JERUSALEM COLLEGE OF ENGINEERING
(An Autonomous Institution Affiliated to Anna University, Chennai)

VISION OF THE INSTITUTION

Jerusalem College of Engineering is committed in emerging as an international institution of excellence in imparting finest quality engineering, technology and management education rooted in ethical and societal values through various academic programmes, multi-disciplinary research, consultancy and entrepreneurship activities and hence to contribute towards social transformation and nation building.

MISSION OF THE INSTITUTION

- Generating abundant resources and making conducive policies, the management led by the Chief Executive Officer strives towards promoting globally competitive academic programmes augmented with value added courses, in-plant training activities, co-curricular activities and ambience that support intellectual growth and skill acquisition

- Promoting collaborative trans-border research programmes continuing education in synergy with academia, industries and research organizations leading to real time solutions and life-long learning

- Transforming young men and women into competent professionals and entrepreneurs motivated by a passion for professional excellence, driven by human values and proactively engage in the betterment of the society through innovative practices and academic excellence

- Facilitating effective interaction among faculty members and students and fostering network of alumni, industries, institutions and other stake-holders for successful career gain and placement

JERUSALEM COLLEGE OF ENGINEERING
(AN AUTONOMOUS INSTITUTION TO ANNA UNIVERSITY, CHENNAI)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION OF THE DEPARTMENT

Department of Electrical and Electronics Engineering is committed to produce **high profile, competent** and **disciplined** Engineers with **technical knowledge**, **ethical leadership** and **entrepreneurship** quality to contribute towards social transformation and nation building.

MISSION OF THE DEPARTMENT

- To make our graduates **highly competent** and expert in practical problem solving with abstract thinking skills.
- To endow students with high quality **technical knowledge** of electrical sciences through innovative teaching and research practices.
- To empower students with leadership and **entrepreneurship** quality, capable of providing their professional mettle with excellent communication skills.
- To encourage **cross border research** with innovative ideas and to impart the quality of life-long learning based on ethical values.

JERUSALEM COLLEGE OF ENGINEERING
(AN AUTONOMOUS INSTITUTION TO ANNA UNIVERSITY, CHENNAI)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

PROGRAM OUTCOMES (POs)

PO1: **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

PO3: **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues an
d the consequent responsibilities relevant to the professional engineering practice.

PO7: **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO1: Graduates use their broad knowledge of electrical engineering as a foundation for on-going learning, and to have realized some success early in their professional careers.

PEO2: Graduates use their creative and critical reasoning skills to solve technical problems, ethically and responsibly, in service to society.

PEO3: Graduates learn and adapt themselves to the constantly evolving technology by pursuing higher studies.

PEO4: Graduates within few year of graduation, should demonstrate leadership and initiative to organizational goals, facilitate the achievements of others and obtain substantive results.

PEO5: Graduates within few year of graduation, should demonstrate a commitment to teamwork while working with others of diverse cultural and interdisciplinary research.

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO 1: Able to utilize the knowledge of Power Electronics and Drives in collaboration with power systems in innovative, dynamic and challenging environment, for the research based teamwork.

PSO 2: Can explore the scientific theories, ideas, methodologies in renewable energy engineering, and use this erudition in their professional envelopment and gain sufficient competence to solve the current and future energy problems universally.

PSO 3: Can **understand** the technologies like PLC, PMC, process controllers, transducers and HMI one can analyze, design electrical and electronics principles to install, test , maintain power system and applications.

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B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

REGULATION 2019

CHOICE BASED CREDIT SYSTEM

I TO VIII SEMESTERS

CURRICULUM AND SYLLABUS

CREDIT SUMMARY

S.No.	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL	Percentage (%)
		I	II	III	IV	V	VI	VII	VIII		
1.	HS	3	3	-	-	1	-	-	-	7	4.4%
2.	BS	10	6	3	3	-	-	-	-	22	13.7%
3.	ES	10	8	11	-	3	-	-	-	32	20%
4.	PC	-	5	8	13	8	10	10	-	54	33.7%
5.	PE	-	-	-	-	3	6	6	-	15	9.4%
6.	OE	-	-	-	3	3	3	3	-	12	7.5%
7.	EEC	-	-	-	1	-	3	4	10	18	11.3%
	Total	23	22	22	20	18	22	23	10	160	100%

JERUSALEM COLLEGE OF ENGINEERING
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B.E. ELECTRICAL AND ELECTRONICS ENGINEERING REGULATION 2019
CHOICE BASED CREDIT SYSTEM
I TO VIII SEMESTERS
CURRICULUM AND SYLLABUS

SEMESTER I

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	JHS1121	Communicative English and Soft Skills I	HS	4	2	0	2	3
2	JMA1101	Matrices and Calculus	BS	4	2	2	0	3
3	JPH1101	Engineering Physics	BS	3	3	0	0	3
4	JCY1101	Engineering Chemistry	BS	3	3	0	0	3
5	JGE1101	Engineering Basics	ES	3	3	0	0	3
6	JGE1102	Programming in C	ES	3	3	0	0	3
PRACTICALS								
7	JPC1111	Physics and Chemistry Laboratory	BS	2	0	0	2	1
8	JGE1112	Programming in C Laboratory	ES	4	0	0	4	2
9	JGE1111	Design Appreciation Laboratory	ES	4	0	0	4	2
TOTAL				**30**	**16**	**2**	**12**	**23**

SEMESTER II

S.No	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS	L	T	P	C
THEORY								
1	JHS1221	Technical English and Soft Skills II	HS	4	2	0	2	3
2	JMA1201	Vector Calculus and Complex Analysis	BS	4	2	2	0	3
3	JBE1223	Applied Science for Electronics and Information Engineering	BS	4	2	0	2	3
4	JGE1201	Python Programming	ES	3	3	0	0	3
5	JEE1201	Circuit Theory	PC	4	2	2	0	3
6	JGE1202	Engineering Graphics & Design	ES	5	1	0	4	3
7	JNC1261	Environmental Science	NCM	3	3	0	0	0
PRACTICALS								
8	JEE1211	Electric Circuits Laboratory	PC	4	0	0	4	2
9	JGE1211	Python Programming Laboratory	ES	4	0	0	4	2
TOTAL				**35**	**15**	**4**	**16**	**22**

SEMESTER III

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	JMA1302	Transforms and Partial Differential Equations	BS	4	2	2	0	3
2	JEC1301	Electronic Devices and Circuits	ES	3	3	0	0	3
3	JEE1301	Electromagnetic Theory	ES	4	2	2	0	3
4	JCS1321	Object Oriented Programming (Integrated)	ES	4	2	0	2	3
5	JEE1302	DC Machines and Transformers	PC	4	2	2	0	3
6	JEE1303	Digital Logic Circuits	PC	4	2	2	0	3
PRACTICALS								
7	JPT1001	Soft Skills and Aptitude I	EEC	2	0	0	2	*
8	JEC1311	Electronic Devices and Circuits Laboratory	ES	4	0	0	4	2
9	JEE1311	DC Machines and Transformers Laboratory	PC	4	0	0	4	2
TOTAL				**33**	**13**	**8**	**12**	**22**

* Only internal assessments will be conducted in the 3rd semester while the end semester examination will be conducted in the 4thsemester

SEMESTER IV

S.No	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS	L	T	P	C
THEORY								
1	JMA1401	Applied Probability and Numerical Methods	BS	4	2	2	0	3
2	JEE1401	Synchronous and Induction Machines	PC	4	2	2	0	3
3	JEE1402	Linear Integrated Circuits and its Applications	PC	3	3	0	0	3
4	JEE1403	Transmission, Distribution and Protection	PC	3	3	0	0	3
5	-	Open Elective I	OE	3	3	0	0	3
PRACTICALS								
6	JPT1001	Soft Skills and Aptitude II	EEC	2	0	0	2	1
7	JEE1411	Synchronous and Induction Machines Laboratory	PC	4	0	0	4	2
8	JEE1412	Linear and Digital Integrated Circuits Laboratory	PC	4	0	0	4	2
TOTAL				**27**	**13**	**4**	**10**	**20**

SEMESTER V

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	JEE1501	Micro processors and Micro controllers (Integrated)	ES	4	2	0	2	3
2	JEE1502	Control & Instrumentation	PC	4	2	2	0	3
3	JEE1503	Power Electronics	PC	3	3	0	0	3
4	-	Professional Elective I	PE	3	3	0	0	3
5	-	Open Elective II	OE	3	3	0	0	3
6	JNC1361	Essence of Indian Traditional Knowledge	NCM	2	2	0	0	0
PRACTICALS								
7	JHS1511	Professional Communication	HS	2	0	0	2	1
8	JEE1512	Control and Instrumentation Laboratory	PC	4	0	0	4	2
9	JPT1002	Technical Skills and Aptitude I	EEC	2	0	0	2	*
TOTAL				**27**	**15**	**2**	**10**	**18**

* Only internal assessments will be conducted in the 5th semester while the end semester examination will be conducted in the 6thsemester

SEMESTER VI

S.No	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS	L	T	P	C
THEORY								
1	JEE1601	Control of Electrical Drives	PC	3	3	0	0	3
2	JEE1602	Power System Analysis, Operation and Control	PC	4	2	2	0	3
3	-	Professional Elective II	PE	3	3	0	0	3
4	-	Professional Elective III	PE	3	3	0	0	3
5	-	Open Elective III	OE	3	3	0	0	3
PRACTICALS								
6	JEE1611	Power Electronics and Drives Laboratory	PC	4	0	0	4	2
7	JEE1612	Power System Simulation Laboratory	PC	4	0	0	4	2
8	JEE1621	Mini Project	EEC	2	0	0	2	1
9	JPT1002	Technical Skills and Aptitude II	EEC	2	0	0	2	1
10	JEE1641	Internship	EEC					1
TOTAL				**28**	**14**	**2**	**12**	**22**

SEMESTER VII

S. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	JEE1701	E- Vehicle	PC	3	3	0	0	3
2	JEE1702	Power Electronics for Renewable Energy Systems	PC	3	3	0	0	3
3		Professional Elective IV	PE	3	3	0	0	3
4		Professional Elective V	PE	3	3	0	0	3
5		Open Elective IV	OE	3	3	0	0	3
PRACTICALS								
6	JBA1711	Entrepreneurship for Engineers	EEC	2	0	0	2	1
7	JEE1712	Renewable Energy Systems Laboratory	PC	4	0	0	4	2
8	JEE1711	Simulation and Hardware implementation laboratory	PC	4	0	0	4	2
9	JEE1731	Project Work –Phase I	EEC	6	0	0	6	3
TOTAL				**31**	**15**	**0**	**16**	**23**

SEMESTER VIII

S. No	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS	L	T	P	C
THEORY								
1	JNC1861	Indian Constitution	NCM	2	2	0	0	0
PRACTICALS								
2	JEE1851	Comprehension and technical seminar	EEC	2	0	0	2	1
3	JEE1832	Project Work – Phase II	EEC	18	0	0	18	9
TOTAL				**22**	**2**	**0**	**20**	**10**

OPEN ELECTIVES OFFERED BY EEE DEPARTMENT

IV SEMESTER									
1.	JEE9001	Electrical Safety Engineering	-	OE	3	3	0	0	3
2.	JEE9002	Design Estimation and Costing Of Electrical Systems	-	OE	3	3	0	0	3
3.	JEE9003	Electrical Machines and Drives	-	OE	3	3	0	0	3
V SEMESTER									
4.	JEE9004	Industrial Electronics	-	OE	3	3	0	0	3
5.	JEE9005	Measurement and Instrumentation	-	OE	3	3	0	0	3
6.	JEE9006	Analog Control Systems	-	OE	3	3	0	0	3
VI SEMESTER									
7.	JEE9007	Renewable Energy Systems	-	OE	3	3	0	0	3
8.	JEE9008	Intelligent Controllers	-	OE	3	3	0	0	3
9.	JEE9009	Introduction to SMPS and UPS	-	OE	3	3	0	0	3
VII SEMESTER									
10.	JEE9010	Introduction to E-Vehicles	-	OE	3	3	0	0	3
11.	JEE9011	Optical Fibers and Laser Technology	-	OE	3	3	0	0	3
12.	JEE9012	Energy Management and SCADA	-	OE	3	3	0	0	3

SEMESTER I

JHS1121	**COMMUNICATIVE ENGLISH & SOFT SKILS I (Common to all B.E/B.Tech Programmes)**	**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**

COURSE OBJECTIVES:

- To enable the students of Engineering and Technology to develop their listening skill by learning the key techniques for comprehending information.
- To facilitate the learners to speak effectively while exchanging ideas in academic and social domains
- To develop their skills in reading and understanding texts through practice
- To expose them to the correct usage of language to develop their writing skill
- To train the students to use appropriate vocabulary in academic and technical writings

UNIT I BASIC GRAMMAR I AND READING FOR INFORMATION 9

Parts of speech - Sentence patterns – Tenses - Wh- questions - Yes/no questions –Countable and Uncountable nouns – Affixation – word formation; Reading short comprehension passages - practice in skimming and scanning for specific information and note - making, Critical reading – finding key information in a given text-shifting facts from opinions and paraphrasing.

SOFT SKILLS LAB 3

Listening to documentaries, inspiring speeches of great leaders, news bulletins, Ted talks, telephonic conversations

UNIT II BASIC GRAMMAR I AND SHARING INFORMATION 9

Pronouns – Adjectives – Adverbs – Imperatives – Direct and indirect questions-Compound words - Guessing meaning of words in contexts – one word substitutes; Auto biographical writing (writing about one's leisure time activities, hometown , favourite place and school life) – Biographical writing (place, people), Letter writing (informal letters)

SOFT SKILLS LAB 3

Self-introduction, peer introduction, picture description , JAM

UNIT III BASIC GRAMMAR III AND FREE WRITING I 9

Conjunctions–Prepositions -Articles-Degrees of comparison–Discourse markers-Reference words; Process description, Coherence and cohesion in writing cause and effect/ compare & contrast / narrative/ analytical paragraphs

SOFT SKILLS LAB 9

Language functions: Giving reasons, talking about future plans, comparing and contrasting, making suggestions

UNIT IV BASIC GRAMMAR IV AND LANGUAGE DEVELOPMENT 9

Subject - verb agreement - Modal verbs - Phrasal verbs - Single word substitutes – Use of abbreviations & acronyms - Cloze reading - Interpreting visual material, Jumbled sentences

SOFT SKILLS LAB 3

Interpersonal Skills: role play, group discussion, debate, conduct of meeting

UNIT V BASIC GRAMMARV AND FREE WRITING II 9

Clause - Direct and indirect speech – Correction of errors-Word association (connotations)- Lexical items (fixed / semi fixed expressions) - Essay writing – different types of essays, dialogue writing

SOFT SKILLS LAB 3

Creative writing and speaking skills: Poster making and description, project proposals

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, students will be able to

- Listen to different talks and lectures and understand them easily
- Communicate their thoughts confidently using communicative strategies
- Read and grasp different genres of texts effortlessly
- Write grammatically correct academic, business and technical texts
- Apply the language skills efficiently in all forms of communication

TEXTBOOKS:

1. Board of Editors, Department of English, Anna University, Chennai. Using English: A Course Book for Undergraduate Engineers and Technologists, Orient Black Swan: Chennai, 2017.
2. Dhanavel.S.P English and Communication Skills for Students of Science and Engineering. Orient Black Swan Publications, Chennai, 2011.
3. Raman, Meenakshi & Sangeetha Sharma, Technical Communication: English Skills for Engineers. Oxford University Press, New Delhi. 2011.

REFERENCE BOOKS:

1. Regional Institute of English. English for Engineers. Cambridge University Press, New Delhi. 2006
2. Rizvi M, Ashraf. Effective Technical Communication. Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007.
3. Rutherford, Andrea J . Basic Communication Skills for Technology. Pearson Edition (II Edition), New Delhi, 2001.
4. Mandel, Steve. Effective Presentation Skills. New Delhi: Viva Books Pvt. Ltd., 2004.
5. Writing Cover Letters-Kilmet, Stephen. "Cover Letter, Enclosures and Attachments." In Writing for Design Professionals. New York.

WEBLINKS:

1. https://www.perfect-english-grammar.com
2. https://edu.gcfglobal.org/en/grammar
3. https://www.talkenglish.com/grammar/grammar.aspx
4. https://learnenglish.britishcouncil.org/skills
5. https://www.myenglishlanguage.com

EXTENSIVE READING:

1. Kalam, Abdul. The Wings of Fire, Universities Press, Hyderabad.1999

CO-PO MAPPING

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

JMA1101	MATRICES AND CALCULUS (Common to all B.E/B.Tech Programmes)	L	T	P	C
		2	2	0	3

COURSE OBJECTIVES:

- To equip students with the knowledge of matrices required for applications in engineering.
- To enable students to understand the concepts of multi variable functions and its calculus.
- To familiarize students on concepts of differential calculus and its applications.
- To introduce concepts of integral calculus as tools required for applications in engineering.
- To introduce ordinary differential equations which is widely used in problem solving and engineering applications.

UNIT I MATRICES 12

Eigen values and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigen values and Eigen vectors – Cayley – Hamilton theorem–Diagonalization of matrices by similarity and orthogonal transformations–Reduction of a quadratic form to canonical form – Nature of quadratic forms.

UNIT II FUNCTIONS OF SEVERAL VARIABLES 12

Partial differentiation – Total derivative – Jacobians –Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT III APPLICATIONS OF DIFFERENTIAL CALCULUS 12

Curvature and radius of curvature – Circle of curvature – Evolutes – Envelopes– Evolute as envelope of normals.

UNIT IV APPLICATIONS OF INTEGRAL CALCULUS 12

Multiple integrals: Double integrals– Change of order of integration– Change of variables– Area enclosed by plane curves – Triple integrals– Volume of solids.

Improper integrals: Beta and Gamma Integrals – Definitions and properties – Simple problems.

UNIT V ORDINARY DIFFERENTIAL EQUATIONS 12

Higher order linear differential equations with constant coefficients –Method of variation of parameters – Method of undetermined coefficients – Homogeneous equation of Euler's and Legendre's type – System of simultaneous first order linear differential equations with constant coefficients.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, students will be able

- To understand applications of matrix theory in quadratic forms
- To use calculus for problems and applications dealing with functions of Several variables
- To apply differential calculus in practical problem solving in the area of geometry
- To gain insight on the applications of multiple integrals in area and volume problems
- To solve ordinary differential equations that occur in many physical and engineering applications

TEXTBOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
3. P.Anuradha and V.Sudhakar, "Matrices and Calculus", Scitech Publications, 1st Edition, Chennai, 2019.

REFERENCES

1.Anton, H, Bivens, IandDavis,S, "Calculus",Wiley,10th Edition,2016.

2.Jain R.K.and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rdEdition, 2007.

3.Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University

Press, 2015.
4. Weir, M.D and JoelHass,"ThomasCalculus",12thEdition,Pearson India,2016.

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1. .https://nptel.ac.in/courses/111/108/111108157/
2. .https://nptel.ac.in/courses/111/107/111107108/
3. https://nptel.ac.in/courses/111/104/111104144/
4. https://nptel.ac.in/courses/111/105/111105122/
5. https://nptel.ac.in/courses/111/107/111107111/

CO-PO MAPPING

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

JPH1101	ENGINEERING PHYSICS (Common to all B.E/B.Tech Programmes)	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To enable the students to understand the basics in crystals structure
- To enable the students to understand the basic concepts in properties of matter
- To impart knowledge in ultrasonic inspections
- To introduce the principles of quantum mechanics
- To impart knowledge of laser and fiber optic communication

UNIT I CRYSTAL PHYSICS 9

Single crystal, Polycrystalline and Amorphous materials – Single Crystals: Unit cell, Crystal systems, Bravais lattices, Directions and Planes in a crystal, Miller indices– Inter planar distances – Coordination number and Packing factor for SC, BCC, FCC, HCP and Diamond structures - Crystal imperfections: Point defects, Line defects– Burgers vector, Stacking faults

UNIT II PROPERTIES OF MATTER 9

Elasticity–Stress- strain diagram and its uses-factors affecting elastic moduli and tensile strength–torsional stress and deformations – twisting couple –torsion pendulum: theory and experiment-bending of beams – stress due to bending in beams-bending moment–cantilever :theory and experiment–uniform and non-uniform bending: theory and experiment

UNIT III ULTRA SONICS 9

Production of ultrasound by Magnetostriction effect and Piezo electric effect Detection of ultrasonic wave – Properties of ultrasonic wave–Acoustic grating-Industrial applications – Drilling, Welding, Soldering and Cleaning – SONAR - Non Destructive Testing – Pulse echo system through Transmission and Reflection modes- A, B and C– scan displays.

UNIT IV PHOTONICS AND FIBRE OPTICS 9

Spontaneous and stimulated emission-Population inversion-Einstein's A and B coefficients derivation–Laser Principle - Semiconductor lasers (homo junction & hetero junction)- Optical Fiber: types (material, refractive index, mode) - Propagation of light in optical fibers–Numerical aperture and Acceptance angle–attenuation, dispersion, bending -Fiber Optical Communication system (Block diagram) -Active and passive fiber sensors-Endoscope.

UNIT V QUANTUM PHYSICS 9

Black body radiation –Planck's theory (derivation) –Deduction of Wien's displacement law and Rayleigh–Jeans' Law from Planck's theory – Compton effect - theory–Properties of Matter waves –G.P Thomson experiment -Schrödinger's wave equation –Time independent and time dependent equations –Physical significance of wave function Particle in a one dimensional box – Scanning electron microscope – Transmission electron microscope

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able

- To enhance knowledge on properties of matter
- To assess the properties of ultrasonics and imaging devices
- To understand and to compute problems in Quantum Physics.
- To learn the use of modern optical fiber communication systems and tools in real life applications.
- To gain more insight on the functioning of optical materials for opto electronics.

TEXTBOOKS:

1. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015.
2. Gaur, R.K.& Gupta, S.L."Engineering Physics". Dhanpat Rai Publishers, 2012.
3. Dr.Beula Shanthi John, Dr. P.mani,"Engineering Physics", Dhanam Publications, First Edition, 2019.

REFERENCES:

1. Halliday, D.,Resnick ,R.&Walker,J."Principles of Physics" .Wiley, 2015.
2. Serway,R .A.&Jewett,J.W."Physics for Scientists and Engineers".Cengage Learning, 2010.
3. Tipler, P.A.&Mosca,G."Physics for Scientists and Engineers with Modern Physics'. W.H.Freeman, 2007

4. Rajendran V, "Engineering Physics", Tata Mc Graw Hill, 2009.
5. John D.Cutnell, “Cutnell and Johnson Physics”, Willey Publications, 2018.

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2. https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-ce18/
3. https://onlinecourses.nptel.ac.in/noc21_bt50/preview
4. https://nptel.ac.in/courses/115/104/115104096/
5. https://nptel.ac.in/courses/108/104/108104113/

CO-PO MAPPING

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

JCY1101	ENGINEERING CHEMISTRY (Common to all B.E / B.Tech Programmes)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE

- To acquaint the student with concepts of photo chemistry and analytical techniques.
- To make the students conversant with boiler feed water and water treatment techniques.
- To make the students acquire sound knowledge in corrosion of materials.
- To understand polymer chemistry and the principle of energy in batteries.
- To impart knowledge on the basics of nano materials and engineering materials.

UNIT I PHOTO CHEMISTRY AND ANALYTICAL TECHNIQUES 9

Photo chemistry- Laws of photochemistry - Grotthuss–Draper law, Stark–Einstein law and Lambert-Beer Law (problems). Photo processes - Internal Conversion, Inter-system crossing, Fluorescence and its applications in medicine – Phosphorescence – Chemiluminescence and Photo - sensitization.
Analytical Techniques – UV-visible spectroscopy – principles – instrumentation (block diagram only) – Colorimetry – Principle - Instrumentation, estimation of iron by colorimetry – Flame photometry – principle – Instrumentation – estimation of sodium by Flame photometry.

UNIT II WATER TECHNOLOGY 9

Hardness - Units of Hardness- Temporary hardness – Permanent hardness-Estimation hardness by EDTA method – Alkalinity – Types – water quality parameters (pH, EC,TDS,DO, BOD, COD) –- Boiler feed water – requirements - boiler troubles (scale and sludge-caustic embrittlement-boiler corrosion - priming and foaming) - softening of hard water - external treatment (zeolite and

demineralization) – internal treatment (phosphate , calgon , carbonate , colloidal) - desalination of brackish water – reverse osmosis.

UNIT III ELECTRO CHEMISTRY AND CORROSION 9

Electro chemistry - Electro chemical cell – redox reaction, electrode potential – oxidation potential – reduction potential , measurement and applications – electro chemical series and its significance - Nernst equation (derivation and problems). Corrosion – causes – types - chemical, electro chemical corrosion – galvanic corrosion – differential aeration corrosion (pitting, waterline, wire fence, pipeline, crevice, stress corrosion),Factors influencing the rate of corrosion – corrosion control – materials election and design aspects –cathodic protection methods (sacrificial anode and impressed current cathodic methods)-Electro plating of Copper and electro less plating of nickel –corrosion inhibitors (anodic and cathodic inhibitors).

UNIT IV POLYMER, COMPOSITES AND ENERGY STORAGE DEVICES 9

Introduction- Classification of polymers – Natural and synthetic; Thermoplastic and Thermo setting. Functionality – Degree of polymerization. Biodegradable polymer – Types – synthetic methods – applications of biodegradable polymers. Polymer composites and its application.

Energy Storage Devices - Batteries and fuel cells: Types of batteries– primary battery (dry cell) secondary battery (lead acid battery, nickel-cadmium battery, lithium-ion-battery). Fuel cell–H_2-O_2 fuel cell – solid oxide fuel cell – polymer electrolyte membrane fuel cell (PEMFC) applications.

UNIT V ENGINEERING MATERIALS AND NANO CHEMISTRY 9

Engineering Materials- Refractories – classification – acidic, basic and neutral refractories – properties (refractoriness, refractoriness underload, dimensional stability, porosity, thermal spalling) – manufacture of alumina, magnesite and zirconia bricks. cement-manufacture and properties – setting and hardening of cement, special cement-water proof and white cement – properties and uses.

Nano chemistry – Introduction – distinction between molecules, nanoparticles and bulk materials; Synthesis: precipitation, thermolysis, hydrothermal, solvothermal, electrodeposition, chemical vapour deposition, laser ablation; Properties and applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Students will be able to

- Understand laws of photo chemistry and principles of instrumentation and their applications in various fields.
- To understand the basic principle of water treatment and techniques involved in the purification process for future learning.
- Apply electro chemical reactions on the process of corrosion and its prevention methods.
- Gain knowledge on biodegradable polymers and understand the principle of batteries for development of new energy resources.
- Gain knowledge on engineering materials and understand the unique behavior of nano.

TEXTBOOKS:

1. Jain P.C.and Monica Jain,“Engineering Chemistry”, Dhanpat Rai Publishing Company(P)Ltd., New Delhi, 2010.
2. R.Gopalan, D.Venkayya, Sulochna Nagarajan,Textbook of Engineering Chemistry,

Vikas publishing pvt ltd, 4th edition, 2013.
3. Dr.N.John Jebarathinam Dr.R.Vaidyanathan Ms.A.U.Ajisha Dr.A.Ravikrishnan, Engineering Chemistry, Sri Krishna Publications, First edition 2019.

REFERENCES:

1. O.G.Palanna, Engineering Chemistry, McGraw Hill,2017
2. Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2013.
3. GowarikerV.R. Viswanathan N.V. and Jayadev Sreedhar,"Polymer Science", New Age International P(Ltd.,), Chennai,2006.
4. Ozin G.A. and Arsenault A.C.,"Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.
5. B.R.Puri, L.R.Sharma, Madan S.Pathana, Principle of physical chemistry, 47thedition, Vishal publishing Co, 2017.

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2. https://www.samcotech.com/what-is-a-boiler-feed-water-treatment-system-how-does-it-work/
3. https://nptel.ac.in/courses/113/101/113101098/
4. https://nptel.ac.in/courses/112/107/112107221/
5. https://nptel.ac.in/courses/113/106/113106093/

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	1	1	-	-	-	1	1
CO2	1	1	1	1	1	1	1	-	1	1	1	-
CO3	1	1	1	1	1	1	1	-	1	1	1	-
CO4	1	1	1	1	1	1	1	1	1	1	1	1
CO5	1	1	1	1	1	1	1	-	1	1	1	1
AVG	1	1	1	1	1	1	1	1	1	1	1	1

	ENGINEERING BASICS	L	T	P	C
JGE1101	(Common to all B.E / B. Tech Programmes)	3	0	0	3

COURSE OBJECTIVES

- To impart knowledge on the basics of Civil Engineering to the students.
- To impart knowledge on the basics of Mechanical Engineering to the students.
- To impart knowledge on the electric circuits and working principles of Electrical Machines.
- To impart knowledge on the Principles and characteristics of various electronic devices.
- To impart knowledge on the basics of various measuring instruments.

UNIT 1 BASICS OF CIVIL ENGINEERING 11

Introduction to Civil Engineering, Types of buildings, Components of a residential building, Building Materials, Types of slabs, beam, column, lintel, floor and foundation - Types of roofs. Surveying and Levelling - Linear and Angular Measurements - Introduction to transport system, role of transportation in society –Green Highway. Sources of water, Hydrological cycle, Irrigation Engineering, Rain water

harvesting, Environmental pollution, Green house gas emission, Ozone depletion, Global warming - Green building concepts.

UNIT 2 BASICS OF MECHANICAL ENGINEERING 11

Introduction to the concepts of Mechanization and Automation, Robotics-Manufacturing methods - casting, machining, forming operations, Introduction to IC Engine –Working principles of four stroke petrol and diesel engines, Types of power plants - Hydel power plant and thermal power plant, Steam generators - Fire tube boiler and water tube boiler, Thermal systems - Heat exchangers, Radiator and oil cooler, Design of ingenious mechanisms-Parts feeding mechanism.

UNIT 3 ELECTRIC CIRCUITS AND ELECTRICAL MACHINES 7

Basic circuit components - Ohms Law - Kirchhoff's Law – Introduction to AC circuits Wave forms and RMS value- Power and power factor – Principles of operation and characteristics of DC machines Transformers - Three Phase and single Phase induction motors.

UNIT 4 ELECTRONIC DEVICES & CIRCUITS 7

Types of Materials - Silicon & Germanium - N type and P type materials -Construction and Characteristics: PN Junction diode - Zener Diode - Bipolar Junction Transistor - Field effect Transistors - IGBT - Introduction to operational amplifier –Inverting Amplifier -Non-inverting Amplifier.

UNIT 5 MEASUREMENTS & INSTRUMENTATION 9

Elements of generalized measurement system - Basic terminologies: Accuracy, precision, resolution, sensitivity, linearity, span and range – Errors in measurement - Standards of Measurement - calibration- Operating forces: Deflection force, controlling force , damping force - Classification of instruments.

TOTAL: 45 PERIODS

COURSE OUTCOMES

The students will be able to

- Gain knowledge on the various fields of Civil Engineering.
- Know the fundamentals of Mechanical Engineering.
- Understand the basic concepts of electric circuits and working principles of electrical machines.
- Gain knowledge on the basics of electronics and apply them in practical situations.
- Choose appropriate instruments for electrical measurement for a specific application.

TEXT BOOKS

1. Shanmugam G and Palanichamy M S,"Basic Civil and Mechanical Engineering", Tata McGrawHill publishing Co., 2016
2. Venugopal K.and Prahu Raja., Basic Mechanical Engineering, Anuradha Publishers, Kumbakonam, 2000.
3. D P Kothari and I.J Nagarath, Electrical Machines - Basic Electrical and Electronics Engineering, Mc Graw Hill Education (India) Private Limited, Third Reprint, 2016.

REFERENCES:

1. Palanikumar, K. Basic Mechanical Engineering, ARS Publications, 2010.
2. Ramamrutham S., Basic Civil Engineering, Dhanpat Rai Publishing Co.(P) Ltd.1999.
3. Thereja. B.L., Fundament also f Electrical Engineering and Electronics, S. Chand &Co.Ltd., 2008.
4. A.K.Sawhney, A Course in Electrical & Electronic Measurements & Instrumentation, Dhanpat Rai and Co, New Delhi, 2010.
5. H.S.Kalsi, Electronic Instrumentation, Tata Mc Graw-Hill,New Delhi,2010.

