	Electronic Devices and Circuits – BVRao, KBR Murty, K Raja Rajeswari, PCR Pantulu, Pearson, 2nd edition
2.	Electronic Devices and Circuit Theory – RL Boylestad and LouisNashelsky, Pearson Publications, 10thEdition
3.	Electronic Devices and Circuits – B P Singh, RekhaSingh,PearsonPublications,Second Edition.
WEB RESOURCES	
1.	https://electronicsforu.com/resources/electronic-devices-and-circuit-theory
2.	https://www.electronics-tutorials.ws/diode/diode_1.html
3.	https://www.electronicshub.org/power-amplifier/
4.	https://www.allaboutcircuits.com/technical-articles/a-review-on-power-semiconductor-devices/

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

I Year II Semester

ENGINEERING DRAWING

Course Category	Engineering Science	**Course Code**	**19ME2T01**
Course Type	Theory	**L-T-P-C**	1-0-3-2.5
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	To introduce the students to use drawing instruments and to draw polygons, Engineering Curves and Scales.
2	To introduce the students to use orthographic projections, projections of points and lines.
3	To make the students draw the projections of the planes.
4	To make the students draw the projections of the various types of solids.
5	To represent the object in 3D view through isometric views.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level***
CO1	Construct polygons, scales and engineering curves.	K3
CO2	Identify the position of points and lines with use of orthographic projections.	K3
CO3	Analyze the location and position of plane figures through orthographic projections.	K4
CO4	Analyze the location and position of solid bodies through orthographic projections.	K4
CO5	Develop 2D and 3D objects by converting their views.	K6

*k1- Remembering, k2- Understanding, k3- Applying, k4- Analyzing, k5- Evaluating, k6- Creating

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1	1	1	-	-	-	-	-	1	-	-	-
CO2	3	2	1	2	1	-	-	-	-	-	1	-	-	-
CO3	3	2	1	2	1	-	-	-	-	-	1	-	1	1
CO4	3	2	1	2	1	-	-	-	-	-	1	-	1	1
CO5	3	2	1	3	3	-	-	-	-	-	1	-	2	2

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT I	Introduction to Engineering Drawing. **Polygons:** Constructing regular polygons by general method. **Curves:** Parabola, Ellipse and Hyperbola by general methods tangent & normal for the curves. Cycloid and Involutes. **Scales:** Vernier and Diagonal scales.
UNIT II	**Orthographic Projections:** Introduction, importance of reference lines, projections of points in various quadrants. Projections of straight lines inclined to both the planes, determination of true lengths and angle of inclination.
UNIT III	**Projections of planes:** Regular planes perpendicular/parallel to one plane. Regular planes inclined to one plane and parallel to other, inclined to both the planes.
UNIT IV	**Projections of Solids:** Simple positions of Prisms, Pyramids, Cones and Cylinders. Solids inclined to both the planes.
UNIT V	**Isometric Projections:** Introduction, Conversion of isometric views to orthographic views, Conversion of orthographic views to isometric views. Introduction to AutoCAD (Demo only)

TEXT BOOKS	
1	Engineering Drawing by N.D. Bhatt, Chariot Publications, 56th Edition.
2	Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age International (P) Limited (2008).
REFERENCE BOOKS	
1	Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers, 3rd Edition.
2	Engineering Graphics for Degree by K.C. John, PHI Publishers.
3	Engineering Graphics by PI Varghese, Mc Graw Hill Publishers, 2013.
4	Engineering Drawing by Basant Agarwal, Tata McGraw Hill Publishers, 2014.
5	B.V.R. Gupta & M. Raja Roy, Engineering Drawing, I.K. International Publishing House Pvt. Ltd., 2009.
WEB RESOURCES	
1	http://nptel.ac.in/courses/112103019/
2	http://www.me.umn.edu/courses/me2011/handouts/drawing/blanco-tutorial.html
3	https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/env_health_science_students/engineeringdrawing.pdf

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

I Year II Semester

PROFESSIONAL COMMUNICATIVE ENGLISH LABORATORY- II

Course Category	Humanities and Social Sciences	**Course Code**	**19HE2L02**
Course Type	Theory	**L-T-P-C**	0 – 0 – 3 – 1.5
Prerequisites	LSRW + Vocabulary Synonyms, antonyms, Grammar.	**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

CO	Course Outcomes Description	COGNITIVE LEVEL
CO1	Develop the required communication skills to present effective presentations and interviews with clarity and impact.	K2
CO2	Able to create constructive and elaborative discussions to share their ideas on several issues.	K3
CO3	Ensure to use of argumentative and critical thinking skills by elaborating ideas relevantly and improve team work.	K3

K1- Remembering , K2- Understanding, K3-Applying, K-4 Analyzing, K5- Evaluating, K6- Creating

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO3	-	-	-	-	-	-	-	-	3	-	-	-	-	-

PRESCRIBED LAB MANUAL FOR SEMESTER II:

'**STRENGTHEN YOUR STEPS**: A Multimodal Course in Communication Skills', Published by Maruthi Publications.

OBJECTIVES: To enable the students to learn demonstratively the communication skills of listening, speaking, reading and writing.

OUTCOME: A study of the communicative items in the laboratory will help the students become successful in the competitive world.

The course content along with the study material is divided into six units.

UNIT-1:

Small Talk & JAM Session

UNIT-2:

Interviews

UNIT-3:

Effective Telephonic Interviews

UNIT-4:

Group Discussions

UNIT-5:

Presentations & Public Speaking

UNIT-6:

Debates

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

I Year II Semester

APPLIED PHYSICS LABORATORY

Course Category	BASIC SCIENCES	**Course Code**	**19BP2L02**
Course Type	Lab	**L-T-P-C**	0 - 0 - 3-1.5
Prerequisites	Intermediate Physics	**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	The student will have exposure to various experimental skills which is essential for an Engineering student.
2	To gain practical knowledge by applying the experimental methods to correlate with the Theoretical Physics.
3	Apply the Analytical techniques and graphical analysis to the experimental data

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	Understand the basics of Interference, Diffraction in Physics using instruments like Spectrometer, Travelling microscope.	Understanding(K 2)
CO2	Determine the Magnetic and Dielectric constants of materials.	Application(K3)
CO3	Apply the basics of Current Electricity and Semiconductors in engineering application	Application(K3)

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO 1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
CO 2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
CO 3	2	2	2	0	0	0	0	0	0	0	0	0	0	0

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT: (Any 10 of the following listed 12 experiments)	
1.	Determination of wavelength of laser by diffraction grating.
2.	Determination of wavelength of a source-Diffraction Grating-Normal incidence.
3.	Newton's rings – Radius of Curvature of Plano - Convex Lens.
4.	Determination of thickness of a spacer using wedge film and parallel interference fringes.
5.	Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus.
6.	Energy Band gap of a Semiconductor p - n junction.
7.	Characteristics of Thermistor – Temperature Coefficients
8.	Determination of dielectric constant by charging and discharging method
9.	Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
10.	Dispersive power of diffraction grating.
11.	To Study the V-I Characteristics and determine the breakdown voltage of a Zener Diode
12.	Determination of Hall Voltage and Hall coefficients of a given semiconductor using Hall effect.

TEXT BOOKS	
1.	Laboratory Manual of Engineering Physics by Dr.Y.Aparna & Dr.K.Venkateswara Rao (V.G.S Publishers)
REFERENCE BOOKS	
1.	College customized manual
WEB RESOURCES	
1.	https://www.youtube.com/watch?v=h_hUBXz-G-Y
2.	https://youtu.be/dgxFFw_1gMo
3.	https://www.youtube.com/watch?v=v2B0QyW8XJ0
4.	https://www.youtube.com/watch?v=AYQLmFqFtlw
5.	https://youtu.be/toggy3WVxV4
6.	https://youtu.be/1CyFsGk-_l4

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

I Year II Semester

CONSTITUTION OF INDIA

Course Category	Humanities including Management	**Course Code**	19HM2T05
Course Type	Theory	**L-T-P-C**	2 -0 -0 - 0
Prerequisites		**Total Marks (Internal Assessment)**	100

Course Outcomes		**Blooms Taxonomy Level**	
On successful completion of the course, the student will be able to			
CO 1	Understand the evolution of Constitution of India	Understanding	K2
CO 2	Make use of their Fundamental rights.	Application	K3
CO 3	Understand the functioning of the Union Government	Understanding	K2
CO 4	Understand the functioning of the State and local self Government.	Understanding	K2
CO 5	Understand the value of Indian Constitution in functioning of the country.	Understanding	K2

Contribution of Course Outcomes towards achievement of Program

Outcomes: 1 – Low, 2 - Medium, 3 – High

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	0	0	0	0	0	3	0	3	0	1	0	2	0	0
CO2	0	0	0	0	0	1	0	2	1	1	0	1	0	0
CO3	0	0	0	0	0	1	0	1	1	1	0	0	0	0
CO4	0	0	0	0	0	1	0	1	1	1	0	0	0	0
CO5	0	0	0	0	0	1	1	1	1	1	0	2	0	0

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT I	**Introduction to Indian constitution:** Meaning of the term constitution - History and development – Preamble of the Constitution – Constituent Assembly – The salient features of Indian Constitution.
UNIT II	**Fundamental Rights and Directive principles of state policy:** Individual and Collective Rights – Limitations of the fundamental Rights – Judicial Interpretation of Fundamental Rights.
UNIT III	**Union Government:** Union Legislature – Lok sabha and Rajya sabha (powers and functions) – President of India (powers and functions) – Prime minister of India (powers and functions) – Union Judiciary (supreme court powers and functions).
UNIT IV	**State and Local self Government:** **State Government:** State Legislature (Legislative Assembly / Vidhan Sabha, Legislative Council / Vidhan Parishad) – Powers and functions of state legislature – The Chief Minister of the state (powers and functions) **Local Self Government:** Election commission of India (Powers and Functions)- The Union Public Service Commission (Powers and Functions)
UNIT V	**Working of the Indian Constitution** The values of the Indian Constitution and Ushering of Social Revolution in India – Nature and Role of Higher Judiciary in India – Amendments (Recent)

Reference Books	
1.	'Indian Polity' by Laxmikanth
2.	'Indian Administration' by Subhash Kashyap
3.	'Indian Constitution' by D.D. Basu
4.	'Indian Administration' by Avasti and Avasti

WEB RESOURCES (Suggested)	
1.	https://www.clearias.com/historical-background-of-indian-constitution/
2.	https://www.civilserviceindia.com/subject/General-Studies/notes/functions-and-responsibilities-of-the-union-and-the-states.html
3.	https://www.tutorialspoint.com/indian_polity/indian_polity_how_constitution_works

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

II Year I Semester

ELECTRICAL CIRCUIT ANALYSIS-II

Course Category	Professional Core Courses	**Course Code**	**19EE3T04**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Electrical Circuit Analysis-I	**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	To understand the applications of network theorems for analysis of electrical networks.
2	To study the transient behavior of electrical networks with different types of excitations.
3	To study the performance of a network based on input and output excitation/response.
4	To study the concepts of balanced and unbalanced three-phase circuits.
5	To understand the application of Fourier series and Fourier transforms for analysis of electrical circuits

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Apply the principles of network theorems to the electrical networks	Applying	K3
CO2	Analyze the transient response of electrical networks for different types of excitations.	Analyzing	K4
CO3	Solve the parameters for different types of network.	Applying	K3
CO4	Solve three- phase circuits under balanced and unbalanced condition.	Applying	K3
CO5	Understand different harmonics components from the response of an electrical network using Fourier series and Fourier transforms.	Understanding	K2

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	0	0	0	0	0	0	0	0	0	0	0	2
CO2	3	3	1	1	1	0	0	0	0	0	0	0	1	0
CO3	3	2	1	0	0	0	0	0	0	0	0	0	0	0
CO4	3	2	2	2	0	0	0	0	0	0	0	0	0	0
CO5	3	2	2	1	1	0	0	0	0	0	0	0	0	0

COURSE CONTENT	
UNIT I	**Network Theorems (DC & AC Excitations)** Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem and compensation theorem.
UNIT II	**Transient Analysis in DC and AC circuits** Transient response of R-L, R-C, R-L-C circuits for DC and AC excitations, Solution using differential equations and Laplace transforms.

UNIT III	**Two Port Networks** Two port network parameters – Z, Y, ABCD, inverse Transmission, hybrid and inverse hybrid parameters and their relations. Cascaded networks - poles and zeros of network functions- Relationship between parameter sets simplification of cascaded and parallel networks. Network functions for the Two-Port bridged – T, Pie and Lattice networks.
UNIT IV	**Three Phase Circuits** Phase sequence- star and delta connection - relation between line and phase voltages and currents in balanced systems - Analysis of balanced three phase circuits. Analysis of three phase unbalanced circuits: Loop method – Star-Delta transformation technique, Two wattmeter method for measurement of three phase power.
UNIT V	**Fourier Analysis and Transforms** Fourier theorem- Trigonometric form and exponential form of Fourier series, Conditions of symmetry- line spectra and phase angle spectra, Analysis of electrical circuits to non sinusoidal periodic waveforms. Fourier integrals and Fourier transforms – properties of Fourier transforms physical significance of the Fourier Transform and its application to electrical circuits.

TEXT BOOKS	
1.	Engineering Circuit Analysis by William Hayt and Jack E. Kemmerley, Mc Graw Hill Company, 6th Edition.
2.	Fundamentals of Electrical Circuits by Charles K.Alexander and Mathew N.O.Sadiku, McGraw Hill Education (India), 6th Edition.
3.	Network Analysis by M.E.Van Valkenburg; Pearson publications Revised Third Edition
REFERENCE BOOKS	
1.	Networks and Systems by D. Roy Choudhury, New Age International publishers, 2nd Edition.
2.	Circuit Theory (Analysis and Synthesis) by A.Chakrabarthi, Dhanpat Rai & Co, 7th Edition.
3.	Network Theory Analysis and Synthesis by Smarajit Ghosh, PHI publications, 1st Edition.
4.	A. Sudhakar, Shyammohan S. Palli, “Circuits and Networks Analysis and Synthesis”, Tata McGraw-Hill, 2nd Edition.
5.	Networks and Systems, Asfaq Hussain, Khanna Publishing House, Delhi, 2nd Edition.
WEB RESOURCES (Suggested)	
1.	https://circuitglobe.com/circuit-analysis-of-3-phase-system-balanced-condition.html
2.	https://nptel.ac.in/courses/108105053/pdf/L-10(GDR)(ET)%20((EE)NPTEL).pdf
3.	https://www.tutorialspoint.com/network_theory/network_theory_twoport_networks
4.	www.electrical4u.com/network-synthesis-hurwitz-polynomial-positive-real-functions
5.	https://www.electrical4u.com/fourier-series-and-fourier-transform/
6.	http://nptel.ac.in/courses/108105065/4

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

II Year I Semester

ELECTRICAL MACHINES - I

Course Category	Professional Core Courses	**Course Code**	**19EE3T05**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	NA	**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	To understand construction, operation and modeling of single phase transformers.
2	To analyze the performance of transformers and testing.
3	To Analyze the three phase transformers and achieve three phase to two phase conversion, Understand construction, principle of operation & performance of DC generators
4	To Learn the characteristics and performance of DC machines
5	To Learn the methods of speed control of DC motors and testing methods of DC machines

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive level**	
CO1	Understand the construction, operation and modeling of single phase transformers.	Understanding	K2
CO2	Analyze the performance of single phase transformers.	Analyzing	K4
CO3	Understand three phase transformers for analysis of power systems Understand construction, principle of operation & performance of DC generators	Understanding	K2
CO4	Analyze the performance of DC machines.	Analyzing	K4
CO5	Analyze the methods of speed control and testing methods of DC motors.	Analyzing	K4

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	1	0	0	0	0	0	0	0	0	0	1	2	2
CO2	3	2	0	0	0	0	0	0	0	0	0	0	0	2
CO3	3	3	0	0	0	0	0	0	0	0	0	0	1	2
CO4	3	2	2	0	0	0	0	0	0	0	0	0	2	1
CO5	3	2	0	0	0	0	0	0	0	0	0	0	0	2

COURSE CONTENT	
UNIT I	**Transformers -I** Types and constructional details - principle of operation - emf equation - operation on no load and on load phasor diagrams of transformers – equivalent circuit – regulation – losses and efficiency – effect of variation of frequency and supply voltage on losses – All day efficiency.

UNIT II	**Transformers-II** Tests on single phase transformers – open circuit and short circuit tests – Sumpner's test – separation of losses – parallel operation with equal voltage ratios – auto transformer – comparison with two winding transformers.
UNIT III	**Transformers-III** Poly phase connections -Y/Y, Y/Δ, Δ/Y, Δ/Δ and open Δ- Scott Connection - Three winding transformers. **Construction and operation of DC Machines** Constructional details - principle of operation of DC machines – EMF and Torque – Classification of DC machines based on excitation – Armature reaction and commutation in DC Machines.
UNIT IV	**Performance of D.C Machines** Characteristics of SEDC, shunt, series and compound generators - applications of DC generators - Characteristics of SEDC, shunt, series and compound motors - applications of DC motors - loss and efficiency calculations - Necessity of starter – Starting by 3 and 4 point starter,
UNIT V	**Speed Control and Testing of D.C. Machines** Speed control by armature voltage and field control - Testing of DC machines - brake test, Swinburne's method – retardation test - principle of regenerative or Hopkinson's method– Field's test- separation of losses.

TEXT BOOKS	
1.	Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education, 5th Edition.
2.	Electric Machinery by A. E. Fitzgerald, Charles kingsley, Stephen D.Umans, TMH, 7th Edition.
3.	Electrical Machines – P.S. Bhimbra, Khanna Publishers, 7th Edition.
4	Electrical Machines by D. P.Kothari, I .J .Nagarth, McGraw Hill Publications, 4th edition
REFERENCE BOOKS	
1.	Electrical Machines by Ashfaq Husain, Dhanpat rai & Co & Sons, 3rd Edition.
2.	Electrical Machines by R.K.Rajput, Lakshmi publications, 5th Edition
3	Electrical Machinery by Abijith Chakrabarthi and Sudhipta Debnath, McGraw-Hill Education, 1st Edition.
4	Electric Machines by Mulukutla S. Sarma & Mukeshk. Pathak, CENGAGE Learning, 2nd Edition.
5	Principles of Alternating Current Machinery By Ralph R. Lawrence, McGraw-Hill Book Company, 4th Edition.
WEB RESOURCES (Suggested)	
1.	http://www.electrical4u.com/principle-of-dc-generator/
2.	https://studyelectrical.com/2014/12/working-principle-of-dc-motor.html
3.	http://www.electrical4u.com/single-three-phase-transformer-vs-bank-of-three-single-phase-transformers/
4	https://www.electronics-tutorials.ws/transformer/transformer-basics.html
5	https://www.allaboutcircuits.com/textbook/alternating-current/chpt-10/three-phase-transformer-circuits/
6	https://www.electricaleasy.com/2014/05/three-phase-transformer-connections.html

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING | II Year I Semester

ELECTROMAGNETIC FIELDS

Course Category	Professional Core Courses	**Course Code**	**19EE3T06**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	NA	**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	To study the production of electric field and potentials due to different configurations of static charges.
2	To study the properties of conductors and dielectrics, calculate the capacitance of different configurations. Understand the concept of conduction and convection current densities.
3	To study the magnetic fields produced by currents in different configurations, application of Ampere's law and the Maxwell's second and third equations and to study the magnetic force and torque through Lorentz force equation in magnetic field environment like conductors and other current loops.
4	To develop the concept of self and mutual inductances and the energy stored.
5	To study time varying and Maxwell's equations in different forms and Maxwell's fourth equation for the induced EMF

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Describe static electric field and their behavior in different media.	Understanding	K2
CO2	Explain the properties of materials under the influence of electric field.	Understanding	K2
CO3	Apply Biot Savart's Law & Ampere Circuit Law for calculation of magnetic force on current carrying conductors.	Applying	K3
CO4	Calculate self and mutual inductance and energy stored in magnetic fields.	Applying	K3
CO5	Relate Electric and Magnetic fields (time varying) by using Maxwell's Laws.	Understanding	K2

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	2	1	0	0	0	1	0	1	2	1	2
CO2	3	2	2	2	1	0	0	0	1	0	1	2	1	2
CO3	3	3	2	2	1	0	0	0	1	0	1	2	1	2
CO4	3	3	2	2	1	0	0	0	1	0	2	2	1	2
CO5	2	3	2	2	1	0	0	0	1	0	2	2	1	2

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT I	**Electrostatics** Scalar and Vector fields, Orthogonal Coordinate Systems & Review of Vector Calculus: Rectangular, Cylindrical, Spherical coordinate systems. Differential length, area and volume. Electrostatic Fields – Coulomb's Law – Electric Field Intensity (EFI) – EFI due to a line and a surface charge – Work done in moving a point charge in an electrostatic field – Electric Potential, Potential gradient – gauss's law in terms of (integral form and point form) Maxwell's first law, div(D)=ρv Laplace's and Poison's equations.
UNIT – II	**Conductors – Dielectrics and Capacitance** Electric dipole – dipole moment – potential and EFI due to an electric dipole, Torque on an Electric dipole in an electric field conductors and Insulators – their behavior in electric field. Polarization, boundary conditions between conduction to dielectric and dielectric to dielectrics. Capacitance of parallel plates, spherical and coaxial cables with composite dielectrics, energy stored and energy density in a static electric field, current density, conduction and convection current densities, Ohm's law in point form – equation of continuity.
UNIT III	**Magnetostatics, Ampere's Law** Static magnetic field – Biot-Savart's law – Magnetic Field Intensity (MFI) – MFI due to a straight current carrying filament, circular, square and solenoid current carrying wire – Maxwell's second Equation, div(B)=0, Ampere's circuital law and its applications. MFI due to an infinite sheet of current and a long filament carrying conductor, point form of Ampere's circuital law, field due to a rectangular loop, Maxwell's third equation. Magnetic force, moving charges in a magnetic field – Lorentz force equation, force on a current element in a magnetic field, force on a straight and a long current carrying conductor in a magnetic field, force between two straight long and parallel current carrying conductors, magnetic dipole and dipole moment – a differential current loop as a magnetic dipole – Torque on a current loop placed in a magnetic field.
UNIT IV	**Self and Mutual Inductance** Scalar and vector magnetic potentials, Self & Mutual Inductance, Self Inductance determination of solenoid and toroid, mutual inductance determination between a straight long wire and a square loop wire in the same plane – energy stored and density in a magnetic field.
UNIT V	**Time Varying Fields** Time varying fields – Faraday's laws of electromagnetic induction – Its integral and point forms, - Displacement current – Maxwell's fourth equation, Curl (E)=-∂B/∂t – Statically and Dynamically induced EMFs.

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

TEXT BOOKS	
1.	Engineering Electromagnetic by William H. Hayt & John. A. Buck McGraw-Hill Companies A. Buck
2.	Introduction to Electrodynamics D J GRIFFITHS, PHI 4th Edition,2013
3.	Principles of Electromagnetics", Sadiku, Kulkarni, OXFORD University Press, 6th Edition ,2015
REFERENCE BOOKS	
1.	Electromagnetic Fields and Waves by R. L. Yadava, Khanna Publication House, 1st Edition,2019
2.	Engineering Electromagnetic by Nathan Ida, Springer 3rd Edition,2015
3	Electromagnetic Field Theory by Yaduvir Singh, Pearson,1st Edition,2011
4	Fundamentals of Engineering Electromagnetic by Sunil Bhooshan, Oxford higher education,1st
5	Electromagnetism: Problems with solutions by Ashutosh Pramanik, PHI Publications,vol-2,2014
WEB RESOURCES (Suggested)	
1.	http://bookboon.com/en/essential-electromagnetism-ebook
2.	https://nptel.ac.in/downloads/115101005/
3.	https://ocw.mit.edu/courses/physics/8-07-electromagnetism-ii-fall-2012/

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

II Year I Semester

THERMAL AND HYDRO PRIMEMOVERS

Course Category	Engineering Science	**Course Code**	**19ME3T03**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment**	40
		Semester End Examination	60
		Total Marks	100

COURSE OBJECTIVES	
1	To understand the basic concepts of thermodynamic and fluid mechanics.
2	To study the basic cycle of Steam Power Plant and their components.
3	To impart the knowledge of gas power plant and the methods to improve the efficiency.
4	To impart the knowledge of diesel power plant, its components and I.C Engines.
5	To impart the knowledge of various types of turbines, their constructional features, working and performance.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level***
CO1	Demonstrate basics of thermodynamics, properties of steam, fluid and analyze jet impact on vanes.	K2
CO2	Illustrate the working of steam boilers, steam turbines and steam condensers.	K2
CO3	Analyze the performance of the gas turbines.	K4
CO4	Classify IC engines and its performance.	K2
CO5	Analyze the performance of the hydraulic turbines.	K4

*1- Remembering, 2- Understanding, 3- Applying, 4- Analyzing, 5- Evaluating, 6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	1	-	3	2	-	-	2	3	1	1	-
CO2	3	3	2	1	-	3	2	-	-	2	3	2	2	-
CO3	3	3	2	1	-	3	2	-	-	2	3	2	2	-
CO4	3	3	2	1	-	3	2	-	-	2	3	2	2	-
CO5	3	3	2	1	-	3	2	-	-	2	3	2	2	-

COURSE CONTENT	
UNIT I	**Basics of Thermodynamics**: Thermodynamic systems and state, process and cycle. Laws of thermodynamics (statements only) - first law of thermodynamics and analysis of various thermodynamic processes. **Steam Properties**: Properties of the steam, use of steam tables, temperature to entropy and enthalpy to entropy diagrams. **Properties of Fluids:** Density, specific weight, specific volume, specific gravity, viscosity,

	surface tension and capillarity. **Impact of Jets**: Impulse momentum equation, impact of jet on stationary vanes (flat and curved), and impact of jet on moving vanes (flat and curved).
UNIT II	**Steam Power Plant:** Schematic layout of steam power plant, site selection for steam power plant, advantages and disadvantages. **Vapor Power Cycles:** Rankine Cycle- analysis of simple Rankine cycle. **Steam Boilers:** Classification and working principle of simple vertical, Bobcock & Wilcox and Lamont boilers. **Steam Turbines:** Classification of steam turbines working principles of simple impulse turbine and Parson's reaction turbine- compounding in turbines- velocity diagrams, work done and efficiency for simple impulse. **Steam Condensers:** Classification, surface Condensers working principle and efficiencies .
UNIT III	**Gas Power Plant**: Classification of gas power plants, applications, advantages and disadvantages of gas power plant. Working principles of closed cycle and open cycle gas power plant. **Methods to Improve the Performance**: Analysis of simple open cycles & cycles with inter cooling, Reheating and Regeneration.
UNIT IV	**Diesel Power Plant:** Schematic layout of diesel power plant, site selection for diesel power plant, advantages and disadvantages. **IC Engines**: Classification of I.C. Engine, working principles of 4 stroke and 2 stroke engines, valve and port timing diagrams - Engine systems: fuel injection, carburetion, ignition, cooling and lubrication systems – Engine performance evaluation.
UNIT V	**Hydraulic Power Plant:** Schematic layout of hydraulic Power Plant, site selection for hydraulic power plant, advantages and disadvantages. **Hydraulic Turbines**: Classification of turbines; Working principle, Efficiency calculation and Design principles for Pelton Wheel, Francis and for Kaplan turbines; Performance equations of turbine; Governing of turbines.