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2. https://nptel.ac.in/courses/105/102/105102088/

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	-	-	-	-	-	-	-
CO2	1	1	1	1	1	-	-	-	-	-	-	-
CO3	1	1	1	1	1	-	-	-	-	-	-	-
CO4	1	1	1	1	1	-	-	-	-	-	-	-
CO5	1	1	1	1	1	-	-	-	-	-	-	-
AVG	1	1	1	1	1	-	-	-	-	-	-	-

JGE1102	PROGRAMMING IN C	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To learn Fundamentals of computing
- To be able to use file operations in C
- To implement programs using basic features of C
- To learn to use C pointers and dynamically allocated memory techniques
- To learn advanced features of the C programming language

UNIT I INTRODUCTION TO PROBLEM SOLVING 9

Simple model of a Computer – Hardware – Software – Data Representation, Problem Solving Techniques – Bottom up design and top down design - applications, Introduction to Algorithms and Flow Chart-Notion of memory, addresses, variables, instructions, execution of instruction - Operating system commands, file editing, compiling, linking, executing a program.

UNIT II C PROGRAMMING 9

Introduction to ‘C’ programming – structure of a ‘C’ program – compilation and linking processes. Conversion of simple algorithm to program - Constants, Variables – Data Types – Expressions using operators in ‘C’ – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problem

UNIT III ARRAYS AND STRINGS 9

Arrays – Initialization – Declaration – One dimensional and two dimensional arrays –String -String operations–Arrays of strings.

UNIT IV FUNCTIONS AND USER DEFINED DATA TYPES 9

Function – definition of function – Declaration of function – Pass by value - Pass by reference – Command Line Argument in C-- Recursion - Enumerators - Structures -Unions.

UNIT V POINTERS AND FILES 9

Macros - storage classes - Pointers- Definition – Initialization – Pointers arithmetic –Double Pointers, Basic file operations-Example problems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

- Design and represent solutions to problems as algorithm and flow chart
- Write simple C Programs using loops and conditional statements
- Write simple C Programs using arrays
- Write simple C Programs using functions
- Write simple C codes using pointers, structures and union

TEXT BOOKS:

1. Pradip Dey, Manas Ghosh, "Programming in C", First Edition, Oxford University Press, 2018
2. Byron S Gott fried, “Programming with C”, Schaum’s Outlines, Third Edition, Mc Graw-Hill, 2010.

REFERENCES:

1. Kernighan, B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2015.
2. Yashavant P.Kanetkar. “Let Us C”,B P B Publications,2011.
3. Paul J Deitel, Dr. Harvey M.Deitel,"C How to Program", Seventh Edition, Pearson Education, 2016.
4. E. Balagurusamy, “Computing Fundamentals and C Programming”, Mc Graw - Hill Publishing Company Limited, (2008).
5. Brian W.Kernighan and Rob Pike, “The Practice of Programming”(Chap1), Pearson Education, 2008

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1. https://www.javatpoint.com/computer-fundamentals-tutorial
2. https://www.geeksforgeeks.org/basics-file-handling-c/
3. https://www.studytonight.com/c/string-and-character-array.php
4. https://www.tutorialspoint.com/cprogramming/c_functions.htm
5. https://www.guru99.com/c-pointers.html

CO-PO MAPPING

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

JPC1111	PHYSICS AND CHEMISTRY LABORATORY (Common to all B.E / B.Tech Programmes)	L	T	P	C
		0	0	2	1

OBJECTIVES:

To provide students the first hand experience of verifying various concepts learnt in theory courses.

LIST OF EXPERIMENTS: Physics

- Determination of Young's modulus for the given uniform bar by uniform bending method
- Determination of wave length of the diode laser and hence determine the size of the coated powder particle
- Determination of velocity of Ultrasound using Ultrasonic interferometer and also find the compressibility of the given liquid
- Determination of moment of inertia of the given circular disc and rigidity modulus of the metal wire using torsional pendulum
- Determination of Planck's constant using different color filters
- Determination of Wave length of spectral lines in mercury spectrum using spectrometer
- Analysis of I-V Characterization of Solar cell

TOTAL: 15 PERIODS

LIST OF EXPERIMENTS: CHEMISTRY

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water samples.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper in brass by Iodometry.
6. Determination of molecular weight of poly vinyl alcohol using Ostwald viscometer.

TOTAL: 15 PERIODS

OUTCOMES:

Students will be able

- Acquire experience in analyzing the elastic materials.

- Understand the acoustic properties of various liquids.
- Acquire knowledge in optical properties of solids.
- Make the student acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- Acquaint the students with the determination of molecular weight of a polymer by viscometry

REFERENCES:

1. Practical Fiber Optics, D.Bailey and E.Wright,2003
2. Jerrad H.G.and McNeil D.B.-Theoretical and Experimental Physics
3. FretterW.B.-Introduction to Experimental Physics, Blackiee
4. J.Mendham, RC Denney, JD Barnes, MJK Thomas, Textbook of quantitative chemical analysis, Vogel's,2008

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1. http://www.digimat.in/nptel/courses/video/105107176/L31.html
2. https://www.canterbury.ac.nz/media/documents/science-outreach/chloride_mohr.pdf
3. http://www.mgcub.ac.in/pdf/material/20200428101433e562a8b8e8.pd
4. http://depthome.brooklyn.cuny.edu/physics/lab/phy2/newlabs/Diffraction-grating-ver-2.pdf
5. http://web.physics.ucsb.edu/~phys128/experiments/interferometry/measuring_wavelength.pdf

CO-PO MAPPING

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

JGE1112	PROGRAMMING IN C LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

The students should be made to:

- To be exposed to the syntax of C
- To be familiar with programming in C
- To learn to use arrays, strings, functions, pointers, structures and union sin C.
- To Learn the fundamentals of File Programming in C
- To solve simple problems using C

LIST OF PROGRAMS

1. Usage of Basic Linux commands
2. C Programming using Simple statements and expressions
3. Scientific problem solving using decision making and looping.

4. Simple programming for one dimensional and two dimensional arrays.
5. Solving problems using Strings
6. C Programming using Pointers
7. C Programming using user defined functions (Pass by value and Pass by reference)
8. C Programming using Recursion
9. C Programming using structures and union
10. C Programming using enumerated data types
11. C Programming using macros and storage classes
12. C Programming using Files

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

- Write simple C Programs
- Able to solve scientific problems using C
- Gain knowledge on the use of functions and arrays
- Use structures, pointers and files in C Programs
- Develop modularized applications in C

TEXTBOOKS:

1. Pradip Dey, Manas Ghosh, "Programming in C – As per the latest AICTE syllabus", First Edition, Oxford University Press,2018
2. Byron S Gott fried, "Programming with C", Schaum's Outlines, Third Edition, Mc Graw-Hill, 2010

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1. https://www.javatpoint.com/first-c-program
2. https://www.w3resource.com/c-programming-exercises/
3. https://www.javatpoint.com/functions-in-c
4. https://www.programiz.com/c-programming/c-structures-pointers
5. https://www.sitesbay.com/cprogramming/c-applications

CO-PO MAPPING

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

JGE1111	DESIGN APPRECIATION LABORATORY (Common to all B.E/B.Tech Programmes)	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

- To provide exposure to the students with hands-on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.
- To kindle your own creativity, ideation and realize the importance of team working.
- To gain knowledge through experience in handling of engineering aggregates.
- To appreciate the use of various mechanisms involved in engineering products.
- To understand the interactions between its sub systems and their functionality.

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE 13

BUILDINGS:

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

PLUMBINGWORKS:

(a) Study of pipe line joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise: Basic pipe connections - Mixed pipe material connection Pipe connections with different joining components.
(e) Demonstration of plumbing requirements of high – rise buildings.

CARPENTRY USING POWER TOOLS ONLY:

(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise: Wood work, joints by sawing, planning and cutting.

I MECHANICAL ENGINEERING PRACTICE 18

WELDING:

(a) Preparation of but joints, lap joints and T-joints by Shielded metal arc welding.
(b) Gas welding practice

BASIC MACHINING:

(a) Simple Turning and Taper turning
(b) Drilling Practice

SHEET METAL WORK:

(a) Forming & Bending:

(b) Model making-Trays and funnels.

(c) Different type of joints.

MACHINE ASSEMBLY PRACTICE:

(a) Study of centrifugal pump

(b) Study of air conditioner

DEMONSTRATION ON:

(a) Smithy operations, upsetting, swaging, setting down and bending.
Example -Exercise-Production of hexagonal headed bolt.

(b) Foundry operations like mould preparation for gear and step cone pulley.

(c) Fitting - Exercises - Preparation of square fitting and V-fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

I ELECTRICAL ENGINEERING PRACTICE 13

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Staircase wiring
4. Measurement of electrical quantities -voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of electrical equipment.

I ELECTRONICS ENGINEERING PRACTICE 16

1. Study of Electronic components and equipment's - Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

- Fabricate carpentry components and pipe connections including plumbing works.
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundry and fittings.
- Carry out basic home electrical works and appliances.
- Measure the electrical quantities.
- Elaborate on the components, gates, soldering practices.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. 15 Sets
2. Carpentry vice (fitted to work bench) 15 Nos
3. Standard wood working tools 15 Sets
4. Models of industrial trusses, door joints, furniture joints 5 each
5. Power Tools:

(a) Rotary Hammer 2 Nos
(b) Demolition Hammer2 Nos
(c) Circular Saw 2 Nos
(d) Planer 2 Nos
(e) Hand Drilling Machine 2 Nos
(f) Jigsaw 2 Nos

MECHANICAL

1. Arc welding transformer with cables and holders 5 Nos
2. Welding booth with exhaust facility 5 Nos
3. Welding accessories like welding shield, chipping hammer, wire brushetc.5 Sets
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.2 Nos
5. Centre lathe 2 Nos
6. Hearth furnace, anvil and smithy tools 2 Sets
7. Moulding table, foundry tools 2 Sets
8. Power Tool: Angle Grinder 2 Nos
9. Study – purpose items: centrifugal pump, air- conditioner 1each

ELECTRICAL

1. Assorted electrical components for house wiring15 Sets
2. Electrical measuring instruments10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp 1 each
4. Megger (250V/500V) 1 No
5. Power Tools:

(a) Range Finder 2 Nos
(b) Digital Live-wire detector 2 Nos

ELECTRONICS

1. Soldering guns 10 Nos
2. Assorted electronic components for making circuits 50 Nos
3. Small PCBs 10 Nos
4. Multi meters 10 Nos
5. Study purpose items: Telephone, FM radio, low-voltage power supply

WEBSITE REFERERENCE:

1. www.vikaspublishing.com/engineering-practices-lab
2. https://archieve.org/mechanicalengineeeringworkshoplaboratory

CO-OP MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	1	1	-	-	-	1	1
CO2	1	1	1	1	1	1	1	-	1	1	1	-
CO3	1	1	1	1	1	1	1	-	1	1	1	-
CO4	1	1	1	1	1	1	1	1	1	1	1	1
CO5	1	1	1	1	1	1	1	-	1	1	1	1
AVG	1	1	1	1	1	1	1	-	1	1	1	1

SEMESTER II

JHS1221	TECHNICAL ENGLISH & SOFT SKILLS II (Common to all B.E / B.Tech Programmes)	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To make the students of engineering and technology enhance their ability to read and comprehend different texts
- To improve their creative and critical thinking so as to use in demanding contexts
- To equip the learners with the skills of writing convincing job applications and effective reports
- To develop their speaking skills to make technical presentations and participate in group discussions
- To facilitate them to hone their soft skills

UNIT I TECHNICAL WRITING AND VISUAL CONVERSION 9

Definitions, Purpose statements, Technical vocabulary, regular and irregular verbs – Process Description and Interpretation of Graphs and Charts

SOFT SKILLS LAB 3

Skimming and scanning, understanding logic and sequencing in reading, inferring the exact meaning of text, making out meaning of pictorial and graphical representations

UNIT II TECHNICAL WRITING AND GUIDELINES PREPARATION 9

Conditional clauses, Numerical adjectives, Collocation, verbal analogies - Instructions, Recommendations, Checklist

SOFT SKILLS LAB 12

Comprehensive listening: Listening to telephonic conversations, listening to native accents, short and long conversations from different domains, listening to various pre-recorded conversations and speeches

UNIT III 9

SOFT SKILLS LAB

Listening and speaking practice based on BEC, IELTS and TOEFL

UNIT IV TECHNICAL WRITING AND BUSINESS LETTERS 9

Cause and effect, impersonal passive voice, idioms and phrases, words used as nouns And verbs -- Letter writing – job application, business correspondence (letters) – calling for quotations, placing order, complaint letters, preparing a memo, notice and email – itinerary

SOFT SKILLS LAB 3

Group Discussions - Process, Skills, Guidelines, Evaluation, Oral Presentation – Planning, Preparing, Organizing, Presenting

UNIT V TECHNICAL WRITING AND REPORT WRITING 9

Degrees of comparison, editing, Email etiquette, Misspelled words -- Report writing: survey, feasibility, industrial visit ,reporting various incidents and accidents, Minutes of meeting

SOFT SKILLS LAB 3

Starting a Career – vision statement, preparing logo and tagline, making short term and long term goals, setting plans

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

- Read and understand general and technical texts
- Apply creative and critical thinking and communicate their ideas efficiently
- Participate in group discussions and deliver short speeches effectively
- Write effectively and persuasively in academic and work place contexts
- Face the future challenges confidently and successfully

TEXT BOOKS:

1. Department of English, Anna University, Chennai. Mindscapes: English for Technologists and Engineers. Orient Black Swan, Chennai, 2012.
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering Orient Black Swan Publications, Chennai, 2011.
3. Rizvi, M. Ashraf, "Effective Technical Communication", Tata Mc Graw – Hill, 2006.

REFERENCE BOOKS:

1. Ibbotson, Mark, "Cambridge English for Engineering", Cambridge University Press, 2008.
2. English, Laura M & Sarah Lynn, "Business Across Cultures: Effective Communication Strategies", Addison Wesley, 1995.
3. Richard Johnson- Sheehan, "Technical Communication Today" 4th Edition Books Long Man Publishing Group, 2011.
4. Porter, Patricia A., and Margaret Grant, "Communicating Effectively in English: Oral Communication for Non – Native Speakers", 2nd Edition, Wadsworth, 1992.
5. Gopalaswamy, Ramesh & Ramesh Mahadevan. ACE of Soft Skills: Attitude, Communication and Etiquette for Success, New Delhi: Pearson, 2010.

WEBLINKS:

1. https://learnenglish.britishcouncil.org/business-english
2. https://www.thebalancecareers.com
3. https://www.deakin.edu.au/students/studying/study-support/academic-skills/report-writing
4. https://www.englishclub.com
5. https://www.ielts.org

EXTENSIVE READING:

1. Wells,H.G. The Time Machine, Peacock, India, 2008.

CO-PO MAPPING

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

JMA1201	VECTOR CALCULUS AND COMPLEX ANALYSIS (Common to all B.E / B.Tech Programmes)	L	T	P	C
		2	2	0	3

COURSE OBJECTIVES:

- To familiarize students with concepts of vector calculus and complex analysis in problem solving.
- To build concepts of Laplace transforms leading up to its applications on solving differential equations

UNIT I VECTOR CALCULUS 12

Vector Differentiation: Gradient and directional derivative – Divergence and curl – Vector identities– Irrotational and Solenoidal vector fields. Vector Integration: Line and surface integrals - Green's theorem – Gauss and Stoke's theorems –Verification and evaluation in simple problems.

UNIT II ANALYTIC FUNCTIONS 12

Analytic functions – Zeros and Singularities - Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates (with out proof) – Properties – Harmonic conjugates – Construction of analytic functions – Conformal mappings – Mapping by functions w = z +c,cz,1/z– Bilinear transformation.

UNIT III COMPLEX INTEGRATION 12

Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series -Types of Singularities and residues – Cauchy's Residue theorem –Application of residue theorem for evaluation of real integrals (Circular contour and semi-circular contour only).

UNIT IV LAPLACE TRANSFORMS 12

Definition - Existence conditions – Transforms of elementary functions – Transforms of unit step function and unit impulse function – Properties with proof – Initial and final value theorems – Transform of periodic functions – Convolution theorem with proof – Problems.

UNIT V INVERSE LAPLACE TRANSFORMS 12

Definition - Evaluation of Inverse Laplace transforms by using properties, partial fractions,

residues and convolution theorem - Applications to solution of linear second order ordinary differential equations with constant coefficients.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, students will be able

- To understand concepts of vector calculus and evaluate line and surface integrals
- To understand analyticity of complex valued functions, bilinear transformation and conformal mappings
- To evaluate complex integrals using Cauchy's integral and Cauchy's residue theorems
- To find Laplace transforms of functions using definition and properties
- To apply Laplace transform method in solving differential equations

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi,43rd Edition, 2014.
2. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
3. P.Anuradha and V.Sudhakar, "Vector Calculus and Complex Analysis", Scitech Publications, 1stEdition, Chennai, 2019.

REFERENCES:

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (Anim print of Lakshmi Publications Pvt.,Ltd.,), New Delhi, 7th Edition, 2009.
2. Jain R.K. and Iyengar S.R.K.," Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
3. O 'Neil, P.V.,"Advanced Engineering Mathematics", Cengage Learning India Pvt Ltd, New Delhi , 2007.
4. Sastry, S.S, Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd,4th Edition, New Delhi, 2014.
5. Wylie, R.C. and Barrett, L.C.," Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

WEB REFERENCES

1.https://nptel.ac.in/courses/111/105/111105122/
2.https://nptel.ac.in/courses/111/106/111106141/
3.https://nptel.ac.in/courses/111/107/111107056/
4.https://nptel.ac.in/courses/111/106/111106139/

CO-PO MAPPING

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

JBE1223	APPLIED SCIENCE FOR ELECTRONICS AND INFORMATION ENGINEERING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

- To understand the essential principles of semiconductor device and Electron transport properties.
- To understand the essential principles of magnetic properties of materials.
- To understand the essential principles of optical properties of materials.
- To compare the basic concepts of hybridization with chemical bonding.
- To understand the principles in various analytical techniques.

UNIT I SEMI CONDUCTING MATERIAL 7

Intrinsic semiconductor – Carrier concentration – Fermi level – Variation of Fermi level with temperature – Electrical conductivity – Band gap determination – Compound semiconductors – Direct and Indirect bandgap –Carrier concentration in N-type and P - type semiconductor – Variation of Fermi level with temperature and Impurity concentration.

UNIT II MAGNETIC AND SUPER CONDUCTING MATERIALS 7

Origin of magnetic moment – Bohr magnet on – comparison of Dia, Para and Ferro magnetism– Domain theory – Hysteresis – Soft and Hard magnetic materials – Anti ferro magnetic materials– Ferrites and its applications – Super conductivity : properties – Type I and Type II superconductors BCS theory of super conductivity (Qualitative) – High Tc super conductors.

UNIT III OPTICAL PROPERTIES OF MATERIALS 7

Classification of Optical materials - metals, insulators and semiconductors) – Carrier generation and Recombination processes - Absorption emission and Scattering of light (concepts only) – Photo current in a P-N diode – Solar cell -LED–Organic LED.

UNIT IV CHEMICAL BONDING AND CONDUCTIVITY IN SOLIDS 11

Band theory - Salient feature - Application of band theory (conductor, semiconductor, insulator)- Semiconductor – Types (intrinsic and extrinsic) - Band energy levels for pure silicon crystal, band model of n-type and p-type semi conductance of silicon. Types - Non elemental semiconductor, Defect semiconductor, Chalcogen semiconductor (definition, properties). Preparation of Germanium - Fractional distillation and crystal growth methods. Fullerenes- preparation, properties and applications .Conducting polymer – Types – mechanism of conduction (poly acetylene) - polyaniline -properties, applications.

UNIT V INSTRUMENTAL METHODS OF ANALYSIS 9

Thermal analysis techniques- Thermogravimetric analysis and Differential thermal analysis- Principle, instrumentation and applications – Concept of chromatography – Principle, instrumentation and applications of Paper chromatography, Column chromatography, Thin layer chromatography and Gas chromatography. Principle and applications of Conductometric titrations , Potentiometric titrations and PH-metry.

PHYSICS LABORATORY

LIST OF EXPERIMENTS: (ANY 5)

1. Determination of dispersive power of the given solid prism using spectrometer
2. Determination of thickness of the given thin material by forming interference fringes using air – wedge setup
3. Analysis of I-V Characterization of Solar cell
4. Determination of energy gap of the given semiconductor by plotting the graph between current and temperature
5. Determination of acceptance angle of the given fiber cable.
6. Determination of Young's modulus for the given uniform bar by non-uniform bending method

10

CHEMISTRY LABORATORY

LIST OF EXPERIMENTS: (ANY5)

1. Determination of strength of hydrochloric acid using pH meter.
2. Determination of strength of acids in a mixture of acids using conductivity meters.
3. Conductometric titration of strong acid vs strong base.
4. Estimation of iron content using potentiometer.
5. Estimation of iron content of the water sample using spectrophotometer (thiocyanate method).
6. Estimation of sodium and potassium present in water using a flame photo meter.
7. Determination of SAP and FAV values of an oil.
8. Estimation of acetic acid adsorbed on charcoal

10

TOTAL: 60 PERIODS

COURSE OUTCOMES

At the end of the course, the students will able to

- Acquire knowledge on basics of conductivity of solids, semiconductor physics and its applications in various devices,
- Get knowledge on magnetic properties of materials and their applications in data storage
- Have the necessary understanding on the functioning of optical materials for opto electronics
- Acquainted with hands-on knowledge in the quantitative chemical analysis through instrumental analysis
- Acquire practical knowledge on interference pattern, semiconductor devices, solar cells and instrumental analysis of acids, bases and heavy metals.

TEXT BOOKS

1. Kasap, S.O.-Principles of Electronic Materials and Devices, Mc Graw, Education, 2007.

2. Jasprit Singh, Semiconductor Devices: Basic Principles, Wiley 2012.
3. Kittel, C. Introduction to Solid State Physics. Wiley, 2005.
4. Umesh K Mishra & Jasprit Singh, "Semiconductor Device Physics and Design", Springer, a. 2008.
5. Jain P.C.and Monica Jain,"Engineering Chemistry",Dhanpat Rai Publishing Company (P) Ltd., New Delhi,2010.

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1. Garcia, N. & Damask,A."Physics for Computer Science Students".Springer-Verlag,2012
2. Wahab, M.A. "Solid State Physics: Structure and Properties of Materials".Narosa Publishing House, 2009.
3. K.Sesha Maheswaramma, Mridula Chugh, Engineering chemistry, Pearson, 2016.
4. O.G.Palanna, Engineering Chemistry, Mc Graw Hill, 2017.
5. GurdeepR.Chatwal, Sham K.Anand, Instrumental methods of chemical analysis, Himalaya Publishing House, 2007.
6. Practical Fiber Optics, D. Bailey and E .Wright, 2003.
7. J.Mendham, RC Denney, JDBarnes, MJK Thomas, Text book of quantitative chemical analysis, Vogel's, 2008.
8. Quantitative and qualitative analysis, U.Alexeyer, MIR publication, Moscow (1979).
9. Analytical Chemistry,G ary D.Christian, Wiley, 2005.

WEBSITE LINK

1. https://nptel.ac.in/courses/115/102/115102025/
2. https://www.youtube.com/watch?v=6QUFuZpCgGw
3. http://tiny.cc/0vhjuz
4. https://nptel.ac.in/content/storage2/courses/103108100/module7/module7.pdf5.
5. https://nptel.ac.in/courses/108/108/108108122

CO-PSO MAPPING

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

JGE1201	PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To provide an introduction to Python Programming Language.
- To understand the decision making and looping concepts.
- To understand functions, strings and lists in Python.
- To understand tuples, dictionaries and files.
- To know the exception handling and 2 D concepts**.**

UNIT 1 INTRODUCTION TO PYTHON 9

History of Python, Features, Installing Python, Running Python Program, Interactive mode programming, Script Mode Programming, Identifiers, Reserved Words, Indentation, Comments, Variables, Data Types, Data Type Conversion

UNIT II DECISION MAKING AND LOOPI.NG 9

Python Operators, Operator Precedence, Decision Making: if Statement, if else Statement, if elif else Statement, nested if Statement, Loops: while loop, for loop, nested loops; Loop Control Statements: continue Statement, break Statement, pass Statement: Iterator and Generator

UNIT III FUNCTIONS, STRING, LIST 9

Functions: Predefined Functions, User defined Functions, Recursion, Lambda Function; String: Functions, methods, modules; Lists: Operations, pre-defined functions, advanced list processing; Packages

UNIT IV TUPLES, DICTIONARY, FILES 9

Tuples: Tuple Operations and methods, Dictionary: Dictionary Operations and methods; Files: Text Files, Reading and writing Files; Format Operator, Command line argument

UNIT V EXCEPTION HANDLING AND GRAPHICS 9

Date & Time Methods, Exception handling clauses, Raising an Exception, User Defined Exception; Simple graphics and image processing, simple 2d drawing-colors and shapes.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the student will be able

Co1 : To understand the evolution of Python and run basic python programs.

Co2: To structure simple python programs for solving programs.

Co3: To Decompose larger programs into functions.

Co4: To Understand compound structures like list, tuple, dictionary.

Co5: To Learn basic 2d graphics concepts in Python.

TEXT BOOKS:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'' ,2 nd ēdition, Updated for Python 3, Shroff / O 'Reilly Publishers, 2016 (http : // greenteapress.com / wp / think python /)
2. Guidovan Rossum and Fred L.Drake Jr,"An Introduction to Python–Revised and updated for Python3.2,Network Theory Ltd., 2011.

REFERENCES:

1. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press ,2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero," Introduction to Programming in Python: An Inter disciplinary Approach, Pearson India Education Services Pvt. Ltd.,2016.
3. Timothy A.Budd,"Exploring Python",Mc-Graw Hill Education (India) Private Ltd.,,2015.
4. Kenneth A. Lambert,"Fundamentals of Python: First Programs ",CENGAGE Learning, 2012.
5. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem – Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Camp bell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.

WEBSITE REFERENCES:

1. https://www.w3schools.com/python/python_reference.asp
2. https://www.pythonforbeginners.com/basics/python-websites-tutorials
3. https://www.programiz.com/python-programming/methods/built-in/list
4. https://www.geeksforgeeks.org/python-convert-dictionary-to-list-of-tuples/
5. https://www.javatpoint.com/python-exception-handling

CO-PO MAPPING

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

JEE1201	CIRCUIT THEORY	L	T	P	C
		2	2	0	3

COURSE OBJECTIVES

- To introduce electric circuits and solving circuit equations using network theorems
- To introduce the phenomenon of resonance in coupled circuits.
- To introduce Phasor diagrams and analysis of three phase circuits
- To educate on obtaining the transient response of circuits.
- To impart knowledge on two port network.

UNIT I BASIC CIRCUIT ANALYSIS AND NETWORK THEOREMS 12

Kirchhoff's laws – Mesh current and node voltage - methods of analysis- Network reduction: voltage and current division, source transformation–star delta conversion, Thevenin's and Norton's Theorems – Super position Theorem – Maximum power transfer theorem

UNIT II RESONANCE AND COUPLED CIRCUITS 12

Series and parallel resonance – frequency response – Quality factor and Band width –Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits

UNIT III THREE PHASE CIRCUITS 12

A.C. circuits – Phasor Diagram – Power, Power Factor and Energy.- Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & unbalanced – phasor diagram of voltages and currents – power measurement in three phase circuits.

UNIT IV TRANSIENT RESPONSE ANALYSIS 12

Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. sinusoidal input.

UNIT V TWO PORT NETWORKS 12

Two port networks, Z parameters, Y parameters, Transmission (ABCD) parameters, Hybrid (H) Parameters, Interconnection of two port networks, Symmetrical properties of T and π networks.

TOTAL: 60 PERIODS

COURSE OUTCOMES

- Ability to analyze electrical circuits and to apply network theorems
- Ability to understand and apply the concept of resonance in coupled circuits
- Ability to analyze the three phase circuits
- Ability to analyze transients
- Ability to understand two port network

TEXTBOOKS:

1. William H.HaytJr, Jack E.Kemmerly and Steven M.Durbin,"Engineering Circuits Analysis", Mc Graw Hill publishers, edition, NewDelhi, 2013.
2. Charles K.Alexander, Mathew N.O.Sadiku, "Fundamentals of Electric Circuits", Second Edition, Mc Graw Hill, 2013.

3. Allan H.Robbins, Wilhelm C.Miller, "Circuit Analysis Theory and Practice", Cengage Learning India, 2013.

REFERENCES:

1. Chakrabarti A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, 1999.
2. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, Mc Graw - Hill, New Delhi, 2010.
3. ME VanValkenburg,"Network Analysis", Prentice - Hall of India Pvt Ltd, New Delhi, 2015.
4. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", Mc Graw Hill, 2015.

CO-PO MAPPING

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

JGE1202	ENGINEERING GRAPHICS & DESIGN (Common to all B.E / B.Tech Programmes)	L	T	P	C
		1	0	4	3

OBJECTIVES

- To understand the importance of graphics in engineering
- To develop skills in preparation of basic drawing
- To improve their technical communication skill in the form of communicative drawing
- To impart knowledge about the standard principle of orthographic projection of objects.
- To improve their visualization skills for developing new products.

UNIT I PLANE CURVES AND ORTHO GRAPHIC PROJECTION 15

Conics - Construction of ellipse, Parabola and hyper bola by eccentricity method – Construction of cycloid - construction of involutes of square and circle - Drawing of tangents and normal to the above curves. Representation of Three Dimensional objects - General principles of orthographic projection -Need for importance of multiple views and their placement - First angle projection – layout views - Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 15

Projection of points and straight lines located in the first quadrant - Determination of true lengths and true inclinations - Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT III PROJECTION OF SOLIDS 15

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 15

Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other –Obtaining true shape of section.

Development of lateral surfaces of simple and truncated solids -Prisms, pyramids, cylinders and cones - Development of lateral surfaces of solids with cylindrical cut- outs and square cut-outs, perpendicular to the axis.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 15

Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones. Perspective projection of prisms, pyramids and cylinders by visual ray method.

TOTAL: 75 PERIODS

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

- Familiarize with the fundamental and standards of engineering graphics.
- Perform free hand sketching of basic geometrical constructions and multiple views of object.
- Project orthographic projections of lines and plane surfaces.
- Draw projection of solids and development of surfaces.
- Interpret isometric and perspective view of objects.

TEXTBOOKS:

1. Natrajan K.V.,“A text book of Engineering Graphics ”, Dhana lakshmi Publishers, Chennai,2009.
2. VenugopalK and Prabhu RajaV.,“Engineering Graphics”,NewAge International (P) Limited, 2008.
3. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50th Edition, 2010.

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1. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata Mc Graw Hill Publishing Company Limited, NewDelhi, 2008.
2. Gopala Krishna K.R., “Engineering Drawing” (Vol.I & II combined), Subhas Stores, Bangalore, 2007.

3. Luzzader,Warren .J and Duff, John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production", Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4. NS Parthasarathy and Vela Murali,"Engineering Graphics", Oxford University, Press, New Delhi,2015.
5. Shah M.Band RanaB.C.,"Engineering Drawing",Pearson, 2nd Edition,2009.

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1. IS10711-2001: Technical products Documentation-Size and layout of drawing sheets.
2. IS9609 (Parts 0&1)-2001: Technical products Documentation - Lettering.
3. IS10714 (Part 20) - 2001 & SP46 -2003: Lines for technical drawings.
4. IS11669 -1986 & SP46 - 2003: Dimensioning of Technical Drawings.
5. IS15021 (Parts1to4) - 2001: Technical drawings – Projection Methods.

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2. https://freevideolectures.com
3. https://nptel.ac.in/courses
4. https://nptel.ac.in/courses/105/104/105104148/
5. https://nptel.ac.in/courses/112/103/112103019/

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	-	1	1	-	1	1	1	1	1
CO2	1	1	1	1	1	1	1	-	1	1	1	-
CO3	1	-	1	1	1	-	1	1	1	1	1	1
CO4	-	1	1	1	-	1	1	1	1	1	1	1
CO5	1	1	1	-	1	1	1	1	1	1	-	1
AVG	1	1	1	1	1	1	1	1	1	1	1	1

JNC1261	ENVIRONMENTAL SCIENCE	L	T	P	C
		3	0	0	0

COURSE OBJECTIVES:

- To study the inter relationship between living organisms and the environment.
- To find and implement scientific, technological and environmental problems due to pollution.
- To study the various natural resources and the responsibility of the individual to conserve it.
- To study the social issues over the environment.
- To get knowledge on population explosion, human rights and value education.

UNIT I ENVIRONMENT, ECO SYSTEMS AND BIO DIVERSITY 9

Definition, scope and importance of environment - need for public awareness - concept of an ecosystem - structure and function of an ecosystem - energy flow in the ecosystem – ecological

succession - food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) –Introduction to biodiversity definition :genetic, species and ecosystem diversity - value of biodiversity - threats to biodiversity - conservation of biodiversity: In-situ and ex-situ conservation of bio diversity.

UNIT II ENVIRONMENTAL POLLUTION 9

Definition-causes, effects and control measures of: (a)Air pollution (b)Water pollution (c)Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards -Solid waste management: causes, effects and control measures of municipal solid wastes – Role of an individual in prevention of pollution.

UNIT III NATURAL RESOURCES 9

Forest resources: Use and over-exploitation, deforestation, case studies - timber extraction, mining, dams and their effects on forests and tribal people - Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams – benefits and problems-Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies - Food resources- effects of modern agriculture, fertilizer - pesticide problems, water logging, salinity. Energy resources: renewable and non renewable energy sources, Land resources: Land as a resource, land degradation, man induced land slides, soil erosion and desertification – role of an individual in conservation of natural resources.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 9

Water conservation- water shed management - resettlement and rehabilitation of policy. – consumerism and waste products - environment production act - Air (Prevention and Control of Pollution) act -Water (Prevention and control of Pollution) act - Wildlife protection act – Forest conservation act -enforcement machinery involved in environmental legislation - central and state pollution control boards-Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 9

Human population growth, variation among nations population explosion - family welfare programme - environment and human health - human rights - value education - HIV / AIDS –women and child welfare-role of information technology in environment and human health.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of course completion, students will be able to

- Explain about ecosystems, their structure and function to conserve biodiversity.
- Recognize the level of environmental pollution and their control measures.
- Explain about the various types of natural resources and role of a human being in maintaining a clean sustainable environment for the future generations.
- Identify the social problems in the environment to reduce social issues.
- Understand environment and human health –human rights –value education, and the role of information technology in environment and human health.

TEXTBOOKS:

1. Erach Bharucha,-Text book of Environmental Studies, Universities Press (I) PVT, LTD, Hydrabad, 2015.
2. Benny Joseph, Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.

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1. Dharmendra S.Sengar, Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
2. Rajagopalan, R, Environmental Studies-From Crisisto Cure', Oxford University Press, 2005.
3. Gilbert M. Masters, Introduction to Environmental Engineering and Science' , 2nd edition, Pearson Education, 2004.
4. G.Tyler Miller and Scott E. Spool man, -Environmental Science, Cengage Learning India PVT, LTD, Delhi, 2014.

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2. https://www.csindia.org/understanding-eia-383
3. https://nptel.ac.in/courses/120108004
4. https://nptel.ac.in/courses/107/103/107103081/
5. .https://nptel.ac.in/courses/109/104/109104045/

CO-PO MAPPING

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

JEE1211	ELECTRIC CIRCUITS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

- To simulate various electric circuits using P spice/Mat lab
- To gain practical experience on electric circuits and verification of theorems.

LIST OF EXPERIMENTS

1. Simulation and experimental solving of electrical circuit problems using Kirchhoff's voltage and current laws.

2. Simulation and experimental solving of electrical circuit problems using Thevenin's theorem.
3. Simulation and experimental solving of electrical circuit problems using Norton's theorem.
4. Simulation and experimental solving of electrical circuit problems using Super position theorem.
5. Simulation and experimental verification of Maximum Power transfer Theorem.
6. Study of Analog and digital oscilloscopes and measurement of sinusoidal voltage, frequency and power factor.
7. Simulation and Experimental validation of R-C electric circuit transients.
8. Simulation and Experimental validation of frequency response of RLC electric circuit.
9. Design and Simulation of series resonance circuit.
10. Design and Simulation of parallel resonant circuits.
11. Simulation of three phase balanced and unbalanced star delta networks circuits.
12. Experimental verification of Two port network parameters.

TOTAL:60 PERIODS

COURSE OUTCOMES

- Understand and apply circuit theorems and concepts in engineering applications.
- Ability to Simulate electric circuits

CO-PO MAPPING

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

JGE1211	PYTHON PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- To implement basic 2 D diagrams.

LIST OF PROGRAMS

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton‘s method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Guess an integer number in a rang
6. Insert a card in a list of sorted cards.
7. Multiply matrices
8. Programs that take command line arguments (word count)
9. Find the most frequent words in a text read from a file
10. Create an User defined Exception
11. Draw a 2d circle and square

TOTAL: 60 PERIODS

PLATFORM NEEDED

Python 3 interpreter for Windows/Linux

COURSE OUTCOMES:

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

Co1: Write, test, and debug simple Python programs.
Co2: Implement Python programs with conditionals and loops.
Co3: Develop Python programs stepwise by defining functions and calling them.
Co4: Use Python lists, tuples, dictionaries for representing compound data.
Co5: Draw 2d graphic diagrams in Python.

WEBSITE REFERENCE:

1. https://www.programiz.com/python-programming/examples
2. https://www.javatpoint.com/python-condition-and-loops-programs
3. https://realpython.com/python-lists-tuples/
4. https://www.tutorialsteacher.com/python/python-user-defined-function
5. https://www.cdslab.org/python/notes/visualization/2d/2d.html

CO-PO MAPPING

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

SEMESTER III

JMA1302	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C
		2	2	0	3

COURSE OBJECTIVES:

- To equip students with the knowledge of transforms theory which is used in signals and systems.
- To introduce methods of solving partial differential equations.
- To familiarize student sin the concepts of Fourier series and use it for solving boundary value problems.

UNIT I FOURIER SERIES 12

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval's identity – Complex form of Fourier series – Harmonic analysis..

UNIT II FOURIER TRANSFORMS 12

Statement of Fourier integral theorem – Complex form of the Fourier integral – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions– Convolution theorem– Parseval's identity.

UNIT III Z-TRANSFORMS AND DIFFERENCE EQUATIONS 12

Z-transforms-Elementary properties–Inverse Z-transform (using partial fraction and residues) – Initial and final value theorems - Convolution theorem - Formation of difference equations– Solution of difference equations using Z –transform.

UNIT IV PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations –Singular integrals-Solutions of standard types of first order partial differential equations-Lagrange's linear equation-Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT V APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

Classification of PDEs – Fourier series solutions - one-dimensional wave and heat conduction equations– Steady state two-dimensional equation of heat conduction.

TOTAL(L:45+T:15):60PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1: To demonstrate efficient use of Fourier series which plays a vital role in engineering applications.

CO2: To understand problem solving in Fourier transforms and Fourier integral representation

CO3: To use Z transforms as a tool for solving difference equations.

CO4: To solve a given partial differential equation for singular and general solutions.

CO5: To model physical problems as boundary value problems and use Fourier series for solving them.

TEXTBOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, NewDelhi, 43rd Edition, 2014.
2. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
3. S.Manicavachagom Pillay.T.K and Ramanaiah.G" Advanced Mathematics for Engineering Students", Vol.II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.

REFERENCES:

1. Andrews, L.C and Shivamoggi,B, "Integral Transforms for Engineers "SPIE Press, 1999.
2. Bali.N.P and Manish Goyal, "A Text book of Engineering Mathematics" 9th Edition, Laxmi Publications Pvt. Ltd, 2014.
3. Ramana.B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, NewDelhi, 2016.
4. Wylie. R.C. and Barrett, L.C., "Advanced Engineering Mathematics "Tata Mc Graw Hill Education Pvt .Ltd, 6th Edition, New Delhi, 2012.
5. James,G.—Advanced Modern Engineering Mathematics, Pearson Education, 2007.

CO–PO MAPPING:

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

CO-PSO MAPPING:

CO\PSO	PSO 1	PSO2	PSO 3
CO1	2	-	-
CO2	2	-	-
CO3	2	-	-
CO4	2	-	-
CO5	1	-	-
AVG	2	-	-

JEC1301	ELECTRONIC DEVICES AND CIRCUITS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the students to the structure, operation and characteristics of various semiconductor diodes.
- To explain the types of rectifiers and power supply circuits.

- To impart knowledge on characteristics, different types of configurations and biasing circuits for Transistors and thyristors.
- To explore the characteristics of amplifier, gain and frequency response.
- To learn the required functionality of positive and negative feedback systems.

UNIT I SEMI CONDUCTOR DIODES 9

Structure, operation and characteristics of PN junction diode–Zener diode–Introduction to special diodes: Schottky diode – Tunnel diode – LED – Laser diode – Photodiode – Photo voltaic cell– TVS Diode– Varactor Diode

UNIT II RECTIFIERS AND POWER SUPPLIES 9

Single phase half-wave and full-wave rectifiers – Ripple factor, rectification efficiency, Transformer utilization factor and PIV–Performance of rectifiers with filters–Regulated Power Supply– Switched Mode Power Supplies.

UNIT III TRANSISTORS AND THYRISTORS 9

Structure, operation, characteristics and biasing of BJT, JFET, MOSFET – Use of heatsink– Structure and characteristics of IGBT, UJT, Photo Transistor, SCR, LASCR –Introduction to 3D Transistor.

UNIT IV AMPLIFIERS 9

Small signal model of BJT–Analysis of CE,CB, CC amplifiers–Small signal model of MOSFET– Analysis of CS Amplifier and Source follower – Cascade amplifier – single tuned amplifier– Gain and frequency response.

UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS 9

Advantages of negative feedback – voltage / current, series / Shunt feedback – positive feedback – Condition for oscillations – Operation and analysis of RC phase shift, Wien bridge, Hartley, Colpitts and Crystal oscillators

TOTAL:45 PERIODS

COURSE OUTCOMES

At the end of the course, the student will be able

CO1 To apply the knowledge of semiconductor device fundamentals to understand the operation of various diodes.

CO2: To design and adapt the required components to construct rectifier and power supply circuits.

CO3: To explain the working of various transistors and thyristors.

CO4: To design a given transistor amplifier and evaluate its performance with respect to gain impedance and b and width.

CO5: To assess the acquired knowledge in design and analysis of Feedback amplifiers and oscillators.

TEXTBOOKS:

1. Jacob Millman, Christos C. Halkias, SatyabrataJit, "Electronic Devices and Circuits", 3rdEdition, McGraw-Hill, 2011.
2. Sedha.R.S., A Text Book of Applied Electronics, 3rd Edition, S Chand Publishers,1999.
3. David A. Bell , "Electronic devices and circuits", Oxford University higher education, 5th edition 2008.

REFERENCES:

1. Sedra, Smith, "Micro electronic Circuits: Theory and Application "Oxford University Press, 7th edition, 2017.
2. Muhammad H.Rashid, "Electronic Devices and Circuits", Cengage Learning, 2nd edition, 2014.
3. BalbirKumar, Shail.B.Jain, "Electronic devices and circuits "PHI learning private limited, 2nd edition 2014.
4. Salivahanan, "Electronic devices and Circuits", Second edition, Tata McGraw Hill International, 2nd edition, 2011.
5. Thomas L.Floyd, "Electronic devices" Conventional current version, Pears on prentice hall, 10th Edition, 2017.
6. David A.Bell, "Electronic Devices and Circuits", 5th Edition, Oxford University Press, 2008.
7. S.Ramareddy, "Electronic Devices and Circuits", Narosa Publications, 1st Edition, 2011.

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1. https://nptel.ac.in/
2. https://www.allaboutcircuits.com/https://youtu.be/Rx43l-QpeWQ
3. https://youtu.be/5ZNeDxfgYAEhttps://youtu.be/36j6hCtL0E4

CO–PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	2	1	2	-	1	-	1	3
CO2	3	2	1	2	2	1	2	-	1	-	2	3
CO3	3	2	1	2	2	1	2	-	1	-	2	3
CO4	3	2	2	2	2	1	2	-	1	-	2	2
CO5	3	2	2	2	2	1	2	-	1	-	2	2
AVG	3	2	1	2	2	1	2	-	1	-	2	3

CO-PSO MAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	2	1	1
CO2	2	-	-
CO3	2	2	-
CO4	2	1	1
CO5	2	2	1
AVG	2	1	1

JEE1301	ELECTROMAGNETIC THEORY	L	T	P	C
		2	2	0	3

COURSE OBJECTIVES

- To introduce the basic mathematical concepts related to electromagnetic vector fields.
- To impart basic Concepts of electrostatics, electrical potential, energy density and their applications.
- To impart basic Concepts of magneto statics, magnetic flux density, scalar and vector potential and its applications.
- To impart basic Faraday's laws and their applications.
- To impart basic Concepts of electromagnetic waves and Poynting vector.

UNIT I INTRODUCTION 12

Sources and effects of electromagnetic fields–Vector fields–Different co-ordinate systems-vector calculus–Gradient, Divergence and Curl –Divergence theorem –Stoke's theorem.

UNIT II ELECTROSTATICS 12

Coulomb's Law–Electric field intensity–Field due to point and continuous charges–Gauss's law and application – Electric potential – Electric field and equipotential plots – Electric field in free space, conductors, dielectric-Di electric strength-Electric field in multiple dielectrics –Boundary conditions, Poisson's and Laplace's equations–Capacitance- Energy density.

UNIT III MAGNETO STATICS 12

Lorentz Law of force, magnetic field intensity–Biot–savart Law-Ampere's Law–Magnetic field due to straight conductors, circular loop, infinite sheet of current–Magnetic flux density (B) – Bin free space, conductor, magnetic materials–Magnetization–Magnetic field in multiple media–Boundary conditions–Scalar and vector potential–Magnetic force–Torque –Inductance–Energy density– Magnetic circuits.

UNIT IV ELECTRO DYNAMIC FIELDS 12

Faraday's laws, induced emf – Transformer and motional EMF – Forces and Energy in quasi-stationary Electromagnetic Fields - Maxwell's equations (differential and integral forms) – Displacement current–Relation between field theory and circuit theory.

UNIT V ELECTRO MAGNETIC WAVES 12

Generation–Electro Magnetic Wave equations–Wave parameters; velocity, intrinsic impedance, propagation constant–Waves in free space, lossy and loss less dielectrics, conductors-skin depth, Poynting vector – Plane wave reflection and refraction – Transmission lines–Line equations–Input impedances–Standing wave ratio and power–Electromagnetic fielding generator and motor.

TOTAL (L:45+T:15): 60 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1: To understand and apply the basic mathematical concepts related to electro magnetic Vector fields.

CO2: To understand the basic Concepts of electro statics, electrical potential, energy density And their applications.

CO3: To understand the basic Concepts of magneto statics, magnetic flux density, scalar and Vector potential and its applications.

CO4: To understand the basic Faraday's laws, induced emf and their applications.

CO5: To understand the basic Concepts of electromagnetic waves and Poynting vector.

TEXTBOOKS:

1. Mathew N.O. Sadiku, 'Elements of Electro magnetics', Oxford University press Inc. First India edition, 2007.
2. Ashutosh Pramanik, 'Electro magnetism–Theory and Applications' Prentice-Hall of India Private Limited, New Delhi, 2006.

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1. Joseph. A.Edminister,'Theory and Problems of Electro magnetics' Second edition, Schaum Series,Tata McGraw Hill, 1993.
2. William .H.Hayt, 'Engineering Electro magnetics', Tata McGraw Hill , 6th edition, 2001.
3. Kraus and Fleish, 'Electro magnetic with Applications', McGraw Hill International Editions, Fifth Edition, 1999.
4. S.Ramareddy,'Electro magnetic Fields', Second Edition, Scitech Publication, 2016.

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2. https://www.youtube.com/watch?v=6FZusYyg0Po&list=PLl6m4jcR_DbOx6s2toprJQx1MORqPa9rG&index=4
3. https://www.youtube.com/watch?v=aaWG_6WCkTA&list=PLl6m4jcR_DbOx6s2toprJQx1MORqPa9rG&index=18
4. https://www.youtube.com/watch?v=deI8cJiCKEo&list=PLl6m4jcR_DbOx6s2toprJQx1MORqPa9rG&index=27
5. https://www.youtube.com/watch?v=n4in7z4NP7Y&list=PLl6m4jcR_DbOx6s2toprJQx1MORqPa9rG&index=32

CO–PO MAPPING:

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

AVG	2	2	2	2	2	1	1	1	1	1	1	1

CO-PSOMAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	1	1	1
CO2	1	-	1
CO3	1	1	1
CO4	1	-	1
CO5	1	1	1
AVG	1	1	1

JCS1321	OBJECT ORIENTED PROGRAMMING (INTEGRATED)	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the basic concepts of Object Oriented Programming in Java
- To know the principles of inheritance and interfaces
- To define exceptions and use of I/O streams
- To learn the concepts of threads and generics classes
- To design and build simple Graphical User Interfaces using swing components

UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 12

Object Oriented Programming–objects and classes–features of OOP-OOP in Java–Characteristics of Java –The Java Environment -Java Source File–Compilation. Fundamental Programming Structures in Java–constructors, methods–method overloading, access specifies

-static members-Comments, Data Types, Variables, Operators, Control Flow, Arrays, Packages, and Naming Conventions, Case study-simple program using objects, classes and constructors.

UNIT II INHERITANCE AND INTERFACES 12

Inheritance –Super classes-sub classes –Protected members –constructors in sub classes-the Object class –abstract classes and methods-final methods and classes –Interfaces –defining an interface, implementing interface, differences between classes and interfaces and extending interfaces-Object cloning-inner classes, Reflection, Array Lists–Strings, Case study-program using inheritance strings and array List.

UNIT III EXCEPTION HANDLING AND I/O 12

Exceptions-exception hierarchy-throwing and catching exceptions–built-in exceptions, creating own exceptions, Stack Trace Elements. Input/ Output Basics–Streams–Byte streams and Character streams–Reading and Writing Console–Reading and Writing Files, Case study-program using Exceptions and File Handling

UNIT IV MULTI THREADING, GENERIC PROGRAMMING AND ADVANCED JAVA 12

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, Fibers, daemon threads, thread groups. Generic Programming –Generic classes – generic methods –Bounded Types –Restrictions and Limitations, Case study-program using Multithreading and Generic Programming.

UNIT V EVENT DRIVEN PROGRAMMING 12

Graphics programming - Frame – Components - working with 2D shapes - Using color, fonts, and images-Basics of event handling-event handlers-adapter classes-actions-mouse events. AWT event hierarchy-Introduction to Swing–layout management-Swing Components–Text Fields, Text Areas–Buttons-Check Boxes–Radio Buttons–Lists-choices-Scrollbars–Windows –Menus–Dialog Boxes, Case study-Program using AWT components and Swing Components.

TOTAL:60 PERIODS

LIST OF EXPERIMENTS:

1. Write a Java Program to capture the personal details of a person.
2. Develop an application with Employee class with Emp_name, Emp_id, Address, Mail id, Mobile no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10% of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
3. Write a program to perform string operations using Array List.
4. Write a program to do the arithmetic operations with required exceptions
5. Write a program to read a file and print on the console
6. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print a value of cube of the number.
7. Write a java program to find the maximum value from the given type of elements using a generic function.
8. Design a login screen using JAVA AWT components.

COURSE OUTCOMES:

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

CO1: Develop Java programs using OOP principles
CO2: Develop Java programs with the concepts in heritance and interfaces
CO3: Build Java applications using exceptions, I/O streams and Java beans
CO4: Develop Java applications with threads and generic classes
CO5: Develop interactive applications using swings

TEXTBOOKS:

1. Herbert Schildt, “Java The complete reference”, Cay S. Horstmann, Gary cornell, “Core
2. Java Volume –I Fundamentals”, 9th Edition, Prentice Hall, 2013.

REFERENCES:

1. Paul Deitel, Harvey Deitel, “Java SE 8 for programmers”, 3rd Edition, Pearson, 2015
2. Steven Holzner, “Java 2 Black book”, Dream tech press, 2011
3. Herbert Schildt, “Java The complete reference”, Cay S. Horstmann, Gary cornell, “Core Java Volume –I Fundamentals”, 9th Edition, Prentice Hall, 2013.

WEBSITE REFERENCES:

1. https://www.w3schools.com/java/java_intro.asp
2. https://www.tutorialspoint.com/java/index.html
3. https://www.javatpoint.com/java-tutorial
4. https://developer.ibm.com/tutorials/j-introtojava1/

CO–PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	3	-	-	-	1	-	-	3
CO2	3	1	3	2	3	-	-	-	1	-	-	3
CO3	3	1	3	2	3	-	-	-	1	-	-	3
CO4	3	1	3	2	3	-	-	-	2	-	-	3
CO5	3	2	3	2	3	-	-	-	2	-	-	3
AVG	3	1	3	2	3	-	-	-	1	-	-	3

CO-PSO MAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	1	1	1
CO2	1	-	1
CO3	1	1	1
CO4	1	-	1
CO5	1	1	1
AVG	1	1	1

JEE1302	**DC MACHINES AND TRANSFORMERS**	**L**	**T**	**P**	**C**
		2	**2**	**0**	**3**

COURSE OBJECTIVES:

To impart knowledge on the following topics

- Magnetic-circuit analysis and introduce magnetic materials
- Principle of operation, construction, basic testing methods of transformers and three phase transformer connections.
- Working principles of electro mechanical energy conversion of electrical machines and basics of Electrical Machines.
- Working principles construction and characteristics of DC Generator.
- Working principle, types and various testing methods of D.C. Motor

UNIT I MAGNETIC CIRCUITS AND MAGNETIC MATERIALS 12

Magnetic circuits –Laws governing magnetic circuits – Flux linkage, Inductance and energy – Statically and Dynamically induced EMF–Torque–Properties of magnetic materials, Hysteresis and Eddy Current losses – AC excitation, introduction to permanent magnets –Transformer as a magnetically coupled circuit.

UNIT II TRANSFORMERS 12

Construction–principle of operation–equivalent circuit parameters–phasor diagrams, losses –testing–efficiency and voltage regulation-all day efficiency-Sumpner's test, per unit representation – in rush current – three phase transformers-connections – Scott Connection – Phasing of transformer– parallel operation of three phase transformers –auto transformer – tap changing transformers-tertiary winding. Special Transformers-VFT-pulse transformer-high Frequency transformer, K-rated Transformer, Digital Distribution Transformer.

UNIT III ELECTRO MECHANICAL ENERGY CONVERSION AND CONCEPTS IN ROTATING MACHINES 12

Energy in magnetic system – Field energy and co energy-force and torque equations –singly and multiply excited magnetic field systems–mmf of distributed windings–Winding Inductances– magnetic fields in rotating machines – rotating mmf waves – magnetic saturation and leakage fluxes.

UNIT IV DC GENERATORS 12

Construction and components of DC Machine–Principle of operation–Lap and wave windings-EMF equations–circuit model–armature reaction–methods of excitation commutation–inter poles, compensating winding–characteristics of DC generators.

UNIT V DCMOTORS 12

Principle and operations–types of DC Motors–Speed Torque Characteristics of DC Motors–starting and speed control of DC motors –Plugging, dynamic and regenerative braking–testing and efficiency – Retardation test- Swinburne's test and Hopkinson's test – Permanent Magnet DC (PMDC) motors-Applications of DC motor.

TOTAL(L:45+T:15):60 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1: To analyze the magnetic-circuits
CO2: To acquire the knowledge in constructional details of transformers.
CO3: To understand the concepts of electro mechanical energy conversion
CO4: To acquire the knowledge in working principles of DC Generator.
CO5: To acquire the knowledge in working principles and testing of DC Motor

TEXTBOOKS:

1. Stephen J. Chapman, 'Electric Machinery Fundamentals' 4th edition, McGraw Hill Education Pvt.Ltd, 2010.
2. P.C.Sen 'Principles of Electric Machines and Power Electronics' John Wiley & Sons; 3rd Edition 2013.
3. Nagrath, I.J. and Kothari.D.P., Electric Machines', McGraw-Hill Education, 3rd Edition, 2004

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1. The odore Wildi,"Electrical Machines, Drives, and Power Systems", Pearson Education., 5th Edition, 2002.
4. B.R.Gupta, 'Fundamental of Electric Machines' New age International Publishers, 3rdEdition ,Reprint 2015.
5. S.K. Bhattacharya, 'Electrical Machines' McGraw-Hill Education, New Delhi, 3rdEdition, 2009.

6. Vincent Del Toro, 'Basic Electric Machines' Pearson India Education, 1st Edition, 2016.
7. Surinder Pal Bali, 'Electrical Technology Machines & Measurements, Vol.II, Pearson, 1stEdition, 2013.
8. Fitzgerald.A.E., Charles Kingsely Jr, Stephen D.Umans, 'Electric Machinery', Sixth edition, McGraw Hill Books Company, 2003.

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2. https://youtu.be/LPcQYXjPdIQ?list=PLp6ek2hDcoNCANsWM2mw3qi0387BhfLyV
3. https://www.youtube.com/playlist?list=PLMYtBmvT7X7QaLu0b0Jn1QQD4EOuT8lCA
4. https://www.youtube.com/playlist?list=PL59861DBF8EC85491
5. https://www.youtube.com/playlist?list=PLPpCFgQP7QKHUOFYvZhQ6ra5XrU3dN2dD
6. https://youtu.be/NkRk_xaRwjg?list=PLLQiBbMXygz5QqZ12mEAss8Vn5WKZoirq

CO–PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO11	PO12
CO1	3	3	3	3	1	2	2	-	-	-	2
CO2	3	3	3	3	1	2	2	-	-	-	2
CO3	3	3	3	3	1	2	2	-	-	-	2
CO4	3	3	3	3	1	2	2	-	-	-	2
CO5	3	3	3	3	1	2	2	-	-	-	2
AVG	3	3	3	3	1	2	2	-	-	-	2

CO-PSOMAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	1	1	1
CO2	1	1	1
CO3	1	2	1
CO4	3	3	1
CO5	3	3	1
AVG	2	2	1

JEE1303	DIGITAL LOGIC CIRCUITS	L	T	P	C
		2	2	0	3

COURSE OBJECTIVES:

- To study various number systems and simplify the logical expressions using Boolean functions.
- To study combinational circuits
- To design various synchronous sequential circuits.
- To introduce asynchronous sequential circuits and PLDs.
- To introduce digital simulation for development of application oriented logic circuits.

UNIT I NUMBER SYSTEMS AND DIGITAL LOGIC FAMILIES 12

Review of number systems, binary, Octal and Hexadecimal codes, error detection and correction codes (Parity and Hamming code) – Introduction to Digital Logic Families-RTL, DTL, TTL, ECL, MOS, LVCMOS, BiCMOS.

UNIT II COMBINATIONAL CIRCUITS 12

Combinational logic-representation of logic functions-SOP and POS forms, K-map representations- minimization using K maps – Quine-Mc Cluskey method -simplification and implementation of combinational logic–multiplexers and demultiplexers–code converters, adders, subtractors, Encoders and Decoders.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 12

Sequential circuits–Flip flops: Triggering, types, excitation tables–Analysis and design procedures–Finite State Machine-State reduction and state assignment–Shift registers–Counters: MOD counters, up-down counter, Ring counters, Johnson counter.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABLE LOGIC DEVICES 12

Analysis and design of a synchronous sequential circuits–Reduction of state and flow tables – Race condition – Hazards-Free State assignment–Introduction to Programmable Logic Devices: PROM–PLA–PAL, CPLD, FPGA.

UNIT V VHDL 12

RTL Design – combinational logic – Sequential circuit – Operators – Introduction to Packages–Sub programs–Test bench. (Simulation/Tutorial Examples: adders, counters, flip flops, Multiplexers & Demultiplexers).

TOTAL(L:30+T:30) :60PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1: To label various number systems and simplify the logical expressions using Boolean functions.

CO2: To design combinational Circuits.

CO3: To design various synchronous sequential circuits.

CO4: To assess the knowledge about a synchronous sequential circuits and PLDs.
CO5: To review VHDL program for various logic circuits.

TEXTBOOKS:

1. James W.Bignel, Digital Electronics, Cengage learning, 5th Edition, 2007.
2. M.Morris Mano, 'Digital Design with an introduction to the VHDL', Pearson Education, 6th Edition , 2013.
3. Comer "Digital Logic & State Machine Design, Oxford, 5th Edition, 2012.

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1. Anand Kumar, "Fundamental Digital Circuits, PHI, 3rd Edition, 2016.
2. Mandal,"Digital Electronics Principles & Application, Mc Graw Hill Edu,1st Edition, 2013.
3. William Keitz, Digital Electronics-A Practical Approach with VHDL, Pearson, 9th Edition, 2013.
4. Thomas L.Floyd, 'Digital Fundamentals', 11th edition, Pearson Education, 2015.
5. Charles H. Roth, Jr.LizyLizy Kurian John, 'Digital System Design using VHDL, Cengage, 2nd Edition ,2013.
6. D.P.Kothari, J.S.Dhillon, 'Digital circuits and Design', Pearson Education, 1st Edition, 2016.

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2. https://youtu.be/RhS-AL2ZcyE
3. https://youtu.be/RO5alU6PpSU
4. https://youtu.be/n8Xs_70d850
5. https://youtu.be/kQ9WICIFWnU
6. https://youtu.be/BDq8-QDXmek

CO–POMAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	-	-	-	-	-	-	3	1	1
CO2	3	3	3	2	1	2	2	1	1	2	-	3
CO3	3	3	3	3	2	3	2	1	1	2	-	3
CO4	3	3	3	3	2	1	1	1	1	2	1	3
CO5	3	3	3	3	3	3	2	1	1	2	-	3
AVG	3	3	3	2	2	2	1	1	1	2	1	3

CO-PSO MAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	1	2	3
CO2	2	3	3
CO3	3	2	3
CO4	2	2	3
CO5	3	3	3
AVG	2	2	3

JPT1001	SOFT SKILLS AND APTITUDE I	L	T	P	C
		0	0	2	0

COURSE OBJECTIVES:

- To help students groom their personality and develop their skill of building social relationships
- To improve the personality traits of students and their creativity
- To help students gain knowledge in rational thinking and aptitude
- To make students think logically and judiciously
- To help student acquire technical skills in C programming language

UNIT I SOFT SKILLS AND APTITUDE-I 5

Self-Realization – Self Motivation – Relationship Building – Personality Enrichment – Personality Traits–Intra Personal Communication–Inter Personal Communication– Behavioral Based Perception– Attitude & Behavior – SWOT Analysis

UNIT II SOFT SKILLS AND APTITUDE –II 5

Dimensions of Personality – Self Confidence – Open Mindedness – Acceptance – Creativity -Strategies for developing creativity – Overcoming myths of creativity – Presence of Mind – Staying Focused– Self Acceptance – Self Growth

UNIT III QUANTITATIVE APTITUDE 8

Number system–Divisibility Rule–Simplification–Surds and Indices–Square root and Cube root–Averages–Percentage.

UNIT IV LOGICALREASONING 6

Number series–Alphabet series–Alphabet test–Word test– Letter Arrangement–Word Arrangement– Coding and Decoding– Analogy

UNIT V TECHNICALAPTITUDEINC-I 8

Technical aptitude in C: Program Structure – Data types – Variables – Constants – Operators –Decision Making - Switch statement –Looping statements – Functions – Call by reference-Recursive Arrays, single dimensional, Multi-dimensional

TOTAL:30 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1: Build better relationship with all in their social settings

CO2: Engage in creative activities focusing on their career

CO3: Solve the real time and complex problems in aptitude

CO4: Solve critical reasoning and real time application problems

CO5: Apply their knowledge in the basics of C programming

TEXTBOOKS:

1. R.SAgrawal, “Quantitative Aptitude”.
2. R.S.Agrawal, “Verbal Reasoning”.
3. R.S.Agrawal “Non Verbal reasoning.
4. Pradip Dey, Manas Ghosh, “Fundamentals of Computing and Programming in C”, First Edition, Oxford University Press, 2009
5. Yashavant P.Kanetkar. “Let Us C”, BPB Publications, 2011.

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3. https://www.youtube.com›watch/average
4. https://www.youtube.com›watch/codinganddecoding
5. https://www.youtube.com›watch/cprograms
6. https://www.youtube.com›watch/selfconfidence
7. https://www.youtube.com›watch/motivation

CO–PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	3	2	-	-	1	3	2	1	-	-
CO2	-	2	3	2	-	-	1	3	2	1	-	-
CO3	-	2	3	2	-	-	1	3	2	1	-	-
CO4	-	2	3	2	-	-	1	3	2	1	-	-
CO5	-	2	3	2	-	-	1	3	2	1	-	-
AVG	-	2	3	2	-	-	1	3	2	1	-	-

CO-PSO MAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	-	2	-
CO2	-	2	-
CO3	-	2	-
CO4	-	2	-
CO5	-	2	-
AVG	-	2	-

JEC1311	ELECTRONIC DEVICES AND CIRCUITS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To learn simulation for analog circuits.
- To enable the students to understand the behavior of semiconductor device based on

experimentation.

LIST OF EXPERIMENTS:

1. Simulation and Experimental Characterization of Semiconductor diode and Zener diode.
2. Simulation and Experimental Characterization of a NPN Transistor under common emitter and common base configurations.
3. Simulation and Experimental Characterization of JFET.
4. Simulation and Experimental Characterization of UJT and generation of saw tooth wave forms.
5. Design and Frequency response characteristics of a Common Emitter amplifier.
6. Experimental Characteristics of photo diode and photo transistor.
7. Design and testing of RC oscillators.
8. Design and testing of LC oscillators.
9. Simulation and Experimental Characterization of Single Phase half-wave rectifiers with filters.
10. Simulation and Experimental Characterization of Single Phase full wave rectifiers with filters.
11. Study of CRO for frequency and phase measurements.