TEXT BOOKS	
1	Thermal engineering by RK Rajput, 10th Edition, Lakshmi Publishers.
2	Fluid mechanics and hydraulic machines by RK Bansal, 8th Edition, Lakshmi Publishers.
REFERENCE BOOKS	
1	Engineering Thermodynamics by PK Nag, McGrawHill Publisher, 6th Edition.
2	I.C Engines, V.Ganesan , 3rd Edition Tata Mcgraw-Hill.
3	Fluid Mechanics- fundamentals and applications, Y.A.Cengel & J.M.Cimbala, Mcgrawhill Publications.
4	Fluid mechanics and hydraulic machines by Modi and Seth, Standard Book House publishers.
5	Applied Thermodynamics by Eastop & McConkoy, 5th Edition, Pearson Education
WEB RESOURCES	
1	https://nptel.ac.in/noc/individual_course.php?id=noc17-me12
2	https://nptel.ac.in/noc/individual_course.php?id=noc18-me34
3	https://ekeeda.com/course/sem-iv/jawaharlal-nehru...hydraulic-machines/4548,
4	https://www.classcentral.com › Subjects › Engineering

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

II Year I Semester

DIGITAL ELECTRONICS

Course Category	Professional Core Courses	**Course Code**	**19EC3T05**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	To solve a typical number base conversion and analyze new error coding techniques.
2	Theorems and functions of Boolean algebra and behavior of logic gates, Boolean function simplification using Karnaugh maps and Quine-McCluskey methods
3	To understand concepts of combinational circuits
4	To understand concepts of basic sequential circuits
5	To develop advanced sequential circuits

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Classify different number systems and apply to generate various codes.	K2
CO2	Use the concept of Boolean algebra in minimization of switching functions	K2
CO3	Design different types of combinational logic circuits	K3
CO4	Apply knowledge of flip-flops in designing of Registers and counters	K3
CO5	The operation and design methodology for synchronous sequential circuits and algorithmic state machines	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	2	2							1			1	
CO2	2	2	2							1			2	
CO3	1	2	3							1				2
CO4	2	1	3							1			1	
CO5	2	2	3							1				1

COURSE CONTENT	
UNIT I	**NUMBER SYSTEM AND LOGIC GATES** Representation of numbers of different radix, conversation from one radix to another radix, r-1's compliments and r's compliments of signed members, problem solving. 4 bit codes, BCD, Excess-3, $9^{'s}$ compliment code etc., Logic operations and error detection & correction codes; Basic logic operations -NOT, OR, AND, Universal building blocks, EX-OR, EX-NOR - Gates, Standard SOP and POS,

	Forms, Gray code, error detection, error correction codes (parity checking, even parity, odd parity, Hamming code) NAND-NAND and NOR-NOR realizations. **B**asic gates implementation using diodes
UNIT II	**MINIMIZATION TECHNIQUES** Boolean theorems, principle of complementation & duality, De-morgan theorems, minimization of logic functions using Boolean theorems, minimization of switching functions using K-Map up to 5 variables, Tabular method, problem solving (code-converters using K-Map etc..).
UNIT III	**COMBINATIONAL CIRCUITS -I** Design of Half adder, full adder, half subtractor, full subtractor, applications of full adders, 4-bit binary subtractor, adder-subtractor circuit, BCD adder circuit, Excess 3 adder circuit, look-a-head adder circuit. **COMBINATIONAL CIRCUITS -II** Design of decoder, de-multiplexer, 7 segment decoder, higher order de-multiplexing, encoder, multiplexer, higher order multiplexing, realization of Boolean functions using decoders and multiplexers, priority encoder, 4-bit digital comparator.
UNIT IV	**SEQUENTIAL CIRCUITS I** Classification of sequential circuits (synchronous and asynchronous); basic flip-flops, truth tables and excitation tables (nand RS latch, nor RS latch, RS flip-flop, JK flip-flop, T flip-flop, D flip-flop with reset and clear terminals). Conversion from one flip-flop to flip-flop. Design of ripple counters, design of synchronous counters, Johnson counter, ring counter. Design of registers - Buffer register, control buffer register, shift register, bi-directional shift register, universal shift register.
UNIT V	**SEQUENTIAL CIRCUITS II** Finite state machine; Analysis of clocked sequential circuits, state diagrams, state tables, reduction of state tables and state assignment, design procedures. Realization of circuits using various flip-flops. Meelay to Moore conversion and vice-versa.

TEXT BOOKS	
1.	Switching and finite Automata theory - Zvi kohavi, third edition, Cambridge university press
2.	Switching Theory and Logic Design by A. Anand Kumar, PHI, 3rd Edition.
3.	Digital Logic and Computer Design by M Morris Mano, PHI.
REFERENCE BOOKS	
1.	Switching Theory and Logic Design by Hill and Peterson Mc-Graw Hill TMH second edition
2.	Modern Digital Electronics by RP Jain, TMH, 4th Edition.
3.	Fundamentals of Logic Design by Charles H. Roth Jr, Jaico Publishers, 5th Edition
4.	Digital electronics logic and design-Cherry Bhargava, BS Publications, 2019
WEB RESOURCES	
1.	http://logos.cs.uic.edu/366/notes/ErrorCorrectionAndDetectionSupplement.pdf
2.	https://www.tutorialspoint.com/digital_circuits/digital_circuits_quine_mccluskey_tabular_method.htm
3.	https://www.electronicshub.org/sequential-circuits-basics/
4.	http://people.ee.duke.edu/~jmorizio/ece261/classlectures/SeqPart2.pdf
5.	https://www.electronics-tutorials.ws/combination/comb_1.html

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

ELECTRICAL CIRCUITS LABORATORY

II Year I Semester

Course Category	Professional Core Courses Courses	**Course Code**	**19EE3L04**
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Electrical Circuit Analysis-I	**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	To verify and demonstrate various theorems, locus diagram, response and two port networks.
2	To determine self and mutual inductance of a magnetic circuits , parameters of a given coil.
3	To measure 3-phase power.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Employ various theorems applied to electrical circuits.	Applying	K3
CO2	Determine self and mutual inductances, two port parameters of a given electric circuits, time constant of RL and RC circuits.	Evaluating	K5
CO3	Draw locus diagrams and to measure the power in different load conditions.	Understanding	K2

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	2	0	0	0	0	3	2	1	0	2	2
CO2	3	3	1	2	2	0	0	0	3	2	1	0	2	2
CO3	3	3	1	2	2	0	0	0	3	2	1	0	2	2

LIST OF EXPERIMENTS:	
Any 10 of the following experiments are to be conducted	
Experiment 1	Verification of Thevenin's and Norton's Theorems.
Experiment 2	Verification of Superposition theorem and Maximum Power Transfer Theorem.
Experiment 3	Verification of Compensation Theorem.
Experiment 4	Verification of Reciprocity, Millman's Theorems.
Experiment 5	Locus Diagrams of RL and RC Series Circuits.
Experiment 6	Series and Parallel Resonance.
Experiment 7	Determination of Self, Mutual Inductances and Coefficient of coupling.
Experiment 8	Z and Y Parameters.
Experiment 9	Transmission & Hybrid Parameters.
Experiment 10	Time response of RL & RC series circuits.
Experiment 11	Measurement of three phase active power using two wattmeter method for balanced and unbalanced loads.
Experiment 12	Parameters of a choke coil

References – Lab Manuals will be provided

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING II Year I Semester

THERMAL AND HYDRO PRIMEMOVERS LABORATORY

Course Category	Professional Core Courses	**Course Code**	**19ME3L04**
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	To impart practical knowledge on the performance evaluation methods of various internal combustion engines.
2	To impart practical knowledge on the performance evaluation methods of various flow measuring devices.
3	To impart practical knowledge on the performance evaluation methods of various hydraulic machines.

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	Evaluate the performance of various internal combustion engines.	K5
CO2	Evaluate the performance of flow measuring devices.	K5
CO3	Evaluate the performance of hydraulic turbines and pumps.	K5

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	2	-	3	3	-	2	-	-	3	-	2
CO2	-	3	3	-	-	-	2	-	-	-	-	-	3	-
CO3	-	-	3	-	-	3	3	-	-	-	-	-	3	-

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

LIST OF EXPERIMENTS

A. Thermal Engineering

1. I.C. Engines valve timing diagrams.
2. I.C. Engines port timing diagrams.
3. Engines performance test on 4 -stroke Diesel engine.
4. I.C. Engines performance test on 2-stroke petrol engine.
5. Evaluation of engine friction by conducting Morse test on 4-stroke multi cylinder petrol engine.
6. Determination of FP by retardation and motoring test on IC engine
7. I.C. Engines heat balance on petrol / Diesel engines.

B. Hydraulic Machines

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Calibration of Venturi meter.
5. Calibration of Orifice meter.
6. Determination of Friction factor for a given pipe line.

Note: From each section a minimum of 5 experiments and a total of 10 experiments should be conducted.

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

II Year I Semester

ELECTRICAL AND IT WORKSHOP

Course Category	Professional Core Courses Courses	**Course Code**	**19EE3L03**
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	NA	**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	To study various electric tools and symbols.
2	To Study the basic Techniques for different types of wiring.
3	To Identify types of resistors and capacitors.
4	To study different types of earthing.
5	To impart trouble shooting of Hardware, Software and Installation of Operating system.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Explain the limitations, tolerance, safety aspects of electrical systems and wiring.	Understanding	K2
CO2	Select wires/cables and other accessories used in different types of wiring.	Understanding	K2
CO3	Make simple lighting and power circuits.	Applying	K3
CO4	Measure current, voltage and power in a circuit.	Evaluating	K5
CO5	Demonstrate the disassembling, assembling of a computer and hardware, software trouble shooting.	Applying	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	0	3	0	0	2	3	0	0	0	0	0	3	1
CO2	3	1	1	0	0	1	1	0	0	0	0	0	3	1
CO3	3	0	1	0	0	1	3	0	0	0	0	0	3	1
CO4	3	1	1	0	0	0	0	0	0	0	0	0	3	1
CO5	3	1	1	0	0	0	0	0	0	0	0	0	1	0

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

LIST OF EXPERIMENTS:	
Any 10 of the following experiments are to be conducted	
Experiment 1	Study of various electrical tools and symbols.
Experiment 2	Identification types of resistors and capacitors.
Experiment 3	Wiring of light/fan circuit using two way control (stair case wiring)
Experiment 4	Godown wiring/Tunnel wiring.
Experiment 5	Measurement of voltage, current, resistance in DC circuit.
Experiment 6	Types of earthing, physical implementation.
Experiment 7	Identification ofperipherals of a computer. To prepare a report containing the block diagram of the CPU along with the configuration of each peripheral and its functions. Description of various I/O devices, power rating of computers.
Experiment 8	A practice on disassembling the components of a PC and assembling them to back to working condition.
Experiment 9	**Hardware trouble shooting (Demonstration):** Identification of a problem and fixing a defective PC (improper assembly of peripherals).
Experiment 10	**Software troubleshooting (Demonstration):** Identification of a problem and fixing the PC for any software issues.
Experiment 11	**MS Word**-Formatting, Page Border, Equations and Symbols. **MS Excel**-Organize data, Usage of formula, graphs and Charts. **MS Power Point**-Guidelines for preparing an effective presentation.
Experiment 12	**Operating system installation:-** Install Windows Operating Systems along with necessary Device Drivers.

References – Lab Manuals will be provided

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

II Year I Semester

ENVIRONMENTAL STUDIES

Course Category	Mandatory Courses	**Course Code**	**19BE3T01**
Course Type	Theory	**L-T-P-C**	2 – 0 – 0 – 0
Prerequisites	Exposure Basic Knowledge in Environment and protection.	**Internal Assessment** **Semester End Examination** **Total Marks**	0 0 0

COURSE OBJECTIVE:	
1	To make the students to get awareness on environment, to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life to save earth from the inventions by the engineers.

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	Recognize the interconnectedness of human dependence on the earth's ecosystems	K2
CO2	Comprehend environmental problems from multiple perspectives with emphasis on human modern lifestyles and developmental activities	K1
CO3	Demonstrate knowledge relating to the biological systems involved in the major global environmental problems of the 21st century	K2
CO4	Gain a higher level of personal involvement and interest in understanding and solving environmental problems.	K2
CO5	Learn the management of environmental hazards and to mitigate disasters and have a clear understanding of environmental concerns and follow sustainable development practices	K3
CO6	Influence their society in proper utilization of goods and services.	K1

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**
CO 1	1	0	1	0	0	1	2	0	0	0	1	0	0	0
CO 2	0	1	0	0	0	0	1	0	0	0	0	0	0	0
CO 3	0	0	0	0	2	0	1	0	0	0	0	0	0	0
CO 4	0	0	0	0	1	1	3	0	0	0	0	0	0	0
CO 5	0	0	0	0	0	0	3	1	0	0	0	0	0	0

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT I	**Multidisciplinary nature of Environmental Studies:** Definition, Scope and Importance- Need for public awareness. **Natural Resources:** Forest resources : deforestation – Mining, dams and other effects on forest and tribal people. Water resources :Use and over utilization of surface and groundwater. Food resources:World food problems, effects of modern agriculture, fertilizer-pesticide problems. Energy resources: renewable and nonrenewable energy sources. Role of an individual in conservation of natural resources.Equitable use of resources for sustainable lifestyles.
UNIT II	**Ecosystems, Biodiversity and its conservation:** Definition of Ecosystem and its structure, Functions Biodiversity Definition-Value of biodiversity, India as a mega-diversity nation, Threats to biodiversity, Conservation of biodiversity
UNIT III	**Environmental Pollution:** Definition, Cause, Effects of Air pollution, Water pollution, Noise pollution, Radioactive pollution, Role of an individual in prevention of pollution. **Solid Waste Management:** Sources, effects and control measures of urban and industrial waste.
UNIT IV	**Social Issues and the Environment:** Air (Prevention and Control of Pollution) Act 1981. –Water (Prevention and control of Pollution) Act 1974,EPA act 1986 ,Issues involved in enforcement of environmental legislation**,** Rain water harvesting, Global Environmental challenges climate change and mitigations and Adaptations (Engineering technologies)
UNIT V	**Human population and the Environment:** Population growth,Women and child welfare, Role of Information technology in environment and human health Awareness to Environmental Assessment& clearance ,Audit .Environmental Governance in india E-Waste management Rules (Biomedical Waste, Solid Waste) **Field work: A** mini project related to Environmental issues / To visit a local polluted site (Submission of project by every student)

TEXT BOOKS	
1.	Environmental Studies for undergraduate courses by ErachBharucha,UGC.
2.	A Textbook of Environmental Studies by Dr.S.AzeemUnnisa,Acadamic publishing company.
3.	Environmental Studies by P.N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson Education, Chennai
4.	A Textbook EIA Notification 2006(2019)
REFERENCE BOOKS	
1.	Text Book of Environmental Studies by Deeshita Dave & P. UdayaBhaskar, Cengage learning.
2.	Glimpses of Environment by K.V.S.G. Murali Krishna Published by Environmental Protection Society, Kakinada, A.P.
3.	Environmental Studies by Benny Joseph, Tata McGraw Hill Co, New Delhi
WEB RESOURCES	
1.	http://www.defra.gov.uk/environment/climatechange
2.	http://conbio.net/vl/ and www.biodiversitya-z.org/content/biodiversity
3.	https://www.omicsonline.org/environment-pollution-climate-change.php
4.	http://www.publichealthnotes.com/solid-waste-management/
5.	**http://IPCC.com**

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

ELECTRICAL MACHINES-II

II Year I Semester

Course Category	Professional Core Courses	**Course Code**	**19EE4T07**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Electrical Machines-I	**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	To Understand the principle of operation and determine the equivalent circuit parameters of 3-phase induction motor.
2	To Deal with the detailed analysis of 3-phase induction motors and quantify the performance of induction motor and induction generator in terms of torque and slip.
3	To Understand the construction, operation and types of single phase motors and understand the constructional features of synchronous generators
4	To Study various methods of finding the regulation of Synchronous generators and their parallel operation.
5	To Impart knowledge on principle of operation and factors affecting the performance of synchronous motor.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Understand the factors affecting the performance of 3-phase Induction Motor from its equivalent circuit.	Understanding	K2
CO2	Analyze the performance of 3-phase Induction Motor under different operating conditions using circle diagram.	Analyzing	K4
CO3	Identify the suitable motor such as single-phase Induction Motor and Understand the construction details of synchronous machine.	Analyzing	K4
CO4	Understand the regulation of synchronous generators using various methods and know their parallel operation.	Understanding	K2
CO5	Draw the power circles and excitation circles of synchronous motor to determine optimum operating point.	Understanding	K2

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	1	2	0	0	0	0	0	0	1	1	2
CO2	3	2	2	1	2	0	0	0	0	0	0	1	1	2
CO3	3	2	2	1	2	0	0	0	0	0	0	1	1	2
CO4	3	2	2	1	2	0	0	0	0	0	0	1	1	2
CO5	3	2	2	1	2	0	0	0	0	0	0	1	1	2

COURSE CONTENT

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

UNIT I	**3-phase Induction Motors** Construction details of cage and wound rotor machines – rotating magnetic field - principle of operation - rotor emf and rotor frequency - rotor current and pf at standstill and during running conditions - rotor power input, rotor copper loss and mechanical power developed and their inter relationship – equivalent circuit – phasor diagram.
UNIT II	**Characteristics, starting and testing methods of Induction Motors** Torque equation - expressions for maximum torque and starting torque - torque slip characteristic – double cage and deep bar rotors - crawling and cogging Speed control methods of induction motor (stator voltage, rotor emf injection, v/f) - no load and blocked rotor tests - circle diagram – starting methods.
UNIT III	**Single Phase Motors** Double revolving field theory - equivalent circuit - Constructional features, Problems of starting. Starting Methods of single phase induction motors - universal motor - Applications. **Synchronous Generators** Constructional features of non – salient and salient pole type – Armature windings – Distribution factor – Pitch factor – E.M.F equation - Phasor diagrams.
UNIT IV	**Voltage Regulation and Parallel operation of Synchronous Generators** Armature reaction – Voltage regulation by synchronous impedance method – MMF method and Potier triangle method –Two reaction theory - Parallel operation with infinite bus and other alternators – Synchronizing power – Load sharing – Control of real and reactive power.
UNIT V	**Synchronous Motors** Operating principle - Phasor diagram – Methods of starting – Variation of current and power factor with excitation – power developed - Synchronous condenser – Hunting and its suppression – Applications.

TEXT BOOKS	
1.	Electric Machinery by A. E. Fitzgerald, Charles kingsley, Stephen D.Umans, TMH 7th Edition.
2.	Electrical Machines – P.S. Bhimbra, Khanna Publishers 7th Edition.
3.	Alternating Current Machines by M. G. Say, Longman Scientific and Technical, 5th Edition.
REFERENCE BOOKS	
1.	Electric Machines by Asfaq Husain,Haroon Ashfaq Dhanpat Rai & co, 2nd Edition
2.	Theory & Performance of Electrical Machines by J. B. Guptha, S. K. Kataria & Sons, 4th Edition.
3.	Electrical Machines by D. P. Kothari, I .J .Nagarth, McGrawHill Publications, 4th Edition
4.	Electrical Machines by R. K. Rajput, Lakshmi publications, 5th edition
5.	Electrical Machinery by Abijith Chakrabarthi and Sudhipta Debnath, McGraw Hill education, 1st Edition.
6.	Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill Education, 4th Edition.
WEB RESOURCES (Suggested)	
1.	http://www.electricaleasy.com/
2.	http://electrical-engineering-portal.com/rotating-magnetic-field-ac-machines
3.	http://nptel.ac.in/courses/108106072/pdf/2_6.pdf

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

CONTROL SYSTEMS

II Year II Semester

Course Category	Professional Core Courses	**Course Code**	**19EE4T08**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	NA	**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	To learn the mathematical modeling of physical systems and to use block diagram algebra and signal flow graph to determine overall transfer function
2	To analyze the time response of first and second order systems and improvement of performance by proportional plus derivative and proportional plus integral controllers and to investigate the stability of closed loop systems using Routh's stability criterion and the analysis by root locus method.
3	To present the Frequency Response approaches for the analysis of linear time invariant (LTI) systems using Bode plots, polar plots and Nyquist stability criterion.
4	To discuss basic aspects of design and compensation of linear control systems using Bode plots.
5	To formulate state models and analyze the systems. To learn the concepts of Controllability and Observability.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Analyze the transfer function of physical systems for modeling of control systems.	Analyzing	K3
CO2	Understanding the time domain specifications to the second order systems and Analyze the stability of control system to know the behavior of the system	Understanding	K2
CO3	Analyze the stability of LTI systems in frequency domain	Analyzing	K4
CO4	Analyze Lag, Lead, Lag-Lead compensators to improve system performance of control systems.	Analyzing	K4
CO5	Summarize the physical systems as state models and determine the response	Understanding	K2

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	2	3	2	0	0	0	0	0	0	1	0	1
CO2	3	3	2	2	2	0	0	0	0	0	0	1	1	1
CO3	3	2	2	2	2	0	0	0	0	0	0	1	0	1
CO4	3	2	2	2	2	0	0	0	0	0	0	1	0	1
CO5	3	3	2	3	2	0	0	0	0	0	0	1	1	1

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT I	**Mathematical modeling of control systems** Classification of control systems, open loop and closed loop control systems and their differences, Feedback characteristics, transfer function of linear system, mathematical modeling of mechanical systems (translational and rotational) - mathematical modeling of electrical circuits, DC servo motor, AC servo motor, synchro, transmitter and receiver – block diagram reduction –signal flow graphs – Mason's gain formula.
UNIT II	**Time response analysis** Standard test signals – time response of first and second order systems – time domain specifications, steady state errors and error constants, effects of proportional (P), proportional integral (PI), proportional derivative (PD), proportional integral derivative (PID) systems. **Stability and root locus technique** The concept of stability – Routh's stability criterion – limitations of Routh's stability, root locus concept – construction of root loci (simple problems), Effect of addition of Poles and zeros to the transfer function on stability.
UNIT III	**Frequency response analysis** Introduction to frequency domain specifications – Bode diagrams – transfer function from the Bode diagram- Polar plots. Stability analysis from Bode plots, phase margin and gain margin, Nyquist stability criterion.
UNIT IV	**Classical control design techniques** Lag, lead, lag-lead compensators, design of compensators using Bode plots
UNIT V	**State space analysis of LTI systems** Concepts of state, state variables and state model, state space representation of transfer function, diagonalization, solving the time invariant state equations, State Transition Matrix and its properties.

TEXT BOOKS	
1.	Modern Control Engineering, Kotsuhiko Ogata, Prentice Hall of India.
2.	Automatic control systems, Benjamin C.Kuo, Prentice Hall of India, 2nd Edition.
3.	Control Systems Engineering by Norman Nise Wiley India Edition, 7th Edition.
4	Control System Engineering by I. J. Nagarath and M. Gopal – 5th Edition, New Age International Publishers.
REFERENCE BOOKS	
1.	Control Systems, Manik Dhanesh N, Cengage publications .
2.	Control Systems principles and design, M.Gopal, Tata Mc Graw Hill education Pvt Ltd., 4th Edition.
3.	Control Systems Engineering, S.Palani, Tata Mc Graw Hill Publications.
4.	Control system by A.Anand Kumar –Second Edition , PHI Learning Private Limited , 2014
5.	Control Systems by William Bolton -1st Edition, Newnes Publishers, 2002,UK.

WEB RESOURCES (Suggested)	
1.	www.electrical4u.com/control systems
2.	www.electrical4u.com/state space analysis
3.	www.tutorialspoint.com/control_systems/control_systems_bode_plots
4.	https://en.wikibooks.org/wiki/Control_Systems/Bode_Plots.
5.	https://www3.nd.edu/~pantsakl/Publications/348A-EEHandbook05.pdf

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

ELECTRICAL POWER GENERATION AND DISTRIBUTION

II Year II Semester

Course Category	Professional Core Courses	**Course Code**	**19EE4T09**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	NA	**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	To study the principle of operation of different components of a thermal power stations
2	To study the principle of operation of different components of Hydro, Gas, and Nuclear power stations.
3	To study the constructional and operation of different components of an Air and Gas Insulated substations.
4	To study the constructional details of different types of cables.
5	To study different types of load curves and tariffs applicable to consumers.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Identify the different components of thermal power plants.	Remembering	K1
CO2	Identify the different components of hydro, gas, nuclear Power plants.	Remembering	K1
CO3	Identify the different components of air and gas insulated substations.	Remembering	K1
CO4	Identify single core and three core cables with different insulating materials.	Remembering	K1
CO5	Analyze the different economic factors of power generation and tariffs.	Analyzing	K4

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	1	1	0	1	0	0	0	0	1	1	2
CO2	3	2	2	1	1	0	1	0	0	0	0	1	1	2
CO3	3	1	2	1	1	0	0	0	0	0	0	1	1	1
CO4	3	2	1	1	1	0	0	0	0	0	0	1	1	2
CO5	3	1	1	2	1	0	0	0	0	0	0	1	1	2

COURSE CONTENT	
UNIT I	**Thermal Power Stations** Selection of site, General layout of a thermal power plant showing paths of coal, steam, water, air, ash and flue gasses, ash handling system, Brief description of components: Boilers, Super heaters, Economizers, electrostatic precipitators steam Turbines : Impulse and reaction

	turbines, Condensers, feed water circuit, Cooling towers and Chimney.
UNIT II	**Hydro, Gas and Nuclear Power Stations** Hydro Power Plant: Layout and working, Types of hydroelectric power plants, Advantages of hydro generation. Gas power plant: Layout, Components of a gas turbine, Open and Combined cycle power stations. Nuclear Power Plant: Location, Working principle, Nuclear fission, Nuclear fuels, Nuclear chain reaction, Components: Moderators, Control rods, Reflectors and Coolants. Types of Nuclear reactors and brief description of PWR, BWR and FBR.
UNIT III	**Substations** **Air Insulated Substations (AIS) -** Indoor & Outdoor substations, Substations Layouts of 33/11KVshowing the location of all substation equipment, Bus bar arrangements in the Sub-Stations: Single bus bar, sectionalized single bus bar, Double bus bar arrangements with one and two circuit breakers, Main and Transfer bus bar system with relevant diagrams. **Gas Insulated Substations (GIS)** – Advantages of GIS, Different types of GIS, Single line diagram of GIS, Constructional aspects of GIS, Installation and maintenance of GIS, Comparison of AIS with GIS
UNIT IV	**Underground Cables** Types of Cables, Construction, Types of insulating materials, Calculation of insulation resistance, stress in insulation and power factor of cable, Capacitance of single and 3-Core belted Cables, Grading of Cables-Capacitance grading and Inter-sheath grading,
UNIT V	**Economic Aspects of Power Generation & Tariff** **Economic Aspects -** Load curve, load duration and integrated load duration curves, discussion on economic aspects: connected load, maximum demand, demand factor, load factor, diversity factor, power capacity factor and plant use factor, Base and peak load plants. **Tariff Methods** - Costs of Generation and their division into Fixed, Semi fixed and Running Costs, Desirable Characteristics of a Tariff Method, Tariff Methods: Simple rate, Flat Rate, Block-Rate, two-part, three–part, and power factor tariff methods

TEXT BOOKS	
1.	Electric Power Generation, Transmission & Distribution by Leonard L. Grigsby, CRC Press Taylor & Francis group, 3rd Edition.
2.	A Text Book on Power System Engineering by M. L. Soni, P. V. Gupta, U. S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co. Pvt. Ltd.
3.	Generation of Electrical Energy by B.R.Gupta S.Chand Publications 7th Edition.
REFERENCE BOOKS	
1.	A Course in Power Systems by J.B. Gupta, S. K. Kataria & sons, 2009 Edition.
2.	Principles of power system by V.K.Mehta & Rohit Mehta, S.Chand Publications
WEB RESOURCES (Suggested)	
1.	**https://www.ntpc.co.in/en/power-generation**
2.	**https://energy.economictimes.indiatimes.com/tag/power+generation**
3.	**https://www.sciencedirect.com/topics/engineering/electric-power-distribution**

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

II Year II Semester

ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

Course Category	Professional Core Courses	**Course Code**	**19EE4T10**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	NA	**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	To study the principle of operation and working of different types of instruments for measurement of Electrical Quantities.
2	To study the working principle of operation of different types of instruments for measurement of power and power factor.
3	To understand the principle of operation and working of various types of bridges for measurement of parameters –resistance, inductance, capacitance and frequency.
4	To understand the principle of operation and working of transducers.
5	To study the principle of operation and working of DVMS, Power Analyser and applications of CRO.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Select the right type of instrument for measurement of AC and DC. Electrical Quantities.	Analyzing	K4
CO2	Understand the construction and principle of operation of instruments for measurement of Power and Power Factor.	Understanding	K2
CO3	Calculate the unknown resistance, inductance, capacitance by using DC and AC bridges.	Applying	K3
CO4	Identify the various transducers used for various applications.	Remembering	K1
CO5	Analyze digital meters for the measurement of voltage, frequency, speed and Energy.	Analyzing	K4

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	3	3	2	0	0	0	0	0	0	0	0	0	1
CO2	2	3	3	2	0	0	0	0	0	0	0	0	0	1
CO3	2	2	2	2	0	0	0	0	0	0	0	0	0	1
CO4	2	2	2	2	0	0	0	0	0	0	0	0	0	1
CO5	3	3	3	2	0	0	0	0	0	0	0	0	1	1

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT I	**Measuring Instruments** Classification – Deflecting, control and damping torques – PMMC, moving iron type and electro static instruments, Construction, Torque Equation, Range Extension – Effect of temperature -- Errors and compensations–Advantages and Disadvantages – Instrument Transformer : Current Transformers and Potential transformers– Construction ,theory, Errors.
UNIT II	**Analog wattmeters and Power factor Meters** Electrodynamometer type wattmeter (LPF and UPF) , Power factor meters – Dynamometer and M.I. Type (single phase and three phase): Construction, Theory, Torque Equation, advantages and disadvantages.
UNIT III	**Measurement of Electrical Parameters** **DC Brides :** Methods of measuring low, medium and high resistance – Sensitivity of Wheatstone's bridge — Kelvin's double bridge for measuring low resistance– Loss of charge method for measurement of high resistance ,Megger– Measurement of earth resistance. **AC Bridges:** Measurement of inductance– Quality Factor – Maxwell's bridge–Hay's bridge –Anderson's bridge–Measurement of capacitance and loss angle – Desauty's bridge– Schering Bridge–Wagner's earthing device–Wien's bridge.
UNIT IV	**Transducers** Definition of transducers – Classification of transducers –Resistive, Inductive and Capacitive Transducers – LVDT – Strain gauge– Thermistors – Thermocouples – Piezoelectric and Photo diode Transducers –Digital Shaft encoders , Hall effect Sensors.
UNIT V	**Digital meters** Digital Voltmeter–Successive approximation type DVM, Ramp type DVM and integrating type DVM –Digital frequency meter, Digital multimeter, Digital Tachometer, Digital Energy meter, LCR Q Meter, Power Analyzer–Measurement of Phase difference and frequency, hysteresis loop using lissajous patterns on CRO.