TOTAL: 60PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1: To demonstrate the simulation tools for analog circuits.
CO2: To explain and analyze characteristics of semiconductor devices.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Semiconductor devices like Diode, Zener Diode, NPN Transistors, JFET, UJT, Photo diode, Photo Transistor
2. Resistors, Capacitors and inductors
3. Necessary digital IC8
4. Function Generators 10
5. Regulated 3 output Power Supply 5, ± 15V 10
6. CRO 10
7. Storage Oscillo scope 1
8. Bread boards
9. Atleast one demo module each for the listed equipments.
10. Component data sheets to be provided
11. Computer 2

REFERENCES:

1. Muhammad H.Rashid, “Electronic Devices and Circuits”, Cengage Learning, 2014.
2. Salivahanan, “Electronic devices and Circuits”, Second edition, Tata McGraw Hill International, 2011.
3. DavidA.Bell, “Electronic Devices and Circuits”, 5th Edition, Oxford University Press, 2008.
4. S.Ramareddy, “Electronic Devices and Circuits”, Narosa Publications.

WEBSITES:

https://www.allaboutcircuits.com/

https://youtu.be/KFHPX1qCnCK

CO–PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	1	2	-	1	1	1	3
CO2	3	3	2	2	1	1	1	-	1	1	2	3
AVG	3	3	2	2	1	1	2	-	1	1	2	3

CO-PSO MAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
AVG	3	3	3

JEE1311	DC MACHINES AND TRANSFORMERS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

- To analyze open circuit and load test on DC generator
- To analyze open circuit and short circuit tests on single phase transformer.
- To perform load test on single and three phase transformer
- To perform load test and speed control on DC motor
- To study different types of starters and 3-phase transformers connections

LIST OF EXPERIMENTS:

1. Open circuit and load characteristics of DC shunt generator
2. Load characteristics of DC compound generator with differential and cumulative connections.
3. Load test on DC shunt and compound motor.
4. Load test on DC series motor.
5. Swinburne’s test
6. Speed control of DC shunt motor.
7. Hopkinson’s test on DC motor–generator set.
8. Load test on single-phase transformer and three phase transformers.
9. Open circuit and short circuit tests on single phase transformer.
10. Sumpner’s test on single phase transformers.
11. Separation of no-load losses in single phase transformer.
12. Study of starters and 3-phase transformers connections
13. Simulation of Load test on separately excited DC motor using MATLAB

TOTAL: 60PERIODS

COURSE OUTCOMES:

- Ability to conduct the open circuit and load test on DC generator
- Ability to conduct open circuit and short circuit test on single phase transformer

- Ability to analyze performance parameters of single phase and three phase transformer by conducting load test.
- Ability to conduct load test and speed control of DC Motors.
- Understand the operation of different types of starters.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. DC Shunt Motor with Loading Arrangement–3 Nos
2. DC Shunt Motor Coupled with Three phase Alternator–1 No.
3. Single Phase Transformer –4 Nos
4. DC Series Motor with Loading Arrangement–1 No.
5. DC compound Motor with Loading Arrangement–1 No.
6. Three Phase Induction Motor with Loading Arrangement–2Nos
7. Single Phase Induction Motor with Loading Arrangement–1 No.
8. DC Shunt Motor Coupled With DC Compound Generator–2 Nos
9. DC Shunt Motor Coupled With DC Shunt Motor–1 No.
10. Tacho meter-Digital/Analog–8 Nos
11. Single Phase Auto Transformer–2 Nos
12. Three Phase Auto Transformer –1 No.
13. Single Phase Resistive Loading Bank–2 Nos
14. Three Phase Resistive Loading Bank.–2 Nos

REFERENCES:

1. NagrathI.J and Kothari D.P. 'Electric Machines', Fourth Edition,Tata McGraw Hill Publishing Company Ltd, 2010.
2. M.N.Bandyopadhyay, Electrical Machines Theory and Practice, PHI Learning PVT LTD., New Delhi, 2009.

CO–PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	2	1	1	3	-	3	3	2	2
CO2	2	3	3	2	1	1	3	-	3	3	2	2
CO3	2	3	3	2	1	1	3	-	3	3	2	2
CO4	2	3	3	2	1	1	3	-	3	3	2	2
CO5	2	1	2	1	1	1	3	-	3	3	2	2
AVG	2	3	3	2	1	1	3	-	3	3	2	2

CO-PSO MAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	2	2	1
CO2	3	3	2
CO3	3	3	2
CO4	2	2	1
CO5	3	3	1
AVG	3	3	2

SEMESTER IV

JMA1401	APPLIED PROBABILITY AND NUMERICAL METHODS	L	T	P	C
		2	2	0	3

COURSE OBJECTIVES:

- To provide basic concepts of one dimensional, two random variables, standard probability distributions and testing of hypothesis.
- To introduce numerical techniques for solving system of equations and interpolation problems that arise in engineering applications.
- To acquaint the students with the understanding of numerical differentiation and integration.

UNIT I RANDOM VARIABLES 12

Discrete and continuous random variables–Moments–Moment generating functions–Binomial, Poisson, Exponential and Normal distributions.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTING OF HYPOTHESIS 12

Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means - Tests based on t, Chi-square and F distributions for mean, variance and proportion-Contingency table -Goodness of fit.

UNIT IV SOLUTION OF EQUATIONS AND INTERPOLATION 12

Solution of algebraic and transcendental equations – Fixed point iteration method and Newton Raphson method–Solution of linear system of equations–Direct methods of Gauss elimination and Gauss Jordan – Iterative methods of Gauss-Jacobi and Gauss-Seidel – Interpolation with equal intervals – Newton's forward and backward difference formulae - Interpolation with unequal intervals –Lagrange interpolation and Newton's divided difference interpolation.

UNIT V NUMERICAL DIFFERENTIATION AND INTEGRATION 12

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 and 3/8 rule – Romberg's Method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's rules.

TOTAL (L:45+T:15):60 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1: To understand random variables and use standard distributions in solvings real time problems.

CO2: To use joint density functions to perform correlation and

regression analysis.

CO3 : To apply hypothesis testing for making statistical inferences in large and small sample real life problems

CO4: To demonstrate efficient use of numerical techniques in solving system of equations And interpolation problems.

CO5: To solve problems of differentiation and integration through numerical methods.

TEXTBOOKS:

1. Ibe,O.C.,"Fundamentals of Applied Probability and Random Processes", 1st Indian Reprint, Elsevier, 2007.
2. Johnson,R.A.,Miller,I and FreundJ.,"Miller and Freund‘s Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
3. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
4. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.

REFERENCES:

1. Devore.J.L., "Probability and Statistics for Engineering and the Sciences”, Cengage Learning, New Delhi, 8th Edition, 2014.
2. Spiegel.M.R., Schiller. J.and Srinivasan, R.A.,"Schaum‘s Outline of Theory and Problems of Probability and Statistics", TataMcGraw Hill Edition, 2004.
3. Yates.R.D.and Goodman.D.J., ”Probability and Stochastic Processes", Wiley India Pvt.Ltd., Bangalore, 2nd Edition, 2012.
4. BrianBradie,"A Friendly Introduction to Numerical Analysis", Pearson Education, Asia, NewDelhi, 2007.
5. Gerald.C.F.and Wheatley.P.O., "Applied Numerical Analysis", Pearson Education, Asia, 6th Edition, New Delhi, 2006.
6. Mathews,J.H. "Numerical Methods for Mathematics, Science and Engineering", 2nd Edition, Prentice Hall, 1992.

CO-PO MAPPING:

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

CO-PSO MAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	1	-	-
CO2	-	-	1
CO3	-	1	-
CO4	1	-	-
CO5	1	-	1
AVG	1	1	1

JEE1401	SYNCHRONOUS AND INDUCTION MACHINES	L	T	P	C
		2	2	0	3

COURSE OBJECTIVES:

- To impart knowledge on Construction and performance of salient and non–salient synchronous generator.
- To impart knowledge on Principle of operation and performance of synchronous s motor.
- To impart knowledge on Construction, principle of operation, and performance of three phase induction machine.
- To impart knowledge on starting and speed control of three phase induction motor.
- To impart knowledge on Construction, principle of operation and performance of Single phase induction motor and other special machines.

UNIT I SYNCHRONOUS GENERATOR 12

Constructional details– Types of rotors–winding factors-emf equation–Synchronous reactance – Armature reaction – Phasor diagrams of non-salient pole synchronous generator connected to infinite bus--Synchronizing and parallel operation – Synchronizing torque – Change of excitation and mechanical input-Voltage regulation–EMF,MMF,ZPF and A.S.A methods – steady state power- angle characteristics– Two reaction theory –slip test –short circuit transients – Capability Curves

UNIT II SYNCHRONOUS MOTOR 12

Principle of operation – Torque equation – Operation on infinite bus bars - V and Inverted Vcurves – Power input and power developed equations – Starting methods – Current loci for constant power input, constant excitation and constant power developed-Hunting – natural frequency of oscillations– damper windings-synchronous condenser.

UNIT III THREE PHASE INDUCTION MOTOR 12

Constructional details–Types of rotors–-Principle of operation–Slip–cogging and crawling-Equivalent circuit–Torque-Slip characteristics- Condition for maximum torque–Losses and efficiency–Load test–No load and blocked rotor tests–Circle diagram–Separation of loses –Double cage induction motors–Induction generators –Synchronous induction motor.

UNIT IV STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR 12

Need for starting–Types of starters–DOL, Rotor resistance, Auto transformer and Star-delta starters – Speed control – Voltage control, Frequency control and pole changing – Cascaded connection-V/f control–Slip power recovery scheme-Braking of three phase induction motor: Plugging, dynamic braking and regenerative braking

UNIT V SINGLE PHASE INDUCTION MOTORS AND OTHER SPECIAL MACHINES 12

Constructional details of single phase induction motor – Double field revolving theory and operation – Equivalent circuit – No load and blocked rotor test – Performance analysis– Starting methods of single-phase induction motors – Capacitor-start capacitor run Induction motor-Shaded pole induction motor–Linear induction motor–Introduction to BLDC, PMSM– A C series motor-Servo motors-Stepper motors–introduction to magnetic levitation systems

TOTAL(L:45+T:15):60PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1: To understand the construction and working principle of Synchronous Generator

CO2: To acquire knowledge on Synchronous motor.

CO3: To understand the construction and working principle and performance analysis of Three phase Induction Motor

CO4: To acquire the knowledge in starting and speed control of three phase induction Motor.

CO5: To acquire the knowledge in working principles of single phase induction motor and other special machines.

TEXTBOOKS:

1. A.E .Fitzgerald, Charles Kingsley, Stephen. D.Umans, 'Electric Machinery' McGraw Hill publishing Company Ltd, 7th edition, 2013.
2. Vincent DelToro, 'Basic Electric Machines 'Pearson India Education, 1st Edition, 2016.
3. Stephen J. Chapman, 'Electric Machinery Fundamentals' 5th edition, Mc Graw Hill Education Pvt. Ltd, 2011.

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2. P.S.Bhimbhra, 'Electrical Machinery', Khanna Publishers,7th Edition, 2009.
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4. B.R.Gupta, 'Fundamental of Electric Machines 'New age International Publishers, 3rd Edition , Reprint 2015.
5. Murugesh Kumar, 'Electric Machines', Vikas Publishing House Pvt .Ltd, 2002.
6. Alexander S.Langsdorf, 'Theory of Alternating-Current Machinery', Mc Graw Hill Publications, 2nd edition, 2004

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5. https://youtu.be/NRxo5aDGG8M
6. https://youtu.be/aoSRYJCykhg

CO–POMAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	2	1	1	-	2	1	3
CO2	3	3	2	2	2	2	1	1	-	2	1	3
CO3	3	3	2	2	2	2	1	1	-	2	1	3
CO4	3	3	3	3	2	3	1	1	-	2	2	3
CO5	3	3	3	3	3	3	1	1	-	2	2	3
AVG	3	3	2	2	2	2	1	1	-	2	1	3

CO-PSOMAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	3	3	1
CO2	3	1	1
CO3	3	3	1
CO4	3	2	1
CO5	3	2	1
AVG	3	2	1

JEE1402	LINEAR INTEGRATED CIRCUITS AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn the IC fabrication technology.
- To know the Op-amp characteristics and its basic applications.
- To study the applications of Op-Amp.
- To acquire knowledge on special IC's and learns the theory and applications of PLL.
- To study various application IC's.

UNIT I IC FABRICATION 9

IC classification, fundamental of monolithic IC technology, Basic Planar process: epitaxial growth, masking and etching, diffusion of impurities. Realization of monolithic ICs and packaging. Fabrication of diodes, capacitance, resistance, FETs–3DIC.

UNIT II CHARACTERISTICS OF OPAMP 9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – Inverting and Non-inverting

Amplifiers, summer, differentiator and integrator–V/I & I/V converters – Comparison IC741andLM358.

UNIT III APPLICATIONS OF OPAMP 9

Instrumentation amplifier and its applications, first and second order active filters, comparators, waveform generators, peak detector, S/H circuit, clipper, clamper, D/A converter (R-2R ladder and weighted resistor types), A/D converters using op-amps.

UNIT IV SPECIAL ICs 9

Functional block, characteristics of IC 555 Timer and its PWM application – IC566 voltage controlled oscillator, IC565-phase locked loop, AD633 Analog multiplier ICs–PLL and VCO Applications.

UNIT V APPLICATION ICs 9

IC voltage regulators–LM78XX, LM79XX; Fixed voltage regulators its application as Linear power supply–LM317, 723 Variable voltage regulators, switching regulator-SMPS–ICL8038 function generator IC.

TOTAL:45 PERIODS

COURSE OUTCOMES

At the end of the course, the student will be able

- To demonstrate different steps involved in the process of fabrication of integrated circuit.
- To identify the characteristics and basic applications of Op-Amp.
- To demonstrate the applications of Op-amp.
- To assess knowledge about functional blocks and the applications of special I Cs like Timers, PLL circuits.
- To explain and acquire knowledge on Application IC's.

TEXTBOOKS

1. David A.Bell,'Op-amp & Linear ICs', Oxford, 2013.
2. D.Roy Chaudhary, Sheila B.Jani, 'Linear Integrated Circuits', IIedition, New Age, 2003.
3. Ramadan A.Gayakward,'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003 / PHI. 2000.**:**

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1. B.S. Sonde, "Introduction to System Design using integrated circuits" New age, 2003.
2. AnFiore, "Op amps & Linear Integrated Circuits Concepts & applications", Cengage, 2010.
2. Floyd, Buchla, "Fundamentals of Analog Circuits", Pearson, 2013.
3. Jacob Millman, Christos C. Halkias, 'Integrated Electronics-Analog and Digital circuits system', McGrawHill, 2003.
4. Robert F.Coughlin, Fredrick F.Driscoll, 'Op-amp and Linear ICs', Pearson, 6thedition, 2012.
5. Sergio Franco, 'Design with Operational Amplifiers and Analog Integrated Circuits', Mc Graw Hill, 2016.
6. Muhammad H. Rashid, 'Micro electronic Circuits Analysis and Design' Cengage Learning, 2011.
7. Katsuyuki Sakuma, "3 D Integration in VLSI Circuits: Implementation technologies and Applications", CRC Press Tailor & Francis group 2018.
8. Hank Zumvahlel "Linear Circuit Design Hand book", Newness publications, 2008

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1.www.nptel.ac.in
2.https://www.youtube.com/watch?reload=9&v=35jWSQXku74
3.https://www.youtube.com/watch?v=kiiA6WTCQn0
4.https://www.youtube.com/watch?v=nqk714QpRos
5.https://www.youtube.com/watch?v=WkI7uYLRbwQ
6..https://www.youtube.com/watch?v=VfxKL4376_8

CO-PO MAPPING

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	2	1	2	-	1	-	1	3
CO2	3	2	1	2	2	1	2	-	1	-	2	3
CO3	3	2	1	2	2	1	2	-	1	-	2	3
CO4	3	2	2	2	2	1	2	-	1	-	2	2
CO5	3	2	2	2	2	1	2	-	1	-	2	2
AVG	3	2	1	2	2	1	2	-	1	-	2	3

CO-PSO MAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	2	-	1
CO2	1	2	2
CO3	1	1	2
CO4	1	-	2
CO5	1	2	1
AVG	1	1	2

JEE1403	TRANSMISSION, DISTRIBUTION AND PROTECTION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To study the structure, transmission line parameters and equivalent circuits of the transmission lines
- To understand the mechanical design of transmission lines, insulator, cabilitys and insulator strings.
- To study about distribution systems, types of substations, methods of grounding EHVAC, HVDC and FACTS.
- To provide knowledge on different types of Circuit Breakers and Relays
- To impart knowledge on equipment protection

UNIT I POWER TRANSMISSION 9

Transmission Line Parameters-Structure of Power System –Parameters of single and three phase transmission lines with single and double circuits-Resistance, inductance and capacitance of solid, stranded and bundled conductors, Symmetrical and unsymmetrical spacing and transposition

Modelling of Transmission Lines- Performance of Transmission lines - short line, medium line and long line – equivalent circuits, phasor diagram, attenuation constant, phase constant, surge impedance-transmission efficiency and voltage regulation

UNIT II OVERHEAD TRANSMISSION AND UNDER GROUND TRANSMISSION 9

Mechanical design of OH lines–Line Supports–Stress and Sag Calculation-Effects of Wind and Ice loading. Insulators: Types, voltage distribution in insulator string, improvement of string efficiency. Underground cabilitys – Construction of single core and 3 core Cabilitys - Insulation Resistance – Potential Gradient - Capacitance of Single-core and 3 core cabilitys-Grading of cabilitys

UNIT III DISTRIBUTION SYSTEMS 9

Distribution Systems–General Aspects–Kelvin's Law–AC and DC distributions-Techniques of Voltage Control and Power factor improvement–Types of Substations –Importance of earthing in substation-Methods of Grounding–Trends in Transmission and Distribution: EHVAC, HVDC and FACTS (Qualitative treatment only).

UNIT IV NEED FOR POWER SYSTEM PROTECTION 9

Protective Relays- Electro mechanical Relays- Static Relays- Comparison and duality of Amplitude and Phase comparators. Static over current, Differential Relay-Principle and Block diagram only, Microprocessor Based Relay-Block diagram and flow chart of over current Relay, Numerical Relay (Basics Only) Circuit breakers – principle of operation-formation of arc-Arc quenching theory, Restriking Voltage-Recovery voltage, RRRV. Interruption of Capacitive currents and current chopping ,Types of Circuit Breakers: Air blast CB– Oil CB– SF6 CB.

UNIT V PROTECTION OF EQUIPMENTS 9

Protection of alternator-Stator inter turn, Earth fault Protection and Differential protection, Protection of transformers-Percentage Differential Protection-Buchholz Relay. Protection of transmission lines-Differential Protection-carrier current protection

TOTAL:45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1: To understand the importance and the functioning of transmission line parameters and Also familiar with the modeling of transmission line
CO2: To acquire knowledge on Insulator and Underground Cabilitys
CO3: To understand the importance of distribution of the electric power in power system.
CO4: To acquire knowledge on different types of Circuit Breakers and Relays
CO5: To acquire knowledge on protection of equipment's

TEXTBOOKS:

1. D.P.Kothari, I.J.Nagarath,'Power System Engineering', Tata McGraw-Hill Publishing Company limited, NewDelhi, Second Edition, 2008.
2. C.L.Wadhwa, 'Electrical Power Systems',New Age International, Seventh Edition2017.
3. V.K.Mehta , Rohit Mehta, 'Principles of power system', S.Chand & Company Ltd, New Delhi, 3rd Edition, 2013
4. Sunil S.Rao, 'Switch gear and Protection', Khanna Publishers, New Delhi, 11th Edition reprint 3rd Edition,, 2008.
5. B.Rabindranath and M.Chander, 'Power System Protection and Switch gear', New Age International Pvt Ltd., Second Edition 2012.

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1. B.R.Gupta,'Power System Analysis and Design', S.Chand Publishing, New Delhi, Fifth Edition, 2008.
2. Luces M.Fualkenberry, Walter Coffer, 'Electrical Power Distribution and Transmission' ,Pearson Education, 2007.
3. J.Brian, Hardy and Colin R.Bayliss 'Transmission and Distribution in Electrical Engineering', Newnes; Fourth Edition, 2012.
4. BadriRam,B.H.Vishwakarma,'Power System Protection and Switchgear', TMH Publication Second Edition 2011.
5. Y.G.Paithankar and S.R.Bhide, 'Fundamentals of power system protection', Second Edition, Prentice Hall of India Pvt.Ltd., New Delhi, 2010.

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2. https://youtu.be/UeaTgT2p-WI
3. https://youtu.be/MOlOLLxenfg
4. https://youtu.be/zZ4li_nzyOk
5. https://youtu.be/K1klGNZYLdc
6. https://youtu.be/TsDHce-k8d4

CO-PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	2	1	1	2	-	1	2
CO2	3	3	2	3	2	2	1	1	2	-	1	2
CO3	3	3	2	2	2	2	1	1	2	-	1	2
CO4	2	2	3	3	2	3	2	1	2	1	1	2
CO5	2	2	3	3	2	3	2	1	2	1	1	2
AVG	3	3	2	3	2	2	1	1	2	1	1	2

CO-PSO MAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	2	1	1
CO2	3	3	2
CO3	3	3	3
CO4	2	1	1
CO5	3	3	3
AVG	3	2	2

JPT1001	SOFT SKILLS AND APTITUDE II	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To help students learn various forms of writing and develop content
- To help students acquire time and stress management skills
- To facilitate students to gain required knowledge to understand practical concept sin aptitude
- To develop the thinking and analytical skills of students
- To gain knowledge in concepts of C programming language

UNIT I SOFT SKILLS AND APTITUDE - III 5

Communication–on Specific topics–both or a land written–Content development–various forms of writing and specific writing–Brain storming–Individual–Concept focusing–Public Speaking– Analytical writing.

UNIT II SOFT SKILLS AND APTITUDE-IV 5

Importance of Time–Time Management techniques–The art of prioritizing and scheduling–Stress – Positive and Negative Stress - Stress Management techniques – Concept of Goal setting–Importance of Goals – Dream vs Goal–Reasons for failure of Goals–SMART.

UNIT III QUANTITATIVE APTITUDE 6

Ratio and Proportions–Allegations and Mixtures–Problem on Ages–Profit and Loss and Discount

UNIT IV LOGICAL REASONING 6

Odd man out series–Blood Relation–Seating Arrangement –Number Ranking

UNIT V TECHNICAL APTITUDE INC-II 8

Strings-Storage Classes–Pointers–Preprocess or directives-Structures–Union. Typed ef– Input / Output – File I/O - Header Files – Type casting – Error handling – Command Line Arguments– Variable Arguments– Memory Management –Bit wise operators.

TOTAL:30 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1: Develop different types of content using the skills learnt
CO2: Manage time and stress competently
CO3: Find answers to real time application problems
CO4: Use logical reasoning skills to solve problems differently
CO5: Apply C programming concepts for coding

TEXT BOOKS:

1. R.SAgrawal, “Quantitative Aptitude”.
2. R.S.Agrawal, “Verba Reasoning”.
3. R.S.Agrawal “NonVerbal reasoning.
4. Pradip Dey, Manas Ghosh,“Fundamentals of Computing and Programming in C”, First Edition, Oxford University Press, 2009
5. Yashavant P.Kanetkar. “Let Us C”, BPB Publications, 2011.

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2. https://m4maths.com/placement-puzzles.php
3. www.freshersworld.com
4. https://www.youtube.com›watch>problemsonages
5. https://www.youtube.com›watch>bloodrelation
6. https://www.youtube.com›watch>content
7. https://www.youtube.com›watch>SMART
8. https://www.youtube.com›watch>stringsinC

CO-PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	-	3	-	-	1	2	2	3
CO2	3	3	1	1	-	3	-	-	1	2	2	3
CO3	3	3	1	1	-	3	-	-	1	2	2	3
CO4	3	3	1	1	-	3	-	-	1	2	2	3
CO5	3	3	1	1	-	3	-	-	1	2	2	3
AVG	3	3	1	1	-	3	-	-	1	2	2	3

CO-PSO MAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	-	2	-
CO2	-	2	-
CO3	-	2	-
CO4	-	2	-
CO5	-	2	-
AVG	-	2	-

JEE1411	SYNCHRONOUS AND INDUCTION MACHINES LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To understand the concept of alternators
- To prepare the students to have a basic knowledge of single phase induction motors
- To prepare the students to have a basic knowledge of three phase induction motors
- Acquire knowledge about equivalent circuits of machines.
- Acquire knowledge about brushless DC motor.

LIST OF EXPERIMENTS:

1. Regulation of three phase alternator by EMF, MMF, ZPF, ASA methods
2. Regulation of three phase salient pole alternator by slip test
3. V and Inverted V curves of Three Phase Synchronous Motor
4. Load test on three-phase induction motor
5. No load and blocked rotor test on three-phase induction motor (Determination of equivalent circuit parameters)
6. Separation of No-load losses of three-phase induction motor
7. Load test on single-phase induction motor
8. No load and blocked rotor test on single-phase induction motor
9. Load test on BLDC Motor
10. Study of Induction motor Starters
11. Simulation of four quadrant operation of 3 phase induction motor using MATLAB

TOTAL: 60PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able

- Ability to analyze the regulation of synchronous machines
- Ability to analyze the performance and characteristics of Synchronous Motor
- Ability to analyze characteristics of single phase induction machines.
- Ability to analyze characteristics of three phase induction n machines.
- Ability to analyze characteristics of brushless DC motor.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Synchronous Induction motor 3HP – 1 No.
2. DC Shunt Motor Coupled With Three phase Alternator–4 Nos
3. DC Shunt Motor Coupled With Three phase Slip ring Induction motor–1No.
4. Three Phase Induction Motor with Loading Arrangement–2 Nos
5. Single Phase Induction Motor with Loading Arrangement–2 Nos
6. Brushless DC Motor with Loading Arrangement–1.No
7. Tachometer-Digital/Analog–8 Nos
8. Single Phase Auto Transformer – 2 Nos
9. Three Phase Auto Transformer –3 Nos
10. Single Phase Resistive Loading Bank–2 Nos
11. Three Phase Resistive Loading Bank–2 Nos
12. Capacitor Bank –1 No.

REFERENCES:

1. Nagrath I. J and Kothari D. P. 'Electric Machines', Fourth Edition, Tata McGraw Hill Publishing Company Ltd, 2010.
2. M.N.Bandyopadhyay, Electrical Machines Theory and Practice, PHI Learning PVT LTD., New Delhi, 2009

CO–PO MAPPING:

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

CO-PSO MAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	2	2	1
CO2	3	3	2
CO3	3	3	2
CO4	2	2	1
CO5	3	3	1
AVG	3	3	1

JEE1412	LINEAR AND DIGITAL INTEGRATED CIRCUITS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To learn the basic concepts of analog and digital ICs
- To familiarize the characteristics of various analog circuits.
- To realize the digital circuits using logic gates
- To impart working practice in EDA tools

LIST OF EXPERIMENTS:

1. Experiment using Basic op-amp circuits (Inverting, Non-Inverting and Adder).
2. Design of Integrators and Differentiators.
3. Simulation and Experimental verification of Comparators using 741.
4. Simulation and experimental verification of Astable and Mono stable multivibrator in IC555 timer.
5. Study of VCO and PLL ICs:
   i. Voltage to frequency characteristics of NE/SE566 IC.
   ii. Frequency Multiplication using NE/SE 565 PLLIC.
6. Verification of Logic gates and Implementation of Boolean Functions
7. Verification of Adder and Sub tractor circuits.
8. Code converters: Excess-3 to BCD and Binary to Gray code converter and vice-versa
9. Parity generator and parity checker
10. Encoders and Decoders
11. Design and implementation of 3-bit modulo counters.
12. Verification of multiplexer and demultiplexer
13. Coding of combinational/sequential circuits using HDL.

TOTAL:60 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1 To design and analyze linear and digital electronic circuits.
CO2 To explain the EDA tools

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

(3 per Batch)

S.No	Name of the equipments/Components	Quantity Required	Remarks
1	Dual, (0-30V) variability Power Supply	10	-
2	CRO	9	30MHz
3	Digital Multimeter	10	Digital
4	Function Generator	8	1MHz
5	IC Tester (Analog)	2	
6	Bread board	10	
7	Computer (PSPICE installed)	1	

CONSUMABILITYS (SUFFICIENT QUANTITY)

1 IC741/ ICNE555/566/565

2 Digital IC types
3 LED
4 LM317
5 LM723
6 ICSG3524/SG3525
7 Transistor–2N3391
8 Diodes, IN4001,BY126
9 Zener diodes
10 Potentiometer
11 Step-down transformer 230V/12-0-12V
12 Capacitor
13 Resistors1/4Watt Assorted
14 Single Strand Wire

REFERENCES:

1. Floyd, Buchla,"Fundamentals of Analog Circuits, Pearson, 2013.
2. Jacob Millman, Christos C. Halkias, 'Integrated Electronics– Analog and Digital circuits system', McGrawHill, 2003.
3. Robert F.Coughlin, Fredrick F.Driscoll, 'Op amp and Linear Ics', Pearson, 6th edition, 2012.
4. Sergio Franco, 'Design with Operational Amplifiers and Analog Integrated Circuits', McGraw Hill, 2016.
5. Muhammad H. Rashid,' Microelectronic Circuits Analysis and Design'Cengage Learning, 2011.

WEBSITES:

www.slideshare.net
www.epfl.ch›labs ›iclab

CO–PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	2	2	-	1	1	1	3
CO2	3	3	2	2	1	2	1	-	1	1	2	3
AVG	3	3	2	2	1	2	2	-	1	1	2	3

CO-PSO MAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	1	2	1
CO2	1	2	2
AVG	1	2	2

SEMESTER V

JEE1501	MICRO PROCESSORS AND MICRO CONTROLLERS (INTEGRATED)	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To impart knowledge on architecture and interrupt structure of µP 8085
- To impart knowledge on addressing modes and ALP of 8085
- To study the architecture and programming of 8051 micro controller.
- To acquire knowledge about the features and functionalities of the peripheral devic and interfacing
- To understand the concepts of developing micro controller based systems for vario applications.

UNIT I THE 8085 MICROPROCESSOR 6

Hardware Architecture – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts–Timing Diagram–Interrupts.

UNIT II PROGRAMMING OF 8085 PROCESSOR 6

Instruction -format and addressing modes – Assembly language format – Data transfer, data manipulation & control instructions–Programming: Loop structure with counting & Indexing–Sub routine instructions–stack- Introduction to16-bitmicroprocessor.

UNIT III 8051 MICRO CONTROLLERS 6

Architecture of 8051 – Special Function Registers (SFRs)- Interrupts –Timer and counter – Instruction set-Addressing modes-Simple assembly language programming

UNIT IV PERIPHERAL INTERFACING 6

Programmable Peripheral Interface (8255) -Keyboard/Display Controller (8279)- Programmable Timer/ Counter (8254) - Programmable Interrupt Controller (8259) – DMA Controller(8257)-Serial Communication Interface (8251)

UNIT V MICRO CONTROLLER PROGRAMMING AND APPLICATIONS 6

Simple programming exercises- key board and display interface –Control of servo motor-stepper motor control-Traffic Light control - ADC/DAC & Sensor Interfacing – Wave form generation.

(TOTAL: 30 PERIODS)

LIST OF EXPERIMENTS:

8085 PROGRAMS USING KITS

- Basic arithmetic and Logical operations

- Move a data block
- Programming with control instructions:
  (i) Ascending/Descending order, Maximum /Minimum of numbers.
  (ii) Programs using Rotate instructions.
  (iii) Code conversion, decimal arithmetic and matrix operations.
  (iv) Floating point operations, string manipulations, sorting and searching

8051 EXPERIMENTS USING KITS

- Basic arithmetic and logical operations
- Conditional jumps & looping
- Code conversion & calling subroutines

PERIPHERALS AND INTERFACING

- Traffic light control
- Stepper motor control
- Key board and Display
- Serial interface and Parallel interface
- A/D and D/A interface and Waveform Generation

8086 DEMONSTRATION USING SOFTWARE PACKAGE

(30 PERIODS)

(TOTAL -60 PERIODS)

OUTCOMES:

At the end of the course, the student should be able:

CO1: To understand about the architecture of 8085 microprocessor.
CO2: To acquire knowledge in addressing modes & instruction set of 8085 and write the assembly language programme.
CO3: To realize the architecture and programming of 8051micro controller.
CO4: To gain knowledge about the features and functionalities of the peripheral devices and interfacing
CO5: To understand the concepts of developing micro controller based systems for various applications.

TEXTBOOKS:

1. Sunil Mathur & Jeebananda Panda, "Micro processor and Micro controllers", PHI Learning Pvt.Ltd, 2016.
2. R.S. Gaonkar, 'Micro processor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013.
3. KrishnaKant, "Micro processor and Micro controllers, Architecture, Programming and System Design 8085, 8086, 8051", Second Edition, PHI Learning Private Limited, 2014.
4. Mohamed Ali Mazidi, Janice GillispieMazidi, RolinMcKinlay, "The 8051 Micro controller and Embedded Systems: Using Assembly and C", Second Edition, Pearson education, 2011.
5. Rajkamal, "Micro controllers - Architecture, Programming, Interfacing and System design, 2nd edition, Pearson, 2012.

REFERENCE BOOKS:

1. KrishnaKant, "Micro processor and Micro controllers", Eastern Company Edition, Prentice Hall of India, New Delhi, 2007.

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3. Doughlas V. Hall, "Micro processors and Interfacing, Programming and Hardware", TMH, 2016.
4. Kenneth J Ayala "The 8051 Microcontroller, Architecture, Programming and Applications "2nd edition Penram International Publishing, 1996.
5. Muhammad H.Rashid, "The 8051 Micro controller and Embedded Systems, Volume 1 "Prentice Hall, 2000.
6. Barry B Brey, "The Intel Microprocessor Architecture Programming and Interfacing", Pearson Education, 4th Edition, 2006.
7. Soumitra Kumar Mandal, Micro processor & Micro controller Architecture, Programming & Interfacing using 8085, 8086, 8051, McGraw Hill Edu, 2013.

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3. http://www.digimat.in/nptel/courses/video/108105102/L31.html
4. https://youtu.be/myw7ycAgJYM
5. https://nptel.ac.in/courses/108107029/6.
6. https://www.iitk.ac.in/new/microprocessor-and-microcontroller laboratory
7. http://209.211.220.205/vlabiitece/mi/labsMI.php

LIST OF EQUIPMENT FORA BATCH OF 30 STUDENTS:

SL.NO	DESCRIPTION OF EQUIPMENT	QUANTITY REQUIRED
1.	8085 Micro processor Trainer with Power Supply	15
2.	8051Micro Controller Trainer Kit with power supply	15
3.	8255 Interface boards	5
4.	8251 Interface boards	5
5.	8259 Interface boards	5
6.	8279Keyboard/Display Interface boards	5
7.	8254timer/counters	5
8.	ADC and DAC cards	5
9.	AC & DC motor with Controller s	5
10.	Traffic Light Control Systems	5

CO-PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	2	1	-	-	-	-	-	-	1
CO2	3	-	-	2	1	-	-	-	-	-	-	1
CO3	3	-	-	2	1	-	-	-	-	-	-	1
CO4	3	-	-	2	1	-	-	-	-	-	-	1
CO5	3	-	-	2	1	-	-	-	-	-	-	1
AVG	3	-	-	2	1	-	-	-	-	-	-	1

CO-PSO MAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	2	1	1
CO3	2	1	1
CO4	2	1	1
CO5	2	1	1
AVG	2	1	1

JEE1502	CONTROL AND INSTRUMENTATION	L	T	P	C
		2	2	0	3

COURSE OBJECTIVES:

- To provides an overview about the methods of representation of systems and to derive their transfer function models.
- To provide adequate knowledge in the time response of systems.
- To accord basic knowledge in obtaining the frequency responses of systems.
- To impart knowledge on basic functional elements of instrumentation and display devices
- To study about various measurement techniques and transducers

UNIT I SYSTEMS AND REPRESENTATION 12

Basic elements in control systems:–Open and closed loop systems–Electrical analogy of mechanical and thermal systems – Transfer function – AC and DC servomotors – Block diagram reduction techniques– Signal flow graphs.

UNIT II TIME RESPONSE 12

Time response: – Time domain specifications – Types of test input – I and II order system response–Error coefficients–Generalized error series–Steady state error–Root locus construction– Effects of P, PI, PID modes of feedback control–Time response analysis

UNIT III FREQUENCY RESPONSE AND STABILITY 12

Frequency response: – Bode plot – Polar plot – Determination of closed loop response from open loop response-Correlation between frequency domain and time domain specifications. Characteristics equation–Routh Hurwitz criterion–Nyquist stability criterion-Lag, lead and lag-lead compensation techniques

UNIT IV ELECTRICAL AND ELECTRONIC INSTRUMENTS, DISPLAY DEVICES 12

Functional elements of an instrument – Principle and types of analog and digital voltmeters, ammeters – Principle and types of multi meters – Single and three phase watt meters and energy meters–Instruments for measurement of frequency and phase-CRT display, digital CRO, LED, LCD

UNIT V COMPARATIVE METHODS OF MEASUREMENTS AND TRANSDUCERS 12

D.C potentiometers, D.C bridges – Wheatstone, Kelvin and Kelvin Double bridge - A.C bridges -Maxwell, Anderson and Schering bridges - self-balancing bridges. Classification of transducers –Selection of transducers – Resistive, capacitive and inductive Transducers – Piezoelectric, Hall effect, optical and digital transducers.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1: To acquire knowledge on systems and their representation
CO2: To gain knowledge about time domain response of the system
CO3: To understand the knowledge of frequency response of the system
CO4: To acquire knowledge on basic functional elements and fundamentals of instrumentation and display devices
CO5: To understand various measurements techniques and concepts of transducers

TEXTBOOKS:

1. Nagarath,I.J. and GopalM.,"Control Systems Engineering", Fifth Edition, New Age International Publishers, 2017.
2. GopalM, "Control System: Principle and design", Fourth Edition, McGraw Hill Education, 2012.
3. Sawhney A.K.,"A Course in Electrical & Electronic Measurements & Instrumentation", Seventh Edition, Dhanpat Rai and Co.,2015.
4. GuptaJ.B, "A Course in Electronic and Electrical Measurements", S.K.Kataria & Sons, Delhi, 2013

REFERENCE BOOKS:

1. Katsuhiko Ogata,"Modern Control Engineering",Fifth Edition, Pearson, 2009.
2. Richard C. Dorf and Bishop R.H., "Modern Control Systems", Twelfth Edition, Pearson,2010.
3. JohnJ.D.,Azzo Constantine and Houpis Sttuart,"Linear Control System Analysis and Design with MATLAB", 6th Edition, CRC Press ,Taylor & Francis Group.
4. Rames C .Panda and Thyagarajan T. "An Introduction to Process Modelling Identification and Control of Engineers", Narosa Publishing House, 2017.
5. Gopal M.,"Control System: Principle and design", Third Edition, McGraw Hill Education, 2012.
6. KalsiH.S.,"Electronic Instrumentation", III Edition, McGrawHill, 2017.
7. Murthy D.V.S. 'Transducers and Instrumentation', Second Edition, Prentice Hall of India Pvt Ltd, 2015.
8. David Bell, "Electronic Instrumentation & Measurements", Third Edition, Oxford University Press, 2013.

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3. https://ocw.mit.edu/resources/res-6-010-electronic-feedback-systems-spring-2013/course-videos/lecture-7-stability-via-frequency-response/
4. https://nptel.ac.in/courses/108/105/108105153/
5. https://www.youtube.com/watch?v=3c_uDCnnBXc
6. https://www.youtube.com/watch?v=I5k66ESHJHM

CO-PO MAPPING:

CO\PO	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO1	3	3	3	2	1	1	2	1	2	2	1	2
CO2	3	3	3	2	1	1	2	1	2	2	1	2
CO3	3	3	3	2	1	1	2	1	2	2	1	2
CO4	2	2	2	2	1	2	3	3	3	2	3	-
CO5	1	-	1	-	1	2	3	3	3	2	2	-
AVG	2	2	2	2	1	1	2	2	2	2	2	1

CO-PSO MAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	2	1	1
CO5	2	1	1
AVG	2	2	2

JEE1503	POWER ELECTRONICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To impart knowledge on various power semiconductor devices and their switching
- To study the operation, characteristics and performance parameters of controlled rectifiers
- To learn the operation, switching techniques and basics topologies of DC-DC switching regulators.
- To impart knowledge on different modulation techniques of pulse width modulated inverters,
- To study the operation of AC voltage controller and cycloconverters.

UNIT I POWER SEMI-CONDUCTOR DEVICES 9

Study of switching devices, SCR, TRIAC, GTO, BJT, MOSFET, IGBT and IGCT-Static characteristics: SCR, MOSFET and IGBT–Features of silicon carbide and gallium nitride devices –Triggering and commutation circuit for SCR- Introduction to Driver and snubber circuits.

UNIT II PHASE-CONTROLLED CONVERTERS 9

2-pulse,3-pulse and 6-pulse converters–performance parameters–Effect of source and load inductance—Firing Schemes for converter–Dual converters, Applications-light dimmer, Excitation system, Solar P V systems

UNIT III DC-DC CONVERTERS 9

Step-down and step-up chopper-control strategy– Introduction to types of choppers-A, B, C, D and E- Switched mode regulators-Buck, Boost, Buck-Boost regulator–Introduction to SEPIC, Fly back converters, Applications-Battery operated vehicles

UNIT IV INVERTERS 9

Single phase and three phase voltage source inverters (both 120 and 180 degree mode)-Voltage and harmonic control –PWM techniques: Multiple PWM, Sinusoidal PWM, modified sinusoidal PWM – Introduction to space vector modulation –Design on Inverters-Current source inverter, Applications-Induction heating, Design of UPS

UNIT V AC-AC CONVERTERS 9

Phase control, Integral cycle control-Single phase AC voltage controllers–Control strategy-Power Factor Control–Multi stage sequence control-single phase and three phase cycloconverters – Introduction to Single phase Matrix converters, Applications–welding.

TOTAL:45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1: To identify different types of power semiconductor devices and their switching Characteristics

CO2: To explain the operation, characteristics and performance parameters of controlled Rectifiers

CO3: To analyze the operation, switching techniques and basics topologies of DC-DC Switching regulators.

CO4: To explain different modulation techniques of pulse width modulated inverters.

CO5: To review the operation of AC voltage controller and cyclo converters

TEXTBOOKS:

1. Muhammad H.Rashid, “Power Electronics: Circuits, Devices and Applications”, Third Edition, Pearson Education, New Delhi, 2013.
2. Bimbra P.S.“Power Electronics”, Fifth Edition, Khanna Publishers, 2014

REFERENCE BOOKS:

1. Joseph Vithayathil, 'Power Electronics, Principles and Applications', 6th Reprint, McGraw Hill Series, 2013.
2. PhilipT.Krein, "Elements of Power Electronics" Oxford University Press, 2017 Edition.
3. Uman and L., "Power Electronics Essentials and Applications", Wiley, 2015.
4. Ned Mohan, Tore.M.Undel and William.P.Robbins, 'Power Electronics: Converters, Applications and Design', third edition, John Wiley and sons, 2009.
5. S.Rama Reddy, 'Fundamentals of Power Electronics', Narosa Publications, 2014.
6. Singh M.D. and Khan chandani K.B., "Power Electronics," second edition, McGraw Hill India, 2013.
7. Agarwal JP, "Power Electronic Systems: Theory and Design "First Edition , Pearson Education, 2002

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1. www.nptel.com
2. https://www.youtube.com/watch?v=fOZ8bUrFJGk
3. https://www.youtube.com/watch?v=P0MK7sWfs9k
4. https://www.youtube.com/watch?v=7CReXeMAXHA
5. https://www.youtube.com/watch?v=tMFFmmw3LTg

CO-PO MAPPING:

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

CO-PSO MAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	3	3	2
CO2	3	3	2
CO3	3	3	2
CO4	3	3	2
CO5	3	3	2
AVG	3	3	2

JNC1361	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

- To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.

UNIT I INTRODUCTION TO TRADITIONAL KNOWLEDGE 6

Define traditional knowledge (TK), nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal Knowledge

UNIT II PROTECTION OF TRADITIONAL KNOWLEDGE 6

The need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

UNIT III LEGAL FRAME WORK AND TK 6

A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act);
B: The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indicators act 2003.

UNIT IV TRADITIONAL KNOWLEDGE AND INTELLECTUAL PROPERTY 6

Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FOR A for increasing protection of Indian Traditional Knowledge.

UNIT V TRADITIONAL KNOWLEDGE IN DIFFERENT SECTORS 6

Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1: To Understand the concept of Traditional knowledge and its importance
CO2: To Know the need and importance of protecting traditional knowledge.
CO3: To Know the various enactments related to the protection of traditional knowledge.
CO4: To Understand the concepts of Intellectual property to protect the traditional knowledge.
CO5: To Know the applications of traditional knowledge in various fields.

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. Traditional Knowledge System in India by Amit Jha , Atlantic publishers, 2002 "Knowledge Traditions and Practices of India" Kapil Kapoor, Michel Danino

WEBSITE REFERENCES:

- https://www.youtube.com/watch?v=LZP1StpYEPM
- http://nptel.ac.in/courses/121106003/

CO-PO MAPPING

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	1	1	1	1	1	-	-	-	-	-
CO2	-	-	1	1	1	1	1	-	-	-	-	-
CO3	-	-	1	1	1	1	1	-	-	-	-	-
CO4	-	-	1	1	1	1	1	-	-	-	-	-
CO5	-	-	1	1	1	1	1	-	-	-	-	-
AVG	-	-	1	1	1	1	1	-	-	-	-	-

CO-PSO MAPPING

CO\PSO	PSO1	PSO2	PSO3
CO1	1	1	1
CO2	1	-	1
CO3	1	1	-
CO4	-	1	1
CO5	1	1	-
AVG	1	1	1

JHS1511	PROFESSIONAL COMMUNICATION	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To enable students to acquire a specialized knowledge of the essential professional skills
- To train them to make effective presentations on a variety of topics
- To help them participate in group discussions displaying team work skills

- To build their confidence and help them attend interviews winningly
- To groom them to become successful professionals

UNIT I EXPOSURE TO PROFESSIONAL SKILLS 6

Introduction to Skills: hard skills and soft skills – communication skills – interpersonal skills – employability and career skills – planning and prioritizing work – time management – stress management– emotional intelligence –SWOT analysis

UNIT II P REPARING AND PRESENTING INSPIRING TALKS 6

Key elements of effective presentation – non verbal communication – impressive self-introduction and short individual presentation – preparing outline – structuring and 93rganizing content –presenting– introducing topic –developing points– concluding– answering questions

UNIT III MEASURES TO CRACK GROUP DISCUSSION 6

Group discussion skills – team building – using key strategies – etiquette – content preparation –brain storming – out of box thinking – mind mapping – turn taking and turn giving – speaking persuasively– questioning and clarifying

UNIT IV INTERVIEW SKILLS TO GET HIRED 6

Interview skills – etiquette – body language – confidence – preparedness – types of interview – Frequently Asked Questions (FAQs)–mock interview– job application and resume writing

UNITV LANGUAGE SKILLS AND CAREER MAPPING 6

Listening skills–understanding different accents–reading skills–verbal ability–email writing – professional grooming –leadership qualities – fundamentals of entrepreneurship–career planning–goal setting–future challenges

TOTAL:30 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1: To have sufficient knowledge of the skills required for professional development
CO2: To give formal and effective presentations
CO3: To participate actively in group discussions
CO4: To attend job interviews and answer questions confidently and effortlessly
CO5: To emerge as professionals ready for placement

RECOMMENDED SOFTWARE:

1. Globe arena
2. Win English

TEXTBOOK:

Inter act English Lab Manual for Undergraduate Students, 2016, Hyderabad: Orient Black Swan.

REFERENCE BOOKS:

1. Alex .K, 2019,Soft Skills: Know Yourself and Know the World, New Delhi: S.Chand & Company Limited.
2. Butter field, Jeff, 2015, Soft Skills for Everyone. New Delhi: Cengage Learning.
3. Kumar, Suresh Eetal, 2015, Communication for Professional Success, Hyderabad: Orient Black Swan.
4. Mitra, Barun K, 2016, Personality Development and Soft Skills, New Delhi : Oxford University Press.
5. Raman, Meenakshi and Sangeeta Sharma, 2014, Professional Communication, Oxford: Oxford University Press.
6. Rizvi, Ashraf, M, 2018, Effective Technical Communication, Chennai: McGraw-Hill Education.

WEBSITE REFERENCES:

- https://www.britishcouncil.in/english/online/resources-websites/moocs
- https://alison.com/courses/communications
- https://in.topresume.com/career-advice/15-free-resources-to-improve-your-presentation-and-speaking-skills
- http://www.washington.edu/doit/TeamN/present_tips.html
- https://www.softwaretestinghelp.com/how-to-crack-the-gd/
- http://www.oxforddictionaries.com/words/writing-job-applications
- http://www.mindtools.com/pages/article/newCDV_34.htm
- https://myinterviewpractice.com/

CO-PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	-	3	3	3	1	2
CO2	-	-	-	-	2	-	-	1	-	3	-	-
CO3	-	-	-	-	-	-	-	3	3	3	-	-
CO4	-	-	-	-	-	-	-	3	2	3	-	2
CO5	-	-	-	-	-	-	-	2	3	-	2	2
AVG	-	-	-	-	1	1	-	2	2	3	1	1

CO-PSO MAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	1	-	-
CO2	-	-	-
CO3	3	-	-
CO4	2	-	-
CO5	3	-	-
AVG	2	-	-

JEE1512	CONTROL AND INSTRUMENTATION LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To impart knowledge on analysis and design of control systems
- To accord an adequate e knowledge and expertise to handle the instruments in industry

LIST OF EXPERIMENTS:

CONTROL SYSTEMS:

1. P,PI and PID controllers
2. Stability Analysis
3. Design of Lag, Lead and Lag-Lead Compensators
4. Position Control Systems
5. Synchro-Transmitter-Receiver and Characteristics
6. Simulation of Control Systems by Mathematical development tools.

INSTRUMENTATION:

7. AC Bridges
8. DC Bridges
9. Dynamics of Sensors/Transducers (a) Temperature (b) pressure (c) Displacement (d) Optical (e) Strain (f)Flow
10. Power and Energy Measurement
11. Signal Conditioning (a) Instrumentation Amplifier (b) Analog – Digital and Digital – Analog converters (ADC and DACs)
12. Simulation study of bridges and transducers

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course, the student will be able

CO1: To experimentally measure the controller parameters and design compensators
CO2: To measure and analyze basic bridge networks.
CO3: To assess the basics of signal conditioning circuits and simulation package.
CO4: To analyze working of various transducers.
CO5: To assess simulation package and simulate basic circuits.

WEBSITE REFERENCES:

1. https://www.vlab.co.in/broad-area-electrical-engineering
2. http://sl-coep.vlabs.ac.in/List%20of%20experiments.html
3. http://sl-coep.vlabs.ac.in/StrainGuage/strainguage.htm
4. https://nationalmaglab.org/education/magnet-academy/watch-play/interactive/wheatstone- bridge
5. http://vlabs.iitkgp.ernet.in/asnm/exp11/index.html
6. http://vlabs.iitkgp.ernet.in/asnm/exp21/index.html
7. http://vlabs.iitkgp.ernet.in/asnm/exp7/js-simulator/power_web.html
8. http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/electronerds/experiments/instrumentation-amplifier-pvg/simulation.html
9. http://vlabs.iitkgp.ernet.in/asnm/#

10. http://sl-coep.vlabs.ac.in/LinearVariableDifferntialTransformer/Simulator.html?domain=Electrical%2 0Engineering&lab=Sensor%20Lab

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS: CONTROL SYSTEMS:

1. PID controller simulation and learner kit–1 No.
2. Digital storage Oscillo scope for capturing transience-1 No
3. Personal Computer with control system simulation packages-5 Nos
4. CRO30MHz– 1 No.
5. 2MHz Function Generator –1 No.
6. Position Control Systems Kit (with manual)–1No.,Tacho Generator Coupling set
7. AC Synchro transmitter & receiver –1 No.
8. Sufficient number of Digital multimeters

INSTRUMENTATION:

9. R, L,C Bridge kit
10. a)Electric heater– 1No.Thermometer– 1No.Thermistor (silicon type) RTD nickel type– 1No.
    b) 30 psi Pressure chamber (complete set) – 1No. Current generator (0 – 20mA) Air foot pump– 1 No. (with necessary connecting tubes)
    c) LVDT 20 mm core length movability type –1No. CRO 30MHz– 1No.
    d) Optical sensor–1 No. Light source
    e) Strain Gauge Kit with Handy lever beam– 1No.72 100gm weights–10nos
    f) Flow measurement Trainer kit – 1 No. (1/2 HP Motor, Water tank, Digital milli ammeter, complete set)
11. Single phase Auto transformer – 1No. Watt-hour meter (energy meter) – 1No. Ammeter Voltmeter Rheostat Stop watch Connecting wires (3/20)
12. Instrumentation Amplifier kit-1No
13. Analog–Digital and Digital–Analog converters (ADC and DACs)-1No
14. Sufficient numbers of bread board

CO-PO MAPPING:

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

CO-PSO MAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	1	2	3
CO2	2	2	3
CO3	2	2	3
CO4	2	2	3
CO5	2	2	3
AVG	2	2	3

JPT1002	TECHNICAL SKILLS AND APTITUDE I	L	T	P	C
		0	0	2	*

COURSE OBJECTIVES:

- To make students analyze and solve problems in technical as well as quantitative aptitude.
- To enhance the Technical skills and basics of programming language
- To make students understand how to apply the practical knowledge with real time applications.
- To make students think and draw a conclusion from different scenarios.
- To help students understand python programming concepts

UNIT I OOPS CONCEPTS 6

What is object oriented programming?. Const and classes. Arrays and string arrays fundamentals. Arrays of object, string, The standard C++ String class. Operator overloading: Overloading unary operations. Concept of inheritance. Derived class and based class. Derived class constructors, member function, Virtual Function

UNIT II PYTHON I 6

Python interpreter and interactive mode; values and types: int, float, 97oolean, string, and list; variables, expressions, statements, tuple assignment, modules and functions.

UNIT III PYTHON II 6

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, list parameters; Tuples: tuple assignment, Dictionaries: operations and methods; advanced list processing–list comprehension

UNIT IV QUANTITATIVE APTITUDE 6

Boats and streams–Time and work–Pipes and Cistern–Time and distance–Problems on Trains

UNIT V LOGICAL REASONING 6

Syllogism – Statement and Conclusion – Inequalities – Non Verbal Reasoning – Figure Analogy – Mirror and Water images – Paper cutting and Folding – Cubes and Dices – Pattern completion.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

CO1: Apply OOPS concepts in applications
CO2: To enhance knowledge in python programming.
CO3: Gain knowledge in coding using the python programming.
CO4 : Solve complex arithmetic problems practically with real time applications.
CO5 : Think logically in solving problems, enhance decision making, for difficult situations.

TEXTBOOKS:

1. Dr. E. Balagurusamy, "Programming in C++" complete reference 8th Edition.
2. "THE COMPLETE REFERENCE PYTHON", Herbert schildt., McGraw Hill Education, 2011.
3. Python: The Complete Reference by Martin Brown and Martin C. Brown Published in 2014.

4. Python in a nut shell by Alex Martelli Revised in March 2013.
5. Dr.R.S Agrawal, “Quantitative Aptitude” and Non Verbal Reasoning published in 2000.

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- https://www.indiabix.com/aptitude/questions-and-answers/
- https://m4maths.com/placement-puzzles.php
- www.freshersworld.com
- www.careerride.com
- www.youtube.com/watch/python
- www.youtube.com/watch/conceptsofpython
- https://stackoverflow.com/
- https://www.w3schools.com/
- https://www.geeksforgeeks.org/

CO-PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	1	2	2	-	-	-	-	1
CO2	1	-	-	-	1	2	2	-	-	-	-	1
CO3	1	-	-	-	1	2	2	-	-	-	-	1
CO4	3	3	-	3	2	1	-	-	1	-	1	2
CO5	-	3	-	1	1	-	-	-	-	-	2	2
AVG	1	1	-	1	1	1	1	-	1	-	1	1

CO-PSO MAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	-	-	-
CO2	-	-	-
CO3	-	-	-
CO4	2	-	-
CO5	-	-	-
AVG	1	-	-

SEMESTER VI

JEE1601	CONTROL OF ELECTRICAL DRIVES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn the steady state operation and transient dynamics of a motor load system.
- To study the operation of the converter/chopper fed dc drives, both qualitatively and quantitatively
- To impart knowledge on the operation and performance of Induction motor drives.
- To study the operation and performance of Synchronous motor drives.
  To accord knowledge on the controllers for DC drives

UNIT I DRIVE CHARACTERISTICS 9

Electric drive–Equations governing motor load dynamics–steady state stability–multi quadrant Dynamics: acceleration, deceleration, starting & stopping – typical load torque characteristics –Selection of motor-heating and cooling curves.

UNIT II CONVERTER/CHOPPER FED DC MOTOR DRIVE 9

Steady state analysis of the single and three phase converter fed separately excited DC motor drive–continuous conduction–Time ratio and current limit control – Type A, B, C, D chopper fed DC motor drives-4 quadrant operation of converter /chopper fed drive

UNIT III DESIGN OF CONTROLLERS FOR DRIVES 9

Transfer function for DC motor / load and converter – closed loop control with current and speed feedback–armature voltage control and field weakening mode – Design of controllers; current controller and speed controller-converter selection and characteristics

UNIT IV INDUCTION MOTOR DRIVES 9

Stator voltage control–v/f control– Voltage source inverter- current source inverter- Rotor resistance control–qualitative treatment of slip power recovery drives—closed loop control-vector control– Applications

UNIT V SYNCHRONOUS MOTOR DRIVES 9

V/f control and self-control of synchronous motor: Margin angle control and power factor control–Three phase voltage/current source fed synchronous motor-Applications

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1: To gain knowledge of steady state operation and transient dynamics of a motor load system.

CO2: To explain the operation of the converter/chopper fed dc drive

CO3: To understand the operation and performance of Induction motor drives

CO4: To understand the operation and performance of Synchronous motor drives
CO5: To understand design the controllers for DC drives

TEXTBOOKS:

1. Gopal K. Dubey, "Fundamentals of Electrical Drives", Second Edition, Narosa Publishing House,2010.
2. Bimal K.Bose., "Modern Power Electronics and AC Drives", First Edition, Pearson Education India, 2015.
3. Krishnan R., "Electric Motor & Drives: Modeling, Analysis and Control", First Edition, Pearson Education India, 2015

REFERENCE BOOKS:

1. Vedam Subramanyam, "Electric Drives Concepts and Applications", Second Edition, McGraw Hill, 2017.
2. Shaahin Felizadeh, "Electric Machines and Drives", First edition, CRC Press (Taylor and Francis Group), 2013.
3. John Hind marshand Alasda in Renfrew, "Electrical Machines and Drives System, "Elsevier 2012.
4. Theodore Wildi, "Electrical Machines, Drives and power systems, 6th edition, Pearson Education, 2015
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3. https://www.youtube.com/watch?v=9h2lEIpo74A
4. https://www.youtube.com/watch?v=96hvtQ8Qlvo
5. https://www.youtube.com/watch?v=5GuOQlNUgiw

CO-PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	-	2	1	3	2	1	2	3	2
CO2	1	2	3	2	1	3	1	-	2	2	1	1
CO3	2	2	1	1	3	1	2	3	2	1	3	2
CO4	2	-	3	3	-	2	2	1	1	3	2	2
CO5	1	3	2	1	2	1	1	3	3	-	1	-
AVG	2	2	2	1	2	2	2	2	2	2	2	1

CO-PSO MAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	2	1	2
CO2	1	3	-
CO3	3	-	3
CO4	1	2	1
CO5	-	2	2
AVG	1	2	2

JEE1602	POWER SYSTEM ANALYSIS, OPERATION AND CONTROL	L	T	P	C
		2	2	0	3

COURSE OBJECTIVES:

- To learn the basic concept of power system and its components.
- To impart knowledge on balanced fault analysis
- To impart knowledge on unbalanced fault analysis
- To provide knowledge on Load Frequency Control
- To study about Economic Dispatch and Unit commitment

UNIT I POWER FLOW ANALYSIS-INTRODUCTION 12

Need for system planning and operational studies–basic components of a power system.– Single line diagram – per phase and per unit analysis – Generator – transformer – transmission line and load representation for different power system studies.-Primitive network–construction of Y-bus using inspection — Z-bus. Importance of power flow analysis in planning and operation of power systems –classification of buses – iterative solution using Gauss-Seidel method and Newton-Raphson method

UNIT II FAULT ANALYSIS—BALANCED FAULTS 12

Importance of short circuit analysis – assumptions in fault analysis – analysis using Thevenin's theorem – Z-bus building algorithm – fault analysis using Z-bus – computations of short circuit capacity, post fault voltage and currents

UNIT III FAULT ANALYSIS—UNBALANCED FAULTS 12

Introduction to symmetrical components – sequence impedances – sequence circuits of synchronous machine, transformer and transmission lines – sequence networks analysis of single line to ground, line to line and double line to ground faults using Thevenin's theorem and Z-bus matrix.

UNIT IV LOAD FREQUENCY CONTROL 12

An overview of power system operation and control–system load variation–load characteristics – load curves and load-duration curve – load factor – diversity factor – Importance of load forecasting and quadratic and exponential curve fitting techniques of forecasting – plant level and system level controls. Basics of speed governing mechanism and modeling–speed-load characteristics–load sharing between two synchronous machines

in parallel–control area concept– LFC control of a single-area system and two-area system

UNIT V UNIT COMMITMENT AND ECONOMIC DISPATCH 12

Formulation of economic dispatch problem – I/O cost characterization – incremental cost curve –coordination equations without and with loss (No derivation of loss coefficients) – solution by direct method and λ-iteration method – statement of unit commitment problem – priority-list method– forward dynamic programming

TOTAL:60 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1: To understand and analyze power system components
CO2: To analyze three phase fault using. Thevenins theorem and bus building algorithm
CO3: To analyze LG, LL and LLG fault using Thevenins theorem and Bus building algorithm
CO4: To understand Load Frequency Control of single and two area system
CO5: To gain knowledge on Economic Dispatch and Unit commitment

TEXT BOOKS:

1.John J. Grainger, William D. Stevenson, 'Power System Analysis' ,McGraw Hill Education (India) Private Limited, New Delhi, 2015.
2.Soni. M.L, P.V.Gupta, U.S. Bhatnagar, A. Chakrabarti, 'A Text Book on Power System Engineering', Dhanpat Rai & Co.,2013.
3. Kothari D.P. and Nagrath I.J., 'Power System Engineering', Second Edition,Tata McGraw-Hill Education, 2008.
4. Allen.J.Wood and Bruce F.Wollenberg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 2016.
5.Abhijit Chakrabarti and Sunita Halder,'Power System Analysis Operation and Control', Third Edition, PHI learning Pvt. Ltd., New Delhi, 2010

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5. https://youtu.be/s894N_KoTek
6. https://youtu.be/6M0t4f_5G20

CO-PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	2	1	1	-	-	-	1	1	1
CO2	2	3	2	2	1	2	1	1	1	1	2	1
CO3	3	2	2	2	1	1	1	1	1	1	2	2
CO4	3	3	3	3	3	2	2	1	1	1	3	2
CO5	2	2	2	1	3	1	3	2	2	2	3	2
AVG	3	3	2	2	2	1	1	1	1	1	2	2

CO-PSO MAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	2	1	1
CO2	2	1	1
CO3	2	1	2
CO4	3	2	3
CO5	3	2	3
AVG	2	1	2

JEE1611	POWER ELECTRONICS AND DRIVES LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To impart theoretical and practical skills in switching characteristics various switches. To experimentally verify the performance of AC to DC converter circuits, DC to AC circuits and AC to AC converters

LIST OF EXPERIMENTS

1. Gate Pulse Generation using R, RC and UJT.
2. Characteristics of SCR and TRIAC
3. Characteristics of MOSFET and IGBT
4. Characteristics of GTO & IGCT.
5. AC to DC half controlled Converter
6. AC to DC fully controlled Converter
7. Step down and step up MOSFET based choppers
8. IGBT based single phase PWM inverter
9. IGBT based three phase PWM inverter
10. AC Voltage controller
11. Switched mode power converter.
12. Simulation of PE circuits (1 Ø & 3Ø semi converters, 1 Ø & 3 Ø full converters, DC-DC converters, AC voltage controllers)
13. Simulation of Stepper Motor.
14. Simulation of 3 ØA synchronous motor
15. Design of 1Ø inverter and UPS

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1: To acquire knowledge on simulation software
CO2: To experiment about switching characteristics various switches
CO3: To demonstrate about AC to DC converter circuits, DC to AC circuits and AC to AC Converters
CO4: To demonstrate about DC to AC circuits
CO5: To demonstrate about AC to AC converters.