TEXT BOOKS	
1.	Electrical Measurements and Measuring Instruments by F. W. Golding and Widdis, Wheeler publishing, 5th Edition.
2.	Modern Electronic Instrumentation and Measurement techniques – by A.D Helfrick and W.D. Cooper, Pearson/Prentice Hall of India ,5th Edition -2002
3.	A Course in Electrical and Electronics Measurements and Instruments by A. K. Sawhney Dhanpat Rai and sons publications, Delhi.
4.	Electronic Instrumentation and Measurements by David A Bell Oxford University Press, 2nd Edition.
REFERENCE BOOKS	
1.	Electrical and Electronics Measurements and Instrumentation by R.K.Rajput, S.Chand publications.
2.	Electrical Measurements by Buckingham and Price,Prentice-Hall
3.	Electrical Measurements by Forest K. Harris ,John Wiley and sons.

4.	Electrical Measurements: Fundamentals, Concepts, Applications by Reissland, M.U, New Age International (P) Ltd. Publishers.
WEB RESOURCES (Suggested)	
1.	https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-071j-introduction-to-electronics-signals-and-measurement-spring-2006/index.htm
2.	http://lrf.fe.uni-lj.si/fkkt_ev/Literatura/Electrical_and_Electronics_Measurment.pdf
3.	https://nptel.ac.in/syllabus/108106070/
4.	https://lecturenotes.in/subject/265/electrical-measurement-and-instrumentation-emi/note?orderBy=desc&sortBy=popular
5.	http://www.vssut.ac.in/lecture_notes/lecture1423813026.pdf

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

II Year II Semester

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

CourseCategory	Humanities including Management	**Course Code**	**19HM4T01**
CourseType	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	NA	**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

Course Outcomes		**Blooms Taxonomy Level**	
On successful completion of the course, the student will be able to			
CO 1	Make use of the concepts of managerial economics and demand in managerial decision making and predicting demand for goods and services	Applying	K3
CO 2	Assess the functional relation among production, cost of production, cost concepts and Break-Even Analysis.	Evaluating	K5
CO 3	Classify market structures as perfect and imperfect markets for price and output decisions	Understanding	K2
CO 4	Appraise the forms of business organizations and trade cycles in economic growth.	Evaluating	K5
CO 5	Apply accounting and capital budgeting techniques in financial decision making	Applying	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	0	2	0	0	0	0	0	0	0	0	0	0	0	0
CO2	0	1	0	0	0	0	0	0	0	0	3	0	0	0
CO3	0	1	0	0	0	0	0	0	0	0	0	0	0	0
CO4	0	0	0	0	0	0	0	0	0	0	0	1	0	0
CO5	0	3	0	0	0	0	0	0	0	0	1	0	0	0

COURSE CONTENT	
UNIT I	**Introduction to Managerial Economics and demand Analysis:** Definition of Managerial Economics and Scope-Managerial Economics and its relation with other subjects-Basic Economic Tools used in Managerial Economics-Concepts of Demand-Types-Determinants-Law of Demand its Exceptions-Elasticity of Demand-Types and Measurement- Law of Supply -Demand forecasting and Methods of demand forecasting.
UNIT II	**Production and Cost Analysis:** Production function- Law of Variable proportions- Iso-quants and Isocosts- Laws of Returns to Scale-Cobb-Douglas Production function-Economies of Scale-Cost Concepts- Fixed vs Variable Costs-Out of Pocket Costs vs Imputed Costs-Cost Volume Profit analysis-Determination of Break-Even Point (Simple Problems).

UNIT III	**Introduction to Markets:** Market Structures: Perfect Competition, Monopoly, Monopolistic and Oligopoly – Features – Price and Output Determination. **Theories of the Firm & Pricing Policies:** Managerial Theories of firm: Marris and Williamson's models – Methods of Pricing: Limit Pricing, Market Skimming Pricing, Internet Pricing: Flat Rate Pricing, Usage sensitive, Transaction based pricing, Priority Pricing.
UNIT IV	**Types of Business Organization and Business Cycles:** Features and Evaluation of Sole Trader – Partnership – Joint Stock Company – State/Public Enterprises and their forms – Business Cycles – Meaning and Features – Phases of Business Cycles.
UNIT V	**Introduction to Accounting and Capital Budgeting:** Introduction to Double Entry Systems-Journal-Ledger- Trail Balance - Preparation of Financial Statements **Capital Budgeting**: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Need for Capital Budgeting-Techniques of Capital Budgeting-Traditional and Modern Methods.

TEXT BOOKS	
1.	Dr. B. Kuberudu and Dr. T. V. Ramana: Managerial Economics & Financial Analysis, Himalaya Publishing House 2011.
2.	Dr. N. Appa Rao, Dr. P. Vijay Kumar: 'Managerial Economics and Financial Analysis', Cengage Publications, New Delhi – 2011
3.	Dr. A. R. Aryasri – Managerial Economics and Financial Analysis, TMH
REFERENCE BOOKS	
1.	V. Maheswari: Managerial Economics, Sultan Chand.
2.	Suma Damodaran: Managerial Economics, Oxford 2011.
3.	Prof. J.V.PrabhakaraRao, Prof. P. Venkatarao. 'Managerial Economics and Financial Analysis', Ravindra Publication.
4.	Vanitha Agarwal: Managerial Economics, Pearson Publications 2011.
5.	Sanjay Dhameja: Financial Accounting for Managers, Pearson.
6.	
WEB RESOURCES (Suggested)	
1.	https://economictimes.indiatimes.com/definition/law-of-supply
2.	https://sites.google.com/site/economicsbasics/managerial-theories-of-the-firm
3.	https://www.managementstudyguide.com/capitalization.htm

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

II Year II Semester

SIGNALS AND SYSTEMS

Course Category	Professional Core Courses	**Course Code**	**19EC4T09**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	Representation and classification of signals and systems, Representation of signals using Fourier series
2	Representation of signals using Fourier transform, properties of Fourier transform and sampling theorem for band limited signals.
3	Time - Domain and Frequency Domain aspects of signals and systems
4	Representation of signals in S-Domain using Laplace transform and ROC
5	Z-Transform of sequences, properties of Z-Transform

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Characterize the signals and systems and analyze the continuous-time signals and continuous-time systems using Fourier series	K1
CO2	To analyze Fourier transform and its applications. □apply sampling theorem to convert continuous-time signals to discrete-time signal and reconstruction.	K2
CO3	Understand the concepts of different types of systems and convolution, correlation operations	K2
CO4	To apply the concepts of Laplace transform for different types of signals along with ROC	K3
CO5	Apply z-transform to analyze discrete-time signals and systems.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**
CO1	3	2											3	1
CO2	3	2											3	1
CO3	3	2											3	1
CO4	3	2											3	1
CO5	3	2											3	1

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT I	**INTRODUCTION:** Definition of Signals and Systems, Classification of Signals, Classification of Systems, Operations on signals: time-shifting, time-scaling, amplitude-shifting, amplitude-scaling. Problems on Signals and Systems. Basic Signals (impulse function, step function, signum function, ramp function, Complex exponential and sinusoidal signals). Representation of periodic signals in frequency domain using Fourier series.
UNIT II	**FOURIER TRANSFORM and SAMPLING THEOREM:** Fourier transform of standard signals, Fourier transform of periodic signals, properties of Fourier transforms, **SAMPLING THEOREM:** Graphical and analytical proof for Band Limited Signals, impulse sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing.
UNIT III	**ANALYSIS OF LINEAR SYSTEMS:** Linear system, impulse response, Linear time invariant (LTI) system, Linear time variant (LTV) system, Transfer functions of a LTI system. Filter characteristics of linear systems, Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Concept of convolution in time domain and frequency domain using integral equations. Cross-correlation and auto-correlation of functions, properties of correlation function. Relation between convolution and correlation, Extraction of signal from noise by filtering
UNIT IV	**LAPLACE TRANSFORMS :** Review of Laplace transforms, Partial fraction expansion, Inverse Laplace transform, Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of L.T's, Relation between L.T's, and F.T. of a signal.
UNIT V	**Z–TRANSFORMS** Fundamental difference between continuous-time and discrete-time signals, Concept of Z-Transform of a discrete sequence. Distinction between Laplace, Fourier and Z transforms. Region of convergence in Z-Transform, constraints on ROC for various classes of signals, Inverse Z-transform, properties of Z-transforms.

TEXT BOOKS	
1.	Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edn 2018.
2.	Signals, Systems & Communications - B.P. Lathi, BS Publications, 2003.
3.	Signals & Systems- Narayan Iyer and K Satya Prasad, Cenage Pub 2011
REFERENCE BOOKS	
1.	Signals & Systems - Simon Haykin and Van Veen, Wiley, 2nd Edition.
2.	Signals and Systems – A.Anand Kumar PHI, 2nd Edn 2012
3.	Signals and Systems – Signals and Systems – M.J. Roberts,3rd Edition,MC Graw-Hill,2019
4.	Fundamentals of Signals and Systems- Michel J. Robert, MGH International Edition, 2008.
5.	Signals and Systems – T K Rawat , Oxford University press, 2011
WEB RESOURCES	
1.	https://nptel.ac.in/downloads/117101055/
2.	http://fourier.eng.hmc.edu/e102/lectures/FourierTransforms/
3.	http://fourier.eng.hmc.edu/e102/lectures/Laplace_Transform/
4.	http://fourier.eng.hmc.edu/e102/lectures/Z_Transform/
5.	http://fourier.eng.hmc.edu/e102/lectures/sampling/

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

II Year II Semester

ELECTRICAL MACHINES-I LABORATORY

Course Category	Lab Course	**Course Code**	**19EE4L05**
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Electrical Machines-I	**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	To determine the performance of DC Machine and Transformer
2	To control the speed of the DC Motor
3	To Obtain three phase to two phase transformation

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Determine the performance of DC Machines and Transformers	Evaluating	K5
CO2	Control the speed of DC motor	Applying	K3
CO3	Obtain three phase to two phase transformation	Applying	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO1 1	PO1 2	PSO 1	PSO 2
CO1	3	2	2	1	0	1	0	0	2	0	0	1	2	1
CO2	3	2	2	1	0	1	0	0	2	0	0	1	2	1
CO3	3	2	2	1	0	1	0	0	2	0	0	1	2	1

LIST OF EXPERIMENTS:	
Any 10 of the following experiments are to be conducted	
Experiment 1	Magnetization characteristics of DC shunt generator.
Experiment 2	Swinburne's test and Brake test on dc shunt motor.
Experiment 3	Hopkinson's test on DC shunt machines.
Experiment 4	Speed control of DC shunt motor by Field and armature voltage Control.
Experiment 5	Retardation test on dc shunt motor.
Experiment 6	Separation of losses in dc shunt motor
Experiment 7	OC & SC test on single phase transformer.
Experiment 8	Sumpner's or Back to back test on identical single phase transformers.
Experiment 9	Scott connection of single phase transformers.
Experiment 10	Separation of core losses of a single phase transformer.
Experiment 11	Parallel operation of single Phase Transformers.
Experiment 12	Load Test on DC shunt Generator.
Experiment 13	Load test on single phase transformer.

References – Lab Manuals will be provided

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

II Year II Semester

BASIC ELECTRONIC DEVICES AND CIRCUITS LABORATORY

Course Category	Lab Course	**Course Code**	**19EC4L02**
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	BEDC	**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	To plot the V-I characteristics of semi conductor diodes, transistors.
2	To calculate ripple factor and efficiency of rectifiers
3	To plot the frequency response of different amplifiers and design of oscillator circuits

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the basic knowledge and analyze the characteristics of PN DIODE, TRANSISTOR, FET, UJT, SCR.	K2
CO2	Calculate the ripple factor for half wave and full wave rectifiers with and without filters	K2
CO3	Analyze ce, cc amplifiers and oscillators.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2								1	3	2
CO2	3	3	2	2								1	3	2
CO3	3	3	2	2								1	3	2

LIST OF EXPERIMENTS:

PART A:

ELECTRONIC WORKSHOP PRACTICE

1. Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Coils, Gang Condensers, Relays, Bread Boards.
2. Identification, Specifications and Testing of active devices, Diodes, BJTs, JFETs, LEDs, LCDs, SCR, UJT.
3. Soldering Practice- Simple circuits using active and passive components.
4. Study and operation of Ammeters, Voltmeters, Transformers, Analog and Digital Multimeter,

Function Generator, Regulated Power Supply and CRO.

PART B: Any 10 of the following experiments are to be conducted

Experiment 1	P-N junction diode (Forward Bias & Reverse Bias)
Experiment 2	Zener diode (V-I Characteristics & Load Characteristics)
Experiment 3	Rectifiers without filter (Half Wave & Full Wave)
Experiment 4	Rectifiers with C-filter (Half Wave & Full Wave)
Experiment 5	BJT CE Characteristics (Input & Output Characteristics)
Experiment 6	FET CS Characteristics (Transfer & Drain Characteristics)
Experiment 7	Silicon Controlled Rectifier Characteristics
Experiment 8	Uni Junction Transistor Characterisctics
Experiment 9	BJT CE Amplifier
Experiment 10	BJT CC Amplifier(Emitter Follower)
Experiment 11	R-C coupled amplifier
Experiment 12	R-C phase shift Oscillator
Experiment 13	Current series feedback amplifier

References – Lab Manuals will be provided

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

II Year II Semester

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

Course Category	Mandatory Courses	**Course Code**	19HM4T06
Course Type	Theory	**L-T-P-C**	2 -0 -0 - 0
Prerequisites		**Total Marks (Internal Assessment)**	100

Course Outcomes		**Blooms Taxonomy Level**	
On successful completion of the course, the student will be able to			
CO1	Understand the evolution of Constitution of India	Understanding	K2
CO2	Make use of their Fundamental rights.	Application	K3
CO3	Understand the functioning of the Union Government	Understanding	K2
CO4	Understand the functioning of the State and local self Government.	Understanding	K2
CO5	Understand the value of Indian Constitution in functioning of the country.	Understanding	K2

Contribution of Course Outcomes towards achievement of Program											
Outcomes: 1 – Low, 2 - Medium, 3 – High											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	0	0	0	0	0	3	0	3	0	1	0	2
CO2	0	0	0	0	0	1	0	2	1	1	0	1
CO3	0	0	0	0	0	1	0	1	1	1	0	0
CO4	0	0	0	0	0	1	0	1	1	1	0	0
CO5	0	0	0	0	0	1	1	1	1	1	0	2

COURSE CONTENT

PRAGATI ENGINEERING COLLEGE : SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

UNIT I	**Introduction to Traditional Knowledge**: Define Traditional Knowledge- Nature and Characteristics- Scope and Importance- kinds of Traditional Knowledge- The historical impact of social change on Traditional Knowledge Systems- Value of Traditional knowledge in global economy.
UNIT II	**Basic structure of Indian Knowledge System**: Astadash Vidya- 4 Ved - 4 Upaved (Ayurved,Dhanurved,GandharvaVed&SthapthyaAdi),6vedanga(Shisha,Kalppa,Nirukha,Vykaran,Jyothisha&Chand),4upanga(Dharmashastra,Meemamsa,purana&Tharka Shastra).
UNIT III	**Modern Science and Indian Knowledge System**-Indigenous Knowledge, Characteristics- Yoga and Holistic Health care-cases studies.
UNIT IV	**Protection of Traditional Knowledge**: The need for protecting traditional knowledge -Significance of Traditional knowledge Protection-Role of government to harness Traditional Knowledge.
UNIT V	**Impact of Traditions:** Philosophical Tradition (Sarvadarshan) Nyaya, Vyshepec, Sankhya, Yog, Meemamsa, Vedantha, Chavanka, Jain &Boudh - Indian Artistic Tradition - Chitra kala, Moorthi kala, Vasthu kala , Sthapthya, Sangeetha, NruthyaYevamSahithya

REFERENCE BOOKS	
1.	Traditional Knowledge System in India, by Amit Jha, 2009.
2.	Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan 2012.
3.	Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya
4.	Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan
5.	Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata.
6.	Pramod Chandra, India Arts, Howard Univ. Press, 1983
7.	Krishna Chaitanya, Arts of India, Abhinav Publications, 1987
WEB RESOURCES	
1.	https://www.wipo.int/wipo_magazine/en/2017/01/article_0004.html
2.	http://iks.iitgn.ac.in/wp-content/uploads/2016/01/Indian-Knowledge-Systems-Kapil-Kapoor.pdf
3.	https://www.wipo.int/edocs/mdocs/tk/en/wipo_grtkf_ic_21/wipo_grtkf_ic_21_ref_facilitators_text.pdf

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

III Year I semester

ELECTRICAL POWER TRANSMISSION SYSTEMS

Course Category	**Professional Core**	**Course Code**	**19EE5T11**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment**	**30**
		Semester End Examination Total	**70**
		Marks	**100**

COURSE OBJECTIVES	
1	To compute inductance/capacitance of transmission lines and to understand the concepts of GMD/GMR
2	To study the short and medium length transmission lines, their models and performance.
3	To study the performance and modeling of long transmission lines.
4	To study the effect of travelling waves on transmission lines.
5	To study the factors affecting the performance of transmission lines and power factor improvement methods.
6	To discuss sag and tension computation of transmission lines as well as to study the performance of overhead insulators.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Compute resistance, inductance and capacitance values of transmission lines.	Understand	K2
CO2	Analyze the performance of short and medium transmission lines.	Analysis	K4
CO3	Estimate the performance of long transmission lines	Understand	K2
CO4	Derive expressions for reflection and refraction coefficients with various terminations of lines	Analysis	K4
CO5	Study the performance of transmission lines under various conditions like Skin, Proximity, Ferranti effect, Corona, Over voltages, Radio Interference…etc	Understand	K2
CO6	Illustrate sag and tension in transmission lines and the use of different types of line insulators for voltage distribution	Application	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	2	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	2	-	-	-	-	-	-	-	-	3	1
CO4	3	1	2	2	-	-	-	-	-	-	-	-	3	-
CO5	3	1	-	-	-	-	-	-	-	-	-	-	3	-

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT 1	**Transmission Line Parameters** Conductor materials - Types of conductors – Calculation of resistance for solid conductors – Calculation of inductance for single phase and three phase– Single and double circuit lines– Concept of GMR and GMD–Symmetrical and asymmetrical conductor configuration with and without transposition–Bundled conductors – Calculation of capacitance for 2 wire and 3 wire systems – Effect of ground on capacitance – Capacitance calculations for symmetrical and asymmetrical single and three phase–Single and double circuit lines-Bundled conductors.
UNIT 2	**Performance Analysis of Transmission Lines** Classification of Transmission Lines – Short, medium, long line and their model representations – Nominal-T–Nominal-Pie and A, B, C, D Constants for symmetrical and Asymmetrical Networks**.** **Effect of load power factor on efficiency and regulation.** Rigorous Solution for long line equations – Surge Impedance and SIL of Long Lines – Representation of Long lines – Equivalent T and Equivalent Pie network models – Mathematical Solutions to estimate regulation and efficiency of all types of lines.
UNIT 3	**Power System Transients** Types of System Transients – Travelling or Propagation of Surges – Attenuation–Distortion– Reflection and Refraction Coefficients – Termination of lines with different types of conditions – Open Circuited Line–Short Circuited Line – T-Junction– Lumped Reactive Junctions.
UNIT 4	**Various Factors governing the Performance of Transmission line** Skin and Proximity effects – Description and effect on Resistance of Solid Conductors – Ferranti effect – Charging Current – Corona – Description of the phenomenon–Factors affecting corona– Critical voltages and power loss – Radio Interference.
UNIT 5	**Sag and Tension Calculations and Overhead Line Insulators** Sag and Tension calculations with equal and unequal heights of towers–Effect of Wind and Ice on weight of Conductor – Stringing chart and sag template and its applications–Types of Insulators – String efficiency and Methods for improvement - Voltage distribution– Calculation of string efficiency – Capacitance grading and Static Shielding.

TEXT BOOKS	
1	Electrical power systems – by C.L.Wadhwa, New Age International (P) Limited, Publishers, 1998.
2	Modern Power System Analysis by I.J.Nagarath and D.P.Kothari, Tata McGraw Hill, 2ndEdition
REFERENCE BOOKS	
1	Power system Analysis–by John J Grainger William D Stevenson, TMC Companies, 4thedition
2	Power System Analysis and Design by B.R.Gupta, Wheeler Publishing.
3	A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar A.Chakrabarthy, DhanpatRai& Co Pvt. Ltd.
4	Electrical Power Systems by P.S.R. Murthy, B.S.Publications.
WEB RESOURCES (Suggested)	
1	nptel.ac.in/courses/108/102/108102047/
2	https://nptel.ac.in/courses/108/102/108102047/

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

III Year I semester

Advanced Microprocessors & Microcontrollers

Course Category	**Professional Core**	**Course Code**	**19EC5T19**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	STLD, Computer Fundamentals	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To Study architecture and memory organization of8086.
2	To Study the interfacing of 8086 with Peripheral devices (I/Odevices).
3	To learn the features of Advanced microprocessors 80286,80386, 80486, Pentium
4	To Learn the programming concepts of 8051microcontroller.
5	To Study architecture and features of PICMicrocontroller.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Demonstrate the concepts of architecture and key features, addressing modes & Instruction sets of microprocessors.	K2
CO2	Understand Interfacing for I/O devices like Stepper motor, LED displays with 8086.	K2
CO3	Understand the advances in Microprocessors (80386 & 80486) and their architectural differences.	K2
CO4	Apply the concepts of 8051 microcontroller for simple applications.	K3
CO5	Illustrate the concepts of PIC microcontroller in embeddedreal time project applications.	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	-	-	-	-	-	-	-	-	1	2
CO2	-	2	2	-	-	-	-	-	-	-	-	-	1	2
CO3	2	-	2	-	-	-	-	-	-	-	-	-	2	2
CO4	2	-	-	-	-	-	-	-	-	-	-	1	2	2
CO5	2	-	2	-	-	-	-	-	-	-	-	1	2	2

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT I	**Introduction to Microprocessor Architecture:** Introduction and evolution of Microprocessors– An overview of 8085 Microprocessor, Architecture of 8086–Register Organization of 8086–Memory organization of 8086– General bus operation of 8086 Minimum and Maximum Mode Operations: Addressing modes of 8086 Instruction set, Assembler Directives, Simple Programs, Minimum and Maximum mode operations of 8086–8086 Control signal interfacing–Read and write cycle timing diagrams.
UNIT II	I/O Interface: 8255 PPI- Architecture of 8255–Modes of operation– Interfacing I/O devices to 8086 using 8255–Interfacing A to D converters– Interfacing D to A converters– Stepper motor interfacing– Static memory interfacing with 8086–DMA controller (8257)–Architecture– Interfacing 8257 DMA controller–Programmable Interrupt Controller (8259)–Command words and operating modes of 8259– Interfacing of 8259–Keyboard/display controller (8279)–Architecture–Modes of operation–Command words of 8279–Interfacing of 8279.
UNIT III	ADVANCED MICROPROCESSORS-Introduction to 80286, programming concepts, special purpose registers, memory organization, Real and Protected mode, virtual mode, memory paging mechanism of 80386, Salient features of Pentium, architectural differences between 80386 and 80486 microprocessors. Salient features of RISC CISC Processors. The Pentium Family and Core 2 Microprocessors: Introduction to the Pentium Processor, Pentium II Microprocessor, Pentium III, Pentium IV and Core2 Processors.
UNIT IV	Introduction to 8051 Micro Controller-Overview of 8051 Micro Controller– Architecture– Register set– I/O ports and Memory Organization– Interrupts–Timers and Counters–Serial Communication. Applications in power systems.
UNIT V	**PIC MICROCONTROLLER:** Introduction, characteristics of PIC microcontroller, PIC microcontroller families, memory organization, parallel and serial input and output, timers, Interrupts, PIC 16F877 architecture, instruction set of the PIC 16F877. ARM-Introduction to ARM Processors and applications in Embedded systems

TEXT BOOKS	
1	Ray and Burchandi, "Advanced Microprocessors and Interfacing", Tata McGraw–Hill.
2	PIC Microcontroller and Embedded Systems using Assembly and C for PIC 18, - Muhammad Ali Mazidi, RolindD.Mckinay , Danny causey -Pearson Publisher 21st Impression.
3	Kenneth J Ayala, "The 8051 Microcontroller Architecture, Programming and Applications", Thomson Publishers, 2nd Edition.
REFERENCE BOOKS	
1	Microprocessors and Interfacing, Douglas V Hall, Mc–Graw Hill, 2nd Edition.
2	Microprocessors, Architecture, programming and interfacing, 8ed, Barry Bray
3	Ajay V. Deshmukh, "Microcontrollers – Theory and Applications", Tata McGraw–Hill Companies,2005.
4	R.S. Kaler, " A Text book of Microprocessors and Micro Controllers", I.K. International Publishing House Pvt. Ltd.
WEB RESOURCES	
1	https://www.nptel.ac.in/ downloads/106108100/

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

III Year I semester

POWER ELECTRONICS

Course Category	**Professional Core**	**Course Code**	**19EE5T12**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment**	**30**
		Semester End Examination Total	**70**
		Marks	**100**

COURSE OBJECTIVES	
1	Study the characteristics of various power semiconductor devices and designing the firing circuits for SCR.
2	Understand the operation of single phase half and fully controlled converters.
3	Study the operation of three phase fully controlled converters and semi converters
4	Analyze the operation of high frequency DC–DC converters.
5	Understand the working of inverters and application of PWM techniques for voltage control.
6	Study the operation of AC – AC converters.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Interpret the characteristics of various power semiconductor and design firing circuits for SCR.	Understand	K2
CO2	Distinguish the operation of single phase half, fully controlled converters and dual converter.	Analysis	K4
CO3	Relate the operation of three phase fully converters.	Knowledge	K1
CO4	State the operation of dc–dc converters.	Understand	K2
CO5	Analyze the working of inverters and application of PWM techniques for voltage control.	Analysis	K4
CO6	Describe the operation of AC-AC converters.	Understand	K2

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	1	2	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	-	-	2	-	-	-	-	-	-	-	3	1
CO4	2	2	-	2	2	-	-	-	-	-	-	-	3	-
CO5	1	2	-	2	-	-	-	-	-	-	-	-	3	-

COURSE CONTENT	
UNIT 1	**Introduction** Basic Theory of Operation - Static Characteristics-Two Transistors analogy -Turn on and Turn off Methods - Methods of SCR Triggering – Static, Dynamic & Gate Characteristics of SCR –Series and Parallel Operation ,Snubber circuit - Characteristics of Power MOSFET and IGBT.