WEBSITE REFERENCES:

1. www.nptel.com
2. http://vlabs.iitb.ac.in/vlabs-dev/labs/mit_bootcamp/power_electronics/labs/index.php
3. https://www.youtube.com/watch?v=odna3YR7oMs
4. https://vlsi-iitg.vlabs.ac.in/MOSFET_theory.html
5. https://www.iitg.ac.in/cseweb/vlab/vlsi/

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Device characteristics (for SCR, MOSFET, TRIAC, GTO, IGCT and IGBT kit with built-in /discrete power supply and meters) -2 each

1. Single phase SCR based half controlled converter and fully controlled converter along with built-in/separate/firing circuit/module and meter–2 each
3. MOSFET based step up and stepdown choppers (Built in/Discrete) –1 each
4. IGBT based single phase PWM inverter module/Discrete Component–2
5. IGBT based three phase PWM inverter module/Discrete Component –2
6. Switched mode power converter module/Discrete Component–2

7. SCR&TRIAC based 1phaseA C controller along with lamp or rheostat load-2
8. Cycloconverter kit with firing module –1
9. Dual regulated DC power supply with common ground
10. Cathode ray Oscilloscope –10
11. Isolation Transformer–5
12. Single phase Auto transformer–3
13. Components (Inductance, Capacitance) 3 set for each
14. Multi meter– 5
15. LCR meter–3
16. Rheostats of various ranges–2 sets of 10 value
17. DC and AC meters of required ranges– 20

CO-PO MAPPING:

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

CO-PSO MAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	3	3	2
CO3	2	3	3
CO4	3	2	2
CO5	3	3	3
AVG	3	3	2

JEE1612	POWER SYSTEM SIMULATION LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To impart knowledge about the concepts of Power System, skills of using computer packages MATLAB coding in power system studies
- To get an exposure about Load frequency control and Economic dispatch in Power systems
- To impart skills of using ETAP software for load flow analysis, short circuit and stability analysis
- To get an overview about State Estimation and electromagnetic Transients in Power systems

LIST OF EXPERIMENTS

1. Computation of Transmission Line Parameters
2. Formation of Bus Admittance and Impedance Matrices and Solution of Networks
3. Power Flow Analysis using Gauss-Seidel Method
4. Power Flow Analysis using Newton Raphson Method
5. DC Load Flow Analysis
6. Symmetric fault analysis
7. Unsymmetrical fault analysis
8. Economic Dispatch in Power Systems
9. Load–Frequency Dynamics of Single-Area and Two-Area Power Systems
10. State estimation: Weighted least square estimation
11. Electromagnetic Transients in Power Systems :Transmission Line Energization

TOTAL:60 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1: To understand the concepts of power system planning and operational studies
CO2: To acquire knowledge on Formation of Bus Admittance and Impedance Matrices and Solution of Networks
CO3: To Design and calculate Transmission line parameters
CO4: To Calculate and understand concept of economic dispatch
CO5: To analyze the load flow, short circuit and stability analysis using ETAP software

REFERENCE BOOKS:

1. Wadhwa.. C.L., 'Electrical Power Systems',6th Edition, NewAge International Ltd.,2018
2. Hadi Saadat, 'Power System Analysis', 21st reprint, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2010.
3. NagrathI.J. and Kothari D.P., 'Modern Power System Analysis', Fourth Edition, Tata McGraw-Hill, 2011
4. Abhijit Chakrabarti and Sunita Halder, 'Power System Analysis Operation and Control',

Third Edition, PHI learning Pvt. Ltd., New Delhi, 2010

5. Metha..VK, 'Principles of Power Systems',3rd Edition, S.Chand Publishing, 2005

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4. https://youtu.be/VPFfHcAhdm4
5. https://youtu.be/FTZNkooQkKI
6. https://youtu.be/s894N_KoTek

CO-PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	1	1	1	2	2	2	1	1
CO2	2	3	2	2	2	1	-	-	-	2	1	1
CO3	2	3	3	3	2	2	1	-	-	1	1	2
CO4	2	3	2	2	1	2	2	1	1	2	1	1
CO5	2	3	3	3	3	3	2	2	2	1	2	3
AVG	2	3	2	2	2	2	1	1	1	2	1	2

CO-PSO MAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	3	1	3
CO2	2	2	2
CO3	2	3	3
CO4	3	3	3
CO5	3	2	3
AVG	3	2	3

JEE1621	MINI PROJECT	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To introduce the basic practical concepts of engineering projects.
- To provide students an opportunity to exercise their creative and innovative qualities in a group project environment.
- To excite the imagination of aspiring engineers, innovators and technopreneurs.

The students in a group of 5 to 6 works on a topic approved by the head of the department and prepares a comprehensive mini project report after completing the work to the satisfaction. The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department.

A mini project report is required at the end Of the semester. The mini project work is evaluated based on oral presentation and the mini Project report jointly by external and internal examiners constituted by the Head of the Department.

METHOD OF EVALUATION:

The assessment of Mini Project consists of assessment by Guide (75%) and assessment by moderator (25%) in the following areas:

- Technical knowledge and Skills
- Project Report
- Oral Presentation
- Attendance and Participation
- Logbook/Interview
- Demonstration

TOTAL:30 PERIODS

COURSE OUTCOMES:

On completion of the mini project, the students will be able

CO1: In a position to take up their final year project work and find solution by formulating proper methodology.

CO2: To work on practical engineering projects.

CO3: To enhance the creativity and group activity and able to apply the practical concepts Into innovative ideas

CO-PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	1	3	3	3	3	3	2	2
CO2	3	3	3	2	1	3	3	3	3	3	2	2
CO3	3	3	3	3	2	1	3	3	3	1	2	2
AVG	3	3	3	2	1	2	3	3	3	2	2	2

CO-PSO MAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	3	3	2
CO2	3	3	2
CO3	3	3	3
AVG	3	3	2

JPT1002	TECHNICAL SKILLS AND APTITUDE II	L	T	P	C
		0	0	2	1

OBJECTIVES

- To make students analyze and solve problems in technical as well as quantitative aptitude. Enhance the technical skills and basics of programming language
- To make the students understand how to apply the practical knowledge in

real time applications.

- To make the students think and draw conclusions from different scenarios.
- To help the students understand JAVA programming concepts
- To help the students understand concepts and develop new applications in JAVA

UNIT I JAVA FUNDAMENTALS 6

OOP in Java–Characteristics of Java–Java Source-File-Structure–Compilation. Fundamental Programming Structures in Java.

UNIT II ADVANCED JAVA PROGRAMMING 6

Defining classes in Java–constructors, methods-access specifiers–static members-Data Types, Variables, Operators, Control Flow, Arrays, Inheritance–Super classes-sub classes–Protected members–constructors in sub classes- Inter faces–Strings.

UNIT III MATHEMATICAL AND ARITHMATIC PROBLEM SOLVING 6

Crypto arithmetic Problem Solving, Logarithms, Trigonometry, Mensuration, Probability, Permutations and Combinations.

UNIT IV LOGICAL REASONING- CO GNITIVE THINKING 6

Numerical Ability, English Ability, Gaming, Arrangements, Visual Reasoning, Flowcharts –Visual Reasoning–DI.

UNIT V LOGICAL REASONING- CRITICAL THINKING 6

Logical Sequence, Inferred Meaning, Agree Disagree Psychometric, Statement & Conclusions, Cubes and Cuboids.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

CO1: Enhance their knowledge in JAVA concepts and Java Programming.

CO2: Gain knowledge in coding using JAVA programming.

CO3: Solve complex arithmetic problems practically with real time applications.

CO4: Think logically in solving problems, enhance decision making, for difficult situations

TEXT BOOKS:

1. Herbert Schildt, “Java The complete reference”, 8th Edition, McGraw Hill Education, 2 011.
2. Cay S. Horstmann, Gary cornell, “Core Java Volume –I Fundamentals”, 9th Edition, Prentice Hall, 2013.
3. Dr.R.S Agrawal, “Quantitative Aptitude” and Non Verbal Reasoning published in 2000.
4. S.Chand–A Modern Approach to Logical Reasoning Published in 2000.

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2. https://m4maths.com/placement-puzzles.php
3. www.freshersworld.com
4. www.careerride.com
5. www.youtube.com/watch/python
6. www.youtube.com/watch/conceptsofpython
7. https://stackoverflow.com/
8. https://www.w3schools.com/
9. https://www.geeksforgeeks.org/

CO-PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	1	2	2	-	-	-	-	1
CO2	1	-	-	-	1	2	2	-	-	-	-	1
CO3	3	3	-	3	2	1	-	-	1	-	1	2
CO4	-	3	-	1	1	-	-	-	-	-	2	2
CO5	-	3	-	1	1	-	-	-	-	-	2	2
AVG	1	2	-	1	1	1	1	-	1	-	1	2

CO-PSO MAPPING:

CO\PSO	PSO1	PSO2	PSO3
CO1	-	-	-
CO2	-	-	-
CO3	2	-	-
CO4	2	-	-
CO5	2	-	-
AVG	1	-	-

SEMESTER VII

JEE1701 E-VEHICLES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the fundamental concepts, principles of hybrid electric vehicles.
- To provide knowledge about various aspects of electric and hybrid drive train and their configuration
- To impart knowledge on the types of electrical machines used for propulsion applications
- To study the energy storage systems and energy management used for vehicle applications
- To learn about charging station required for electric vehicles.

UNIT I INTRODUCTION TO E-VEHICLE 9

Basics of vehicles mechanisms, history of Electric Vehicles (EV) and Hybrid Electric Vehicles (HEV), need and importance of EV and HEV, Power/Energy supplies requirements for EV/HEV applications, vehicle power source characterization, and transmission characteristics.

UNIT II DRIVE-TRAIN TOPOLOGIES 9

Review of electric traction, various electric drive-train topologies, basics of hybrid traction system, various hybrid drive-train topologies, power flow control in drive-train topologies, fuel efficiency analysis.

UNIT III DC AND AC MACHINES FOR PROPULSION APPLICATIONS 9

Electric system components for EV/HEV, suitability of DC and AC machines for EV/HEV applications, AC and DC Motor drives. Advanced permanent magnet and switch reluctance machines, configuration and control of drives.

UNIT IV ENERGY STORAGE AND MANAGEMENT IN EV/HEV 9

Requirements of energy supplies and storage in EV/HEV, Review of batteries, fuel cells, flywheels and ultra-capacitors as energy sources for EV/HEV, characteristics and comparison of energy sources for EV/HEV, hybridization of different energy sources.

Energy management: EV/HEV energy management strategies, classification and comparison of various energy management strategies, energy efficiency comparison for various EV and HEV variants.

UNIT V ELECTRIC VEHICLES CHARGING STATION 9

Electric Vehicles charging station, Components of charging station, Type of Charging station, Selection and Sizing of charging station, Single line diagram of charging station, Introduction to Electric Vehicle Charging Infrastructure .

TOTAL : 45 PERIODS

COURSE OUTCOMES: At the end of the course, the student will be able

- To understand the basic concepts and principles of electric vehicles

- To gain knowledge on different topologies of drive trains.
- To acquire the knowledge on various machines used for propulsion applications
- To gain knowledge about energy storage systems and energy management
- To gain knowledge on Electric vehicle charging station.

TEXT BOOKS:

1.Babu.A.K, "Electric and Hybrid Vehicles ", Khanna Publishing Housing, Second Edition, 2022
2.Iqbal Hussain, "Electric and Hybrid Vehicles-Design Fundamentals", CRC Press, Second Edition, 2011.
3.Mehrdad Ehsani, YiminGao, and Ali Emadi, "Modern Electric, Hybrid and Fuel Cell Vehicles: Fundamentals", CRC Press,2010.

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1.Sunil.R.Pawar, “Electrical Vehicle Technology: The Future Towards Eco-Friendly Technology”, Notion Press,2021.
2.James Larminie, “Electric Vehicle Technology Explained”, John Wiley & Sons, 2003.
3.Sandeep Dhameja, “Electric Vehicle Battery Systems”, Newnes, 2000
4.Chris Mi, MA Masrur, and D W Gao, "Hybrid Electric Vehicles- Principles and Applications with Practical Perspectives", Wiley,2011.

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4. https://youtu.be/GFpEXekI-BM
5. https://youtu.be/Blo9vyV_QDE
6. https://youtu.be/LDRq-odYAbA

CO –PO& PSO MAPPING

CO\ PO, PSO	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O1	PS O2	PS O3
CO1	2	3	1	1	-	1	1	-	1	1	-	2	2	1	-
CO2	2	2	1	1	-	1	1	-	1	1	-	1	2	1	-
CO3	2	2	1	1	-	1	1	-	1	1	-	1	2	2	-
CO4	2	2	1	1	-	1	1	-	1	1	-	2	2	1	-
CO5	2	2	1	1	-	1	1	-	1	1	-	1	2	1	-
AV G	2	2	1	1	-	1	1	-	1	1	-	1	2	1	-

JEE1702 POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To study the various types of renewable energy systems
- To learn the principle of operation and working of machines used for renewable energy conversion
- To equip with required skills to derive the criteria for the design of power converters for renewable energy applications.
- To impart knowledge on the stand alone and grid connected renewable energy systems
- To introduce the concept of hybrid renewable energy system and MPPT techniques.

UNIT I INTRODUCTION TO RENEWABLE ENERGY SYSTEMS 9

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems

UNIT II ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION 9

Review of reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG

UNIT III POWER CONVERTERS 9

Solar: Block diagram of solar photo voltaic system -Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection of inverter, battery sizing, array sizing Wind: Three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters.

UNIT IV ANALYSIS OF WIND AND PV SYSTEM 9

Stand alone operation of fixed and variable speed wind energy conversion systems and solar system- Grid connection Issues -Grid integrated PMSG, SCIG Based WECS, grid Integrated solar system.

UNIT V HYBRID RENEWABLE ENERGY SYSTEMS 9

Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV -Maximum Power Point Tracking (MPPT).

TOTAL : 45 PERIODS

COURSE OUTCOMES: At the end of the course, the student will be able

- To gain knowledge about the environmental aspects and impacts of renewable energy resources.
- To understand the concepts of various machines used for renewable energy conversion
- To design and understand the operation of various power converters.
- To acquire knowledge on the stand alone and grid connected renewable energy systems
- To pertain the knowledge on hybrid energy systems and concepts of various MPPT techniques

TEXT BOOKS:

1.KothariD.P. ,Singal K.C, Rakesh Ranjan , "Renewable Energy Sources and Emerging Technologies", PHI learning 2022

2. Bhadra S. N., Kastha D., BanerjeeS., "Wind Electrical Systems", Oxford University Press, 2005.

3.KhanB.H. Non-conventional Energy sources Tata McGraw-hill Publishing Company, New Delhi, 2017.

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2.Ion Boldea, "Variable speed generators", Taylor & Francis group, 2006.

3.Rai. G.D, "Non conventional energy sources", Khanna publishes, 1993.

4.Gray, L. Johnson, "Wind energy system", prentice hall linc, 1995.

5.Andrzej M. Trzynnadlowski, 'Introduction to Modern Power Electronics', Second edition, wiley India Pvt. Ltd, 2014

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4. https://youtu.be/xKxrkht7CpY

5. https://youtu.be/Tjm-Oa4GKW0

6. https://youtu.be/JSTDFJXAdNM

CO –PO & PSO MAPPING

CO\PO ,PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O1	PS O2	PS O3
CO1	2	3	-	1	-	1	1	-	-	1	-	2	2	2	1
CO2	2	2	-	1	-	1	1	-	-	1	-	1	2	1	1
CO3	2	2	-	1	-		1	-	-	1	-	1	2	2	1
CO4	2	2	-	1	-	1	1	-	-	1	-	2	2	2	1
CO5	2	2	-	1	-	1	1	-	-	1	-	1	2	1	1
AVG	2	2	-	1	-	1	1	-	-	1	-	1	2	2	1

JBA 1711 ENTREPRENEURSHIP FOR ENGINEERS

L	T	P	C
0	0	2	1

COURSEOBJECTIVES:

- To provide exposure on insight of entrepreneurship
- To investigate the feasibility study for the new venture.
- To identify the right process for successful business plan

Sl.No	LIST OF ACTIVITIES	No.of Periods
1	Insight of Entrepreneurship	1
2	Business Idea	1
3	Business sources	1
4	Business Plan	1
5	Financial Plan	1
6	Market Survey	2
7	Feasibility report	2
8	Case study	3
9	Entrepreneurship Que Card	2
10	Prevention of Sickness & Measures	1

TOTAL: 20 PERIODS

COURSE OUTCOMES:

Students will be able,

- To procure knowledge on setting up of new venture
- To draft and approval of financial plan and appraisal of new project
- To impart the knowledge of effectiveness of innovation in entrepreneurship

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1.Hisrich, RobertD.,Michael Peters and Dean Shepherded, Entrepreneurship,Tata Mc Graw Hill,2014.
2. SS.Khanka, Entrepreneurial Development,Third Edition,S.Chand&company,NewDelhi2001.
3. Srinivasan, Case Studies in marketing Indian context, sixth edition PHI learning private Limited 2014.
4. Lall, Madhurima, and Shikha Sahai, Entrepreneurship, Excel Book, NewDelhi. 2008.

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- https://ideadrop.co/innovation-management/top-five-favourite-idea-generationtechniques/
- https://www.bajajfinserv.in/what-are-the-sources-of-finance-for-entrepreneurs
- https://www.babson.edu/academics/undergraduate-school/core-experiences/foundations-of-management-and-entrepreneurship/
- https://www.businessgig.com/business-plan-preparation
- https://www.financierworldwide.com/the-impact-of-social-entrepreneurship-on-economic-growth

JEE1712 RENEWABLE ENERGY SYSTEMS LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To familiarize with Renewable Energy Sources and technologies
- To provide the adequate skills to perform the simulation study of various renewable energy conversion systems and controllers.
- To impart knowledge on the experimental verification of renewable energy systems.

LIST OF EXPERIMENTS

1. Simulation study on Solar PV Energy System
2. Simulation study of V-I characteristics of solar panel at various levels of insolation
3. Study of 1kW solar PV plant
4. Experiment on "VI-Characteristics and Efficiency of Solar PV System".
5. Experiment on "Shadowing effect &diode-based solution in Solar PV System".
6. Simulation study on Wind Energy Generator.
7. Simulation study on Hybrid (Solar-Wind) Power System.
8. Simulation study on Hydroelectric Generator.
9. Simulation on Performance Assessment of Fuel Cell.
10. Simulation study on Intelligent Controllers for solar PV Systems.

TOTAL :60 PERIODS

COURSE OUTCOMES: At the end of the course, the student will able

- To understand and analyze Renewable energy systems
- To attain adequate inputs on a variety of issues in harnessing Renewable Energy.
- To simulate various Renewable energy sources
- To acquire knowledge about hybrid system.
- To understand basics of Intelligent Controllers

WEBSITES:

1.www.nptel.ac.in
2. https://youtu.be/44Wp3WE1AHs
3. https://youtu.be/DNPu_JcGeTY
4. https://youtu.be/xKxrkht7CpY
5. https://youtu.be/Tjm-Oa4GKW0
6. https://youtu.be/JSTDFJXAdNM

CO –PO & PSO MAPPING

CO\ PO, PSO	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O1	PS O2	PS O3
CO1	2	3	-	1	-	1	1	-	-	1	-	2	2	2	1
CO2	2	2	-	1	-	1	1	-	-	1	-	1	2	1	1
CO3	2	2	-	1	-		1	-	-	1	-	1	2	2	1
CO4	2	2	-	1	-	1	1	-	-	1	-	2	2	2	1
CO5	2	2	-	1	-	1	1	-	-	1	-	1	2	1	1
AV G	2	2	-	1	-	1	1	-	-	1	-	1	2	2	1

JEE1711 SIMULATION AND HARDWARE IMPLEMENTATION LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To impart knowledge on simulation of various power electronic converters.
- To learn the pulse generation using microcontrollers
- To provide knowledge on hardware implementation of converter and inverter

LIST OF EXPERIMENTS

1. Simulation of Single Phase controlled Rectifiers with various filters.
2.Simulation of Single Phase square wave / PWM inverters
3.Simulation of Buck-Boost Converter
4. Simulation of Cuk Converter
5. Simulation of SEPIC Converter
6. Simulation of Three Phase square wave inverters
7.Implementation of Power Supply Circuit
8.Implementation of Driver Circuit using IR2110
9. Implementation of Driver Circuit using MCT2E (Opto Coupler)
10.Study of microcontroller programming
11.Implementation of Controller Circuit
12.Implementation of Boost Converter
13. Implementation of Single-Phase Rectifier
14. Implementation of Single-Phase Inverter

TOTAL :60 PERIODS

COURSE OUTCOMES: At the end of the course, the student will able

- To simulate various power electronic converters.
- To understand the working of power converter circuits.
- To analyze the performance of power converter circuits.
- To execute the program using micro controller circuits
- To design and realize the hardware implementation of control and power circuits.

CO –PO & PSO MAPPING

CO\ PO, PSO	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O1	PS O2	PS O3
CO1	2	3	2	2	2	1	-	-	-	2	1	1	1	1	1
CO2	1	3	3	3	2	2	1	-	-	1	1	-	2	1	1
CO3	2	3	2	2	1	2	2	-	-	2	1	1	2	-	1
CO4	1	2	2	2	1	2	2	-	-	1	-	1	3	1	-
CO5	2	3	3	3	2	1	2	-	-	1	1	1	2	2	-
AV G	2	3	2	2	2	2	2	-	-	1	1	1	2	1	1

JEE1731 PROJECT WORK -PHASE I

L	**T**	**P**	**C**
0	**0**	**6**	**3**

COURSE OBJECTIVES:

- To identify a specific problem for the present need of the society and collecting information related to the same through detailed literature survey.
- To develop the methodology to solve the identified problem.
- To design, analyze and simulate the chosen problem using the software package.
- To train the students in preparing project reports and to face reviews and viva-voce examination.

METHOD OF EVALUATION:

The students in a group of 3 to 4 work on a topic approved by the Head of the Department under the guidance of a faculty member, prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee is constituted by the Head of the Department. The project work is evaluated based on oral presentation and the project report, jointly by external and internal examiners.

TOTAL: 90 PERIODS

COURSE OUTCOMES:

On completion of the phase - 1 project work, the students will be able to

- Analyze and formulate the problem
- Identify the methodology needed to solve the problem.
- Identify the tools and techniques required to solve the problem.
- Work with team mates to acquire the required material needed to find solutions to the chosen problem.
- Effectively communicate the outcomes of the findings.

SEMESTER VIII

		L	T	P	C
JNC1861	**INDIAN CONSTITUTION**	**2**	**0**	**0**	**0**

COURSE OBJECTIVES:

- To understand the importance of Indian constitution, Administration, Concept and Development of Human Rights, election commission.

UNIT I INTRODUCTION TO INDIAN CONSTITUTION 6

Constitution' meaning of the term, Indian Constitution- Sources and constitutional history, Features- Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy

UNIT II UNION GOVERNMENT AND ITS ADMINISTRATION 6

Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions; **State Government and its Administration** Governor: Role and Position, CM and Council of ministers, State Secretariat: Organization, Structure and Functions

UNIT III LOCAL ADMINISTRATION 6

A: Local Administration District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation,

B: Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

UNIT IV CONCEPT AND DEVELOPMENT OF HUMAN RIGHTS 6

Meaning Scope and Development of Human Rights, United Nations and Human Rights – UNHCR, UDHR 1948, ICCPR 1996 and ICESCR 1966, Human Rights in India: Protection of Human Rights Act,1993 (NHRC and SHRC), First, Second and Third Generation Human Rights, Judicial Activism and Human Rights.

UNIT V ELECTION COMMISSION 6

Election Commission- Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

TOTAL:30 PERIODS

COURSE OUTCOMES:

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

- Know the sources, features and principles of Indian Constitution.
- Learn about Union Government, State government and its administration.
- Get acquainted with Local administration and Pachayati Raj.
- Be aware of basic concepts and developments of Human Rights.
- Gain knowledge on roles and functioning of Election Commission.

REFERENCES:

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd. New Delhi
2. Subash Kashyap, Indian Constitution, National Book Trust
3. J.A. Siwach, Dynamics of Indian Government &Politics
4. D.C. Gupta, Indian Government and Politics
5. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
6. J.C. Johari, Indian Government and Politics Hans
7. J. Raj Indian Government and Politics
8. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd. New Delhi
9. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012

WEBSITE REFERENCES:

1. nptel.ac.in/courses/109104074/8
2. nptel.ac.in/courses/109104045/
3. nptel.ac.in/courses/101104065/
4. www.hss.iitb.ac.in/en/lecture-details
5. www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution.

JEE1832	PROJECT WORK - PHASE - 2	L	T	P	C
		0	0	18	9

COURSE OBJECTIVES:

- To develop the ability to solve a specific problem related to their subject expertise.
- To develop the methodology to solve the identified problem.
- To design, analyze and implement the chosen problem using the hardware components.
- To validate the simulation, hardware results with the theoretical results.
- To train the students in preparing project reports and to face reviews and viva-voce examination.

METHOD OF EVALUATION:

The students in a group of 3 to 4 work on a topic approved by the Head of the Department under the guidance of a faculty member, prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee is constituted by the Head of the Department. The project work is evaluated based on oral presentation and the project report, jointly by external and internal examiners.

TOTAL: 270 PERIODS

COURSE OUTCOMES:

On Completion of the project work, the student will be able to

- Apply the technical knowledge acquired for solving real world problems.
- Develop skills such as self learning, critical thinking, problem solving, project management and finance.
- Apply modern tools and techniques.
- Work with team mates and collectively work towards the success of the project.
- Communicate effectively to present the outcomes of the project both in written and oral forms.

JEE1851	COMPREHENSION & TECHNICAL SEMINAR	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To revamp the knowledge gained in the semester and prepare the students to face interview both at the academic and the Industrial Sector
- To encourage the students to study about the recent developments in the field
- To prepare and present technical reports
- To encourage the students to use various teaching aids such as Power point presentation and Demonstrative models

METHOD OF EVALUATION:

COMPREHENSION:

One period is allotted for comprehension. During this period, a test with objective type questions from competitive exams is conducted in identified technical courses. The evaluation is purely internal. Average of all the test marks shall be calculated , a weightage of 50 marks is awarded to the comprehension component.

TECHNICAL SEMINAR:

Three periods are allotted for the technical seminar. During the seminar session each student is expected to prepare and present a technical topic for duration of 10 minutes.

Each student is expected to make presentation at least twice during the semester and the student is evaluated based on various parameters such as topic chosen, content delivery, communication skills and presentation. A faculty guide is allotted who shall guide and monitor the progress and attendance of all the students. Equal weightage is considered for the two seminar sessions for a total weightage of 50 marks.

The total mark awarded for the course shall be the sum of marks scored out of 50 each for the two components. Evaluation is purely internal.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

- Consolidate all the engineering concepts acquired in the course of study.
- Enrich their technical knowledge.
- Prepare and present technological developments.
- Communicate effectively the concepts related to the various topics.
- Face the interviews with confidence during the placement drives

JERUSALEM COLLEGE OF ENGINEERING

(An Autonomous Institution)

Approved by AICTE & Affiliated to Anna University

Accredited by NAAC with 'A' Grade

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

Professional Electives

REGULATION 2021
CHOICE BASED CREDIT SYSTEM

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

R2021

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I **Renewable Energy Systems**	Vertical II **Embedded Systems**	Vertical III **Control Engineering**	Vertical IV **Instrumentation and Industrial Automation**	Vertical V **Power Systems**	Vertical VI **Electric Vehicle Technology**
JEE1023 - Power Semiconductor Devices	JEE1031 - Embedded System Framework	JEE1037 - Signals and Systems	JEE1019 - Sensors and Transducers	JEE1011 - High Voltage Direct Current Transmission	JEE1052 - Electric Vehicle Architecture
JEE1024 - Forms of Energy and Energy Crisis	JEE1032 - ARM Processors	JEE1018 - Advanced Control Systems	JEE1044 - Analytical Instruments	JEE1014 - Electric Energy Generation, Utilization and Conservation	JEE1053 - Energy Storage System for E-Mobility
JEE1025 - Solar and Energy Storage Systems	JEE1033 - Software for Embedded systems	JEE1038 - Digital Signal Processing System Design	JEE1045 - PLC Programming	JEE1007 - Power System Transients	JEE1054 - Power Converter for Electric Vehicle Drive Systems
JEE1026 - Solar Power Plant Designing	JEE1001- Real Time Operating Systems	JEE1039 - Model Based Control	JEE1046 - Advanced Integrated Automation	JEE1010 - Power Quality	JEE1055 - Vehicle Dynamics
JEE1027 - Software Tools for Energy Analysis	JEE1034 - Embedded System Networking	JEE1040- System Identification	JEE1047 - Intelligent Automation	JEE1009 - Flexible AC Transmission Systems	JEE1056 - Electric Vehicle Charging Systems
JEE1028 - Wind Energy Conversion Systems	JEE1035 - Embedded System Security	JEE1041 - Adaptive Control	JEE1048 - Robotics	JEE1051 - Under Ground Cable Engineering	JEE1057 - Grid Integration of Electric Vehicles
JEE1029 - Energy Conversion Techniques	JEE1005- Smart System Design	JEE1042 - Machine Monitoring System	JEE1049 - Artificial Intelligence For Robotics	JEE1013 - Distributed Generation and Microgrids	JEE1058 - Battery Management Systems
JEE1030 - Energy Economics	JEE1036 - Embedded System for Automotive Applications	JEE1043 - Computer Control of processes	JEE1050 - Industry 4.0	JEE1016 - Smart Grid	JEE1059 - Testing of Electric Vehicles

Vertical I- Renewable Energy Systems

JEE1023	POWER SEMICONDUCTOR DEVICES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the concepts related to power switches and their requirements.
- To know about the developments and characteristics of Silicon Carbide (SiC) and Gallium Nitride (GaN) devices.
- To understand the working, steady state, and switching characteristics of current-controlled and voltage-controlled silicon devices.
- To study the working of driving circuits, and protection circuits for power devices.
- To understand the thermal characteristics of power devices and the ability to design heat sinks for the power devices.

Pre-Requisites: Basic Engineering

UNIT I INTRODUCTION **9**

Power switching devices overview – Attributes of an ideal switch, application requirements, circuit symbols; Power handling capability – (SOA); Power diodes – Types, forward and reverse characteristics, switching characteristics – rating. Features and Brief History of Silicon Carbide- Promise and Demonstration of SiC Power Devices- Physical Properties of Silicon Carbide devices–Unipolar and Bipolar Diodes- GaN Technology Overview

UNIT II CURRENT CONTROLLED DEVICES **9**

BJT's Construction, static characteristics, switching characteristics; Negative temperature coefficient and second breakdown; - Thyristors – Construction, working, static and transient characteristics, types, series, and parallel operation; comparison of BJT and Thyristor – steady state and dynamic models of BJT & Thyristor- Basics of GTO, SiC-based Bipolar devices-Applications- Building a GaN Transistor –GaN Transistor Electrical Characteristics

UNIT III VOLTAGE CONTROLLED DEVICES **9**

Power MOSFETs and IGBTs – Principle of voltage-controlled devices, construction, types, static and switching characteristics, steady-state and dynamic models of MOSFET and IGBTs – and IGCT. New semiconductor materials for devices – Intelligent power modules- the study of modules like APTGT100TL170G, MSCSM70TAM05TPAG. Integrated gate commutated thyristor (IGCT) SiC-based unipolar devices-applications

UNIT IV DEVICE SELECTION, DRIVING AND PROTECTING CIRCUITS 9

Device selection strategy – On-state and switching losses – EMI due to switching . Necessity of isolation, pulse transformer, optocoupler – Gate drive integrated circuit: Study of Driver IC – IRS2110/2113. SCR, MOSFET, IGBTs, and base driving for power BJT. – Over voltage, overcurrent and gate protections; Design of snubbers

UNIT V THERMAL PROTECTION 9

Heat transfer – conduction, convection, and radiation; Cooling – liquid cooling, vapour – phase cooling; Guidance for heat sink selection – Thermal resistance and impedance –Electrical analogy of thermal components, heat sink types, and design – Mounting types- switching loss calculation for power device

Total: 45 Periods

Course Outcomes: At the end of the course, the student will be able to

- Identification of a suitable device for the application.
- Know the advantages of Silicon Carbide devices and Gallium Nitride devices.
- Understand the principles and characteristics of Silicon devices, Silicon Carbide devices, and Gallium Nitride devices.
- Design proper driving circuits and protection circuits.
- Construct proper thermal protective devices for power semiconductor devices.

TEXT BOOKS:

1. Rashid M.H., “Power Electronics Circuits, Devices and Applications”,Fourth Edition, Pearson, 2021.

2. Tsunenobu Kimoto and James A. Cooper, “Fundamentals of Silicon Carbide Technology: Growth, Characterization, Devices, and Applications”, First Edition., 2014

3. Ned Mohan, T.M.Undel and, W.P.Robbins, “Power Electronics: Converters, applications, and design”, Third Edition (reprint), John Wiley and Sons, 2009

REFERENCE BOOKS:

1. Mohan, Undel and Robins, “Power Electronics: Converters Applications and Design”, Third Edition, Wiley Media Enhanced, 2007

2. Alex Lidow, Johan Strydom, Michael de Rooij, David Reusch, “GaN Transistors for efficient power conversion”, Second Edition, Wiley, 2015

3. Biswanath Paul, “Power Electronics”, Universities Press 2019

WEB SITE REFERENCES:

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2. https://youtu.be/djbJm-xWo2w?list=PLgwJf8NK-2e4B9bchhZBBvsoEEhCQfQ4k
3. https://youtu.be/KTzQgAFTbCY
4. https://youtu.be/WWjldCmRteg
5. https://youtu.be/pkIxCmaxWFg

CO-PO&PSO MAPPING:

CO\PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
AVG	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3

JEE1024 FORMS OF ENERGY AND ENERGY CRISIS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the various forms of energy
- To get an idea about demand and energy consumption
- To understand various energy resources
- To get an insight into the energy crisis and energy conservation practice
- To get the knowledge of fundamental energy calculation.

UNIT I FORMS OF ENERGY 9

Introduction – various forms of energy – thermal, sound, light electrical, magnetic, chemical, nuclear, mechanical, Elastic, Gravitational energy, Types of energy sources – Renewable – Non – Renewable sources

UNIT II ENERGY CONSUMPTION AND DEMAND 9

Energy consumption – energy consumption (per capita) and economic growth Global energy consumption – Energy demand – primary energy demand and cumulative energy demand

UNIT III ENERGY RESOURCES 9

Energy routes for non-renewable energy resources – age of renewables and alternatives Energy developments – energy requirements and future prospects

UNIT IV ENERGY CRISIS ITS CAUSES AND SOLUTIONS 9

Introduction: Causes of energy crisis: Over consumption, over population, infrastructure Unexplored Renewable Energy Options – Commissioning of Power Plants Moving toward renewable energy sources – energy conservation practices Technology up gradation and strategies to meet energy requirements

UNIT V SITE ANALYSIS: FUNDAMENTAL ENERGY CALCULATIONS AND WORKPLACE SAFETY 9

Energy calculations: units and conversion dimensional equations – Joules, kWh/units Energy crisis: Global scenario – Energy crisis of developing countries – Report Energy storage various energy storage systems and Energy savings – Comparative study of power consumption in electrical appliances Basic First aid & Safety at workplace

Total: 45 Periods

Course Outcomes: At the end of the course, the student will be able to

- Pertain knowledge of the various forms of energy
- Insight into demand and energy consumption
- Acquire Knowledge of various energy resources
- Get an insight into the energy crisis and energy conservation practice
- Work with the fundamental energy calculation.

TEXT BOOKS:

1. Rao. S and Parulakar. B, "Energy Technology", New Delhi: Khanna Publishers, 1997

2. Sastri .M, "Energy Sources, resources and options"**,** Mumbai: Himalaya Publishing House,1994

REFERENCE BOOKS:

1. Thipse. S.S. "Non- Conventional and Renewable energy sources" , New Delhi: Narosa Publishing.

WEB SITE REFERENCE:

1. https://onlinecourses.nptel.ac.in/

CO-PO&PSO MAPPING:

CO\PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
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CO2	3	3	3	2	-	-	-	-	-	-	-	-	3	2	2
CO3	3	3	3	2	-	-	-	-	-	-	-	-	3	2	2
CO4	3	3	3	2	-	-	-	-	-	-	-	-	3	2	2
CO5	3	3	3	2	-	-	-	-	-	-	-	-	3	2	2
AVG	3	3	3	2	-	-	-	-	-	-	-	-	3	2	2

JEE1025 SOLAR AND ENERGY STORAGE SYSTEMS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To study the behavior of solar cells and the interconnection of PV cells.
- To impart knowledge on the power regulation of standalone systems.
- To learn the performance of grid-connected PV systems.
- To provide an overview of various energy storage systems.
- To familiarize with various applications of solar energy systems.

Pre-Requisites: Basic Engineering, Power Semiconductor Devices

UNIT I INTRODUCTION TO PHOTOVOLTAIC SYSTEM 9

Characteristics of sunlight – semiconductors and P-N junctions – the behaviour of solar cells – cell properties – PV cell interconnection.

UNIT II STAND-ALONE PV SYSTEM 9

Solar modules – storage systems – power conditioning and regulation - MPPT- protection – stand-alone PV systems design – sizing.

UNIT III GRID-CONNECTED PV SYSTEMS 9

PV systems in buildings – design issues for central power stations – safety – Economic aspect –Efficiency and performance - International PV programs.

UNIT IV ENERGY STORAGE SYSTEMS **9**

Impact of intermittent generation – Battery energy storage – solar thermal energy storage – pumped hydroelectric energy storage.

UNIT V APPLICATIONS **9**

Water pumping – battery chargers – solar car – direct-drive applications – Space – Telecommunications.

Total: 45 Periods

COURSE OUTCOMES: At the end of the course, the student will be able to

- Work with the interconnection of photovoltaic systems.
- Design and develop the power tracking algorithms for a standalone system.
- Design and analyze the performance of grid-connected PV systems.
- Acquire knowledge about the modeling of different energy storage systems and their performances.
- Pertain knowledge of various applications of solar energy systems.

TEXT BOOKS:

1. Solanki C.S., "Solar Photovoltaics: Fundamentals, Technologies and Applications", PHI Learning Pvt. Ltd., 2015.
2. Chetan Sigh Solanki, "Energy Swaraj My Experiment with Solar Truth", Notion Press, 2019.
3. Eduardo Lorenzo G. Araujo, "Solar electricity engineering of photovoltaic systems", Progensa, 1994.
4. Frank S. Barnes & Jonah G. Levine, "Large Energy Storage Systems Handbook", CRC Press, 2011.

REFERENCE BOOKS:

1. McNeils, Frenkel, Desai, "Solar & Wind Energy Technologies", Wiley Eastern, 1990
2. S.P. Sukhumi, "Solar Energy", Tata McGraw Hill, 1987.

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1. https://swayam.gov.in/
2. https://www.coursera.org/
3. https://youtu.be/so3XT69Q4eo
4. https://youtu.be/iZyzvDj6Y3c

CO-PO&PSO MAPPING:

CO\PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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CO3	3	-	2	-	-	-	-	-	-	-	-	-	3	3	3
CO4	3	-	3	-	-	-	-	-	-	-	-	-	3	3	3
CO5	3	3	2	3	-	-	-	-	-	-	-	-	3	3	3
AVG	3	3	2	3	-	-	-	-	-	-	-	-	3	3	3

JEE1026 SOLAR POWER PLANT DESIGNING L T P C
3 0 0 3

COURSE OBJECTIVES:

- To be able to assess the solar power plant needs.
- To gain simulation experience in designing solar power plants.
- To gain Hands on Experience in designing solar power plants.
- To gain knowledge on safety measures for working in a Solar power plant.
- To gain the knowledge in design of foundation.

Pre-Requisites: Basic Engineering

UNIT I STRUCTURAL DESIGN OF SOLAR PV POWER PLANT 9

Basics of electricity and the structure of the electricity supply system Alternating currents - AC Generator - AC Power –Three-phase Ac generation and distribution Electrical power system components: Substations and transformers –Overhead lines and underground cables – Faults, circuit breakers, fuses and electrical protection Study of site survey and soil test reports Design and documentation: Plant Infrastructure - overall plant layout - solar module mounting and other components - switchyard and power transmission system

UNIT II ELECTRICAL DESIGN OF SOLAR PV POWER PLANT AND THE ENERGY SIMULATION 9

Design the capacity of solar power plant. Design and selection of solar modules Selection of other components: Inverters, Strings, Combiner boxes, switchgear, batteries, and Inverters

UNIT III ENERGY SIMULATION OF ROOFTOP OFF-GRID SOLAR PV POWER PLANT 9

Design of combiner boxes, switchgear, batteries, and Inverters Energy simulation report for the design of combiner boxes, and switchgear. Energy simulation report for the design of batteries and Inverters

UNIT IV PERSONAL HEALTH & SAFETY AT SOLAR PV PROJECT SITE 9

Establish and Follow safe work procedures - Use and maintain personal protective equipment Identify and mitigate safety hazards - Demonstrate safe and proper use of required tools and equipment Identify work safety procedures and instructions for working at height

UNIT V DESIGN OF FOUNDATION FOR OTHER COMPONENTS 9

Design plan for Earthing pits, lightning arrestor foundation, Design of Street light foundation, and switchyard - Design of power transmission system and structure of the transmission tower, Design of mounting structures for Rooftop

Total: 45 Periods

Course Outcomes: At the end of the course, the student will be able to

- Assess the solar power plant needs.
- Simulate the designing solar power plants.
- Experience in designing solar power plants.
- Ensure the safety measures for working in a solar power plant.
- Design of foundation.

TEXT BOOKS:

1. Solanki C.S, "Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers and Engineers", Delhi, PHI Learning Private Limited, 2013
2. Michael Boxwell, "The Solar Electricity Handbook: A Simple, Practical Guide to Solar Energy:How to Design and Install Photovoltaic Solar Electric Systems", UK, Green Stream Publishing Limited, 2016

REFERENCE BOOKS:

1. Solanki C.S, "Solar Photovoltaics - Fundamentals, Technologies and Applications" , PHI Learning Private Limited, 2015
2. Kapur A S., "Practical Guide for Total Engineering of MW capacity Solar PV Power Project" White Falcon Publishing, 2016

WEB SITE REFERENCES:

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CO-PO&PSO MAPPING:

CO\PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	-	-	-	-	-	-	-	3	3	2
CO2	3	3	2	3	3	-	-	-	-	-	-	-	3	3	2
CO3	3	3	2	3	3	-	-	-	-	-	-	-	3	3	2
CO4	3	3	2	3	3	-	-	-	-	-	-	-	3	3	2
CO5	3	3	2	2	2	-	-	-	-	-	-	-	3	3	2
AVG	3	3	2	3	3	-	-	-	-	-	-	-	3	3	2

JEE1027 SOFTWARE TOOLS FOR ENERGY ANALYSIS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To inculcate knowledge of the overview solar software
- To illustrate the concepts of Solar PVsyst
- To learn about the PVsyst demonstration
- To impart knowledge on Solar RETSCREEN software.
- To impart knowledge in application of PVsyst.

Pre-Requisites: Basic Engineering, Power Semiconductor Devices

UNIT I OVERVIEW 9

Overview of effective tools for energy systems Analysis Of Software Parameters - PVSYST, RETScreen.

UNIT II PVSYST DEMONSTRATION 9

Demonstration of the software to study the sizing, simulation and data analysis of the PVsystems . Preliminary design , Project Design and economic evaluation of the PV systems.

UNIT III PVSYST STAND ALONE SYSTEM 9

Arranging of PV panel on rooftop, Analysis of stand-alone system, shadow analysis.

UNIT IV RET SCREEN 9

Identification , assessment and optimization of the technical viability of potential clean energy projects. Measurement and verification of actual energy performance Evaluation of additional energy savings /production opportunities.

UNIT V APPLICATIONS 9

Analysis of solar array electrical behavior using software, Simulation of panel installation in building using software, Real-time analysis of power generation using software, Economic evaluation – 'Return on investment study

Total: 45 Periods

Course Outcomes: At the end of the course, the student will be able to

- Design flatness-based control for power converters. To inculcate knowledge of the overview solar software
- Incorporate the concepts of Solar in PVsyst software
- Work with the PVsyst demonstration software.
- Work with Solar RETSCREEN software.
- Expose knowledge in various PVsyst applications.

TEXT BOOKS:

1. "Step by Step Guide to Solar Simulation Software PVsyst: Practical Approach to Solar Simulation", 2021

2. Solanki C.S., "Solar Photovoltaics: Fundamentals, Technologies and Applications", PHI Learning Pvt. Ltd.,2015.

3. Chetan Sigh Solanki, "Energy Swaraj My Experiment with Solar Truth", Notion Press, 2019.

REFERENCE BOOKS:

1. Help in PVsyst software

WEB SITE REFERENCES:

1. https://youtube.com

CO-PO&PSO MAPPING:

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CO3	2	3	3	2	-	-	-	-	-	-	-	-	2	2	2
CO4	2	3	3	3	-	-	-	-	-	-	-	-	2	2	2
CO5	2	3	3	3	-	-	-	-	-	-	-	-	2	2	2
AVG	2	3	3	3	-	-	-	-	-	-	-	-	2	2	2

JEE1028 WIND ENERGY CONVERSION SYSTEMS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To learn about the basic concepts of wind energy conversion system
- To learn the design and control principles of Wind turbines.
- To study the concepts of fixed-speed wind energy conversion systems.
- To study the concepts of variable speed wind energy conversion systems.
- To familiarize with various grid integration issues.

Pre-Requisites: Basic Engineering, Power Semiconductor Devices

UNIT I INTRODUCTION TO WIND ENERGY CONVERSION SYSTEMS 9

Components of WECS-WECS schemes-Power obtained from wind-simple momentum theory Power coefficient- Sabinin's Theory-Aerodynamics of Wind turbine.

UNIT II WIND TURBINES 9

HAWT - VAWT - Power Developed – Thrust – Efficiency -Rotor Selection-Rotor design considerations Tip speed ratio-Blade profile-Power Regulation-yaw control-Pitch angle control stall control-Schemes for maximum power extraction.

UNIT III FIXED SPEED SYSTEMS 9

Generating Systems - Constant speed constant frequency systems - Choice of Generators Deciding Factors- Synchronous Generator-Squirrel Cage Induction Generator- Model of Wind

Speed - Model wind turbine rotor - Drive Train model- Generator model for Steady-state and Transient stability analysis.

UNIT IV VARIABLE SPEED SYSTEMS **9**

Need of variable speed systems-Power-wind speed characteristics-Variable speed constant frequency systems synchronous generator- DFIG- PMSG -Variable speed generators modeling - Variable speed variable frequency schemes.

UNIT V GRID CONNECTED SYSTEMS **9**

Wind interconnection requirements, low-voltage ride through (LVRT), ramp rate limitations, and supply of ancillary services for frequency and voltage control, current practices, and industry trends wind interconnection impact on the steady-state and dynamic performance of the power system including modeling issues.

Total: 45 Periods

Course Outcomes: At the end of the course, the student will be able to

- Acquire knowledge of the basic concepts of Wind energy conversion systems.
- Analyze the mathematical modeling and control of the Wind turbine.
- Design and develop fixed speed wind energy conversion systems.
- Design and develop Variable speed wind energy conversion systems.
- Analyze various Grid integration issues and current practices of wind interconnections with power systems.

TEXT BOOKS:

1. S.N.Bhadra, D.Kastha, S.Banerjee–"Wind Electrical Systems", Oxford University Press , 2013.
2. L.L.Freris "Wind Energy Conversion Systems", Prentice Hall, 1990.
3. Muhammed Kamran, Muhammed Rayyan Fazal, "Renewable Energy Conversion System", Elsevier Science, 2021.
4. Ion Boldea, "Variable speed generators", Taylor & Francis Group, 2006.
5. E.W. Golding "The generation of Electricity by wind power", Redwood burns Ltd.,Trowbridge,1976.

REFERENCE BOOKS:

1. N. Jenkins," Wind Energy Technology" John Wiley & Sons, 1997
2. S.Heir "Grid Integration of WECS", Wiley 1998.

WEB SITE REFERENCES:

1. https://swayam.gov.in/
2. https://www.coursera.org/

CO-PO&PSO MAPPING:

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CO4	3	-	3	-	-	-	-	-	-	-	-	-	3	3	3
CO5	3	3	2	-	-	-	-	-	-	-	-	-	3	3	3
AVG	3	3	2	-	-	-	-	-	-	-	-	-	3	3	3

JEE1029 ENERGY CONVERSION TECHNIQUES L T P C
3 0 0 3

COURSE OBJECTIVES:

- To analyze the conventional energy conversion techniques.
- To develop an understanding of direct energy conversion systems.
- To study the concepts of electrochemical and hydrogen generation systems.
- To appreciate the need and necessity of energy storage systems and their desirable.
- To gain knowledge in practical case studies in energy conversion systems.

Pre-Requisites: Basic Engineering

UNIT I INTRODUCTION 9

Introduction – energy conversion –conventional techniques. Reversible and irreversible cycles.

UNIT II DIRECT CONVERSION OF THERMAL TO ELECTRICAL ENERGY 9

Thermoelectric converters – thermoelectric refrigerator – thermoelectric generator– Thermionic converters – Ferro electric converter – Nernst effect generator – thermomagnetic converter.

UNIT III CHEMICAL, ELECTROCHEMICAL ENERGY AND HYDROGEN ENERGY GENERATION 9

Batteries – types – working – performance governing parameter– Dye sensitized solar cells - Quantum dots sensitized solar cells – Photo catalysis – Photo electro catalysis–Photo bio synthesis–Bio reactors- Water splitting–Hydrogen generation

UNIT IV ENERGY STORAGE SYSTEMS 9

Introduction – storage of mechanical energy, electrical energy, chemical energy thermal energy. Electro chemical energy storage – super capacitor- pseudo capacitor- ultra capacitor.

UNIT V CASE STUDY 9

Types of batteries- Chemical Energy to Electrical Energy - Conversion of Solar Energy to Heat Energy- Solar Water heater - Conversion of Solar Energy to Electrical Energy-Solar Water pump

Total: 45 Periods

Course Outcomes: At the end of the course, the student will be able to

- Analyze the conventional energy conversion techniques.
- Develop an understanding of direct energy conversion systems.
- Analyzing the concepts of electrochemical and hydrogen generation systems.
- Work of energy storage systems and their desirable
- Incorporate practical case studies in energy conversion systems.

TEXT BOOKS:

1. Archie.W.Culp. “Principles of Energy Conversion”, McGraw-Hill Inc., 1991,

2. Kordesch. K. and Simader.G. “Fuel Cell and Their Applications”, Germany: Wiley-Vch, 1996

REFERENCE BOOKS:

1. Kettari, M.A. “Direct Energy Conversion” , Addison-Wesley Pub. Co. 1997

2. Hart A.B and Womack. G.J. “Fuel Cells: Theory and Application”, London: Prentice Hall,

WEB SITE REFERENCES:

1. https://swayam.gov.in/
2. https://www.coursera.org/

CO-PO&PSO MAPPING:

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CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	-	-	-	-	-	-	-	-	-	3	3	3
CO5	3	3	2	-	-	-	-	-	-	-	-	3	3	3	3
AVG	3	3	2	-	-	-	-	-	-	-	-	3	3	3	3

JEE1030 ENERGY ECONOMICS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To develop in the students an awareness of the basic issues and problems relating to Energy Economics.
- To develop knowledge of sustainable energy
- To help in critically analyzing the energy market in the Indian context
- To develop knowledge of energy policies.
- To develop knowledge of energy management systems.

UNIT I INTRODUCTION TO MICRO ECONOMICS CONCEPTS 9

Supply and Demand – Applying supply and demand - elasticity Consumer theory –Preference and utility- Budget Constraints- Deriving Demand C Curve C Producer Theory – Productivity and costs

UNIT II INTRODUCTION TO SUSTAINABLE ENERGY 9

Historical Context – post-industrialization- growth of the developed countries and growing energy needs of less developed countries Overview of energy use and related issues Global climate change issues and responses – Greenhouse gas emissions and potential effects – effect on ecology and biodiversity- Responses to CO build up– Mitigation – Policy – Carbon tax- Command and Control Sustainability, energy, and clean technologies – Sustainability attributes-population and consumption growth

UNIT III ENERGY DECISION, MARKETS 9

Natural Gas – Introduction to Natural gas markets- Future Electricity, Coal, Renewable Energy, Nuclear power – Prospects and Future

.

UNIT IV ENERGY POLICIES 9

Future of global energy, Climate Change - Understanding public complacency Energy supply and economics of deflectable resources, Energy Security – Clean Energy – Energy paradox Pollution Control Public Policies- Indian Environmental Policies – Social Movements – energy efficiency policies – renewable energy policies – Regulations- Emission trading

UNIT V ENERGY MANAGEMENT & CASE STUDY 9

Energy use by individuals and households – energy calculator – energy consumption , Industry Power management.

Total: 45 Periods

Course Outcomes: At the end of the course, the student will be able to

- Pertain the basic issues and problems relating to Energy Economics.
- Incorporate the concept of sustainable energy
- Analyzing the energy market in the Indian context
- Analyze the various energy policies.
- Working in any energy management systems.

TEXT BOOKS:

1. Banks F.E. “Energy Economics: A Modern Introduction ” , Kluwer Academic Publishers Dordrecht 2000.
2. Griffin J.M. and H.B. Steele. “ Energy Economics and Policy”, Academic, Orlando, 1986
3. Hussen. Ahmed.M. “Principles of Environmental Economics: Economics, Ecology and Public Sector”, London: Routledge.1999.

REFERENCE BOOKS:

1. Kolestad. Charles D. “Environmental Economics” , New York: Oxford University Press. 2000.
2. Singh, Katar. And Shishodia. Anil. “Environmental Economics: An Indian Perspectives”, New Delhi: Oxford University Press. 2007

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2. https://www.tutorialspoint.com
3. https://youtu.be/ZbvWe9xBu3Q?list=PLp6ek2hDcoND7i5-DAD9mPmYF1Wg6ROdO
4. https://youtu.be/EEETzABZ8Sc

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CO3	3	-	2	-	-	-	-	-	-	-	-	-	2	2	-
CO4	3	-	3	-	-	-	-	-	-	-	-	-	2	2	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	2	2	-
AVG	3	3	2	-	-	-	-	-	-	-	-	-	2	2	-

Vertical II - EMBEDDED SYSTEMS

JEE1031	EMBEDDED SYSTEM FRAMEWORK	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To study and analyze embedded systems.
- To impart knowledge about embedded firm ware development
- To learn about various Embedded Development Strategies
- To study about RTOS based embedded system design
- To provide overview on various embedded system applications

Prerequisites: Digital Logic Circuits, Microprocessor and microcontroller

UNIT I BASICS OF EMBEDDED SYSTEMS 9

History of embedded systems, Classification of embedded systems based on generation and complexity – Structural Units in Embedded processor, Selection of processor & memory devices – DMA– Memory management methods – Timer and Counting devices, Watch dog Timer, Real Time Clock, Target Hardware Debugging.

UNIT II EMBEDDED NETWORKING 9

Embedded Networking: Introduction, I/O Device Ports & Buses – Serial Bus communication protocols RS232 standard–RS422–RS485-USB bus-CAN Bus-Serial Peripheral Interface (SPI)–Inter Integrated Circuits (I2C) – Blue tooth, Wi-Fi, ZigBee, GPRS, GSM.

UNIT III EMBEDDED FIRM WARE DEVELOPMENT ENVIRONMENT 9

Embedded firmware design approaches –super loop-based approach – Embedded Product Development Life Cycle-objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co- design, Data Flow Graph, State machine model, Sequential Program Model, Concurrent Model, Object oriented Model.

UNIT IV RTOS BASED EMBEDDED SYSTEM DESIGN 9

Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multitasking and Multithreaded system, Preemptive and non –preemptive scheduling, Task communication: shared memory-message passing-Inter process Communication– synchronization between processes- Semaphores, Mailbox, Pipes, priority inversion, priority in heritance.

UNIT V EMBEDDED SYSTEM APPLICATION AND DEVELOPMENT 9

Case Study of Washing Machine – Automotive Application – Air pollution detector – Smart card System Application-Digital camera

Total: 45 Periods

COURSE OUTCOMES: At the end of the course, the student will be able to

- Understand and analyze embedded systems
- Acquire knowledge about embedded firm ware development
- Gain knowledge on various Embedded Development Strategies
- Understand about RTOS based embedded system design
- Acquire knowledge on various embedded system applications

TEXT BOOKS:

1. Peckol, "Embedded system Design", John Wiley & Sons, 2010
2. Lyla B Das, "Embedded Systems-An Integrated Approach", Pearson, 201
3. Shibu.K.V, "Introduction to Embedded Systems", 2e, Mc Graw Hill, 2017.
4. Mazidi,"The8051 micro controller and embedded system: using Assembly and C", Pearson, 2013.
5. XiaoCongFab,"Real-time Embedded systems Design Principles and Engineering Practices", Newnes, 2015.

REFERENCE BOOKS:

1.RajKamal, 'Embedded System-Architecture, Programming, Design', McGraw Hill, 2013.
2.C.R.Sarma, "Embedded Systems Engineering", University Press (India) Pvt. Ltd, 2013.
3.Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006.
4.Han-Way Huang, "Embedded system Design Using C8051", Cengage Learning, 2009.
5.Rajib Mall "Real-Time systems Theory and Practice" Pearson Education, 2007.

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4. https://www.skillshare.com/
5. https://www.udemy.com

CO - PO & PSO MAPPING:

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CO4	3	2	2	1	2	1	1	1	1	1	1	2	1	1	-
CO5	2	1	2	2	2	1	1	-	-	1	1	2	2	2	3
AVG	3	2	3	2	2	1	1	0	0	1	1	2	1	1	1

JEE1032 **ARM PROCESSORS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To introduce the architecture of the ARM Cortex A35 processor.
- To discuss memory management and train students in ARM Cortex A35 programming.
- To learn about the ARM peripherals and their interfacing methods.
- To involve and familiarize the communication concepts.
- To impart the knowledge on Raspberry Pi.

Prerequisites: Digital Logic Circuits, Microprocessor and microcontroller

UNIT I ARM Cortex-A35 PROCESSOR FUNDAMENTALS **9**

Introduction to ARM -Key features- ARM Cortex-A35 processor-Architecture – instruction set, pipeline architecture, and memory system-Instruction Set Architecture (ISA)- Different Instruction formats and Addressing Modes

UNIT II ARM Cortex-A35 PROGRAMMING **9**

Memory System-memory hierarchy-different levels of cache- Memory management unit (MMU) and virtual memory support- Power Management-Basic programming.

UNIT III ARM PERIPHERALS & INTERFACING **9**

System integration features- – I/O Ports – Interrupt handling; standard and vector control - Timers – Serial Communication with PC – ADC/DAC Interfacing-Stepper motor interfacing

UNIT IV ARM COMMUNICATION & SOFTWARE TOOLS **9**

ARM communication protocols-Types-UART, USART, USB- **I2C, SPI and CAN**- Software development tools and environments- Keil MDK-Debug Probes and Adapters - C/C++ Compilers for Arm.

UNIT V RASPBERRY PI **9**

Introduction to Raspberry Pi- Different Models – SoC architecture- Pin Description- On-board components-Peripherals- Communication using RPi-Applications.

Total: 45 Periods

COURSE OUTCOMES: At the end of the course, the student will be able to

- Interpret the basics and functionality of ARM Cortex A35 processor functional blocks.
- Observe the specialty of Memory management and programming.
- Incorporate the I/O hardware interface of processor with peripherals.

- Emphases the communication features of the processor.
- Enhance knowledge up gradation on the Raspberry Pi.

TEXT BOOKS:

1. Muhammad Tahir, Kasif Javed, "ARM Microprocessor Systems, Cortex- M Architecture, Programmingand Interfacing", 1st Edition, CRC Press,2017.
2. Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield's, "ARM System Developer's Guide Designing and Optimizing System Software"', Elsevier, 1st Edition, 2004.
3. Joseph Yiu ,"The Definitive Guide to ARM® Cortex®-M3 and Cortex®-M4 Processors" 3rd Edition, Newnes Publishers, October 2013.

REFERENCE BOOKS:

1. Steve Furber, Addisonn, "ARM system on chip architecture", Wesley,2nd Edition,2015.
2. Larry D. Pyeatt, "modern assembly language programming with the arm processor", Newnes, 2016.
3. Andrew sloss, Chris Wright, Dominic Symes " ARM System Developer's Guide: Designingand Optimizing System Software", 1st Edition**,** Publisher: Morgan Kaufmann Publishers, 2011.
4. William Hohl, "ARM Assembly Language Fundamentals and Techniques", CRC Press, 2ndEdition 2014.

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3.https://www.csie.ntu.edu.tw/~cyy/courses/assembly/12fall/lectures/handouts/lec08_ARMar ch.pdf
4. https://maxembedded.com/2013/07/introduction-to-single-board-computing/
5.https://www.youtube.com/watch?v=J4fhE4Pp55E&list=PLGs0VKk2DiYypuwUUM2wxzc I9B

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CO4	2	2	1	2	2	1	1	-	-	-	-	1	2	2	2
CO5	2	2	1	2	1	1	2	-	-	-	--	1	2	1	1
AVG	2	2	2	2	2	1	1	-	-	-		1	2	2	2

JEE1033 SOFTWARE FOR EMBEDDED SYSTEMS L T P C

3 0 0 3

COURSE OBJECTIVES:

- To expose the students to the fundamentals of embedded Programming

- To Introduce the GNU C Programming Tool Chain in Linux.
- To study the basic concepts of embedded C.
- To teach the basics of Java technology for embedded systems
- To involve Discussions/ Practice onto the concepts in Android framework

Prerequisites: Digital Logic Circuits, Microprocessor and microcontroller

UNIT I BASICS OF EMBEDDED C 9

Typical C Program Development Environment - Introduction to C Programming - Structured Program Development in C - Data Types and Operators - C Program Control - C Functions - Introduction to Arrays.

UNIT II PROGRAMMING IN EMBEDDED C 9

Adding Structure to 'C' Code: Object oriented programming with C, Header files for Project and Port, Examples. Meeting Real-time constraints: Creating hardware delays - Need for timeout mechanism - Creating loop timeouts - Creating hardware timeouts.

UNIT III C PROGRAMMING TOOL-CHAIN IN LINUX 9

C preprocessor - Stages of Compilation - Introduction to GCC - Debugging with GDB - The Make utility - GNU Configure and Build System - GNU Binary utilities - Profiling - using gprof - Introduction to GNU C Library.

UNIT IV JAVA TECHNOLOGY FOR EMBEDDED SYSTEMS 9

Basic concepts of Java - IO streaming – Object serialization – Networking – Threading – RMI – distributed databases — Advantages and limitations of Internet – Web architecture for embedded systems – security model for embedded systems.

UNIT V ANDROID FRAMEWORK 9

Android SDK – Access to Hardware - Framework development - Peer-to-Peer communication Android security design and architecture – Case study.

Total: 45 Periods

COURSE OUTCOMES: At the end of the course, the student will be able to

- Demonstrate C programming and its salient features for embedded systems
- Deliver insight into various programming languages/software compatible to embedded process development with improved design & programming skills.
- Develop knowledge on C programming in Linux environment.
- Possess ability to write Java programming for Embedded applications.
- Develop knowledge on android framework

TEXT BOOKS:

1. Noel Kalicharan, "Learn to Program with C", A press Inc., 2015.
2. Mattis Hayes and Isaiah Johansen, "Java Software and Embedded Systems", Computer Science, Technology and Applications, Nova, 2010
3. Adam Gerber, Clifton Craig, David Selvaraj, "Learn Android Studio Build Android Apps Quickly and Effectively", Apress, 2018.

REFERENCE BOOKS:

1. Noel Kalicharan, "Learn to Program with C", Apress Inc., 2015.
2. Martin Schoeberl , "JOP Reference Handbook: Building Embedded Systems with a Java Processor", Kindle, 2019
3. Michael Burton , "Android App Development For Dummies 3e", Wiley, March 201

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3. https://www.allaboutcircuits.com/technical-articles/introduction-to-the-c-programming language- for-embedded-applications/
4. https://onlinecourses.nptel.ac.in/noc19_cs42/preview
5. https://microcontrollerslab.com/8051-microcontroller-tutorials-c/
6. https://www.circuitstoday.com/getting-started-with-keil-uvision

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CO4	2	2	1	1	2	1	1	-		-	-	2	1	2	2
CO5	2	2	1	1	1	2	2	-	-	-	-	2	2	2	1
AVG	2	2	2	1	2	2	1	-	-	-	-	2	2	2	2

JEE1001 REAL TIME OPERATING SYSTEMS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To expose the students to the fundamentals of interaction of OS with a computer and User computation.
- To teach the fundamental concepts of how process are created and controlled with OS.
- To study on programming logic of modeling Process based on range of OS features
- To compare types and Functionalities in commercial OS, application development using RTOS
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the subject for improved employability skills

Prerequisites: Embedded system

UNIT I REVIEW OF OPERATING SYSTEMS 9

Basic Principles - Operating System structures – System Calls – Files – Processes – Design and Implementation of processes – Communication between processes – Introduction to Distributed operating system – Embedded operating systems

UNIT II OVERVIEW OF RTOS 9

RTOS Task and Task state –Multithreaded Preemptive scheduler- Process Synchronization- Message queues– Mail boxes -pipes – Critical section – Semaphores – Classical synchronization problem – Deadlocks

UNIT III REALTIME MODELS AND LANGUAGES 9

Event Based – Process Based and Graph based Models – Real Time Languages – RTOS Tasks – RT scheduling - Interrupt processing – Synchronization – Control Blocks – Memory Requirements.