UNIT 2	**Single Phase AC-DC Converters** Single Phase half wave controlled rectifiers - R load and RL load with and without freewheeling diode - Single Phase fully controlled bridge converter with R load, RL load and RLE load - Continuous and Discontinuous conduction - Effect of source inductance in 1-phase fully controlled bridge rectifier with continuous conduction, Expression for output voltages – Single Phase semi Converter with R load, RL load and RLE load – Continuous and Discontinuous conduction – Input power factor- Single Phase Dual Converters - Numerical Problems
UNIT 3	**Three Phase AC-DC Converters & AC – AC Converters** Three Phase half wave Rectifier with R and RL load -Three Phase fully controlled rectifier with R and RL load - Three Phase semi converter with R and RL load - Expression for Output Voltage - Three Phase Dual Converters - Numerical Problems. AC-AC power control by phase angle control with R and RL loads - Three phase AC voltage regulator with R load, Single phase step down Cyclo-converter - Numerical Problems.
UNIT 4	**DC–DC Converters** Operation of Basic Chopper - Classification - Control Techniques - Analysis of Buck, Boost and Buck-Boost converters in Continuous Conduction Mode (CCM) and Discontinuous Conduction Modes (DCM) , Output voltage equations using volt-sec balance in CCM & DCM – Expressions for output voltage ripple and inductor current ripple- Numerical Problems.
UNIT 5	**DC–AC Converters** Introduction - Classification - Single Phase half bridge and full bridge inverters with R and RL loads –square wave output- Quasi-square wave pulse width modulation- Sinusoidal Pulse Width Modulation - Unipolar & Bipolar Switching - Three Phase inverters - 120^0 conduction and 180^0 conduction modes of operation – Sinusoidal PWM - Numerical Problems.

TEXT BOOKS	
1	Power Electronics: Converters, Applications and Design by Ned Mohan, Tore M Undeland, William P Robbins, John Wiley & Sons.
2	Power Electronics: Circuits, Devices and Applications – by M. H. Rashid, Prentice Hall of India, 2nd edition, 1998
3	Power Electronics: Essentials & Applications by L.Umanand, Wiley, Pvt. Limited, India, 2009.
REFERENCE BOOKS	
1	Elements of Power Electronics–Philip T.Krein.oxford.
2	Power Electronics – by P.S.Bhimbra, Khanna Publishers.
3	Thyristorised Power Controllers – by G. K. Dubey, S. R. Doradla, A. Joshi and R. M. K.Sinha, New Age International (P) Limited Publishers, 1996.
4	Power Electronics: by Daniel W.Hart, Mc Graw Hill.
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/108/102/108102145/
2	https://nptel.ac.in/courses/108/101/108101038/

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

III Year I semester

LINEAR AND DIGITAL IC APPLICATIONS

Course Category	**Professional Core**	**Course Code**	**19EC5T17**
Course Type	THEORY	**L-T-P-C**	3-0-0-3
Prerequisites	Electronic devices and Circuits, Digital Electronics	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
The student will:	
1	To understand the basic operation &performance parameters of differentialamplifiers. To learn the linear and non-linear applications of operationalamplifiers.
2	To understand the analysis & design of different types of active filters usingop-amps To understand & learn the measuring techniques of performance parameters ofOp-Amp
3	Understand design specifications of DAC and ADC
4	Understand logic circuits using CMOS and TTL families.
5	design of various combinational and sequential circuits using hardware description language.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Design circuits using operational amplifiers for variousapplications.	K4
CO2	Analyze and design amplifiers and active filters using Op-amp.	K3
CO3	Diagnose and trouble-shoot linear electroniccircuits.	K2
CO4	Implement Basic Logic circuits using CMOS and TTL their interfacing.	K2
CO5	Design combinational and sequential logic circuits using VHDL	K4

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	2	3										1	2
CO2	2	2	2										1	1
CO3	2	1	1										2	1
CO4	1	2	1										2	2
CO5	2	1	2										1	2

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT I	Introduction: Internal Block Diagram of various stages of Op-Amp and Roll of each Stage. Differential Amplifier using BJTs and With RE DC and AC Analysis, Basic Current Mirror Circuit, Improved Version of current mirror circuit, current repeated circuit, Wilson current source. OP-Amp Block Diagram (Symbolic Representation), Characteristics of Op-Amp, Ideal and Practical Op-Amp specifications, DC and AC Characteristics LINEAR and NON-LINEAR APPLICATIONS OF OP-AMPS: Inverting and Non-inverting amplifier, Integrator and differentiator, V to I, I to V converters. Non- Linear function generation, Comparators, Multivibrators, Triangular and Square wave generators.
UNIT II	ACTIVE FILTERS: Design & Analysisof Butterworth active filters – 1st order LPF, HPF filters. Band pass, Band reject and all pass filters. TIMERS & PHASE LOCKED LOOPS: Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications. PLL - introduction, block schematic, principles and description of individual blocks, 565 PLL, Applications of PLL
UNIT III	DIGITAL TO ANALOG AND ANALOG TO DIGITAL CONVERTERS: Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC, Different types of ADCs – parallel Comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC.DAC and ADC Specifications, Specifications AD 574 (12-bit ADC).
UNIT IV	DIGITAL LOGIC FAMILIES AND INTERFACING: Introduction to logic families, CMOS logic, CMOS steady state and dynamic electrical behavior, CMOS logic families, Bipolar logic, transistor-transistor logic, TTL families, CMOS/TTL interfacing, low voltage CMOS logic and interfacing.
UNIT V	**COMBINATIONAL LOGIC DESIGN:** Adders and Subtractors, ALU, Decoders, Encoders, Multiplexers and De-Multiplexers, Comparators, Multipliers, Cascading Comparators, Design using VHDL. **SEQUENTIAL LOGIC DESIGN:** Latches and Flip-Flops, Counters- ripple counter, synchronous counter, Design of Counters using Digital ICs, Ring Counter, Johnson Counter, Design using VHDL. **Memories:** ROM, Static RAM, Dynamic RAM, Internal structure, timing.

TEXT BOOKS	
1.	Linear Integrated Circuits – D. Roy Choudhury, New Age International (p)Ltd, 2nd Edition,2003.
2.	Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI,1987.
3.	Digital Design Principles and Practices – John F.Wakerly, PHI/ Pearson Education Asia, 3rd Edition, 2005.
REFERENCE BOOKS	
1.	Operational Amplifiers & Linear Integrated Circuits –Sanjay Sharma ;SKKataria& Sons; 2nd Edition, 2010
2.	VHDL Primer – J. Bhasker, Pearson Education/ PHI, 3rd Edition.

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

III Year I semester

DIGITAL CONTROL SYSTEMS

Course Category	**Professional Core**	**Course Code**	**19EE5T13**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment**	**30**
		Semester End Examination Total Marks	**70** **100**

COURSE OBJECTIVES	
1	Understand the concepts of digital control systems and assemble various components associated with it.
2	Study the theory of z–transformations and application for the mathematical analysis of digital control systems.
3	Represent the discrete–time systems in state–space model and evaluation of state transition matrix.
4	Examine the stability of the system using different tests.
5	Study the conventional method of analyzing digital control systems in the w–plane.
6	Study the design of state feedback control by "the pole placement method

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Apply the concept of sample and hold operation to digital systems.	Application	K3
CO2	Relate the Z-transforms to Digital systems.	Analysis	K4
CO3	Test the performance of digital control systems with the concept of state space.	Evaluate	K5
CO4	Examine the stability of digital control systems.	Evaluate	K5
CO5	Design controllers to meet the desire performance by conventional methods.	Application	K3
CO6	Develop the controller by pole-placement technique for desired system behavior.	Application	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO8**	**PO9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**
CO1	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	-	-	-	-	1	-
CO4	-	2	3	-	-	-	-	-	-	-	-	-	1	-
CO5	-	1	3	-	-	-	-	-	-	-	-	-	1	-

COURSE CONTENT	
UNIT 1	**Introduction and signal processing** Introduction to analog and digital control systems – Advantages of digital systems – Typical examples – Continuous and Discrete Time Signals – Sample and hold devices – Sampling theorem and data reconstruction – Frequency domain characteristics of zero order hold.

UNIT 2	**z–transformations** z–Transforms – Theorems – Finding inverse z–transforms – Formulation of difference equations and solving – Block diagram representation – Pulse transfer functions and finding open loop and closed loop responses.
UNIT 3	**State space analysis and the concepts of Controllability and observability** State space representation of discrete time systems – Solving Discrete Time state space equations – State transition matrix and its properties – Discretization of continuous time state equations – Concepts of controllability and observability – Tests(without proof). **State Feedback Controllers and State Observers** Design of state feedback controller through pole placement – Necessary and sufficient conditions – Ackerman's formula – Design of state observers (Full Order and Reduced Order).
UNIT 4	**Stability analysis** Mapping between the s–Plane and the z–Plane – Primary strips and Complementary strips – Stability criterion – Modified Routh's stability criterion and Jury's stability test.
UNIT 5	**Design of discrete–time control systems by conventional methods** Transient and steady state specifications – Design using frequency response in the w–plane for lag and lead compensators – Root locus technique in the z–plane..

TEXT BOOKS	
1	Discrete–Time Control systems – K. Ogata, Pearson Education/PHI, 2nd Edition.
2	Digital Control and State Variable Methods by M.Gopal, TMH, 4th Edition.
REFERENCE BOOKS	
1	Digital Control Systems, Kuo, Oxford University Press, 2nd Edition, 2003.
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/108/107/108107115/
2	https://nptel.ac.in/courses/107/106/107106081/

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

III Year I semester

DATA STRUCTURES

Course Category	**Professional Core**	**Course Code**	19IT5T01
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	**30** **70** **100**

COURSE OBJECTIVES

The objective of the course is to

1	Introduce the fundamental concept of data structures and abstract data types
2	Emphasize the importance of data structures in developing and implementing efficient algorithms
3	Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms

COURSE OUTCOMES		**Cognitive level**
Upon successful completion of the course, the student will be able to:		
CO1	Summarize the properties, interfaces, and behaviors of basic abstract data types	K2
CO2	Discuss the computational efficiency of the principal algorithms for sorting & searching	K2
CO3	Use arrays, records, linked structures, stacks, queues, trees, and Graphs in writing programs	K3
CO4	Demonstrate different methods for traversing trees	K2
CO5	Implement algorithms on Graphs	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	2	1	1	-	-	-	-	-	-	2	1
CO2	2	3	1	1	1	-	-	-	-	-	-	-	1	1
CO3	2	3	1	2	1	-	-	-	-	-	-	-	1	1
CO4	2	3	1	1	1	-	-	-	-	-	-	-	1	1
CO5	3	3	1	1	1	-	-	-	-	-	-	-	1	1

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT I	Data Structures - Definition, Classification of Data Structures, Operations on Data Structures, Abstract Data Type (ADT), Preliminaries of algorithms. Time and Space complexity. Searching - Linear search, Binary search, Fibonacci search. Sorting- Insertion sort, Selection sort, Exchange (Bubble sort, quick sort), distribution (radix sort), merging (Merge sort) algorithms.
UNIT II	Linked List: Introduction, Single linked list, Representation of Linked list in memory, Operations on Single Linked list-Insertion, Deletion, Search and Traversal ,Reversing Single Linked list, Applications on Single Linked list- Polynomial Expression Representation ,Addition and Multiplication, Sparse Matrix Representation using Linked List, Advantages and Disadvantages of Single Linked list, Double Linked list-Insertion, Deletion, Circular Linked list-Insertion, Deletion.
UNIT III	Queues: Introduction to Queues, Representation of Queues-using Arrays and using Linked list, Implementation of Queues-using Arrays and using Linked list, Application of Queues, Circular Queues, Deques, Priority Queues, Multiple Queues. Stacks: Introduction to Stacks, Array Representation of Stacks, Operations on Stacks, Linked list Representation of Stacks, Operations on Linked Stack, Applications-Reversing list, Factorial Calculation, Infix to Postfix Conversion, Evaluating Postfix Expressions.
UNIT IV	Trees: Basic Terminology in Trees, Binary Trees-Properties, Representation of Binary Trees using Arrays and Linked lists. Binary Search Trees- Basic Concepts, BST Operations: Insertion, Deletion, Tree Traversals, Applications-Expression Trees, Heap Sort, Balanced Binary Trees- AVL Trees, Insertion, Deletion and Rotations.
UNIT V	Graphs: Basic Concepts, Representations of Graphs-Adjacency Matrix and using Linked list, Graph Traversals (BFT & DFT), Applications- Minimum Spanning Tree Using Prims &Kruskals Algorithm, Dijkstra's shortest path, Transitive closure, Warshall's Algorithm.

TEXT BOOKS	
1.	Data Structures Using C. 2nd Edition.ReemaThareja, Oxford.
2.	Data Structures and algorithm analysis in C, 2nded, Mark Allen Weiss.

REFERENCE BOOKS	
1.	Fundamentals of Data Structures in C, 2nd Edition, Horowitz, Sahni, Universities Press.
2.	Data Structures: A PseudoCode Approach, 2/e, Richard F.Gilberg, Behrouz A. Forouzon, Cengage.
3.	Data Structures with C, Seymour Lipschutz TMH

WEB RESOURCES	
1.	http://algs4.cs.princeton.edu/home/
2.	https://faculty.washington.edu/jstraub/dsa/Master_2_7a.pdf

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

III Year I semester

ELECTRICAL MACHINES-II LABORATORY

Course Category	**Professional Core**	**Course Code**	**19EE5L06**
Course Type	**Laboratory**	**L-T-P-C**	**0-0-3-1.5**
Prerequisites	**NA**	**Internal Assessment**	**25**
		Semester End Examination Total	**50**
		Marks	**75**

COURSE OBJECTIVES	
1	Understand the performance of various types of AC machines -induction motors, alternators and synchronous motors.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Distinguish the performance of single phase induction motors, three phase induction motors with suitable test method and provide equivalent circuit.	Analysis	K4
CO2	Analyze the performance of synchronous motors through Xd-Xq, V-inverted V curves.	Analysis	K4
CO3	Determine the regulation of alternator by various methods	Evaluate	K5

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	-	-	-	-	-	-	1	2	-	-	1	-
CO2	2	2	-	-	-	-	-	-	1	2	-	-	1	1
CO3	2	2	-	-	-	-	-	-	1	2	-	-	1	1

List of Experiments **Any 10 of the following experiments are to be conducted**	
Experiment 1	Brake test on three phase Induction Motor
Experiment 2	No–load & Blocked rotor tests on three phase Induction motor
Experiment 3	Regulation of a three –phase alternator by synchronous impedance &m.m.f. Methods
Experiment 4	Regulation of three–phase alternator by Potier triangle method
Experiment 5	V and Inverted V curves of a three—phase synchronous motor.
Experiment 6	Determination of Xd and Xq of a salient pole synchronous machine
Experiment 7	Determination of equivalent circuit of single phase induction motor
Experiment 8	Speed control of induction motor by V/f method.
Experiment 9	Determination of efficiency of three-phase alternator by loading with three phase induction motor.
Experiment 10	Power factor improvement of single-phase induction motor by using capacitors and load test on single-phase induction motor.
Experiment 11	Brake test on single-phase AC series Motor.
Experiment 12	Starting methods of a capacitor start and capacitor start run single-phase Induction motor
Experiment 13	Brake test on single-phase Induction Motor.

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

III Year I semester

CONTROL SYSTEMS LABORATORY

Course Category	**Professional Core**	**Course Code**	**19EE5L07**
Course Type	**Laboratory**	**L-T-P-C**	**0-0-3-1.5**
Prerequisites	**NA**	**Internal Assessment**	**25**
		Semester End Examination Total	**50**
		Marks	**75**

COURSE OBJECTIVES	
1	Understand time response of second order system and effect of different controllers on it.
2	Understand the characteristics of AC servo motor, DC servo motor and synchros.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Expertise the response of second order system and effect of P, PI, PID controllers on it	Analysis	K4
CO2	Calculate the transfer function of DC motor and characteristics of AC servo motor, DC servo motor and synchro's.	Analysis	K4

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	-	-	-	-	1	2	-	-	1	1
CO2	2	-	-	-	-	-	-	-	1	2	-	-	1	-

List of Experiments **Any 10 of the following experiments are to be conducted**	
Experiment 1	Time response of Second order system
Experiment 2	Characteristics of Synchros
Experiment 3	Effect of P, PD, PI, PID Controller on a second order system
Experiment 4	Study of Lag and lead compensators – Magnitude and phase plot
Experiment 5	Transfer function of armature voltage controlled DC motor
Experiment 6	Bode Plot, Root locus, Nyquist Plots for the transfer functions of systems up to 5th order using MATLAB.
Experiment 7	Controllability and Observability Test using MAT LAB.
Experiment 8	Temperature controller using PID
Experiment 9	Characteristics of magnetic amplifiers
Experiment 10	Characteristics of AC servo motor
Experiment 11	Characteristics of DC servo motor
Experiment 12	Block Diagram Representation of Field Controlled DC servo Motor Using Simulink.

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

III Year I semester

DATA STRUCTURES LABORATORY

Course Category	Engineering Science	**Course Code**	
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	**30** **70** **100**

COURSE OBJECTIVES

1	The objective of this lab is to demonstrate the different data structures implementation.

COURSE OUTCOMES		**Cognitive level**
Upon successful completion of the course, the student will be able to:		
CO1	Use basic data structures such as arrays and linked list.	K3
CO2	Programs to demonstrate fundamental algorithmic problems including Tree Traversals, Graph traversals, and shortest paths.	K2
CO3	Use various searching and sorting algorithms.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	1	-	-	-	-	-	-	2	1
CO2	2	3	1	2	1	-	-	-	-	-	-	-	1	1
CO3	2	3	1	1	1	-	-	-	-	-	-	-	1	1

COURSE CONTENT

Exercise -1 (Searching)	a) Write C program that use both recursive and non recursive functions to perform Linear search for a Key value in a given list. b) Write C program that use both recursive and non recursive functions to perform Binary search for a Key value in a given list.
Exercise -2 (Sorting-I)	a) Write C program that implement Bubble sort, to sort a given list of integers in ascending order b) Write C program that implement Quick sort, to sort a given list of integers in ascending order c) Write C program that implement Insertion sort, to sort a given list of integers in ascending order
Exercise - 3(Sorting-II)	a) Write C program that implement radix sort, to sort a given list of integers in ascending order b) Write C program that implement merge sort, to sort a given list of integers in ascending order
Exercise -4 (Singly Linked List)	a) Write a C program that uses functions to create a singly linked list b) Write a C program that uses functions to perform insertion operation on a singly linked list c) Write a C program that uses functions to perform deletion operation on a singly linked list d) Write a C program to reverse elements of a single linked list.

Exercise -5 (Queue)	a) Write C program that implement Queue (its operations) using arrays. b) Write C program that implement Queue (its operations) using linked lists
Exercise -6 (Stack)	a) Write C program that implement stack (its operations) using arrays b) Write C program that implement stack (its operations) using Linked list c) Write a C program that uses Stack operations to evaluate postfix expression
Exercise -7 (Binary Tree)	Write a recursive C program for traversing a binary tree in preorder, inorder and postorder.
Exercise -8 (Binary Search Tree)	a) Write a C program to Create a BST b) Write a C program to insert a node into a BST. c) Write a C program to delete a node from a BST.

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

III Year II semester

DC AND AC MOTOR DRIVES

Course Category	**Professional Core**	**Course Code**	**19EE6T14**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment** **Semester End Examination Total** **Marks**	**30** **70** **100**

COURSE OBJECTIVES	
1	Learn the fundamentals of electric drive and different electric braking methods.
2	Analyze the operation of three phase converter controlled dc motors and four quadrant operation of dc motors using dual converters.
3	Discuss the converter control of dc motors in various quadrants.
4	Understand the concept of speed control of induction motor by using AC voltage controllers and voltage source inverters.
5	Learn the principles of static rotor resistance control and various slip power recovery schemes. Understand the speed control mechanism of synchronous motors

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Express the torque of drive to process requirement and different electric braking methods	Understand	K2
CO2	Execute the four quadrant operation of three phase converter and dual converters.	Application	K3
CO3	Relate the Drives continuous operation at various quadrants in converter control.	Understand	K2
CO4	Implementation of AC voltage controllers and voltage source inverters in the induction Motor drives for speed control mechanism.	Application	K3
CO5	Clarify the stator side control and rotor side control of three phase induction motor. Generalize the Control mechanism of speed requirement in industrial domain machines like synchronous motors.	Understand	K2

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	2	-	-	-	-	-	-	-	-	-	-	2	-
CO2	1	2	1	-	-	-	-	-	-	-	-	-	2	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-	2	-
CO4	-	2	2	-	-	-	-	-	-	-	-	-	2	1
CO5	-	2	-	-	-	-	-	-	-	-	-	-	2	1

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT 1	**Fundamentals of Electric Drives** Electric drive – Fundamental torque equation – Load torque components – Nature and classification of load torques – Load characteristics – Steady state stability – Load equalization– Four quadrant operation of drive (hoist control) – Braking methods: Dynamic – Plugging – Regenerative methods.
UNIT 2	**Rectifier Controlled DC Motors** 1-phase half and fully controlled converter fed separately and self-excited DC motor drive – Output voltage and current waveforms – Speed-torque expressions – Speed-torque characteristics – Principle of operation of dual converters and dual converter fed DC motor drives, Numerical problems.
UNIT 3	**Chopper controlled DC Motors** Single quadrant – Two quadrant and four quadrant DC-DC converter fed separately excited and self- excited DC motors – Continuous current operation – Output voltage and current waveforms – Speed–torque expressions – Speed–torque characteristics – Four quadrant operation – Closed loop operation (qualitative treatment only)
UNIT 4	**Stator side control of 3-phase Induction motor Drive** Variable Voltage control, Variable Frequency control, v/f control of induction motor – Speed torque characteristics - Closed loop v/f control of induction motor drives (qualitative treatment only),
UNIT 5	**Rotor side control of 3-phase Induction motor Drive & Synchronous Motor Drives** Static rotor resistance control – Slip power recovery schemes – Static Scherbius drive – Static Kramer drive – Performance and speed torque characteristics – Advantages – Applications. Separate control of synchronous motor – self control of synchronous motor employing load commutated thyristor inverter - closed loop control of synchronous motor drive – PMSM (Basic operation only).

TEXT BOOKS	
1	Fundamentals of Electric Drives – by G K Dubey, Narosa Publications
2	Power Semiconductor Drives, by S.B.Dewan, G.R.Slemon, A.Straughen, Wiley-India Edition.
REFERENCE BOOKS	
1	Electric Motors and Drives Fundamentals, Types and Applications, by Austin Hughes and Bill Drury, Newnes
2	Thyristor Control of Electric drives – VedamSubramanyam Tata McGraw Hill Publications.
3	Power Electronic Circuits, Devices and applications by M.H.Rashid, PHI
4	Power Electronics handbook by Muhammad H.Rashid, Elsevier
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/108/108/108108077/
2	https://www.youtube.com/watch?v=2Gjs7IPOCXs

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

III Year II semester

POWER SYSTEM ANALYSIS

Course Category	**Professional Core**	**Course Code**	**19EE6T15**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment**	**30**
		Semester End Examination Total	**70**
		Marks	**100**

COURSE OBJECTIVES	
1	Develop the per unit impedance diagram (p.u) and formation of Ybus
2	Study the concept of the Zbus building algorithm.
3	Obtain load flow solution using different load flow methods.
4	Evaluate short circuit currents for symmetrical faults
5	Analyze the effect of unsymmetrical faults on system behavior. Learn different methods of stability for analysis.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Formulate incidence, network matrices, per unit impedance diagrams and Y-bus matrix	Understand	K2
CO2	Analyze the behavior of the power system under steady state conditions using various load flow methods	Analysis	K4
CO3	Develop Zbus matrix for changes in the network configurations such as Addition of element from a new bus to reference, from a new bus to an old bus, between an old bus to reference & between two old buses	Application	K5
CO4	Analyze the behavior of the power system under short circuit conditions	Analysis	K4
CO5	Design the proper protective equipment for the power system under asymmetrical fault conditions. Suggest the methods for improving the stability of the power system under various operating conditions	Analysis	K4

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	2	-	-	-	-	-	-	-	-	-	-	2	-
CO2	1	2	1	-	-	-	-	-	-	-	-	-	2	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-	2	-
CO4	1	2	2	-	-	-	-	-	-	-	-	-	2	1
CO5	2	2	-	-	-	-	-	-	-	-	-	-	2	1

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT 1	**Circuit Topology & Per Unit Representation** Graph theory definition – Formation of element node incidence and bus incidence matrices – Primitive network representation – Formation of Ybus matrix by singular transformation and direct inspection methods - Per Unit Quantities–Single line diagram– Impedance diagram of a power system.
UNIT 2	**Power Flow Studies** Necessity of power flow studies – Derivation of static power flow equations – Power flow solution using Gauss-Seidel Method – Newton Raphson Method (Rectangular and polar coordinates form)- Decoupled and Fast Decoupled methods – Algorithmic approach – Problems on 3–bus system only.
UNIT 3	**Z-Bus Algorithm & Symmetrical Fault Analysis:** Formation of Zbus: Algorithm for the Modification of Zbus Matrix (without mutual impedance). **Symmetrical Fault Analysis:** Reactance's of Synchronous Machine – Three Phase Short Circuit Currents - Short circuit MVA calculations for Power Systems
UNIT 4	**Symmetrical Components & Fault analysis** Definition of symmetrical components - symmetrical components of unbalanced three phase systems – Power in symmetrical components – Sequence impedances: Synchronous generator – Transmission line and transformers – Sequence networks –Various types of faults LG– LL– LLG and LLL on unloaded alternator–unsymmetrical faults on power system for numerical problems only.
UNIT 5	**Power System Stability Analysis** Elementary concepts of Steady state – Dynamic and Transient Stabilities – Description of Steady State Stability Power Limit –Transfer Reactance–Synchronizing Power Coefficient – Power Angle Curve and Determination of Steady State Stability – Derivation of Swing Equation–Determination of Transient Stability by Equal Area Criterion –Applications of Equal Area Criterion – Methods to improve steady state and transient stability.

TEXT BOOKS	
1	Power System Analysis by Grainger and Stevenson, Tata McGraw Hill
2	Modern Power system Analysis – by I.J.Nagrath & D .P.Kothari: Tata McGraw–Hill Publishing Company, 2nd edition.
REFERENCE BOOKS	
1	Power System Analysis – by A.R.Bergen, Prentice Hall, Inc
2	Power System Analysis by HadiSaadat – TMH Edition.
3	Power System Analysis by B.R.Gupta, Wheeler Publications.
4	Power System Analysis and Design by J.Duncan Glover, M.S.Sarma, T.J.Overbye – Cengage Learning publications.
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/117/105/117105140/
2	https://onlinecourses.nptel.ac.in/noc20_ee72/preview

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

III Year II semester

DIGITAL SIGNAL PROCESSING

Course Category	Professional Core	**Course Code**	**19EC6T27**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Signals and systems	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Analyse the discrete-time signals and systems in time and frequency domains.
2	Know the importance of FFT algorithm for computation of Discrete Fourier Transform
3	Understand the various implementations of digital filter structures
4	Learn the FIR and IIR Filter design procedures
5	Learn the concepts of DSP Processors

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Formulate engineering problems in terms of DSP operations. Analyze digital signals and systems	K4
CO2	Analyze discrete time signals infrequency domain	K4
CO3	Design IIR digital filters and implement with different structures	K6
CO4	Design IIR digital filters and implement with different structures	K6
CO5	Understand the key architectural	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	3	-	-	-	-	-	-	-	3	3
CO2	3	3	-	-	3	-	-	-	-	-	-	-	3	3
CO3	3	2	3	-	3	-	-	-	-	-	-	-	3	3
CO4	3	2	3	-	3	-	-	-	-	-	-	-	3	3
CO5	3	1	-	-	-	-	-	-	-	-	-	-	2	3

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT I	**INTRODUCTION:** Introduction to Digital Signal Processing: Discrete time signals and sequences, linear shift invariant systems, stability, and causality. Linear constant coefficient difference equations. Frequency domain representation of discrete time signals and systems. Review of Z-transforms: Applications of Z – transforms, solution of difference equations.
UNIT II	**DISCRETE FOURIER SERIES & FOURIER TRANSFORMS:** Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, linear filtering methods based on DFT, Fast Fourier transforms (FFT)-Radix-2 decimation-in-time and decimation-in-frequency FFT Algorithms, Inverse FFT, Circular convolution and linear convolution using DFT.
UNIT III	**DESIGNOF IIRDIGITAL FILTERS& REALIZATIONS:** Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital filters from analog filters, Design Examples, Analog and Digital frequency transformations. Basic structures of IIR systems, Transposed forms.
UNIT IV	**DESIGN OF FIR DIGITAL FILTERS & REALIZATIONS:** Characteristics of FIR Digital Filters, Frequency response. Design of FIR Digital Filters using Window technique and Frequency Sampling technique, Comparison of IIR & FIR filters. Basic structures of FIR systems.
UNIT V	INTRODUCTION TO DSP PROCESSORS: Introduction to programmable DSPs: Multiplier and Multiplier Accumulator, Modified bus structures and memory access schemes in P-DSPs, Multiple Access Memory, Multi ported memory, VLIW architecture, Pipelining, Special addressing modes, On-Chip Peripherals. **Architecture of ARM processors:** Technical details of ARM Processors, Introduction toCortex-M3 and cortex M4 processors - Processor type, processor architecture, instruction set, block diagram, memory systems.

TEXT BOOKS	
1.	Digital Signal Processing, Principles, Algorithms, and Applications --John G. Proakis,DimitrisG.Manolakis, 4th edition, PHI, 2013.
2.	Digital Signal Processors, Architecture, Programming and Applications – B.Venkataramani, M.Bhaskar, TATA McGraw Hill, 2002.
3.	Digital Signal Processing Using the ARM Cortex M4, DonaldS.Reay,2015.
REFERENCE BOOKS	
1.	Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer,4th edition ,PHI,2007.
2.	Digital Signal Processing—Tarunkumar Rawat, 1st edition, Oxford, 2015.
3.	Digital signal Processing --A Anand Kumar, Eastrn economy edition, PHI, 2013.
WEB RESOURCES	
1.	www.nptelvideos.in/2012/12/digital signal processing.html

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

III Year II semester

BUILDING MATERIALS AND CONSTRUCTION

Course Category	Open Elective	**Course Code**	19CE6T23
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	-----	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To create a strong understanding on the importance of various building materials like bricks, tiles and lime used in Civil Engineering construction.
2	To create a strong knowledge on the manufacturing of various building materials like cement and other materials used in Civil Engineering construction.
3	To Identify the uses of wood, stones and their applications in Civil Engineering.
4	Identifying the various structural components of buildings, bridges, embankments, etc.
5	To create a strong understanding on the importance of surface finishing of a structure.

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Know about various building materials like lime, brick, and tiles.
CO2	Know about various types of cement and other construction materials.
CO3	Identify the various types of wood, stones and their uses.
CO4	Identify the structural components, sub-components and their applications.
CO5	Know the concepts of surface finishing of a structure.

Contribution of Course Outcomes towards achievement of program

Outcomes (1 - Low, 2- Medium, 3-High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	1	1	-	2	3	3	2	2	-	3	2
CO2	2	-	-	-	-	2	-	-	2	-	1	2	3	2
CO3	2	3	3	-	1	-	-	2	1	-	-	-	-	2
CO4	2	2	3	-	2	-	-	2	-	-	2	2	2	2
CO5	-	-	2	2	-	2	-	-	2	-	2	-	2	2

COURSE CONTENT	
UNIT-I	**BRICKS, TILES & LIME** Composition of good brick, methods of manufacturing of bricks. Characteristics of good tile, manufacturing methods, Types of tiles. Uses of materials like Aluminium, Gypsum, Glass and Bituminous materials – their quality. LIME: Various ingredients, Constituents, classification and various methods of manufacture of lime.

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

UNIT-II	**CEMENT & OTHER CONSTRUCTION MATERIALS** **CEMENT**: Portland cement- Chemical Composition, Various types of cement and their properties. **Other Construction Materials** - Galvanized Iron, Fiber Reinforced Plastics, Steel, Aluminium and soil
UNIT-III	**STONE & TIMBER PRODUCTS** **WOOD:** Structure, Properties, Seasoning of timber, Classification of various types of woods used in buildings, Defects in timber. **STONE:** Properties of building stones, classification of stones, stone quarrying, precautions in blasting, dressing of stone.
UNIT-IV	**BUILDING COMPONENTS** Definitions of terms in masonry, Types of masonry-stone masonry, Brick masonry-English and Flemish bonds. Different types of floors - Cement Concrete Flooring, Marble Flooring, Tiled Flooring, Timber Flooring, and Rubber Flooring. **STAIRS:** Technical terms, Requirements of Good Stair, Classification of Stairs. **LINTELS & ARCHES:** Classification of Lintels and Arches. **DOORS AND WINDOWS:** Location of Doors and Windows-Types of Doors–Types of Windows.
UNIT-V	**FINISHINGS AND PIPES** Damp Proofing and water proofing materials and uses, Plastering Pointing, white washing and distempering **PAINTS**: Constituents of paint, Types of paints, Painting of new/old wood, Varnish. Form Works and Scaffolding **PIPES:** Pipes used in building construction. **ADHESIVES:** Used in timber, tile fixing, Joining concrete, cladding, sealing compounds & joint fillers.

TEXT BOOKS	
1.	Environmental Impact Assessment, Canter Larry W.,McGraw-Hill education Edi (1996)
2.	Environmental Impact Assessment Methodologies, by Y.Anjaneyulu, B.S. Publication, Sultan Bazar, Hyderabad.
REFERENCE BOOKS	
1.	Environmental Science and Engineering, by J. Glynn and Gary W.HeinKe – Prentice Hall Publishers.
2.	Environmental Science and Engineering, by Suresh K.Dhaneja – S.K.Katania&Sons Publication, NewDelhi.
3.	Environmental Pollution and Control, by Dr H.S. Bhatia – Galgotia Publication (P) Ltd., NewDelhi.
WEB REFERENCES	
	www.nptel.ac.in/courses

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

INTERNET OF THINGS

III Year II semester

Course Category	Open Elective	**Course Code**	**19EC7T10**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Embedded Systems	**InternalAssessment** **Semester EndExamination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To assess the vision and introduction of IoT.
2	To Understand IoT Market perspective.
3	To Implement Data and Knowledge Management and use of Devices in IoT Technology
4	To Understand State of the Art - IoT Architecture
5	To classify Real World IoT Design Constraints, Industrial Automation in IoT.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the concepts of Internet of Things	K2
CO2	Understand Challenges in IoT	K2
CO3	Understand the concept of M2M(machine to machine) with necessary protocols	K2
CO4	Analyze the domain specific applications of IoT	K3
CO5	Develop real life IoT based projects	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	1							1		2	2
CO2	3	2	2	2							1		3	2
CO3	3	3	2	1							1		3	2
CO4	2	2	1	2							1		2	2
CO5	3	3	2	2							1		3	1

COURSE CONTENT	
UNIT I	**INTRODUCTION TO IOT** Definition of IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs.
UNITII	**CHALLENGES IN IOT** Design challenges, Development challenges, Security challenges, Technological challenges, Business challenges, Societal problems

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

UNITIII	**IOT & M2M** Machine to Machine, Difference between IoT and M2M, Software define Network **Hardware Components**- Computing (Arduino, Raspberry Pi), Communication, Sensing,Actuation, I/O interfaces. Communication Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP
UNITIV	**DOMAIN SPECIFIC APPLICATIONS OF IOT** Home automation, Environment, Industry applications, Surveillance applications, Other IoT applications
UNITV	**DEVELOPING IOTS** Introduction to Python, Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python.

TEXT BOOKS	
1.	Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1 stEdition, VPT, 2014. (ISBN: 978-8173719547)
2.	WaltenegusDargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"
REFERENCE BOOKS	
1.	Srinivasa K.G., SiddeshG.M.,Hanumantha Raju R. "Internet of Things" Cengage Publications, 1st Edition 2018
2.	Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224
WEB RESOURCES	
1.	https://link.springer.com/chapter/10.1007/978-3-319-04223-7_3
2.	https://www.businessinsider.com/internet-of-things-devices-applications-examples-2016-8?IR=T

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

INDUSTRIAL ROBOTICS

III Year II semester

Course Category	Open Elective	**Course Code**	19ME6T28
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	NIL	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To impart knowledge about industrial robots and their configurations.
2	To acquire knowledge about components of industrial robots.
3	To learn sensing and machine vision.
4	To familiarize robot programming.
5	To impart knowledge industrial applications.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Explain various robots and their configuration related to industries.	K2
CO2	Demonstrate working of various components of industrial robots.	K2
CO3	Illustrate robot sensing and machine vision.	K2
CO4	Make use of robot programming and artificial intelligence.	K3
CO5	Develop industrial applications in various conditions.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	2	-	-	-	3	-
CO2	3	3	2	2	-	-	-	-	2	-	-	-	3	-
CO3	3	3	2	2	-	-	-	-	2	-	-	-	3	-
CO4	3	3	2	2	-	-	-	-	2	-	-	-	3	-
CO5	3	3	2	2	-	-	-	-	2	-	-	-	3	-

COURSE CONTENT

UNIT I

Introduction:

Definition of a robot – Basic concepts, types of industrial robots – Robot configurations – Types of robot drives – Basic robot motions – point to point control, continuous path control. Programming of Robots and Vision System- Lead through programming methods- Teach pendent overview
Of various textual programming languages like VAL etc.

UNIT II

Components of the Industrial Robotics: Function line diagram representation of robot arms, common types of arms. Manipulators - Types of Robot end effectors - Grippers - Tools as end effectors - Robot/End - effort interface.

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors.

Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors.

UNIT III

Sensing:

Range sensing - Proximity sensing - Touch sensing - Force and Torque sensing.

Kinematics-Manipulators Kinematics, Rotation Matrix, Homogenous Transformation Matrix, D-H Transformation matrix, D-H method of assignment of frames. Direct and Inverse Kinematics for Industrial robots. Differential

Kinematics for planar serial robots

UNIT IV

Trajectory planning: Joint space scheme- Cubic polynomial fit-Obstacle avoidance in operation space-cubic polynomial fit with via point, bleding scheme. Introduction Cartesian space scheme. Control- Interaction control, Rigid Body mechanics, Control architecture- position, path velocity, and force control systems, computed torque control, adaptive control, and Servo system for robot control.

UNIT V

Industrial Applications:

Application of robots in machining - Welding - Assembly - Material handling - Loading and unloading - CIM - Hostile and remote environments.

TEXT BOOKS

1. Industrial Robotics by Mikell P Groover, Pearson Education.
2. Robotics and Control by Mittal R K & Nagrath I J, TMH Publications

REFERENCE BOOKS

1. Robotic Engineering – An integrated Approach by Richard D Klafter, Thomas Achmielewski and Mickael Negin, Prentice Hall India, New Delhi, 2001.
2. Automation, Production Systems, and Computer-Integrated Manufacturing by Mikell P Groover, Pearson Education, 2015.
3. Robotics Control sensing, Vision and Intelligence by K.S. Fu., R.C. Gonalez, C.S.G. Lee, McGraw Hill International Edition, 1987.

WEB RESOURCES

1. http://www.nptel.ac.in/courses/112101099/1#
2. https://www.toptal.com/robotics/programming-a-robot-an-introductory-tutorial#:~:text=Two%20main%20programming%20languages%20are,tests%20or%20proof%20of%20 concepts.
3. https://www.plantautomation-technology.com/articles/different-types-of-robot-programming-languages

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

Complex Variables and Statistical Methods

III Year II semester

Course Category	**Open Elective**	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	NIL	**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.
2	The skills derived from the course will help the student form a necessary base to develop analytic and design concepts.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	discuss the continuity, differentiability and analyticity	K3
CO2	evaluate the integrals over a domain, Taylor and Laurent expansions of simple functions, determining the nature of the singularities and calculating residues	K2
CO3	find the confidence intervals for a statistic from the given population	K3
CO4	apply the concept of hypothesis testing to real world problems (large samples)	K2
CO5	apply the concept of hypothesis testing to real world problems (small samples)	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	1	2	-	-	-	-	-	-	-	-	-	2	-
CO4	3	3	3	2	-	-	-	-	-	-	-	-	-	2	-
CO5	3	3	2	2	-	-	-	-	-	-	-	-	-	1	-

COURSE CONTENT	
UNIT I	**Functions of a complex variable: I**ntroduction – Continuity – Differentiability – Analyticity – Properties – Cauchy-Riemann equations in Cartesian and polar coordinates. Harmonic and conjugate harmonic functions – Milne – Thompson method.

UNIT II	**Complex Integration and Power Series:** Line integral – Cauchy's integral theorem, Cauchy's integral formula, Generalized integral formula (all without proofs)- Radius of convergence – Expansion in Taylor's series, Maclaurin's series and Laurent series – Residue theorem
UNIT III	**Sampling Distributions:** Review of Normal distribution – Population and samples – Sampling distribution of mean (with known and unknown variance), proportion, variances – Sampling distribution of sums and differences -Point and interval estimators for means, variances, proportions.
UNIT IV	**Tests of Hypothesis (Large Samples):** Type I and Type II errors -Maximum error- One tail, two-tail tests – Tests concerning one mean and proportion, two means- Proportions and their differences using Z-test.
UNIT V	**Tests of Hypothesis (Small Samples):** Tests concerning one mean and proportion, two means- Proportions and their differences using Student's t-test – F-test and Chi -square test.

TEXT BOOKS	
1.	**B.S. Grewal**, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2.	**Murugesan.K,** Probability and Statistics & Random processes, Anuradha Publications
REFERENCE BOOKS	
1.	**T.K.V. Iyengar et. al.,** Probability and Statistics, S Chand Publications.
2.	**Erwin Kreyszig,** Advanced Engineering Mathematics, 10th Edition, Wiley-India.
3.	**Miller and John E. Freund,** Probability and Statistics for Engineers: Prentice Hall of India.
4.	**Jay L. Devore,** Probability and Statistics for Engineering and Sciences, 8th Edition, Cengage Learning. ISBN 13: 978-81-315-1839-7.
5.	**Ronald E. Walpole, Sharon L. Mayers and Keying Ye**, Probability and statistics for Engineers and Scientists, Perarson.
WEB RESOURCES	
1.	https://en.wikipedia.org/wiki/Complex_analysis
2.	https://en.wikipedia.org/wiki/Contour_integration http://mathonline.wikidot.com/complex-power-series
3.	https://en.wikipedia.org/wiki/Normal_distribution https://en.wikipedia.org/wiki/Sampling_(statistics) https://nptel.ac.in/courses/111104073/
4.	https://en.wikipedia.org/wiki/Statistical_hypothesis_testing
5.	https://machinelearningmastery.com/statistical-hypothesis-tests/

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

III Year II semester

ELECTRICAL DISTRIBUTION SYSTEM

Course Category	**Professional Elective**	**Course Code**	**19EE6T16**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment**	**30**
		Semester End Examination Total	**70**
		Marks	**100**

COURSE OBJECTIVES	
1	To study different factors of Distribution system.
2	To study and design the substations and distribution systems.
3	To study the concepts of voltage drop and power loss.
4	To study the distribution system protection and its coordination.
5	To study the effect of compensation for power factor improvement and voltage control on distribution system

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Understand various factors of distribution system.	Understand	K2
CO2	Design the substation and feeders. Determine the voltage drop and power loss.	Analysis	K4
CO3	Understand the protection and its coordination.	Understand	K2
CO4	Understand the effect of compensation for p.f improvement.	Understand	K2
CO5	Understand the effect of voltage control.	Understand	K2

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	2	-	-	-	-	-	-	-	-	-	-	2	-
CO2	1	2	1	-	-	-	-	-	-	-	-	-	2	-
CO3	-	2	1	-	-	-	-	-	-	-	-	-	1	-
CO4	-	2	2	-	-	-	-	-	-	-	-	-	2	1
CO5	-	2	-	-	-	-	-	-	-	-	-	-	2	1

COURSE CONTENT	
UNIT 1	**General Concepts** Introduction to distribution systems - Distribution system losses – Coincidence factor – Contribution factor loss factor – Numerical Problems – Load Modeling and Characteristics – Relationship between the load factor and loss factor – Classification and characteristics of loads (Residential, commercial, Agricultural and Industrial).
UNIT 2	**Substations** Location of substations**:** Rating of distribution substation – Service area with 'n' primary feeders – Benefits and methods of optimal location of substations.. **Distribution Feeders** Design Considerations of distribution feeders**:** Radial and loop types of primary feeders – Voltage levels – Feeder loading – Basic design practice of the secondary distribution system.
UNIT 3	**System Analysis** Voltage drop and power–loss calculations**:** Derivation for voltage drop and power loss in lines – Uniformly distributed loads and non-uniformly distributed loads – Numerical problems – Three phase balanced primary lines.

UNIT 4	**Protection, Coordination & Automation** Objectives of distribution system protection –Time current characteristics – Protective devices**:** Principle of operation of fuses – Circuit reclosures – Line sectionalizes and circuit breakers, Modulated case circuit breakers, Earth leakage circuit breakers – Protection schemes of parallel & Ring main feeders. Coordination of protective devices**:** General coordination procedure –Various types of coordinated operation of protective devices - Residual Current Circuit Breaker Automation: Block diagram approach of SCADA.
UNIT 5	**Compensation for Power Factor Improvement** Capacitive compensation for power factor control – Different types of power capacitors – shunt and series capacitors – Effect of shunt capacitors (Fixed and switched) –Power factor correction – Capacitor allocation – Economic justification – Procedure to determine the best capacitor location – Numerical problems. **Voltage Control** Voltage Control**:** Equipment for voltage control – Effect of series capacitors – Effect of AVB/AVR – Line drop compensation – Numerical problems.

TEXT BOOKS	
1	"Electric Power Distribution system, Engineering" – by TuranGonen, McGraw–hill Book Company.
2	Electrical Distribution Systems by Dale R.Patrick and Stephen W.Fardo, CRC press
REFERENCE BOOKS	
1	Electric Power Distribution – by A.S. Pabla, Tata McGraw–hill Publishing company, 4th edition, 1997.
2	Electrical Power Distribution Systems by V.Kamaraju, Right Publishers.
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/108/107/108107112/
2	https://www.nptel.ac.in/noc/courses/noc19/SEM2/noc19-ee61/

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

III Year II semester

ARTIFICIAL INTELLIGENCE TECHNIQUES

Course Category	**Professional Elective**	**Course Code**	**19EE6T17**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment**	**30**
		Semester End Examination Total Marks	**70** **100**

COURSE OBJECTIVES	
1	To have a basic proficiency in a traditional AI language including an ability to write simple to intermediate programs and an ability to understand code written in that language
2	To have an understanding of the basic issues of knowledge representation and blind and heuristic search, as well as an understanding of other topics such as minimax, resolution, etc. that play an important role in AI programs
3	To have a basic understanding of some of the more advanced topics of AI such as learning, natural language processing, agents and robotics, expert systems, and planning
4	To evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Outline problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem	Apply	K3
CO2	Apply the language/framework of different AI methods for a given problem	Apply	K3
CO3	Implement basic AI algorithms- standard search algorithms or dynamic programming	Apply	K3
CO4	Design and carry out an empirical evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports	Analysis	K4

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	-	-	3	-	-	-	-	-	-	-	-	-
CO2	1	2	-	-	3	-	-	-	-	-	-	-	-	-
CO3	-	2	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	2	-	-	3	-	-	-	-	-	-	-	-	-

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
NIT 1	Introduction, history, intelligent systems, foundations of AI, applications, tic-tac-toe game playing, development of AI languages, current trends.
UNIT 2	Problem solving: state-space search and control strategies: Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative deepening A*, constraint satisfaction. Problem reduction and game playing: Introduction, problem reduction, game playing, alpha beta pruning, two-player perfect information games.
UNIT 3	Logic concepts: Introduction, propositional calculus, proportional logic, natural deduction system, axiomatic system, semantic tableau system in proportional logic, resolution refutation in proportional logic, predicate logic.
UNIT 4	Knowledge representation: Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge representation using frames. Advanced knowledge representation techniques: Introduction, conceptual dependency theory, script structure, CYC theory, case grammars, semantic web
UNIT 5	Expert system and applications: Introduction phases in building expert systems, expert system versus traditional systems Uncertainty measure: probability theory: Introduction, probability theory, Bayesian belief networks, certainty factor theory, dempster-shafer theory Fuzzy sets and fuzzy logic: Introduction, fuzzy sets, fuzzy set operations, types of membership functions, multi valued logic, fuzzy logic, linguistic variables and hedges, fuzzy propositions, inference rules for fuzzy propositions, fuzzy systems.

TEXT BOOKS	
1	Artificial Intelligence- Saroj Kaushik, CENGAGE Learning
2	Artificial intelligence, A modern Approach , 2nded, Stuart Russel, Peter Norvig, PEA
REFERENCE BOOKS	
1	Artificial Intelligence- Deepak Khemani, TMH, 2013
2	Introduction to Artificial Intelligence, Patterson, PHI
3	Atificial intelligence, structures and Strategies for Complex problem solving, -George F Lugar, 5thed, PEA
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/106/105/106105077/
2	http://aima.cs.berkeley.edu/

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

III Year II semester

ELECTRICAL MACHINE MODELING AND ANALYSIS

Course Category	Professional Elective	**Course Code**	**19EE6T18**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment**	**30**
		Semester End Examination Total Marks	**70** **100**

COURSE OBJECTIVES	
1	To modeling of dc and ac machines using Kron's primitive machine.
2	To mathematical modeling concept to DC Machine.
3	To Understand the concept of phase transformation and to apply mathematical modelling of single phase induction machines.
4	To know the performance of three phase Induction Machine.
5	To get the performance characteristics of machine in d-q modeling.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Apply the modeling of dc and ac machines using Kron's primitive machine.	Apply	K3
CO2	Apply mathematical modeling concept to DC Machine.	Apply	K3
CO3	Understand the concept of phase transformation and to apply mathematical modelling of single phase induction machines.	Understand	K2
CO4	Analyze the performance of three phase Induction Machine.	Analyze	K4
CO5	Evaluates the performance characteristics of machine in d-q modeling.	Analyze	K4

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	2	-	-	-	-	-	-	-	-	-	-	2	-
CO2	1	2	1	-	-	-	-	-	-	-	-	-	2	-
CO3	-	2	1	-	-	-	-	-	-	-	-	-	2	-
CO4	-	2	2	-	-	-	-	-	-	-	-	-	2	1
CO5	-	2	-	-	-	-	-	-	-	-	-	-	2	1

COURSE CONTENT	
UNIT 1	**Basic concepts of Modeling** Basic Two-pole Machine representation - Commutator machines, 3-phase synchronous machine with and without damper bars and 3-phase induction machine, Kron's primitive Machine-voltage, current and Torque equations.

UNIT 2	**DC Machine Modeling** Mathematical model of separately excited D.C motor – Steady State analysis-Transient analysis- Sudden application of Inertia Load-Transfer function of Separately excited D.C Motor- Mathematical model of D.C Series motor, Shunt motor-Linearization Techniques for small perturbations.
UNIT 3	**Reference frame theory & Modeling of single phase Induction Machines** Linear transformation-Phase transformation - three phase to two phase transformation (abc to dq0) and two phase to three phase transformation dq0 to abc -Power equivalence-Mathematical modeling of single phase induction machines.
UNIT 4	**Modeling of three phase Induction Machine** Generalized model in arbitrary reference frame-Electromagnetic torque-Derivation of commonly used Induction machine models- Stator reference frame model-Rotor reference frame model- Synchronously rotating reference frame model-state space model with flux linkages as variables.
UNIT 5	**Modeling of Synchronous Machine** Synchronous machine inductances–voltage equations in the rotor's dq0 reference frame, electromagnetic torque-current in terms of flux linkages-three phase synchronous machine model. **Modeling of Special Machines** Modeling of PM Synchronous motor, modeling of BLDC motor, modeling of Switched Reluctance motor.

TEXT BOOKS	
1	Generalized theory of Electrical Machinery –P.S.Bimbra- Khanna Publishers.
2	Analysis of Electrical Machinery and Drive systems – P.C. Krause, Oleg Wasynczuk, Scott D. Sudhoff – Second Edition-IEEE Press.
REFERENCE BOOKS	
1	Electric Motor Drives - Modeling, Analysis& control -R.Krishnan- Pearson Publications- 1st edition -2002.
2	Dynamic simulation of Electric machinery using Matlab / Simulink –CheeMunOng-PHI.
3	Modern Power Electronics and AC Drives-B.K. Bose – PHI
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/108/106/108106023/
2	https://nptel.ac.in/courses/108/105/108105017/

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

III Year II semester

ADVANCED CONTROL SYSTEMS

Course Category	Professional Elective	**Course Code**	**19EE6719**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment** **Semester End Examination Total** **Marks**	**30** **70** **100**

COURSE OBJECTIVES	
1	To familiarize the state space representation in controllable, observable, diagonal and Jordan canonical forms and introduce the concept of controllability and observability tests through canonical forms.
2	Design of state feedback controller by pole placement technique and State Observer design.
3	Analysis of a nonlinear system using describing function approach and the Lypanov's method of stability analysis of a system.
4	Formulation of Euler Laugrange equation for the optimization of typical functionals and solutions.
5	Formulation of linear quadratic optimal regulator (LQR) problem by parameter adjustment and solving riccatti equation.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Formulate different state models in canonical forms.	Understand	K2
CO2	Design of state feedback control using the pole placement technique and state observer design for a given control system.	Analyze	K4
CO3	analyse of nonlinear system using the describing function technique and determine the stability of a linear autonomous system using lypnov method.	Analyze	K4
CO4	determine minimization of functionals using calculus of variation studied	Analyze	K4
CO5	Formulate and solve the LQR problem and riccatti equation.	Understand	K2

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO8**	**PO9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**
CO1	1	2	-	-	-	-	-	-	-	-	-	-	2	-
CO2	1	2	1	-	-	-	-	-	-	-	-	-	2	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-	2	-
CO4	-	2	2	-	-	-	-	-	-	-	-	-	2	1
CO5	-	2	-	-	-	-	-	-	-	-	-	-	2	1

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT 1	**State space analysis** State Space Representation in Canonical forms – Controllable canonical form – Observable canonical form – Diagonal Canonical Form - Jordan Canonical Form - Principle of duality – Controllability and observability test from Jordan canonical form and other canonical forms.
UNIT 2	**Design of state feedback controllers and state Observers** Design of state feedback control through pole placement and Ackerman's formula – Design of state observers (Full order & reduced order).
UNIT 3	**Describing function analysis** Introduction to nonlinear systems, Types of nonlinearities, describing functions, stability using describing functions. **Stability analysis** Stability in the sense of Lyapunov – Lyapunov's stability and Lypanov's instability theorems – Direct method of Lyapunov for the linear and nonlinear continuous time autonomous systems.
UNIT 4	**Calculus of variations** Minimization of functional of single function – Constrained minimization – Minimum principle – Control variable inequality constraints – Control and state variable inequality constraints – Euler lagrangine equation.
UNIT 5	**Optimal control** Linear Quadratic Optimal Regulator (LQR) problem formulation – Optimal regulator design by parameter adjustment (Lyapunov method) – Optimal regulator design by Continuous Time Algebraic Riccatti equation (CARE) - Optimal controller design using LQG framework.

TEXT BOOKS	
1	Modern Control Engineering – by K. Ogata, Prentice Hall of India, 3rd edition, 1998
2	Automatic Control Systems by B.C. Kuo, Prentice Hall Publication
REFERENCE BOOKS	
1	Modern Control System Theory – by M. Gopal, New Age International Publishers, 2nd edition,1996
2	Control Systems Engineering by I.J. Nagarath and M.Gopal, New Age International (P) Ltd.
3	Digital Control and State Variable Methods – by M. Gopal, Tata McGraw–Hill Companies, 1997.
4	Systems and Control by Stainslaw H. Zak , Oxford Press, 2003.
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/108/103/108103007/
2	https://nptel.ac.in/courses/101/108/101108047/

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

III Year II semester

POWER ELECTRONICS LABORATORY

Course Category	Laboratory	**Course Code**	**19EE6L08**
Course Type	Theory	**L-T-P-C**	**0-0-3-1.5**
Prerequisites	**NA**	**Internal Assessment**	**25**
		Semester End Examination Total Marks	**50** **75**

COURSE OBJECTIVES	
1	To study the characteristics of various power electronic devices and analyze firing circuits and commutation circuits of SCR
2	To analyze the performance of single–phase and three–phase full–wave bridge converters with both resistive and inductive loads
3	To understand the operation of AC voltage regulator with resistive and inductive loads
4	To understand the working of Buck converter, Boost converter and inverters

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	study the characteristics of various power electronic devices	Understrand	K2
CO2	Analyze the performance of single–phase and three–phase full–wave bridge converters with both resistive and inductive loads	Analysing	K4
CO3	Understand the operation of single phase AC voltage regulator with resistive and inductive loads	Understrand	K2
CO4	Understand the working of Buck converter, Boost converter, single–phase square wave inverter and PWM inverter.	Understrand	K2

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	-	-	-	-	-	-	-	-	2	-	-	2	-
CO2	1	-	-	-	-	-	-	-	-	1	-	-	2	1
CO3	1	-	-	-	-	-	-	-	-	2	-	-	2	1
CO4	1	-	-	-	-	-	-	-	-	1	-	-	2	-

Any 10 of the Following Experiments are to be conducted	
Experiment 1	Characteristics of Thyristor, MOSFET & IGBT
Experiment 2	R, RC & UJT firing circuits for SCR
Experiment 3	Single -Phase semi converter with R & RL loads.
Experiment 4	Single -Phase full converter with R & RL loads
Experiment 5	Three- Phase full converter with R &RL loads.
Experiment 6	Single Phase dual converter in circulating current & non circulating current mode of operation.
Experiment 7	Single -Phase AC Voltage Regulator with R & RL Loads.
Experiment 8	Single Phase step down Cycloconverter with R & RL Loads.
Experiment 9	Boost converter in Continuous Conduction Mode operation.
Experiment 10	Buck converter in Continuous Conduction Mode operation.
Experiment 11	Single -Phase square wave bridge inverter with R & RL Loads.
Experiment 12	Single - Phase PWM inverter.

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

III B. Tech II Semester

ADVANCED MICROPROCESSORS & MICROCONTROLLERS LABORATORY

Course Category	Professional Core	**Course Code**	**19EC6L10**
Course Type	Laboratory	**L-T-P-C**	3-0-0-3
Prerequisites	Advanced Microprocessor & Microcontrollers	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

Course Outcomes: The student will be able to

	COURSE OUTCOME	BLOOMS TAXONOMY LEVEL
CO-1	Develop assembly level language program using MASM.	K3
CO-2	Understand Interfacingof 8 0 8 6 Microprocessorwith peripheral devices.	K2
CO-3	Develop assembly l e v e l language program using8051	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO-1	PO-2	PO-3	PO-4	PO-5	PO 6	PO- 7	PO- 8	PO 9	PO 10	PO- 11	PO- 12	PSO-1	PSO- 2
CO-1	**2**	**3**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
CO-2	**1**	**1**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
CO-3	**1**	**1**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

LIST OFEXPERIMENTS (Any 10 of the following experiments are to be conducted)

PART-A: Introduction to MASM/TASM.	
1	Arithmetic operation – Multi byte addition and subtraction, multiplication and division – Signed and unsigned arithmetic operation, ASCII – Arithmetic operation.
2	Logic operations – Shift and rotate – Converting packed BCD to unpacked BCD, BCD to ASCII conversion.
3	By using string operation and Instruction prefix: Move block, Reverse string Sorting, Inserting, Deleting, Length of the string, String comparison. Sorting of an array
PART-B: Interface using 8086	
4	PPI Intel 8255 Interface using 8086
5	Programmable Interrupt controller 8259 Interface using 8086
6	D/A Interface through Intel 8255
7	Keyboard and display interface through Intel 8279
8	Elevator Interface using 8086
PART-C: Interface using 8051	
9	Arithmetic operations using 8051
10	Timer in different modes using 8051
11	Serial communication implementation using 8051
12	Traffic Light Controller using 8051.
13	Stepper Motor Interfacing Using 8051

Equipment Required:

a)Regulated Power supplies
b)Analog/DigitalStorage Oscilloscopes c)8086 Microprocessor kits
d)8051 microcontroller kits e)ADC module
f)DAC module
g)Stepper motormodule h)Keyboard module
i)LED, 7-SegemtUnits
j)DigitalMultimeters
k)ROM/RAMInterface module l)Bread Board
etc.

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

III B. Tech II Semester

LINEAR AND DIGITAL IC APPLICATIONS LAB

Course Category	Professional Core	**Course Code**	**19EC6L07**
Course Type	Laboratory	**L-T-P-C**	3-0-0-3
Prerequisites	Linear and Digital IC Applications	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

Course Objective:

- To study the characteristics of Integrated circuits – IC 741, 555, 565.
- To develop the application circuits using IC's.
- To model the digital circuits for different applications.

Course Outcomes:

COURSE OBJECTIVES	
The student will:	
1	To study the characteristics of Integrated circuits – IC 741, 555, 565.
2	To develop the application circuits using IC's.
3	To model the digital circuits for different applications.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Analyze the characteristics of Integrated circuits of IC 741, 555, 565	K4
CO2	Develop application circuits using ICs	K3
CO3	Analyze digital circuit design for different application using VHDL	K4

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	2	3		2								2	2
CO2	2	2	2		2								1	2
CO3	2	1	1		1								2	1

List of experiments:

1. Determination of parameters like input & output offset voltages and currents, Slew rate, CMRR of op amp 741.
2. Inverting & Non-Inverting Amplifiers.
3. Adders & Subtractors.
4. Integrator & Differentiator.

5. Active filter circuits: LPF & HPF (First Order)
6. IC 555 – Monostable & Astable Multivibrators Circuits
7. IC 556, 565-VCO & PLL applications.
8. Schmitt Trigger circuit using IC 741.
9. ADC using IC 0809 & DAC using IC 741 circuits.
10. Multiplexers (74151)& De-multiplexers (74155).
11. MOD counter design using D & JK Flipflop.
12. Universal Shift Register.
13. Decade counter -7490
14. 7 segment Decoder using 74138.
15. ALU Design.

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year I semester

UTILIZATION OF ELECTRICAL ENERGY

Course Category	**Professional Core**	**Course Code**	**19EE7T20**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment** **Semester End Examination Total** **Marks**	**30** **70** **100**

COURSE OBJECTIVES	
1	To study the basic principles of illumination and its measurements and to design the different types lighting systems.
2	To acquaint with the different types of heating and welding techniques.
3	To understand the operating principles and characteristics of various motors with respect to speed, temperature and loading conditions.
4	To understand the basic principles of electric traction including speed–time curves of different traction services and calculation of braking, acceleration and other related parameters.
5	To Introduce the concept of various types of energy storage systems.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Understand various levels of illuminosity produced by different illuminating sources and able to estimate the illumination levels produced by various sources and recommend the most efficient illuminating sources and should be able to design different lighting systems by taking inputs and constraints in view.	Understand	K2
CO2	Identify most appropriate heating and welding techniques for suitable applications.	Understand	K2
CO3	identify a suitable motor for electric drives and industrial applications	Understand	K2
CO4	Determine the speed/time characteristics of different types of traction systems and determination of various traction parameters.	Analysis	K4
CO5	Know the necessity and usage of different energy storage schemes for different applications.	Understand	K2

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	2	1	1	--	-	-	-	-	-	-	-	2	-
CO2	2	2	-	1	-	-	-	-	-	-	-	-	-	-
CO3	-	2	1	-	-	-	-	-	-	-	-	-	2	2
CO4	3	2	-	-	-	-	-	-	-	-	-	-	2	2
CO5	1	2	1	-	-	-	-	-	-	-	-	-	2	2

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT 1	**Illumination fundamentals** Introduction, terms used in illumination–Laws of illumination–Polar curves–Integrating sphere–Lux meter–Sources of light **Various Illumination Methods** Discharge lamps, MV and SV lamps – Comparison between tungsten filament lamps and fluorescent tubes–Basic principles of light control- Types and design of lighting and flood lighting–LED lighting, Energy conservation.
UNIT 2	**Electric Heating** Advantages and methods of electric heating–Resistance heating induction heating and dielectric heating. **Electric Welding** Electric welding–Resistance and arc welding–Electric welding equipment–Comparison between AC and DC Welding
UNIT 3	**Selection of Motors** Choice of motor, type of electric drives, starting and running characteristics–Speed control–Temperature rise–Applications of electric drives–Types of industrial loads–continuous–Intermittent and variable loads–Load equalization, Introduction to energy efficient motors.
UNIT 4	**Electric Traction – I** System of electric traction and track electrification– Review of existing electric traction systems in India– Special features of traction motor– Mechanics of train movement–Speed–time curves for different services – Trapezoidal and quadrilateral speed time curves. **Electric Traction – II** Calculations of tractive effort– power –Specific energy consumption for given run–Effect of varying acceleration and braking retardation–Adhesive weight and braking retardation adhesive weight and coefficient of adhesion–Principles of energy efficient motors.
UNIT 5	**Introduction to energy storage systems** Need for energy storage, Types of energy storage-Thermal, electrical, magnetic and chemical storage systems, Comparison of energy storage technologies-Applications.

TEXT BOOKS	
1	Utilization of Electric Energy – by E. Openshaw Taylor, Orient Longman.
2	Art & Science of Utilization of electrical Energy – by Partab, DhanpatRai&Sons.
3	"Thermal energy storage systems and applications"-by Ibrahim Dincer and Mark A.Rosen. John Wiley and Sons 2002.
REFERENCE BOOKS	
1	Utilization of Electrical Power including Electric drives and Electric traction – by N.V.Suryanarayana, New Age International (P) Limited, Publishers, 1996.
2	Generation, Distribution and Utilization of electrical Energy – by C.L. Wadhwa, New Age International(P)Limited,Publishers,1997.
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/108/105/108105060/
2	https://www.youtube.com/watch?v=ftr5QB91LDw

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year I semester

RENEWABLE ENERGY SOURCES

Course Category	**Professional Core**	**Course Code**	**19EE7T21**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment**	**30**
		Semester End Examination Total	**70**
		Marks	**100**

COURSE OBJECTIVES	
1	To study the solar radiation data, extraterrestrial radiation, radiation on earth's surface.
2	To study solar photo voltaic systems.
3	To study maximum power point techniques in solar pv and wind energy.
4	To study wind energy conversion systems, Betz coefficient, tip speed ratio.
5	To study basic principle and working of hydro, tidal, biomass, fuel cell and geothermal systems.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Analyze solar radiation data, extraterrestrial radiation, and radiation on earth's surface.	Analyze	K4
CO2	Design solar photo voltaic systems.	Analyze	K4
CO3	Develop maximum power point techniques in solar PV and wind energy systems.	Analyze	K4
CO4	Explain wind energy conversion systems, wind generators, power generation.	Understand	K2
CO5	Explain basic principle and working of hydro, tidal, biomass, fuel cell and geothermal systems.	Understand	K2

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	3	1	1	--	-	-	-	-	-	-	-	2	-
CO2	2	3	3	1	-	-	-	-	-	-	-	-	-	-
CO3	-	3	1	-	-	-	-	-	-	-	-	-	2	2
CO4	3	3	3	-	-	-	-	-	-	-	-	-	2	2
CO5	1	3	2	-	-	-	-	-	-	-	-	-	2	2

COURSE CONTENT	
UNIT 1	**Fundamentals of Energy Systems and Solar energy** Energy conservation principle – Energy scenario (world and India) – various forms of renewable energy - Solar radiation**:** Outside earth's atmosphere – Earth surface – Analysis of solar radiation data – Geometry – Radiation on tilted surfaces – Numerical problems.

UNIT 2	**Solar Photovoltaic Systems** Solar photovoltaic cell, module, array – construction – Efficiency of solar cells – Developing technologies – Cell I-V characteristics – Equivalent circuit of solar cell- Series resistance – Shunt resistance – Applications and systems – Balance of system components - System design**:** storage sizing – PV system sizing – Maximum power point tracking.
UNIT 3	**Wind Energy** Sources of wind energy - Wind patterns – Types of turbines –Horizontal axis and vertical axis machines - Kinetic energy of wind – Betz coefficient – Tip–speed ratio – Efficiency – Power output of wind turbine – Selection of generator(synchronous, induction) – Maximum power point tracking – wind farms – Power generation for utility grids.
UNIT 4	**Hydro and Tidal power systems** Basic working principle – Classification of hydro systems**:** Large, small, micro – measurement of head and flow – Energy equation – Types of turbines – Numerical problems. Tidal power – Basics – Kinetic energy equation – Turbines for tidal power - Numerical problems – Wave power – Basics – Kinetic energy equation – Wave power devices – Linear generators.
UNIT 5	**Biomass, fuel cells and geothermal systems** Biomass Energy**:** Fuel classification – Pyrolysis – Direct combustion of heat – Different digesters and sizing. Fuel cell**:** Classification of fuel for fuel cells – Fuel cell voltage– Efficiency – V-I characteristics. Geothermal**:** Classification – Dry rock and hot acquifer – Energy analysis – Geothermal based electric power generation.

TEXT BOOKS	
1	Renewable Energy Resources, John Twidell and Tony Weir, Taylor and Francis -second edition,2013.
2	Non Conventional sources of Energy by G.D.Rai, Kanna Publications.
REFERENCE BOOKS	
1	Energy Science**:** Principles, Technologies and Impacts, John Andrews and Nick Jelly, Oxford University Press.
2	Solar Energy**:** Principles of Thermal Collection and Storage, S. P. Sukhatme and J. K. Nayak, TMH, New Delhi, 3rd Edition.
3	Renewable Energy- Edited by Godfrey Boyle-oxford university.press,3rd edition,2013.
4	Handbook of renewable technology Ahmed and Zobaa, Ramesh C Bansal, World scientific, Singapore.
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/121/106/121106014/
2	https://nptel.ac.in/courses/103/107/103107157/

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year I semester

POWER SYSTEM PROTECTION

Course Category	**Professional Core**	**Course Code**	**19EE7T22**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment**	**30**
		Semester End Examination Total Marks	**70** **100**

COURSE OBJECTIVES	
1	To provide the basic principles and operation of various types of circuit breakers.
2	To study the classification, operation and application of different types of electromagnetic protective relays.
3	To explain protective schemes, for generator and transformers.
4	To impart knowledge of various protective schemes used for feeders and bus bars. To explain the principle and operation of different types of static relays.
5	To study different types of over voltages in a power system and principles of different protective schemes for insulation co–ordination.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Formulate incidence, network matrices, per unit impedance diagrams and Y-bus matrix	Understand	K2
CO2	Analyze the behavior of the power system under steady state conditions using various load flow methods	Analysis	K4
CO3	Develop Zbus matrix for changes in the network configurations such as Addition of element from a new bus to reference, from a new bus to an old bus, between an old bus to reference & between two old buses	Application	K5
CO4	Analyze the behavior of the power system under short circuit conditions	Analysis	K4
CO5	Design the proper protective equipment for the power system under asymmetrical fault conditions. Suggest the methods for improving the stability of the power system under various operating conditions	Analysis	K4

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1	1	--	-	-	-	-	-	-	-	3	-
CO2	1	2	1	1	-	-	-	-	-	-	-	-	3	-
CO3	3	1	1	-	-	-	-	-	-	-	-	-	3	-
CO4	2	2	2	-	-	-	-	-	-	-	-	-	3	1
CO5	3	2	3	-	-	-	-	-	-	-	-	-	3	-

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT 1	**Circuit Breakers** Fuses: Introduction, types of fuses, ratings and specifications, HRC fuses and applications. Miniature Circuit Breaker(MCB)– Elementary principles of arc interruption– Restriking Voltage and Recovery voltages– Re-striking phenomenon - RRRV– Average and Max. RRRV– Current chopping and Resistance switching– Introduction to oil circuit breakers– Description and operation of Air Blast– Vacuum and SF6 circuit breakers– CB ratings and specifications– Concept of Auto reclosing.
UNIT 2	**Electromagnetic Protection** Relay connection – Balanced beam type attracted armature relay - induction disc and induction cup relays–Torque equation - Relays classification–Instantaneous– DMT and IDMT types– Applications of relays**:** Over current and under voltage relays– Directional relays– Differential relays and percentage differential relays– Universal torque equation– Distance relays**:** Impedance– Reactance– Mho and offset mho relays– Characteristics of distance relays and comparison.
UNIT 3	**Generator Protection** Protection of generators against stator faults– Rotor faults and abnormal conditions– restricted earth fault and inter turn fault protection– Numerical examples. **Transformer Protection** Protection of transformers**:** Percentage differential protection– Design of CT's ratio– Buchholz relay protection–Numerical examples.
UNIT 4	**Feeder and Bus bar Protection** Protection of lines**:** Over current Protection schemes – PSM,TMS - Numerical examples - Carrier current and three zone distance relay using impedance relays–Protection of bus bars by using Differential protection.
UNIT 5	**Static and Digital Relays & Protection against over voltage and grounding** Static relays**:** Static relay components– Static over current relays– Static distance relay– Micro processor based over current relay, block diagram approach of Numerical Relays. Generation of over voltages in power systems– Protection against lightning over voltages– Valve type and zinc oxide lighting arresters – Grounded and ungrounded neutral systems– Effects of ungrounded neutral on system performance– Methods of neutral grounding**:** Solid– resistance– Reactance–Arcing grounds and grounding Practices.

TEXT BOOKS	
1	Power System Protection and Switchgear by Badari Ram and D.N Viswakarma, TMH Publications
2	Power system protection- Static Relays with microprocessor applications.by T.S.MadhavaRao,TMH
REFERENCE BOOKS	
1	Fundamentals of Power System Protection by Paithankar and S.R.Bhide.,PHI, 2003.
2	Art & Science of Protective Relaying – by C R Mason, Wiley Eastern Ltd.
3	Protection and SwitchGear by BhaveshBhalja, R.P. Maheshwari, Nilesh G.Chothani, Oxford University Press, 2013.
WEB RESOURCES (Suggested)	
1	https://www.youtube.com/watch?v=zCiPlEBolsI
2	https://www.youtube.com/watch?v=_0T2Osgxdxs

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year I semester

HIGH VOLTAGE ENGINEERING

Course Category	**Professional Elective**	**Course Code**	**19EE7T23**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment** **Semester End Examination Total** **Marks**	**30** **70** **100**

COURSE OBJECTIVES	
1	To understand HV breakdown phenomena in gases, liquids and solids dielectrics.
2	To acquaint with the generating principle of operation and design of HVDC, AC and Impulse voltages and currents.
3	To understand various techniques for AC, DC and Impulse measurement of high voltages and currents.
4	To understand the insulating characteristics of dielectric materials.
5	To understand the various testing techniques of HV equipments.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Measure the performance of high voltages with regard to different configurations of electrode systems.	Understand	K2
CO2	Describe the theory of breakdown and withstand phenomena of all types of dielectric materials.	Analysis	K4
CO3	Differentiate the operating principles of HVDC, AC & Impulse voltages and currents.	Apply	K3
CO4	Recognize the various techniques in measurement of HVDC, AC & Impulse voltages and currents	Understand	K2
CO5	Propose dielectric property of material used for HV equipment. Illustrate the techniques of testing various equipment's used in HV engineering	Analysis	K4

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1	1	--	-	-	-	-	-	-	-	3	-
CO2	1	2	1	1	-	-	-	-	-	-	-	-	3	-
CO3	3	1	1	-	-	-	-	-	-	-	-	-	3	-
CO4	2	2	2	-	-	-	-	-	-	-	-	-	3	1
CO5	3	2	3	-	-	-	-	-	-	-	-	-	3	-

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT 1	**Break down phenomenon in gaseous, liquid and solid insulation** Gases as insulating media – Collision process – Ionization process – Townsend's criteria of breakdown in gases – Paschen's law – Liquid as Insulator – Pure and commercial liquids – Breakdown in pure and commercial liquid – Intrinsic breakdown – Electromechanical breakdown –Thermal breakdown –Breakdown of solid dielectrics, composite dielectrics used in practice.
UNIT 2	**Generation of High voltages and High currents** Generation of high DC voltages – Generation of high alternating voltages – Generation of impulse voltages and currents – Tripping and control of impulse generators.
UNIT 3	**Measurement of high voltages and High currents** Measurement of high AC, DC and Impulse voltages – Voltages and measurement of high currents – Direct, alternating and Impulse.
UNIT 4	**Non–destructive testing of material and electrical apparatus** Measurement of DC resistivity – Measurement of dielectric constant and loss factor – Partial discharge measurements.
UNIT 5	**High voltage testing of electrical apparatus** Testing of insulators and bushings – Testing of isolators and circuit breakers – Testing of cables – Testing of transformers – Testing of surge arresters – Radio interference measurements.

TEXT BOOKS	
1	High Voltage Engineering: Fundamentals by E.Kuffel, W.S.Zaengl, J.Kuffel by Elsevier,2nd Edition.
2	High Voltage Engineering and Technology by Ryan, IET Publishers.
REFERENCE BOOKS	
1	High Voltage Engineering by M.S.Naidu and V. Kamaraju – TMH Publications, 3rd Edition
2	High Voltage Engineering by C.L.Wadhwa, New Age Internationals (P) Limited, 1997.
3	High Voltage Insulation Engineering by RavindraArora, Wolfgang Mosch, New Age International (P)Limited,1995.
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/108/108/108108099/
2	https://www.youtube.com/watch?v=0as-VQq9igA

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year I semester

ENERGY AUDIT, CONSERVATION AND MANAGEMENT

(Professional Elective-II)

Course Category	**Professional Elective**	**Course Code**	**19EE7T24**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment** **Semester End Examination Total** **Marks**	**30** **70** **100**

COURSE OBJECTIVES	
1	To understand energy efficiency, scope, conservation and technologies.
2	To design energy efficient lighting systems.
3	To estimate/calculate power factor of systems and propose suitable compensation techniques.
4	To understand energy conservation in HVAC systems.
5	To calculate life cycle costing analysis and return on investment on energy efficient technologies.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Analyze the principles of energy auditing along with energy conservation schemes and management methods	Analysis	K4
CO2	Employ different illumination and energy conservation methods for effective lighting	Application	K3
CO3	Acquire knowledge on power factor with improvement methods	Knowledge	K1
CO4	Differentiate space heating and ventilation methods. Calculate life cycle costing analysis and return on investment on energy efficient motors	Analysis	K4
CO5	Determination of recovery investment on energy efficient technologies	Analysis	K4

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	1	1	--	-	-	-	-	-	-	-	1	-
CO2	1	2	1	1	-	-	-	-	-	-	-	-	1	-
CO3	1	1	1	-	-	-	-	-	-	-	-	-	2	-
CO4	2	2	2	-	-	-	-	-	-	-	-	-	2	1
CO5	1	2	3	-	-	-	-	-	-	-	-	-	2	-

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT 1	**Energy sources** Energy consumption – world energy reserves – prices – alternative sources – power – energy policies – choice of fuels. **Energy Auditing** Energy conservation schemes: Short term - Medium term - Long term energy conservation schemes – Industrial energy use - Energy index – Cost index . Representation of energy consumption: Pie charts - Sankey diagrams – Load Profile. Energy auditing: General Auditing, Detailed Energy Audit.
UNIT 2	**Heat Transfer Theory** Heat – Heat content – Rate of heat transfer – Heat transfer coefficient - Conduction – Convention and radiation. Thermal insulation & its importance - space heating – HVAC system – Heating of Buildings – District heating – Factors & affecting the choice of district heating.
UNIT 3	**Energy Efficient Instruments** Digital Energy Meter – Data loggers – Thermo couples – Pyranometer – Lux meters – Tong testers – Power analyzers – Power factor – effects with non-linear loads – effect of harmonics on power factor – Power Factor Improvement – Capacitor rating – Effects of power factor improvements - Electric lighting – Types of lighting – Luminaries – Energy efficient lighting.
UNIT 4	**Economic Aspects and Financial Analysis** Understanding energy cost: Depreciation methods – time value of money – rate of return – present worth method. Basic payback calculations –depreciation – net present value calculations. Taxes and tax credit – numerical problems.
UNIT 5	**Demand Side Management** Introduction to DSM - concept of DSM - benefits of DSM - different techniques of DSM – time of day pricing - multi-utility power exchange model - time of day models for planning. Load management - load priority technique - peak clipping - peak shifting - valley filling - strategic conservation - energy efficient equipment. Management and organization of energy conservation awareness programs.

TEXT BOOKS	
1	Energy management by W.R. Murphy & G. Mckay Butter worth, Elsevier publications. 2012
2	Hand Book of Energy Audit by Sonal Desai- Tata McGraw hill
REFERENCE BOOKS	
1	Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill publishing company Ltd. New Delhi.
2	Energy management by Paul o' Callaghan, Mc–Graw Hill Book company–1st edition, 1998.
3	Energy management hand book by W.C.Turner, John wiley and sons.
4	Energy management and conservation –k v Sharma and pvenkataseshaiah-I K International Publishing House pvt.ltd,2011.
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/105/102/105102175/
2	https://www.youtube.com/watch?v=M1zijCmeXJg

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year I semester

SPECIAL ELECTRICAL MACHINES

(Professional Elective-II)

Course Category	**Professional Elective**	**Course Code**	**19EE8T25**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment** **Semester End Examination Total** **Marks**	**30** **70** **100**

COURSE OBJECTIVES	
1	To explain theory of operation and control of switched reluctance motor.
2	To explain the performance and control of stepper motors, and their applications.
3	To describe the operation and characteristics of permanent magnet dc motor.
4	To distinguish between brush dc motor and brush less dc motor**.**
5	To explain the theory of travelling magnetic field and applications of linear motors.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Distinguish between brush dc motor and brush less dc motor**.**	Apply	K3
CO2	Explain the performance and control of stepper motors, and their applications.	Understand	K2
CO3	Explain theory of operation and control of switched reluctance motor.	Understand	K2
CO4	Explain the theory of travelling magnetic field and applications of linear motors.	Understand	K2
CO5	Understand the significance of electrical motors for traction drives.	Understand	K2

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO8**	**PO9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**
CO1	2	2	1	-	-	-	-	-	-	-	-	-	2	-
CO2	1	2	1	1	-	-	-	-	-	-	-	-	2	-
CO3	-	1	-	-	-	-	-	-	-	-	-	-	2	1
CO4	2	3	2	-	1	-	-	-	-	-	-	-	-	1
CO5	2	3	1	-	-	-	-	-	-	-	-	-	2	1

COURSE CONTENT

UNIT 1	**Permanent magnet materials and PMDC motors** Introduction-classification of permanent magnet materials used in electrical machines-minor hysteresis loop and recoil line-Stator frames of conventional dc machines-Development of electronically commutated dc motor from conventional dc motor-Permanent-magnet materials and characteristics-B-H loop and demagnetization characteristics-high temperature effects reversible losses-Irreversible losses-Mechanical properties, handling and magnetization- Application of permanent magnets in motors-power density-operating temperature range-severity of operation duty.
UNIT 2	**Stepper Motors** Principle of operation of Stepper Motor – Constructional details - Classification of stepper motors – Different configuration for switching the phase windings - Control circuits for stepper motors – Open loop and closed loop control of two phase hybrid stepping motor.
UNIT 3	**Switched Reluctance Motors** Construction and Principle of operation of Switched Reluctance Motor – Comparison of conventional and switched reluctance motors – Design of stator and rotor pole arcs – Torque producing principle and torque expression – Different converter configurations for SRM – Drive and power circuits for SRM – Position sensing of rotor – Applications of SRM.
UNIT 4	**Permanent Magnet Brushless DC Motor** Principle of operation of BLDC motor - Types of constructions - Surface mounted and interior type permanent magnet DC Motors - Torque and EMF equations for Square wave & Sine wave for PMBLDC Motor – Torque - Speed characteristics of Square wave & Sine wave for PMBLDC Motor - Merits & demerits of Square wave & Sine wave for PMBLDC Motor - Performance and efficiency – Applications.
UNIT 5	**Linear Induction Motors (LIM)** Construction– principle of operation–Double sided LIM from rotating type Induction Motor – Schematic of LIM drive for traction – Development of one sided LIM with back iron-equivalent circuit of LIM.

TEXT BOOKS	
1	Brushless Permanent magnet and reluctance motor drives, Clarenden press, T.J.E. Miller, 1989, Oxford.
REFERENCE BOOKS	
1	Special electrical Machines, K.VenkataRatnam, University press, 2009, New Delhi.
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/108/102/108102156/
2	https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ee01/

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year I semester

HVDC Transmission

(Professional Elective II)

Course Category	Professional Elective	**Course Code**	**19EE7T26**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment**	**30**
		Semester End Examination Total	**70**
		Marks	**100**

COURSE OBJECTIVES	
1	To understand the phenomena of HVDC, HVDC equipment comparison with AC and the latest state of art in HVDC transmission.
2	To understand method of conversion of AC to DC, performance of various level of pulse conversion and control characteristics of conversion. It also provides knowledge of effect of source inductance as well as method of power control
3	To understand the requirements of reactive power control in HVDC system.
4	To understand the harmonics in AC side of power line in a HVDC system
5	To understand the requirements of filters in a HVDC system and design of filters for various levels of pulse conversion.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Understand the transmission of HVDC power with regard to terminal equipments, type of HVDC connectivity and planning of HVDC system	Understanding	K2
CO2	Develop the knowledge with regard to choice of pulse conversion, control characteristic, firing angle control and effect of source impedance.	Applying	K3
CO3	Revise the converter control characteristics from that the flexibility of power control in HVDC systems	Understanding	K2
CO4	Observation reactive power requirements of conventional control, filters and reactive power compensation in AC side of HVDC system.	Applying	K3
CO5	Calculate the voltage and current harmonics, and to get knowledge in multi terminal HVDC Systems protection schemes.	Applying	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1	1	--	-	-	-	-	-	-	-	3	-
CO2	1	2	1	1	-	-	-	-	-	-	-	-	3	-
CO3	3	1	1	-	-	-	-	-	-	-	-	-	3	-
CO4	2	2	2	-	-	-	-	-	-	-	-	-	3	1
CO5	3	2	3	-	-	-	-	-	-	-	-	-	3	-

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT 1	**Basic Concepts of DC Transmission** Economics & Terminal equipment of HVDC transmission systems**:** Types of HVDC Links – Apparatus required for HVDC Systems – Comparison of AC&DC transmission – Application of DC Transmission System – Planning - Recent trends in DC transmission.
UNIT 2	**Analysis of HVDC Converters** Choice of Converter configuration – Analysis of Graetz – Characteristics of 6-Pulse & 12-Pulse converters –3 phase converters – Y-Y & Y- configurations - performance.
UNIT 3	**Converter & HVDC System Control** Principle of DC Link Control – Converters Control Characteristics – Firing angle control – Current and extinction angle control – Effect of source inductance on the system – Starting and stopping of DC link - Power Control.
UNIT 4	**Reactive Power Control in HVDC** Reactive Power Requirements in steady state – Conventional and alternate control strategies - Sources of reactive power – AC Filters– Shunt capacitors – Synchronous condensers- Modeling of DC Links-DC Network-DC Converter-Controller Equations-Solution of DC load flow – solution of AC-DC Power flow-Simultaneous method-Sequential method.
UNIT 5	**Converter Faults & Protection** Converter faults – protection against over current and over voltage in converter station – surge arresters –smoothing reactors – DC breakers –Audible noise-space charge field-corona effects on DC lines-Radio interference. **Harmonics and Filters** Generation of Harmonics – Characteristic harmonics – Non–Characteristic harmonics – Calculation of Harmonic components -Adverse effects of harmonics– Calculation of voltage & current harmonics – Effect of Pulse number on harmonics. Types of AC filters, Design of Single tuned filters –Design of High pass filters.

TEXT BOOKS	
1	HVDC Power Transmission Systems: Technology and system Interactions – by K.R.Padiyar, New Age International (P) Limited, and Publishers
2	Direct Current Transmission – by E.W.Kimbark, John Wiley & Sons.
3	EHVAC Transmission Engineering by R. D. Begamudre, New Age International (p) Ltd
REFERENCE BOOKS	
1	EHVAC and HVDC Transmission Engineering and Practice – S.Rao.
2	Power Transmission by Direct Current – by E.Uhlmann, B.S.Publications
3	HVDC Transmission – J.Arrillaga.
WEB RESOURCES (Suggested)	
1	https://www.youtube.com/watch?v=yP7OACmLP48
2	https://onlinecourses.nptel.ac.in/noc20_ee09/preview

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year I semester

WASTE WATER MANAGEMENT

Course Category	Open Elective	**Course Code**	19CE6T24
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Basic Chemistry & Fluid Mechanics	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Enables the student to distinguish between the quality of domestic and industrial water requirements and wastewater quantity generation.
2	To impart knowledge on selection of treatment methods for industrial waste water.
3	To know the common methods of treatment in different industries.
4	To acquire knowledge on operational problems of common effluent treatment plant
5	Enables the student to distinguish between the quality of domestic and industrial water requirements and wastewater quantity generation.

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Analyse the industrial waste quantity and quality requirements.
CO2	Identify the treatment methods for industrial wastewater
CO3	Know the basic theories of industrial waste water management.
CO4	Decide the need of common effluent treatment plant for the industrial area in their vicinity
CO5	Examine the effects and treatment methods of liquid waste from the manufacturing industries

Contribution of Course Outcomes towards achievement of program

Outcomes (1 - Low, 2- Medium, 3-High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	--	--	2	3	--	--	1	3	--	3	3	--	--	3
CO2	3	--	3	2	2	2	--	3	--	3	--	--	3	3
CO3	3	--	3	2	--	2	--	--	--	3	--	--	3	2
CO4	2	--	3	2	3	--	--	--	--	3	2	3	3	2
CO5	2	2	3	2	2	--	--	3	3	3	2	3	3	3

COURSE CONTENT

UNIT-I	**INDUSTRIAL WATER QUANTITY AND QUALITY REQUIREMENTS:** Boiler and cooling waters–Process water for Textiles, Food processing, Brewery Industries, power plants, fertilizers, sugar mills.
UNIT-II	**MISCELLANEOUS TREATMENT**: Use of Municipal wastewater in Industries – Advanced water treatment - Adsorption, Reverse Osmosis, Ion Exchange, Ultra filtration, Freezing, elutriation, Removal of Iron and Manganese, Removal of Colour and Odour**.**
UNIT-III	**BASIC THEORIES OF INDUSTRIAL WASTEWATER MANAGEMENT:** Industrial waste survey - Measurement of industrial wastewater Flow-generation rates – Industrial wastewater sampling and preservation of samples for analysis - Civil Engineering Wastewater characterization-Toxicity of industrial effluents-Treatment of wastewater-unit operations and processes-Volume and Strength reduction – Neutralization – Equalization and proportioning- recycling, reuse and resources recovery.
UNIT-IV	**INDUSTRIAL WASTEWATER DISPOSAL MANAGEMENT:** discharges into Streams, Lakes and oceans and associated problems, Land treatment – Common Effluent Treatment Plants: advantages and suitability, Limitations and challenges- Recirculation of Industrial Wastes- Effluent Disposal Method.
UNIT-V	**PROCESS AND TREATMENT OF SPECIFIC INDUSTRIES:** Manufacturing Process and origin, characteristics, effects and treatment methods of liquid waste from Steel plants, Fertilizers, Textiles, Paper and Pulp industries, Oil Refineries, Coal and Gas based Power Plants.

TEXT BOOKS	
1.	Wastewater Treatment by M.N. Rao and A.K. Dutta, Oxford & IBH, New Delhi.
2	Wastewater Treatment for Pollution Control and Reuse, by Soli. J Arceivala, Shyam R Asolekar, Mc-Graw Hill, New Delhi; 3rd Edition.
REFERENCE BOOKS	
1.	Industrial Water Pollution Control by W. Wesley Eckenfelder, Mc- GrawHill, Third Edition.
2.	Wastewater Treatment- Concepts and Design Approach by G.L. Karia & R.A. Christian, Prentice Hall of India.

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year I semester

EMBEDDED SYSTEMS

Course Category	**Open Elective**	**Course Code**	**19EC7T30**
Course Type	**Theory**	**L-T-P-C**	3-0-0-3
Prerequisites	**Microprocessors and Microcontrollers**	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	The basic concepts of an embedded system areintroduced. The various elements of embedded hardware and their design principlesare explained.
2	Different steps involved in the design and development of firmware for embedded systems iselaborated.
3	Internals of Real-Time operating system and the fundamentals of RTOS based embedded firmware design isdiscussed.
4	Fundamental issues in hardware software co-design were presented andexplained. Familiarize with the different IDEs for firmware development for different family of processors/controllers and embedded operatingsystems.
5	Embedded system implementation and testing tools are introduced anddiscussed.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the basic concepts of an embedded system and able to know an embedded system design approach to perform a specificfunction.	K2
CO2	The hardware components required for an embedded system and the design approach of an embeddedhardware	K2
CO3	The various embedded firmware design approaches on embeddedenvironment.	K2
CO4	Understand how to integrate hardware and firmware of an embedded system using real time operatingsystem	K2
CO5	Familiarize with the different IDEs for firmware development for different family of processors/controllers and testing tools are introduced anddiscussed.	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3												1	1
CO2	3												1	1
CO3	2												1	1
CO4	2		1										1	1
CO5	**2**				1								1	1

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT I	Embedded system-Definition, history of embedded systems, classification of embedded systems, major application areas of embedded systems, purpose of embedded systems, the typical embedded system-core of the embedded system, Memory, Sensors and Actuators, Communication Interface, Embedded firmware, Characteristics of an embedded system, Quality attributes of embedded systems, Application-specific and Domain-Specific examples of an embedded system. Introduction to IoT, Introduction to robotics
UNIT II	Analog and digital electronic components, I/O types and examples, Serial communication devices, Parallel device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock.
UNIT III	Embedded Firmware design approaches, Embedded Firmware development languages, ISR concept, Interrupt sources, Interrupt servicing mechanism, Multiple interrupts, DMA, Device driver programming, Concepts of C versus Embedded C and Compiler versus Cross-compiler
UNIT IV	Operating system basics, Types of operating systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling, Task communication, Task synchronization, Device Drivers. HARDWARE SOFTWARE CO-DESIGN: Fundamental Issues in Hardware Software Co-Design, Computational models in embedded design, Hardware software Trade- offs, Integration of Hardware and Firmware,ICE
UNIT V	The integrated development environment, Types of files generated on cross- compilation, Deassembler/Decompiler, Simulators, Emulators and Debugging, Target hardware debugging, Boundary Scan, Embedded Software development process and tools The main software utility tool, CAD and the hardware, Translation tools-Pre- processors, Interpreters, Compilers and Linkers, Debugging tools, Quality assurance and testing of the design, Testing on host machine, Simulators, Laboratory Tools

TEXT BOOKS	
1.	Embedded Systems Architecture- By Tammy Noergaard, Elsevier Publications, 2013
2.	Embedded Systems-By Shibu.K.V-Tata McGraw Hill Education Private Limited, 2013.
REFERENCE BOOKS	
1.	Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications, 2013
2.	Embedded Systems-Lyla B.Das-Pearson Publications, 2013
WEB RESOURCES	
1.	http://nptel.ac.in/courses/117103063
2	www.satishkashayap.com/2013/03/video-lectures-on-electron-devices-by.html

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year I semester

PRODUCTION PLANNING AND CONTROL

Course Category	Open Elective	**Course Code**	19ME8T44
Course Type	Theory	**L-T-P-C**	3-0-0-3
0Prerequisites	Industrial Engineering and Management	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To learn the concept of production and service systems
2	To understand the general principle techniques and types of forecasting
3	To learn the concept of inventory management.
4	To learn the principles of routing and it effect and methods of scheduling and controlling policies and aspects.
5	To understand dispatching procedures and role of computer in production planning and control.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Demonstrate various production and service systems in production planning and control.	K1
CO2	Summarize the concept of forecasting and their techniques.	K3
CO3	Recall the inventory management and its techniques.	K2
CO4	Utilize routing procedure, bill of material and scheduling processes and apply different scheduling and balancing techniques.	K4
CO5	Explain dispatching procedure and role of computer in production planning and control.	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	2	2	1	1	--	--	--	--	--	--	--	1	1
CO2	--	3	2	2	1	--	--	--	2	1	1	--	3	2
CO3	--	3	2	--	1	--	--	--	2	1	1	--	1	1
CO4	2	3	2	2	1	--	--	--	2	1	1	--	3	2
CO5	2	2	2	1	1	--	--	--	2	--	--	--	1	1

COURSE CONTENT

UNIT I

INTRODUCTION : Definition – Objectives of production Planning and Control – Functions of production planning and control – Elements of production control – Types of production – Organization of production planning and control department – Internal organization of department – Product design factors – Process Planning sheet.

UNIT II

FORECASTING – Importance of forecasting – Types of forecasting, their uses – General principles of forecasting – Forecasting techniques– qualitative methods and quantitative methods.

UNIT III

INVENTORY MANAGEMENT: Functions of inventories – relevant inventory costs – ABC analysis – VED analysis – EOQ model – Inventory control systems – P– Systems and Q-Systems. Introduction to MRP & ERP, LOB (Line of Balance), JIT inventory, and Japanese concepts, Introduction to supply chain management.

UNIT IV

ROUTING: Definition – Routing procedure – Route sheets – Bill of material – Factors affecting routing procedure. Scheduling – definition –Difference with loading.

SCHEDULING POLICIES: Techniques, Standard scheduling methods. Line Balancing, Aggregate planning, Chase planning, Expediting, controlling aspects.

UNIT V

DISPATCHING: Activities of dispatcher – Dispatching procedure –follow up – definition – Reason for existence of functions – types of followup, applications of computer in production planning and control.

TEXT BOOKS

1. Elements of Production Planning and Control / Samuel Eilon.
2. Manufacturing, Planning and Control, Partik Jonsson Stig-Arne Mattsson, Tata Mc Graw Hill

REFERENCE BOOKS

1. Production Control A Quantitative Approach / John E. Biegel.
2. Baffa & Rakesh Sarin, ―Modern Production / Operations Management‖, 8th Edition, John Wiley & Sons, 2002.
3. Production Planning and Control – Text & cases/ SK Mukhopadhyaya/PHI.
4. Management Science- A R Aryasri-4e-TMH

WEB RESOURCES

1. https://nptel.ac.in/courses/112/107/112107143/
2. https://cosmolearning.org/video-lectures/mod-1-lec-1-production-planning-and-control-8823/
3. https://m.videoken.com/embed/9qBZyzjoqAo

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

PYTHON PROGRAMMING

IV Year I semester

(Common to CE, ME, EEE, ECE, CSE, IT)

Course Category	Open Elective	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Exposure to Programming for Problem Solving using C	**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	To impart various programming constructs in Python.
2	To introduce the usage of fundamental data structures like List, Tuples and Dictionaries.
3	To imbibe the philosophy of object oriented programming in Python.
4	To bring the awareness of file handling.

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Develop python programs using conditional statements and expressions	L3
CO2	Apply loop statements for List and String manipulations	L3
CO3	Differentiate Tuples and Dictionary data structures	L2
CO4	Design classes with private and public members	L3
CO5	Develop Python programs using file concepts.	L3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1	1	1	0	0	0	0	0	0	1	3	3
CO2	3	2	1	1	1	0	0	0	0	0	0	1	3	3
CO3	3	2	1	1	1	0	0	0	0	0	0	1	3	3
CO4	3	2	2	3	3	0	0	0	0	0	0	1	3	3
CO5	3	2	2	3	3	0	0	0	0	0	0	1	3	3

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT I	Basics of Python Programming & Decision Statements Features of Python, Writing and Executing First Python Program, Literal Constants, Variables and Identifiers, Data Types, Input Operation, Comments, Reserved words, Indentation, Operators and Expressions, if, if-else, Nested if and if-elif-else.
UNIT II	Control Statements and Lists while loop, for loop, nested loops, break statement, continue statement and pass statement. Strings- Concatenating, Appending and Multiplying strings, Slice operation, Lists: Access values in List, Updating values in List, Nested Lists, Basic List Operations, List Methods
UNIT III	Tuples and Dictionaries Tuples: Creating a Tuple, Accessing values in a Tuple, updating Tuple, Basic Tuple operations, Nested Tuples, Checking the index, Counting the elements, List comprehension and Tuples, Advantages of Tuple over List. Dictionaries: Creating a Dictionary, Accessing values, Adding and modifying an item I a Dictionary, deleting items, Sorting Items in a Dictionary, Looping over a Dictionary, Nested Dictionaries, Difference between a List and a Dictionary.
UNIT IV	Functions- Introduction, Function Definition, the return statement, Required Arguments, Keyword Arguments, Default Arguments, Variable length Arguments. Object Oriented Programming: Features of OOP, Merits and Demerits of OOP, Defining Classes, Creating Objects, Data Abstraction, and Hiding through classes, Class Method and Self Argument, The__init () method, Public and Private data members, Private Methods.
UNIT V	Inheritance- Introduction, Inheriting Classes in python, Types of Inheritance- Single, Multiple, Multi-level, Multi-path inheritance. File Handling- Introduction, Types of Files, Opening and Closing Files, Reading and Writing Files.

TEXT BOOKS	
1.	Python: The Complete Reference, Martin C Brown, McGraw Hill Education
2.	Python Programming using Problem Solving Approach, ReemaThareja, OXFORD University Press, 2017.
REFERENCE BOOKS	
1.	Fundamentals of Python, Kenneth A Lambert, B L Juneja, Cengage Learning
2.	Programming and Problem Solving with Python, Ashok NamdevKamthane, Amit Ashok Kamthane, McGraw Hill Education
WEB RESOURCES	
1.	https://docs.python.org/3/tutorial/index.html
2.	https://swayam.gov.in/nd1_noc19_cs40/preview
3.	https://www.udemy.com/pythonforbeginnersintro/
4.	https://www.coursera.org/learn/python-programming

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

NUCLEAR SCIENCE AND TECHNOLOGY

Course Category	**OPEN ELECTIVE**	**Course Code**	**19BP_T03**
Course Type	Theory	**L-T-P-C**	3 -0-0-3
Prerequisites	Intermediate Physics	**InternalAssessment** **Semester EndExamination** **Total Marks**	40 60 100

COURSE OBJECTIVES	
1	To introduce to the students the various basic concepts in Nuclear science and Technology
2	To impart understanding of the Nuclear Radiation hazards and Nuclear Radiation Safety Measures.

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	Understand the basics of the properties of the Nuclei.	Understanding (K2)
CO2	Understand the concepts of Radioactivity and Radioactive dating technique	Understand(K2)
CO3	Understand the basics of Nuclear Reactions	Understand(K2)
CO4	Application of the various types of Nuclear Detectors and Accelerators	Apply (K3)
CO5	Analyze the various Nuclear Radiation safety measures in Nuclear Power plants.	Analyze(K3)

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2													
CO2	2	1												
CO3	1													
CO4					2									
CO5							1		1					

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT I	**General Properties of Nuclei (11hrs)** Nuclear constituents- Charge, Mass-shape, and Size of Nucleus, Spin - Mass Defect- Binding Energy-Packing Fraction-Semi empirical Mass formula and applications-Quantum numbers for individual nucleons - Quantum properties of nuclear states: i) Nuclear energy levels ii) Nuclear angular momentum iii) parity iv) Iso-spin – nuclear magnetic dipole moment.
UNIT II	**Radioactivity** Characteristic properties of Radioactive radiation -Properties of alpha ,beta and gamma rays- Natural radioactivity-Laws of radioactive disintegration-radioactive decay- half life- average life time- Units of radio activity and radiation exposure - Curie, Roentgen, Becquerel - RAD, Rep,REM, -Radioactive dating.
UNIT III	**Nuclear Fission and Fusion** **Fission:** Introduction – Energy released in Nuclear Fission-Nuclear chain reaction- Fissile and fertile materials- Fission reactors- heavy water reactors and breeder reactors **Fusion:** Introduction- Fusion and Thermal reactions-Fusion reaction in stars- Controlled thermonuclear reactions
UNIT IV	**Detection of Nuclear radiation and Accelerators** **Detection of Nuclear radiation:** Introduction-Types of detectors-Geiger Muller counter, Proportional counter, Scintillation counter Wilson cloud chamber, solid state detectors **Accelerators:** Introduction-Linear accelerators, Cyclotron, Synchrocyclotron, Betatron
UNIT V	**Nuclear Radiation Safety** **Nuclear Fuel Cycle:** Characteristics of Nuclear Fuels- Uranium- Production and Purification of Uranium- Reprocessing and Waste disposal. **Nuclear Radiation Safety:** Safety considerations in regulations and operations- Design Criteria, accident analysis, probabilistic risk assessment, and risk informed regulations..

TEXT BOOKS	
1.	Nuclear Physics by D.C Tayal,Himalayan Publication
2.	Nuclear Physics by Irving Kaplan
REFERENCE BOOKS	
1.	Atomic Nucleus by RD Evans
2.	P. D. Wilson, ed. The Nuclear Fuel Cycle: from Ore to Wastes, Oxford University Press (1996)
WEB RESOURCES	
1.	https://youtu.be/DVvK7_1Kldo
2.	https://youtu.be/Zc9xfUnrTxg
3.	https://www.youtube.com/watch?v=6axVVhi62ac
4.	https://youtu.be/avvXftiyBEs
5.	https://youtu.be/qYDjjJxc4h4 https://youtu.be/rrKFz1fxcLw https://youtu.be/uKkjrUtmg68 https://youtu.be/Cjpp66GlZiI

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year I semester

POWER SYSTEM AND SIMULATION LABORATORY

Course Category	**Professional Core Lab**	**Course Code**	**19EE7L09**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment** **Semester End Examination** **Total Marks**	**25** **50** **75**

COURSE OBJECTIVES	
1	Impart the practical knowledge of functioning of various power system components and determination of various parameters and simulation LFC and Economic dispatch.
2	Simulate Boost converter, Buck converter.
3	Simulate lossy transmission line.
4	Perform analysis of single machine connected to infinite bus (SMIB).

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Understand the practical knowledge of functioning of various power system components and determination of various parameters and simulation LFC and Economic dispatch.	Understand	K2
CO2	Analysis Simulate Boost converter, Buck converter.	Analysis	K4
CO3	Design and Simulate lossy transmission line.	Analysis	K4
CO4	Analysis Perform of single machine connected to infinite bus (SMIB).	Analysis	K4

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	2	2	-	3	-	-	-	-	2	-	-	2	-
CO2	-	2	3	-	3	-	-	-	-	2	-	-	2	1
CO3	-	2	3	-	3	-	-	-	-	2	-	-	2	-
CO4	-	-	3	-	3	-	-	-	-	2	-	-	-	2

ANY FIVE EXPERIMENTS ARE TO BE CONDUCTED FROM EACH PART	
PART – A: Hardware Based	
Experiment 1	Sequence impedances of 3 phase Transformer.
Experiment 2	Sequence impedances of 3 phase Alternator by Fault Analysis.
Experiment 3	Sequence impedances of 3 phase Alternator by Direct method.
Experiment 4	ABCD parameters of Transmission network.
Experiment 5	Dielectric strength of Transformer oil.
Experiment 6	Calibration of Tong Tester

PART – B: Simulation Based (using MATLAB)	
Experiment 1	Transient analysis of single machine connected to infinite bus (SMIB).
Experiment 2	Modeling of transformer and simulation of lossy transmission line.
Experiment 3	Load frequency control with and without control
Experiment 4	Economic load dispatch with & without losses.
Experiment 5	Load flow studies using Gauss-seidel method
Experiment 6	Load flow studies using N-R method.

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year I semester

ELECTRICAL MEASUREMENTS AND INSTRUMENT LABORATORY

Course Category	**Professional Core Lab**	**Course Code**	**19EE7L10**
Course Type	Theory	**L-T-P-C**	**0-0-3-1.5**
Prerequisites	**NA**	**Internal Assessment** **Semester End Examination** **Total Marks**	**25** **50** **75**

COURSE OBJECTIVES	
1	To understand the correct function of electrical parameters and calibration of voltage, current, single phase and three phase power and energy, and measurement of electrical characteristics of resistance, inductance and capacitance of a circuits through appropriate methods.
2	To understand the calibration of DC and AC Potentiometers.
3	To understand the testing of CT and PT.
4	To Understand and the characteristics of Thermo couples, LVDT, Capacitive transducer, piezoelectric transducer.
5	To understand the measurement of strain, Phase difference and frequency.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Measure the electrical parameters voltage, current, power, energy and electrical characteristics of resistance, inductance and capacitance.	Analysis	K4
CO2	Known the characteristics of transducers.	Understand	K2
CO3	Measure the strains, frequency and phase difference.	Apply	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	1	-	-	-	-	-	-	-	2	-	-	-	-
CO2	1	-	2	-	-	-	-	-	-	2	-	-	1	1
CO3	1	-	-	-	-	-	-	-	-	2	-	-	-	-

Any 10 of the following experiments are to be conducted	
Experiment 1	Calibration of dynamometer wattmeter using phantom loading
Experiment 2	Crompton D.C. Potentiometer - Calibration of PMMC ammeter and PMMC voltmeter
Experiment 3	Kelvin's double Bridge - Measurement of resistance - Determination of tolerance.
Experiment 4	Capacitance Measurement using Schering Bridge.
Experiment 5	Inductance Measurement using Anderson Bridge.

Experiment 6	Calibration of LPF Wattmeter – by direct loading.
Experiment 7	Measurement of 3 phase power with single watt meter and 2 No's of C.T.
Experiment 8	Testing of C.T. using mutual inductor – Measurement of % ratio error and phase angle of given C.T. by Null method.
Experiment 9	P.T. testing by comparison – V.G as Null detector – Measurement of % ratio error and phase angle of the given P.T.
Experiment 10	AC Potentiometer – Polar form/Cartesian form – Calibration of AC Voltmeter, Parameters of Choke
Experiment 11	LVDT – characteristics.
Experiment 12	Capacitive transducers characteristics.
Experiment 13	Calibration of single phase Energy meter by direct loading
Experiment 14	Measurement of strain using strain gauge
Experiment 15	Measurement of phase difference, frequency using Lissajous patterns in CRO.
Experiment 16	Measurement of reactive power in 3-phase balanced loads using single phase wattmeter.

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year II semester

POWER SYSTEM OPERATION AND CONTROL

Course Category	**Professional Core**	**Course Code**	**19EE8T27**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment**	**30**
		Semester End Examination Total	**70**
		Marks	**100**

COURSE OBJECTIVES	
1	To understand optimal dispatch of generation with and without losses.
2	To study the optimal scheduling of hydro thermal systems.
3	To study the optimal unit commitment problem.
4	To study the load frequency control for single area and two area system with and without controllers
5	To understand the reactive power control and compensation of transmission lines.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Compute optimal scheduling of Generators. Understand hydrothermal scheduling.	Analysis	K3
CO2	Understand the unit commitment problem.	Understand	K2
CO3	Understand importance of the frequency.	Understand	K2
CO4	Understand importance of PID controllers in single area and two area systems.	Understand	K2
CO5	Understand reactive power control and compensation for transmission line.	Understand	K2

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	1	-	-	-	-	-	-	-	-	-	2	-
CO2	1	2	1	-	-	-	-	-	-	-	-	-	2	-
CO3	-	1	-	-	-	-	-	-	-	-	-	-	2	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	1
CO5	2	3	1	-	-	-	-	-	-	-	-	-	2	-

COURSE CONTENT	
UNIT 1	**Economic Operation of Power Systems** Optimal operation of Generators in Thermal power stations, Heat rate curve – Cost Curve – Incremental fuel and Production costs – Input–output characteristics – Optimum generation allocation with line losses neglected – Optimum generation allocation including the effect of transmission line losses – Loss Coefficients – General transmission line loss formula.

UNIT 2	**Hydrothermal Scheduling & Unit Commitment** Optimal scheduling of Hydrothermal System**:** Mathematical Formulation – Solution Technique. Optimal unit commitment problem – Need for unit commitment – Constraints in unit commitment – Cost function formulation – Solution methods – Priority ordering – Dynamic programming.
UNIT 3	**Load Frequency Control-I** Modeling of steam turbine – Generator – Mathematical modeling of speed governing system – Transfer function –Necessity of keeping frequency constant – Definitions of Control area – Single area control system –Block diagram representation of an isolated power system – Steady state analysis – Dynamic response – Uncontrolled case. Proportional plus Integral control of single area and its block diagram representation – Steady state response.
UNIT 4	**Load Frequency Control-II** Block diagram development of Load Frequency Control of two area system uncontrolled case and controlled case. Tie-line bias control. Load Frequency Control and Economic dispatch control.
UNIT 5	**Compensation in Power Systems** Overview of Reactive Power control – Reactive Power compensation in transmission systems – Advantages and disadvantages of different types of compensating equipment for transmission systems – Load compensation – Specifications of load compensator – compensated transmission lines – Introduction of FACTS devices – Types of FACTS devices - Need of FACTS controllers.

TEXT BOOKS	
1	Power Generation, Operation and Control by Allen J Wood, Bruce F WollenBerg 3rd Edition, Wiley Publication 2014.
2	Electric Energy systems Theory – by O.I.Elgerd, Tata McGraw–hill Publishing Company Ltd., Second edition.
3	Modern Power System Analysis – by I.J.Nagrath&D.P.Kothari Tata McGraw Hill Publishing Company Ltd, 2nd edition.
REFERENCE BOOKS	
1	Power System Analysis and Design by J.Duncan Glover and M.S.Sarma., Thompson, 3rdEdition.
2	Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.
3	Power System Analysis by HadiSaadat – TMH Edition.
4	Power System stability & control, PrabhaKundur,TMH
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/108/104/108104052/
2	https://www.youtube.com/watch?v=49EM82UO99c

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year II semester

ELECTRIC POWER QUALITY

(Professional Elective-III)

Course Category	**Professional Elective**	**Course Code**	**19EE8T28**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment**	**30**
		Semester End Examination Total	**70**
		Marks	**100**

COURSE OBJECTIVES	
1	Learn different types of power quality phenomena.
2	Identify sources for voltage sag, voltage swell, interruptions, transients, long duration over voltages and harmonics in a power system.
3	Describe power quality terms and study power quality standards.
4	Learn the principle of voltage regulation and power factor improvement methods.
5	Explain the relationship between distributed generation and power quality. Understand the power quality monitoring concepts and the usage of measuring instruments.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Raise the different problems related to power quality.	Understand	K2
CO2	Explore the power quality terms as per IEEE and IEC standards	Understand	K2
CO3	Analyze over voltage protection and voltage regulation with improvement devices.	Analysis	K4
CO4	Propose different solutions for harmonic distortion with effect on power factor.	Application	K3
CO5	Demonstrate the distribution generator with power quality issues. Examine the different instruments used to power quality measurements as per standards	Analysis	K4

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	1	-	-	-	-	-	-	-	-	-	2	-
CO2	1	2	1	-	-	-	-	-	-	-	-	-	2	-
CO3	-	1	-	-	-	-	-	-	-	-	-	-	2	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	1
CO5	2	3	1	-	-	-	-	-	-	-	-	-	2	-

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT 1	**Introduction** Overview of power quality – Concern about the power quality – General classes of power quality and voltage quality problems – Transients – Long–duration voltage variations – Short–duration voltage variations – Voltage unbalance – Waveform distortion – Voltage fluctuation – Power frequency variations.
UNIT 2	**Voltage imperfections in power systems** Power quality terms – Voltage sags – Voltage swells and interruptions – Sources of voltage sag, swell and interruptions – Nonlinear loads – IEEE and IEC standards. Source of transient over voltages – Principles of over voltage protection – Devices for over voltage protection – Utility capacitor switching transients.
UNIT 3	**Voltage Regulation and power factor improvement:** Principles of regulating the voltage – Device for voltage regulation – Utility voltage regulator application – Capacitor for voltage regulation – End–user capacitor application – Regulating utility voltage with distributed resources – Flicker – Power factor penalty – Static VAR compensations for power factor improvement.
UNIT 4	**Harmonic distortion and solutions** Voltage distortion, Current distortion – Harmonics vs Transients – Harmonic indices – Sources of harmonics – Effect of harmonic distortion – Impact of capacitors, transformers, motors and meters – Point of common coupling –Passive and active filtering.
UNIT 5	**Distributed Generation and Power Quality** Resurgence of distributed generation – DG technologies – Interface to the utility system – Power quality issues and operating conflicts – DG on low voltage distribution networks. **Monitoring and Instrumentation** Power quality monitoring and considerations – Historical perspective of PQ measuring instruments – PQ measurement equipment – Assessment of PQ measuring data – Application of intelligent systems – PQ monitoring standards.

TEXT BOOKS	
1	Electrical Power Systems Quality, Dugan R C, Mc Granaghan M F, Santoso S, and Beaty H W, Second Edition, McGraw–Hill, 2012, 3rd edition.
2	Electric power quality problems –M. H. J. Bollen IEEE series-Wiley India publications, 2011.
REFERENCE BOOKS	
1	Power Quality Primer, Kennedy B W, First Edition, McGraw–Hill, 2000.
2	Understanding Power Quality Problems: Voltage Sags and Interruptions, Bollen MHJ, First Edition, IEEE Press; 2000
3	Power System Harmonics, Arrillaga J and Watson N R, Second Edition, John Wiley & Sons, 2003.
4	Electric Power Quality control Techniques, W. E. Kazibwe and M. H. Sendaula, Van Nostrad Reinhold, New York.
WEB RESOURCES (Suggested)	
1	http://nptel.ac.in/courses/108106025/
2	https://nptel.ac.in/courses/108/107/108107112/

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year II semester

HYBRID ELECTRIC VEHICLES

(Professional Elective-III)

Course Category	**Professional Elective**	**Course Code**	**19EE8T29**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment**	**30**
		Semester End Examination Total Marks	**70** **100**

COURSE OBJECTIVES	
1	To familiarize the students with the need and advantages of electric and hybrid electric vehicles.
2	To known various architectures of hybrid electric vehicles.
3	To understand the power management of plug in electric vehicles.
4	To study and understand different power converters used in electrical vehicles.
5	To familiarize with different batteries and other storage systems.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Know the concept of electric vehicles and hybrid electric vehicles.	Understand	K2
CO2	Familiar with different configuration of hybrid electric vehicles.	Understand	K2
CO3	Understand the power converters used in hybrid electric vehicles	Understand	K2
CO4	Know different batteries and other energy storage systems.	Understand	K2

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO8**	**PO9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**
CO1	-	1	3	-	-	-	-	-	-	-	-	-	2	-
CO2	-	1	3	-	2	-	-	-	-	-	-	-	2	2
CO3	2	-	3	-	-	-	-	-	-	-	-	-	2	-
CO4	2	2	3	-	-	-	-	-	-	-	-	-	2	2

COURSE CONTENT	
UNIT 1	**Introduction** Fundamentals of vehicle, components of conventional vehicle and propulsion load; Drive cycles and drive terrain; Concept of electric vehicle and hybrid electric vehicle; History of hybrid vehicles, advantages and applications of Electric and Hybrid Electric Vehicles, different Motors suitable for of Electric and Hybrid Electric Vehicles.
UNIT 2	**Hybridization of Automobile** Architectures of HEVs, series and parallel HEVs, complex HEVs. Plug-in hybrid vehicle, constituents of PHEV, comparison of HEV and PHEV; Fuel Cell vehicles and its constituents.

UNIT 3	**Plug-in Hybrid Electric Vehicle** PHEVs and EREVs blended PHEVs, PHEV Architectures, equivalent electric range of blended PHEVs; Fuel economy of PHEVs, power management of PHEVs, end-of-life battery for electric power grid support, vehicle to grid technology, PHEV battery charging.
UNIT 4	**Power Electronics in HEVs** Rectifiers used in HEVs, voltage ripples; Buck converter 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.
UNIT 5	**Battery and Storage Systems** Energy Storage Parameters; Lead–Acid Batteries; Ultra capacitors; Flywheels - Superconducting Magnetic Storage System; Pumped Hydroelectric Energy Storage; Compressed Air Energy Storage - Storage Heat; Energy Storage as an Economic Resource

TEXT BOOKS	
1	Ali Emadi, Advanced Electric Drive Vehicles, CRC Press, 2014.
2	Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
REFERENCE BOOKS	
1	MehrdadEhsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
2	James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.
3	H. Partab: Modern Electric Traction - DhanpatRai& Co, 2007.
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/108/106/108106170/
2	https://onlinecourses.nptel.ac.in/noc20_ee18/preview

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year II semester

ELECTRICAL MACHINE DESIGN

(Professional Elective-III)

Course Category	**Professional Elective**	**Course Code**	**19EE7T30**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment**	**30**
		Semester End Examination Total	**70**
		Marks	**100**

COURSE OBJECTIVES	
1	To understand the basics of design and cooling methods of rotating machines.
2	To understand the design of DC machines.
3	To understand the design concepts of transformers.
4	To understand the design concepts of Induction motor.
5	To understand the design concepts of Synchronous machines.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Design main dimensions of rotating machines	Creating	K6
CO2	Design field circuit and armature of DC machines	Creating	K6
CO3	Design transformers and determine main dimensions	Creating	K6
CO4	Design stator and rotor of an Induction machine	Creating	K6
CO5	Design field circuit and armature of Synchronous machines	Creating	K6

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	3	1	--	-	-	-	-	-	-	-	2	1
CO2	1	2	3	1	-	-	-	-	-	-	-	-	2	-
CO3	1	2	3	-	-	-	-	-	-	-	-	-	2	-
CO4	2	2	3	-	-	-	-	-	-	-	-	-	2	1
CO5	1	2	3	-	-	-	-	-	-	-	-	-	2	1

COURSE CONTENT	
UNIT 1	**Fundamental Aspects of Electrical Machine Design** Design of machines - design factors - limitation in design - modern trends in electrical machine design – types of magnetic and insulating materials – modes of heat dissipation – cooling of rotating machines – methods of cooling.
UNIT 2	**Design of DC Machines** Construction details – design of different windings – output equation –selection of specific magnetic and electric loadings - separation of D and L – estimation of number of conductors, armature slots and conduct dimensions – choice of number of poles and calculation of length of air gap – design of field systems, inter poles and brushes.

UNIT 3	**Design of transformers** Transformer windings – output equation – determination of number of turns and length of mean term– design of core - choice of flux density – resistance and leakage reactance – no load current calculation – losses and efficiency – design of efficiency - cooling of transformers- calculation of number of tubes.
UNIT 4	**Design of Induction motors** Comparison between squirrel cage and wound rotors – choice of average flux density and ampere conduction for meter – output equation – design of stator slots and rotor slots – design of no load current – dispersion coefficient and its effects on performance of induction motor. **Design of Synchronous Machines** Types of construction – output equation - main dimensions – short circuit ration and its effects on the performance – design of rotor – temperature rise and its effects.
UNIT 5	**Introduction to special machines design** Classification - axial flux, radial flux, identification magnetic circuit and electric circuit. Classification - linear induction and linear synchronous machines.

TEXT BOOKS	
1	"Electrical Machines Design" , A.K.Sawhney, Dhanpath Rai & Co.
2	"Special Electrical Machines" K. Venkataratnam Universities Press (India) Private Limited, Hyderabad, First Edition reprinted in 2013.
REFERENCE BOOKS	
1	"Performance and Design of DC Machines", Clayton & Hancock, ELBS.
2	"Performance and Design of AC Machines", M.G.Say; Pitman, ELBS.
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/108/106/108106023/
2	https://nptel.ac.in/courses/108/102/108102146/

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year II semester

ADVANCED POWER CONVERTERS

(Professional Elective-III)

Course Category	**Professional Elective**	**Course Code**	**19EE8T31**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment** **Semester End Examination** **Total** **Marks**	**30** **70** **100**

COURSE OBJECTIVES	
1	To understand the control principle of ac to ac conversion with suitable power semi -conductor devices.
2	To have the knowledge of ac to dc conversion and different ac to dc converter topologies.
3	To understand the effect of operation of controlled rectifiers on p.f. and improvement of p.f. with PFC converters
4	To acquire the knowledge on dc-ac converters and to know the different control techniques of dc-ac converters.
5	To know multilevel inverter configuration to improve the quality of the inverter output voltage.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Describe and analyze the operation of AC-DC converters.	Analyze	K4
CO2	Analyze the operation of power factor correction converters.	Analyze	K4
CO3	Analyze the operation of three phase inverters with PWM control.	Analyze	K4
CO4	Study the principles of operation of multi- level inverters and their applications.	Analyze	K4

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	3	-	-	2	-	-	-	-	-	-	-	3	-
CO2	-	3	2	-	2	-	-	-	-	-	-	-	3	2
CO3	1	3	-	-	2	-	-	-	-	-	-	-	3	2
CO4	-	3	-	-	-	-	-	-	-	-	-	-	3	-

COURSE CONTENT	
UNIT 1	**Overview of Switching Devices:** Power MOSFET, IGBT, GTO, GaN and SiC devices-static and dynamic characteristics, gate drive circuits for GaN and SiC devices.

UNIT 2	**AC-DC converters:** Single phase fully controlled converters with RL load– Evaluation of input power factor and harmonic factor- Continuous and Discontinuous load current, Power factor improvements, Extinction angle control, symmetrical angle control, PWM control. Three Phase AC- DC Converters, fully controlled converters feeding RL load with continuous and discontinuous load current, Evaluation of input power factor and harmonic factor-three phase dual converters
UNIT 3	**Power Factor Correction Converters:** Single-phase single stage boost power factor corrected rectifier, power circuit principle of operation, and steady state- analysis, three phase boost PFC converter
UNIT 4	**PWM Inverters:** Principle of operation-Voltage control of single phase inverters - sinusoidal PWM – modified PWM – phase displacement Control – Trapezoidal, staircase, stepped, harmonic injection and delta modulation. Voltage Control of Three-Phase Inverters-Sinusoidal PWM- 60^0 PWM- Third Harmonic PWM- Space Vector Modulation-Comparison of PWM Techniques- Three phase Current Source Inverters- Variable dc link inverter.
UNIT 5	**Multi level inverters:** Introduction, Multilevel Concept, Types of Multilevel Inverters-Diode- Clamped Multilevel Inverter, Principle of Operation, Features of Diode-Clamped Inverter, Improved Diode- Clamped Inverter- Flying-Capacitors Multilevel Inverter-Principle of Operation, Features of Flying- Capacitors Inverter- Cascaded Multilevel Inverter- Principle of Operation- Features of Cascaded Inverter- Switching Device Currents-DC-Link Capacitor Voltage Balancing- Features of Multilevel Inverters-Comparisons of Multilevel Converters.

TEXT BOOKS	
1	Power Electronics: Converters, Applications, and Design- Ned Mohan, Tore M. Undeland, William P. Robbins, John Wiley& Sons, 2nd Edition, 2003.
2	Power Electronics-Md.H.Rashid –Pearson Education Third Edition- First IndianReprint-2008.
REFERENCE BOOKS	
1	Elements of Power Electronics – Philip T. Krein, Oxford University press, 2014.
2	Power Electronics: Converters, Applications, and Design- Ned Mohan, Tore M. Undeland, William P. Robbins, John Wiley& Sons, 2nd Edition, 2003.
3	Power Converter Circuits – William Shepherd & Li Zhang-Yes Dee CRC Press, 2004.
4	
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/108/107/108107128/
2	https://onlinecourses.nptel.ac.in/noc20_ee28/preview

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year II semester

SMART GRID

(Professional Elective-IV)

Course Category	**Professional Elective-IV**	**Course Code**	**19EE8T32**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment** **Semester End Examination** **Total Marks**	**30** **70** **100**

COURSE OBJECTIVES	
1	To understand concept of smart grid and developments on smart grid.
2	To understand smart grid technologies and application of smart grid concept in hybrid electric vehicles etc.
3	To have knowledge on smart substations, feeder automation and application for monitoring and protection.
4	To have knowledge on micro grids and distributed energy systems.
5	To know power quality aspects in smart grid.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Understand smart grids and analyse the smart grid policies and developments in smart grids.	Analyze	K4
CO2	develop concepts of smart grid technologies in hybrid electrical vehicles etc	Analyze	K4
CO3	understand smart substations, feeder automation, GIS etc.	Understand	K2
CO4	Analyze micro grids and distributed generation systems.	Analyze	K4
CO5	Analyze the effect of power quality in smart grid and to understand latest developments in ICT for smart grid.	Analyze	K4

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO8**	**PO9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**
CO1	2	2	1	-	-	-	-	-	-	-	-	-	2	-
CO2	1	2	1	-	-	-	-	-	-	-	-	-	2	-
CO3	-	1	-	-	-	-	-	-	-	-	-	-	2	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	1
CO5	2	3	1	-	-	-	-	-	-	-	-	-	2	-

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENT	
UNIT 1	**Introduction to Smart Grid** Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart Grid, Difference between conventional & smart grid, Concept of Resilient &Self Healing Grid, Present development & International policies on Smart Grid. Case study of Smart Grid.
UNIT 2	**Smart Grid Technologies: Part 1** Introduction to Smart Meters, Real Time Prizing, Smart Appliances, Automatic Meter Reading(AMR), Outage Management System(OMS), Plug in Hybrid Electric Vehicles(PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation, Phase Shifting Transformers.
UNIT 3	**Smart Grid Technologies: Part 2** Smart Substations, Substation Automation, Feeder Automation. Geographic Information System(GIS), Intelligent Electronic Devices(IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System(WAMS), Phase Measurement Unit(PMU).
UNIT 4	**Micro grids and Distributed Energy Resources** Concept of micro grid, need & applications of microgrid, formation of microgrid, Issues of interconnection, protection & control of microgrid. Plastic & Organic solar cells, Thin film solar cells, Variable speed wind generators, fuelcells, microturbines, Captive power plants, Integration of renewable energy sources.
UNIT 5	**Power Quality Management in Smart Grid** Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit. **Information and Communication Technology for Smart Grid** Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighborhood Area Network (NAN), Wide Area Network (WAN).

TEXT BOOKS	
1	Ali Keyhani, Mohammad N. Marwali, Min Dai "Integration of Green and Renewable Energy in Electric Power Systems", Wiley
2	Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response",CRC Press
3	JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama,"Smart Grid: Technology and Applications", Wiley
REFERENCE BOOKS	
1	Jean Claude Sabonnadière, NouredineHadjsaïd, "Smart Grids", Wiley Blackwell 19
2	Peter S. Fox Penner, "Smart Power: Climate Changes, the Smart Grid, and the Future of Electric Utilities", Island Press; 1 edition 8 Jun 2010
3	Andres Carvallo, John Cooper, "The Advanced Smart Grid: Edge Power Driving Sustainability: 1", Artech House Publishers July 2011
4	James Northcote, Green, Robert G. Wilson "Control and Automation of Electric Power Distribution Systems (Power Engineering)", CRC Press
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/108/107/108107113/
2	https://onlinecourses.nptel.ac.in/noc19_ee64/preview

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year II semester

POWER SYSTEM DEREGULATION

(Professional Elective-IV)

Course Category	**Professional Elective**	**Course Code**	**19EE8T33**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment** **Semester End Examination** **Total** **Marks**	**30** **70** **100**

COURSE OBJECTIVES	
1	To provide in-depth understanding of operation of deregulated electricity market systems.
2	To examine typical issues in electricity markets and how these are handled world –wide in various markets
3	To enable students to analyse various types of electricity market operational and control issues using new mathematical models.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Understand of operation of deregulated electricity market systems. Typical issues in electricity markets	Understand	K2
CO2	Analyze various types of electricity market operational and control issues using new mathematical models.	Analyze	K4
CO3	Understand LMP's wheeling transactions and congestion management	Understand	K2
CO4	Analyze impact of ancillary services	Analyze	K4

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO8**	**PO9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**
CO1	-	3	1	-	-	-	-	-	-	-	-	-	1	1
CO2	-	3	2	2	-	-	-	-	-	-	-	-	-	1
CO3	1	2	1	2	-	-	-	-	-	-	-	-	1	-
CO4	1	3	1	-	-	-	-	-	-	-	-	-	1	-

COURSE CONTENT	
UNIT 1	Need and conditions for deregulation. Introduction of Market structure, Market Architecture, Spot market, forward markets and settlements. Review of Concepts: marginal cost of generation, least-cost operation, incremental cost of generation. Power System Operation.
UNIT 2	Electricity sector structures and Ownership /management, the forms of Ownership and management. Different structure model like Monopoly model, Purchasing agency model, wholesale competition model, Retail competition model.
UNIT 3	Framework and methods for the analysis of Bilateral and pool markets, LMP based markets, auction models and price formation, price based unit commitment, country practices

UNIT 4	Transmission network and market power. Power wheeling transactions and marginal costing, transmission costing. Congestion management methods- market splitting, counter-trading; Effect of congestion on LMPs- country practices
UNIT 5	Ancillary Services and System Security in Deregulation. Classifications and definitions, AS management in various markets- country practices. Technical, economic, & regulatory issues involved in the deregulation of the power industry,

TEXT BOOKS	
1	Power System Economics: Designing markets for electricity - S. Stoft, wiley
2	Operation of restructured power systems - K. Bhattacharya, M.H.J. Bollen and J.E. Daalder, Springer
REFERENCE BOOKS	
1	Power generation, operation and control, -J. Wood and B. F. Wollenberg, Wiley.
2	Market operations in electric power systems - M. Shahidehpour, H. Yaminand Z. Li,Wiley.
3	Fundamentals of power system economics - S. Kirschen and G. Strbac, Wiley.
4	Optimization principles: Practical Applications to the Operation and Marketsof the Electric Power Industry - N. S. Rau, IEEE Press series on Power Engineeirng.
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/108/101/108101005/
2	https://nptel.ac.in/courses/108/101/108101040/

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year II semester

PLC and SCADA

(Professional Elective-IV)

Course Category	**Professional Elective**	**Course Code**	**19EE8T34**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment**	**30**
		Semester End Examination Total Marks	**70** **100**

COURSE OBJECTIVES	
1	To have knowledge on PLC.
2	To acquire the knowledge on programming of PLC.
3	To understand different PLC registers and their description
4	To have knowledge on data handling functions of PLC. To know how to handle analog signal and converting of A/D in PLC.
5	To have knowledge on SCADA systems in operation and control of interconnected power system

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Understand the PLCs and their I/O modules.	Understand	K2
CO2	Develop control algorithms to PLC using ladder logic etc.	Analysis	K4
CO3	Manage PLC registers for effective utilization in different applications.	Analysis	K4
CO4	Handle data functions and control of two axis and their axis robots with PLC. Design PID controller with PLC	Analysis	K4
CO5	Understand the SCADA and its operations	Understand	K2

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO8**	**PO9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**
CO1	1	2	3	-	3	-	-	-	-	-	-	-	2	3
CO2	1	2	3	1	3	-	-	-	-	-	-	-	2	-
CO3	1	2	3	1	3	-	-	-	-	-	-	-	-	-
CO4	-	2	3	-	3	-	-	-	-	-	-	-	2	-
CO5	-	2	3	-	3	-	-	-	-	-	-	-	2	3

COURSE CONTENT	
UNIT 1	**Introduction to PLC:** Definition & History of PLC, Overall PLC system, PLC Input & Output modules, central processing unit, CPUs & Programmer/monitors, Solid state memory, the processor, Input modules (Interfaces), Power supplies, PLC advantages & disadvantages. Selection criteria for PLC

UNIT 2	**Programming of PLC:** Programming equipment's, proper construction of PLC ladder diagram, Basic components & their symbols in ladder diagram, Fundamentals of ladder diagram, Boolean logic & relay logic, and analysis of rungs. Input ON/OFF switching devices, Input analog devices, Output ON/OFF devices, Output analog devices, programming ON/OFF Inputs to produce ON/OFF outputs
UNIT 3	**Advanced PLC Function:** Analog PLC operation, PID control of continuous processes, simple closed loop systems, problems with simple closed loop systems, closed loop system using Proportional, Integral & Derivative (PID), PLC interface, and Industrial process example. Motors Controls: AC Motor starter, AC motor overload protection, DC motor controller, Variable speed (Variable Frequency) AC motor Drive and ON-OFF temperature control
UNIT 4	**SCADA Systems:** Introduction and definitions of SCADA, Fundamental principles of modern SCADA systems, SCADA system evolution. Basic SCADA system Architecture: Human Machine Interface, Master Terminal Unit, Remote Terminal Unit. SCADA data transfer through PLCC. Communication Technologies-SCADA Communication in an electrical power system. SCADA system desirable Properties, Real Time System, SCADA server, SCADA functions. Interfacing of SCADA with PLC
UNIT 5	**SCADA Architecture:** First generation - Monolithic, Second generation - Distributed, Third generation – Networked Architecture, Intelligent Electronic Devices. Operation and control of interconnected power system, Automatic substation control, SCADA configuration, Energy management system, system operating states, system security, State estimation, and SCADA system security issues overview. **The Evolution of SCADA Protocols:** Overview of Open systems interconnection (OSI) Model, Functions of OSI Model Layers, Process Field bus (Profibus).

TEXT BOOKS	
1	Gary Dunning, "Introduction to Programmable Logic Controllers", Thomson, 2nd Edition.
2	John R. Hackworth, Frederick D., Hackworth Jr., "Programmable Logic Controllers Programming Methods and Applications", PHI Publishers.
3	Stuart A Boyer, "SCADA supervisory control and data acquisition", ISA, 4th Revised edition
REFERENCE BOOKS	
1	John W. Webb, Ronald A. Reis, "Programmable Logic Controllers: Principles and Application", PHI Learning, New Delhi, 5th Edition.
2	L.A. Bryan, E. A. Bryan, "Programmable Controllers Theory and Implementation" Industrial Text Company Publication, Second Edition.
3	Stuart A. Boyer: "SCADA- Supervisory Control and Data Acquisition", Instrument Society of America Publications, USA, The Instrumentation system and Automation Society, 4th Edition, 2010
4	Gordon Clarke, Deon Reynders" Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems", Newnes An imprint of Elsevier Publications, 1st Edition, 2004
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/108/105/108105088/
2	https://nptel.ac.in/courses/108/105/108105062/

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year II semester

FLEXIBLE AC TRANSMISSION SYSTEMS (FACTS)

(Professional Elective-IV)

Course Category	**Professional Elective**	**Course Code**	**19EE8T35**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment**	**30**
		Semester End Examination Total	**70**
		Marks	**100**

COURSE OBJECTIVES	
1	To study the performance improvements of transmission system with FACTS.
2	To study the effect of static shunt compensation.
3	To study the effect of static series compensation.
4	To study the effect of UPFC.

COURSE OUTCOMES			
Upon successful completion of the course, the student will be able to:		**Cognitive Level**	
CO1	Know the performance improvement of transmission system with FACTS.	Apply	K3
CO2	Get the knowledge of effect of static shunt and series compensation.	Apply	K3
CO3	Know the principle of operation and various controls of UPFC	Understand	K2
CO4	Determine an appropriate FACTS device for different types of applications.	Analysis	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	3	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	-	1	2	-	-	-	-	-	-	-	-	1	1
CO3	-	2	1	2	-	-	-	-	-	-	-	-	-	1
CO4	1	2	-	2	-	-	-	-	-	-	-	-	1	

COURSE CONTENT	
UNIT 1	FACTS concepts, Transmission interconnections, power flow in an AC System, loading capability limits, Dynamic stability considerations, importance of controllable parameters, basic types of FACTS controllers, benefits from FACTS controllers.
UNIT 2	**Voltage source and Current source converters** Concept of voltage source converter (VSC) – Single phase full wave bridge converter – Square wave voltage harmonics for a single–phase bridge converter – Three–phase full wave bridge converter – Transformer connections for 12, 24 and 48 pulse operation, concept of Current Source Converter (CSC), Three–phase current source converter – Comparison of current source converter with voltage `source converter.

UNIT 3	**Shunt Compensators** Objectives of shunt compensation – Mid–point voltage regulation for line segmentation – End of line voltage support to prevent voltage instability – Improvement of transient stability – Power oscillation damping – variable Impedance type VAR generator - Thyristor Switched/Controlled Reactor (TSR/TCR) – Thyristor Switched Capacitor(TSC) – Fixed Capacitor–Thyristor Controlled Reactor (FC-TCR), Thyristor Switched Capacitor and Thyristor Controlled Reactor (TSC–TCR), Switching Converter type VAR generator – principle of operation - Comparison of SVC and STATCOM.
UNIT 4	**Series Compensators** Static series compensators: Concept of series capacitive compensation, improvement of transient stability, power oscillation damping, functional requirements. GTO thyristor controlled series capacitor (GSC), thyristor switched series capacitor (TSSC), and thyristor controlled series capacitor (TCSC), control schemes for GSC, TSSC and TCSC.
UNIT 5	**Combined Controllers** Voltage and Phase Angle Regulator - TCVR and TCPAR – Switched Converter Based Voltage- Phase Angle Regulator **Unified Power Flow Controller:** Basic operating principle, conventional transmission control capabilities, independent real and reactive power flow control, comparison of the UPFC to series compensators and phase angle regulators. Introduction to Inter line Power Flow Controller (IPFC)

TEXT BOOKS	
1	"Understanding FACTS Devices" N.G.Hingorani and L.Guygi, IEEE Press. Indian Edition is available:- -Standard Publications
REFERENCE BOOKS	
1	Sang.Y.HandJohn.A.T, "Flexible AC Transmission systems" IEEE Press (2006).
2	HVDC & FACTS Controllers: applications of static converters in power systems- Vijay K.Sood- Springer publishers
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/108/107/108107114/
2	https://www.digimat.in/nptel/courses/video/108107114/L01.html