UNIT IV REALTIME KERNEL 9

Principles – Design issues – Polled Loop Systems – RTOS Porting to a Target – Comparison and Basic study of various RTOS like – VX works – Linux supportive RTOS – C Executive.

UNIT V APPLICATION DEVELOPMENT 9

Discussions on Basics of Linux supportive RTOS – uCOS-C Executive for development of RTOS Application –Free RTOS -RTOS Firmware Design-Task-Queue-Interrupt Management.

Total: 45 Periods

COURSE OUTCOMES: At the end of the course, the student will be able to

- Outline Operating System structures and types.
- Insight into scheduling, disciplining of various processes execution.
- Illustrate knowledge on various RTOS support modelling.
- Demonstrate commercial RTOS Suite features to work on real time processes design.
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in RTOS and embedded automation design.

TEXT BOOKS:

1. Silberschatz,Galvin,Gagne" Operating System Concepts,6th ed,John Wiley,2003

2. Charles Crowley, "Operating Systems-A Design Oriented approach" McGraw Hill,1997

3. Raj Kamal, "Embedded Systems- Architecture, Programming and Design" Tata McGraw Hill,2006.

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1. Karim Yaghmour,Building Embedded Linux System",O'reilly Pub,2003

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4. https://onlinecourses.nptel.ac.in/

CO - PO & PSO MAPPING:

CO\PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2	2	2	1	-	-	-	-	2	2	2	2
CO2	2	2	2	2	1	2	-	-	-	-	-	2	2	2	1
CO3	1	1	2	2	1	2	2	-	-	-	-	1	1	2	2
CO4	2	2	2	2	2	2	1	-	-	-	-	2	2	1	2
CO5	2	2	1	1	2	1	2	-	-	-	-	2	2	2	1
AVG	2	2	2	2	2	2	1	-	-	-	-	2	2	2	2

JEE1034 EMBEDDED SYSTEM NETWORKING L T P C
3 0 0 3

COURSE OBJECTIVES:

- To expose the students to the fundamentals of wired embedded networking techniques.
- To introduce the concepts of embedded Ethernet.
- To expose the students to the fundamentals of wireless embedded networking.
- To discuss the fundamental building blocks of digital instrumentation.
- To introduce design of Programmable measurement & control of electrical Device.

Prerequisites: Embedded system

UNIT I EMBEDDED PROCESS COMMUNICATION WITH INSTRUMENT BUS 9

Embedded networking: Introduction – Cluster of instruments in System: Introduction to bus protocols – comparison of bus protocols –USB standards – embedded ethernet – MOD bus and LIN bus.

UNIT II EMBEDDED ETHERNET 9

Elements of a network – Inside Ethernet – Building a Network : Hardware options – Cables, Connections and network speed – Ethernet controllers – Inside the internet protocol – Exchanging messages using UDP and TCP – Email for Embedded systems using FTP –

Keeping devices and network secure.

UNIT III WIRELESS EMBEDDED NETWORKING 9

Wireless sensor networks – Introduction – Node architecture – Network topology - Localization – Time synchronization – Energy efficient MAC protocols – SMAC – Energy efficient and robust routing – Data centric routing - WSN Applications - Home Control - Building Automation - Industrial Automation.

UNIT IV BUILDING SYSTEM AUTOMATION 9

Data acquisition system- Signal conditioning circuit design- microcontroller Based & PC based data acquisition – microcontroller for automation and protection of electrical appliances –processor based digital controllers for switching Actuators: Stepper motors, Relays .

UNIT-V COMMUNICATION FOR ELECTRICAL SYSTEM AUTOMATION 9

Data Acquisition, Monitoring, Communication, Event Processing, and Polling Principles, SCADA system principles – outage management– Decision support application - substation automation, extended control feeder automation, Performance measure and response time.

TOTAL: 45 PERIODS

COURSE OUTCOMES: At the end of this course, the students will have the ability to

- Analyze the different bus communication protocols used for embedded networking
- Explain the basic concepts of embedded networking
- Apply the embedded networking concepts in wireless networks
- Relate different data acquisition concepts
- Build a system automation for different applications

TEXTBOOKS

1. Mohammad Ilyas And ImadMahgoub, "Handbook of sensor Networks: Compact wireless and wired sensing systems", CRC Press,2005

2. Peter W Gofton , “Understanding Serial Communication”, Sybes International, 2000

REFERENCE BOOKS:

1. Jan Axelson "Embedded Ethernet and Internet Complete", Penram publications, 2006

2. Krzysztof Iniewski,"Smart Grid ,Infrastructure& Networking”, The McGraw-Hill,2012

3. James Northcote-Green, Robert Wilson, "Control and automation of electrical power distribution systems", CRC, Taylor and Francis, 2006

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4. https://onlinecourses.nptel.ac.in/noc19_cs42/preview

5. https://microcontrollerslab.com/8051-microcontroller-tutorials-c/
6. https://www.circuitstoday.com/getting-started-with-keil-uvisio

CO - PO & PSO MAPPING:

CO\PO& PSO	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
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CO3	-	2	2	1	2	1	1	-	-	-	-	1	2	2	2
CO4	1	2	1	1	2	1	1	-	-	-	-	2	1	1	2
CO5	1	2	1	1	1	1	2	-	-	-	-	1	2	2	1
AVG	1	2	2	1	2	2	1	-	-	-	-	2	2	2	2

JEE1035 EMBEDDED SYSTEM SECURITY L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce the fundamentals related to Cryptography and Data Security
- To teach the mathematical foundations for Cryptography.
- To impart knowledge about Embedded Cryptography and Data Protection Protocols
- To make them understand the practical aspects of Embedded System Security.
- To involve the students in Discussions/Tutorials/Programming to familiarize the concepts for improved employability skills.

Prerequisites: Embedded system

UNIT I BACKGROUND AND INTRODUCTION 9

Computer and Network Security Concepts: Computer Security Concepts – The OSI Security Architecture – Security Attacks – Security Services – Security Mechanisms – Fundamentals of Security Design Principles – Attack Surfaces and Attack Trees – A Model for Network Security. Introduction to Number Theory: Divisibility and the Division Algorithm – The Euclidean Algorithm – Modular Arithmetic – Prime Numbers – Fermet's and Euler's Theorems – Testing for Primality – The Chinese Remainder Theorem – Discrete Logarithms.

UNIT II SYMMETRIC CIPHERS 9

Classical Encryption Techniques: Symmetric Cipher Model – Substitution Techniques – Transposition Techniques. Block Ciphers and the Data Encryption Standard (DES): Traditional Block Cipher Structure – The Data Encryption Standard – A DES Example – Strength of DES. Advanced Encryption Standard: Finite Field Arithmetic – AES Structure – AES Transformation Functions – AES Key Expansion – An AES Example – AES Implementation.

UNIT III EMBEDDED SYSTEMS SECURITY 9

Embedded Security Trends – Security Policies – Security Threats. System Software Considerations: The Role of Operating System – Microkernel versus Monolithic – Core Embedded OS Security Requirements – Access Control and Capabilities – Hypervisors and System Virtualization – I/O Virtualization – Remote Management – Assuring Integrity of the TCB

UNIT IV EMBEDDED CRYPTOGRAPHY AND DATA PROTECTION PROTOCOL 9

The One-time Pad – Cryptographic Modes – Block Ciphers – Authenticated Encryption – Public Key Cryptography – Key Agreement – Public Key Authentication – Elliptic Curve Cryptography – Cryptographic Hashes – Message Authentication Codes – Random Number Generation – Key Management for Embedded Systems – Cryptographic Certifications. Data Protection Protocols for Embedded Systems: Data-in-Motion Protocols – Data-at-Rest Protocols. Emerging Applications: Embedded Network Transactions – Automotive Security – Secured Android.

UNIT V PRACTICAL EMBEDDED SYSTEM SECURITY 9

Network Communications Protocols and Built-in Security – Security Protocols and Algorithms – The Secured Socket Layer – Embedded Security – Wireless – Application-Layer and Client/Server Protocols – Choosing and Optimizing Cryptographic Algorithms for Resource-Constrained Systems – Hardware Based Security.

TOTAL: 45 PERIODS

COURSE OUTCOMES: At the end of the course, the student will be able to

- Explain the significance of Security.
- Understand the major concepts and techniques related to Cryptography.
- Demonstrate thorough knowledge about the aspects of Embedded System Security.
- Delivers insight onto role of Security Aspects during Data Transfer and Communication.
- Applying the Security Algorithms for Real-time Applications.

TEXT BOOKS:

1. William Stallings, “Cryptography and Network Security Principles and Practice”, 7th Edition – Global Edition, Pearson Education Limited, 2017.

2. David Kleidermacher and Mike Kleidermacher, “Embedded Systems Security - Practical Methods for Safe and Secure Software and Systems Development”, Newnes (an imprint of Elsevier), 2012.

3. Timothy Stapko, “Practical Embedded Security - Building Secure Resource-Constrained Systems”, Newnes (an imprint of Elsevier), 2008.

REFERENCE BOOKS:

1. Ashford Lee Edward, "Introduction To Embedded Systems", 2nd Edition, PHI publication, 2019.

2. James K. Peckol, "Embedded Systems: A Contemporary Design Tool" , wiley, January 2009.

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2) https://www.embedded.com/mcus-or-dsps-which-is-in-motor-control/
3) https://www.e3sconferences.
org/articles/e3sconf/pdf/2019/13/e3sconf_SeFet2019_01004.pdf
4) https://www.electronics-tutorials.ws/blog/pulse-width-modulation.html
5) http://kaliasgoldmedal.yolasite.com/resources/SEM/SRM.pdf

CO - PO & PSO MAPPING:

CO\PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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CO3	2	2	2	1	2	1	1	-	-	-	-	2	2	2	2
CO4	1	2	2	2	2	2	2	-	-	-	-	2	1	1	2
CO5	2	2	1	1	1	1	2	-	-	-	-	2	2	2	1
AVG	2	2	2	2	2	2	1	-	-	-	-	2	2	2	2

JEE1005 SMART SYSTEM DESIGN L T P C
3 0 0 3

COURSE OBJECTIVES:

- To learn about the smart system technologies and its role in real time applications
- To expose students to different open-source platforms.
- To provide knowledge on Home automation systems.
- To familiarize the design of smart appliances and energy management techniques.
- To study about robots and controllers

Prerequisites: Embedded system

UNIT 1 INTRODUCTION TO EMBEDDED SYSTEMS 9

Over view of smart system design and requirements-Hardware and software selection & co-design –Communications-smart sensors and actuators-Open-source resources for embedded system-Android 42 for embedded system-Embedded system for Ecommerce-Embedded system for Smart card design and development– Recent trend.

UNIT 2 MOBILE EMBEDDED SYSTEM 9

Design requirements-Hardware platform-OS and Software development platform-Mobile Apps development – Applications: heart beat monitoring, blood pressure monitoring, mobile banking and appliances control.

UNIT 3 HOME AUTOMATION 9

Home Automation System – Architecture-Essential Components-Linux and Raspberry Pi–design and real time implementation.

UNIT 4 SMART APPLIANCES AND ENERGY MANAGEMENT 9

Overview-functional requirements-Embedded and Integrated Platforms for Energy Management-Energy Measurement Techniques for Smart Metering-Smart Embedded Appliances Networks–Security Considerations.

UNIT 5 ROBOTS AND CONTROLLERS **9**

Robots and Controllers –components-Aerial Robotics-Mobile Robot Design –Three-Servo Ant Robot-Autonomous Hexa copter System

TOTAL: 45 Periods

COURSE OUTCOMES: At the end of the course, the student will be able to

- Understand the concepts of smart System design and its present developments.
- Acquire knowledge on various embedded open-source platforms
- Analyze different effective techniques for developing solution for real time Applications
- Acquire knowledge on smart appliances and energy management techniques
- Understand about robots and controllers

TEXT BOOKS:

1. Thomas Bräunl, "Embedded Robotics", Springer, 2003.
2. Grimm, Christoph, Neumann, Peter, Mahlknech and Stefan, "Embedded Systems for SmartAppliances and Energy Management" , Springer 2013.
3. RajKamal, "Embedded Systems-Architecture, Programming and Design", McGraw-Hill, 2008
4. Nilanjan Dey, Amartya Mukherjee, "Embedded Systems and Robotics with Open Source Tools",CRC press, 2016.
5. Karim Yaghmour, "Embedded Android", O'Reilly, 2013

REFERENCE BOOKS:

1. Steven Good win, "Smart Home Automation with Linux and Raspberry Pi", A press, 2013
2. TohC.K., "Adhoc mobile wireless networks", Prentice Hall, Inc, 2002.
3. Kazem Sohraby, Daniel Minoli and Taieb Znati, "Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley & Sons, 2007.
4. Anna Hác, "Wireless Sensor Network Designs", John Wiley & Sons Ltd, 2003.
5. Robert Faludi, "Wireless Sensor Networks", O' Reilly, 2011.

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2. https://nptel.ac.in
3. https://youtu.be/JO4AEkOVF2M
4. https://youtu.be/rlWVYBR-W54
5. https://youtu.be/Yjf77P062BU
6. https://youtu.be/JUwIC73uiIw

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CO\PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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CO2	3	3	3	3	3	2	1	1	-	1	1	3	1	2	2
CO3	3	3	3	3	2	1	1	-	1	1	1	3	1	2	2

CO4	3	2	2	1	2	1	1	1	1	1	1	2	1	1	-
CO5	2	1	2	2	2	1	1	-	-	1	1	2	2	3	3
AVG	3	2	3	2	2	1	1	0	0	1	1	2	2	2	2

JEE1036 EMBEDDED SYSTEM FOR AUTOMOTIVE APPLICATIONS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To expose the students to the fundamentals and building of Electronic Engine Control systems.
- To teach on functional components and circuits for vehicles.
- To discuss on programmable controllers for vehicles management systems.
- To teach logics of automation & commercial techniques for vehicle communication.
- To introduce the embedded systems concepts for E-vehicle system development.

UNIT I BASICS OF ELECTRONICALLY CONTROLLED ENGINE 9

Overview of Automotive systems, fuel economy, air-fuel ratio, emission limits and vehicle performance; Automotive microcontrollers- Electronic control Unit- Hardware & software selection- Introduction to AUTOSAR.

UNIT II SENSORS AND ACTUATORS FOR AUTOMOTIVES 9

Review of sensors- sensors interface to the ECU, conventional sensors and actuators, Modern sensor and actuators - LIDAR sensor- smart sensors- MEMS/NEMS sensors and actuators for automotive applications.

UNIT III VEHICLE MANAGEMENT SYSTEMS 9

Electronic Engine Control-engine mapping, air/fuel ratio spark timing control strategy, fuel control, electronic ignition- Adaptive cruise control - speed control-anti-locking braking system-electronic suspension - electronic steering, Automatic wiper control.

UNIT IV ONBOARD DIAGONSTICS AND TELEMATICS 9

On board diagnosis of vehicles -System diagnostic standards and regulation requirements Vehicle communication protocols MOST, KWP2000 and recent trends in vehicle communications- Navigation- Connected Cars technology – Tracking- Security for data communication- dashboard display and Virtual Instrumentation.

UNIT V ELECTRIC VEHICLES 9

Electric vehicles –Components- Plug in Electrical vehicle- Charging station – Aggregators- Fuel cells/Solar powered vehicles- Autonomous vehicles.

Total: 45 Periods

COURSE OUTCOMES: At the end of the course, the student will be able to

- Insight into the significance of the role of embedded system for automotive applications.
- Illustrate the need, selection of sensors and actuators and interfacing with ECU
- Develop the Embedded concepts for vehicle management and control systems.
- Demonstrate the need of Electrical vehicle and able to apply the embedded system technology for various aspects of EVs

- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design and its application in automotive systems.

TEXT BOOKS:

1. William B. Ribbens ,"Understanding Automotive Electronics", Elseiver,8th Edition, 2017.
2. Jurgen, R., "Automotive Electronics Hand Book", McGraw Hill, 2nd Edition, 1999.
3. L.Vlacic,M.Parent,F.Harahima,"Intelligent Vehicle Technologies",SAE International, 2001, 1st Edition, 2017.

REFERENCE BOOKS:

1. Ali Emedi, Mehrdedehsani, John M Miller , "Vehicular Electric power system- land, Sea, Air and Space Vehicles" Marcel Decker, 2004.
2. Jack Erjavec,JeffArias,"Alternate Fuel Technology-Electric ,Hybrid& Fuel Cell Vehicles",Cengage , 2nd Edition, 2012.
3. Automotive Electricals / Electronics System and Components, Tom Denton, 5th Edition, 2017.
4. Uwe Kiencke, Lars Nielsen, "Automotive Control Systems: For Engine, Driveline, and Vehicle", Springer; 1st Edition, 2005.
5. Robert Bosch Gmbh, "Automotive Electricals Electronics System and Components", 5 th Edition, 2014.
6. Robert Bosch "Automotive Hand Book", Bently Publishers, 10th Edition, 2018.

CO - PO & PSO MAPPING:

CO\PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	0PSO1	PSO2	PSO3
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CO2	2	1	2	1	1	1	-	-	-	-	-	2	2	2	1
CO3	1	1	1	1	2	2	1	-	-	-	-	2	1	2	2
CO4	2	2	2	2	2	2	2	-	-	-	-	2	2	1	2
CO5	2	2	1	1	2	2	2	-	-	-	-	2	2	1	1
AVG	2	2	2	2	2	2	1	-	-	-	-	2	2	2	2

Vertical III- Control Engineering

JEE1037	SIGNALS AND SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the basic properties of signal & systems
- To know the methods of characterization of LTI systems in time domain
- To analyze continuous time signals and system in the Fourier and Laplace domain
- To analyze discrete time signals and system in the Fourier and Z transform domain
- To analyze Linear time variant discrete time system

Pre-Requisites: Engineering Mathematics, Control Systems

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 9

Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals Classification of systems- CT systems and DT systems- – Linear & Nonlinear, Time variant & Time-invariant, Causal & Non-causal, Stable & Unstable.

UNIT II NEURAL NETWORKS FOR CONTROL 9

Fourier series for periodic signals - Fourier Transform – properties- Laplace Transforms and Properties

UNIT III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS 9

Impulse response - convolution integrals- Differential Equation- Fourier and Laplace transforms in Analysis of CT systems - Systems connected in series / parallel.

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS 9

Baseband signal Sampling–Fourier Transform of discrete time signals (DTFT)– Properties of DTFT - Z Transform & Properties

UNIT V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS 9

Impulse response–Difference equations-Convolution sum- Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems-DT systems connected in series and parallel.

TOTAL: 45 PERIODS

Course Outcomes: At the end of the course, the student will be able to

- Determine if a given system is linear/causal/stable
- Determine the frequency components present in a deterministic signal
- Characterize continuous LTI systems in the time domain and frequency domain
- Characterize discrete LTI systems in the time domain and frequency domain
- Compute the output of an LTI system in the time and frequency domains

TEXT BOOKS:

1. Oppenheim, Willsky and Hamid, "Signals and Systems", Second Edition, Pearson Education, New Delhi, 2015.
2. Simon Haykin, Barry Van Veen, "Signals and Systems", Second Edition, Wiley, 2002

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1. B. P. Lathi, "Principles of Linear Systems and Signals", Second Edition, Oxford, 2009.
2. M. J. Roberts, "Signals and Systems Analysis using Transform methods and MATLAB", Mc Graw- Hill Education, 2018.
3. John Alan Stuller, "An Introduction to Signals and Systems", Thomson, 2007.

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CO –PO & PSO MAPPING:

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CO3	3	3	-	3	2	-	-	-	-	-	-	3	2	-	1
CO4	3	3	-	3	2	-	-	-	-	-	-	3	-	3	1
CO5	3	3	-	3	2	-	-	-	-	-	-	3	-	3	1
AVG	3	3	-	3	2	-	-	-	-	-	-	3	2	3	1

JEE1018 ADVANCED CONTROL SYSTEMS L T P C

3 0 0 3

Course Objectives:

- To impart knowledge on state-space modeling.
- To provide an overview of the phase plane analysis.
- To learn the concept behind describing function analysis.
- To study the design of an optimal controller.
- To educate in the design of optimal estimators including Kalman

Pre-Requisites: Engineering Mathematics, Basic Engineering, Control Systems

UNIT I STATE VARIABLE DESIGN 9

Introduction to state Model- effect of state Feedback- Necessary and Sufficient Condition for Arbitrary Pole-placement- pole placement Design- design of state Observers- separation principle servo design: -State Feedback with integral control.

UNIT II PHASE PLANE ANALYSIS 9

Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, singular points, phase-plane analysis of linear and nonlinear control systems

UNIT III DESCRIBING FUNCTION ANALYSIS 9

Basic concepts, derivation of describing functions for common non-linearities – Describing function analysis of non-linear systems – limit cycles – Stability of oscillations.

UNIT IV OPTIMAL CONTROL 9

Introduction - Time varying optimal control – LQR steady state optimal control – Solution of Ricatti's equation – Application examples

UNIT V OPTIMAL ESTIMATION 9

Optimal estimation – Kalman Bucy Filter-Solution by duality principle-Discrete systems-Kalman Filter- Application examples.

TOTAL: 45 PERIODS

Course Outcomes: At the end of the course, the student will be able to

- Design a state feedback controller and state observer.
- Analyze linear and nonlinear systems using the phase plane method
- Analyze nonlinear systems using describing function method.
- Design an optimal controller.
- Optimize the optimal estimator including Kalman Filter.

TEXT BOOKS:

1. Nagarath. I.J and Gopal.M," Control Systems Engineering", New Age International (P)Ltd., 2017
2.Richard Dorf, "Modern Control system", Global Technical Publishers, 2017.
3.G. J. Thaler, "Automatic Control Systems", Jaico Publishing House, 1993.

REFERENCE BOOKS:

1.Ogata. K, "Modern Control Engineering", Fourth edition, PHI, New Delhi, 2015
2. Gopal.M, "Modern Control System Theory", New Age International Publishers, 2002
3.Ashish Tewari, "Modern Control Design with Matlab and Simulink", John Wiley, New Delhi, 2002.
4.William S Levine, "Control System Fundamentals," The Control Handbook, CRC Press, Tayler and Francies Group, 2011
5.Glad.Tand Ljung.L, "Control Theory –Multivariable and Non-Linear Methods", Taylor & Francis, 2002.

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CO5	3	1	2	3	-	-	-	-	-	-	-	2	-	-	1
AVG	3	2	2	2	-	-	-	-	-	-	-	2	-	1	2

JEE1038 DIGITAL SIGNAL PROCESSING SYSTEM DESIGN L T P C

3 0 0 3

Course Objectives:

- To introduce the concept of analyzing discrete-time signals & systems in the time and frequency domain through mathematical representation.

- To study the various time-to-frequency domain transformation techniques.
- To understand the computation algorithmic steps for Fourier Transform.
- To study filters and their design for digital implementation.
- To introduce the programmable digital signal processor & its application.

Pre-Requisites: Engineering Mathematics, Basic Engineering, Control Systems

UNIT I INTRODUCTION **9**

Classification of systems: Continuous, discrete, linear, causal, stable, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect. Digital signal representation.

UNIT II DISCRETE TIME SYSTEM ANALYSIS **9**

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform, application to discrete systems - Stability analysis, frequency response – Convolution –Introduction to Fourier Transform– Discrete-time Fourier transform.

UNIT III DISCRETE FOURIER TRANSFORM & COMPUTATION **9**

DFT properties, magnitude, and phase representation - Computation of DFT using FFT algorithm –DIT & DIF - FFT using radix 2 – Butterfly structure.

UNIT IV DESIGN OF DIGITAL FILTERS **9**

FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. IIR design: Analog filter design – Butterworth and Chebyshev approximations; digital design using impulse invariant and bilinear transformation - Warping, pre-warping -Frequency transformation.

UNIT V DIGITAL SIGNAL PROCESSORS **9**

Introduction – Architecture of one DSP processor for motor control – Features – Addressing Formats– Functional modes - Introduction to Commercial Processors

TOTAL: 45 PERIODS

Course Outcomes: At the end of the course, the student will be able to

- Work with digital signal processing
- Illustrate the system representation using transforms
- Work with transformation techniques for time-to-frequency conversion
- Design suitable digital FIR, IIR algorithm for the given specification

- Use digital signal processor for application development

TEXT BOOKS:

1. J.G. Proakis and D.G. Manolakis, "Digital Signal Processing Principles, Algorithms and Applications", Fourth Edition ,Pearson Education, New Delhi, 2007.
2. Robert J. Schilling& Sandra L. Harris, "Introduction to Digital Signal Processing using MATLAB" , Second Edition ,Cengage Learning, 2013.
3. Emmanuel C Ifeachor and Barrie W Jervis, "Digital Signal Processing – A Practical Approach" Second edition , Pearson Education, 2002.
4. Alan V. Oppenheim, Ronald W. Schafer, and John R. Buck, "Discrete – Time Signal Processing", Second Edition , Pearson Education, New Delhi, 2012.
5.SenM.Kuo, Woonsen, s.gan, "Digital Signal Processors, Architecture, Implementations & Applications", First Edition , Pearson, 2004.

REFERENCE BOOKS:

1. S.K. Mitra, "Digital Signal Processing – A Computer Based Approach", Fourth Edition Tata McGraw Hill, New Delhi, 2013.
2. B. Venkataramani, M. Bhaskar, "Digital Signal Processors, Architecture, Programming and Applications", First Edition, Tata McGraw Hill, New Delhi, 2003.

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5. https://www.electronicshub.org/introduction-to-fpga/

CO-PO&PSO MAPPING:

CO\PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO12	PSO1	PSO2	PSO3
CO1	1	3	2	2	1	-	-	-	-	-	-	-	1	2	1
CO2	2	3	3	2	2	-	-	-	-	-	-	-	2	3	1
CO3	3	3	3	3	3	-	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	3	-	-	-	-	-	-	-	2	2	3
CO5	3	3	3	2	1	-	-	-	-	-	-	-	2	2	3
AVG	2.4	3	2.8	2.4	2	-	-	-	-	-	-	-	1.8	2.2	2

JEE1039	MODEL BASED CONTROL	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the Knowledge about Multivariable and Multiloop systems.
- To understand the Model predictive control schemes and its elements.
- To get exposed to state space MPC along with case studies.
- To acquire knowledge on various constrained MPC.
- To make the student design simple adaptive controllers for linear systems

Pre-Requisites: Engineering Mathematics, Basic Engineering, Control Systems

UNIT I INTRODUCTION TO MIMO CONTROL 9

Introduction to MIMO Systems-Multivariable Control-Multiloop Control-Multivariable IMC-IMCPID Case studies.

UNIT II MODEL PREDICTIVE CONTROL SCHEMES 9

Introduction to Model Predictive Control - Model Predictive Control Elements – Generalized Predictive Control Scheme – Multivariable Generalized Predictive Control Scheme – Multiple Model-based Model Predictive Control Scheme Case Studies.

UNIT III STATE SPACE-BASED MODEL PREDICTIVE CONTROL SCHEME 9

State Space Model Based Predictive Control Scheme - Review of Kalman Update-based filters – State Observer Based Model Predictive Control Schemes – Case Studies.

UNIT IV CONSTRAINED MODEL PREDICTIVE CONTROL SCHEME 9

Constraints Handling: Amplitude Constraints and Rate Constraints –Constraints and Optimization – Constrained Model Predictive Control Scheme – Case Studies.

UNIT V ADAPTIVE CONTROL SCHEME 9

Introduction to Adaptive Control-Gain Scheduling-Self tuning regulators–MARS-Adaptive Model Predictive Control Scheme –Case Studies.

TOTAL: 45 PERIODS

Course Outcomes: At the end of the course, the student will be able to

- Apply engineering knowledge to understand the control schemes on MIMO systems.

- Design a controller for the MIMO system.
- Analyze the control schemes available in industries.
- Design MPC, Adaptive controllers for practical engineering problems.
- Choose suitable controllers for the given problems.

TEXT BOOKS:

1. Coleman Brosilow, Babu Joseph, "Techniques of Model-Based Control", First Edition, Prentice Hall PTR Pub ,2002.
2. E. F. Camacho, C. Bordons,"Model Predictive Control",Springer-Verlag London Limited 2007,
3. K.J. Astrom and B. J. Wittenmark, "Adaptive Control", Second Edition, Pearson Education Inc., 2013.
4. Paul Serban Agachi, Zoltan K. Nagy, Mircea Vasile Cristea, and Arpad Imre-Lucaci , "Model Based Control Case Studies in Process Engineering", Second Edition,WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim 2007.
5. Ridong Zhang, Anke Xue Furong Gao, "Model Predictive Control Approaches Based on the Extended State Space Model and Extended Non-minimal State Space Model", First Edition, Springer Nature Singapore Pte Ltd.,2019.

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1.J.A. ROSSITER "Model-Based Predictive Control A Practical Approach", First Edition ,Taylor & Francis e-Library, 2005.

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3 https://youtu.be/XMfH2P2Fc6Q?list=PLWPirh4EWFpGpH_Rb6Q4iQ6vGGRA6MORZ

CO-PO&PSO MAPPING:

CO\PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	-	-	-	-	-	-	-	2	2	2
CO2	3	3	3	3	-	-	-	-	-	-	-	-	2	2	2
CO3	3	3	3	2	-	-	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	-	-	-	-	-	-	-	-	2	2	2

CO5	3	3	3	3	-	-	-	-	-	-	-	-	2	2	2
AVG	3	2.8	2.8	2.6	-	-	-	-	-	-	-	-	2	2	2

JEE1040 SYSTEM IDENTIFICATION L T P C
3 0 0 3

Course Objectives:

- To elaborate the concept of estimating the state variables of a system using state estimation algorithms.
- To elaborate the concept of estimating the parameters of the Input-output models using parameter estimation algorithms.
- To make the student understand the various closed-loop system identification techniques.
- To make the student understand the various closed-loop system identification techniques.
- To provide the background on the practical aspects of conducting experiments for real-time system identification.

Pre-Requisites: Engineering Mathematics, Basic Engineering, Control Systems

UNIT I NON-PARAMETRIC METHODS 9

Nonparametric methods: Transient analysis - frequency analysis - Correlation analysis – Spectral analysis.

UNIT II PARAMETRIC METHODS 9

Parametric model structures: ARX, ARMAX, OE, BJ models - The Least square estimate - Best linear unbiased estimation under linear constraints - Updating the Parameter estimates for linear regression models - Prediction error methods: Description of Prediction error methods - Optimal Prediction – Relationships between prediction error methods and other identification methods –a theoretical analysis.

UNIT III RECURSIVE IDENTIFICATION METHODS 9

The recursive least squares method - Recursive Instrumental variable method-the recursive prediction error method-model validation and model structure determination. Identification of

systems operating in closed loop: Identifiability considerations - Direct identification – Indirect identification - Joint input – Output identification.

UNIT IV CLOSED-LOOP IDENTIFICATION **9**

Identification of systems operating in closed loop: direct identification and indirect identification – Subspace Identification methods: classical and innovation forms – Relay feedback identification of stable processes.

UNIT V NONLINEAR SYSTEM IDENTIFICATION **9**

Modeling of nonlinear systems using ANN- NARX & NARMAX - Training Feed-forward and Recurrent Neural Networks – TSK model – Adaptive Neuro-Fuzzy Inference System (ANFIS) - Introduction to Support Vector Regression.

TOTAL: 45 PERIODS

Course Outcomes: At the end of the course, the student will be able to

- Design and implement state estimation schemes.
- Develop various models (Linear & Nonlinear) from the experimental data.
- Choose a suitable model and parameter estimation algorithm for the identification of systems.
- Illustrate verification and validation of the identified model.
- Develop the model for prediction and simulation purposes using suitable control schemes.

TEXT BOOKS:

1. Karel J. Keesman, “System Identification an Introduction”, First Edition, Springer, 2011.
2. Dan Simon, “Optimal State Estimation Kalman, H-infinity and Non-linear Approaches”, John Wiley and Sons, 2006,
3. Tangirala, A.K., “Principles of System Identification: Theory and Practice”, First Edition , CRC Press, 2014.
4. Van der Heijden, F., Duin, R.P.W., De Ridder, D., and Tax, D.M.J., “Classification, Parameter Estimation, and State Estimation- An Engineering Approach Using MATLAB”, Second Edition, John Wiley & Sons Ltd., 2017.
5. Tao Liu and Furong Gao, “Industrial Process Identification and Control Design, Step-test and relay-experiment-based methods”, First Edition , Springer- Verlag London Ltd., 2012.

REFERENCE BOOKS:

1. Cortes, C., and Vapnik, V., “Support-Vector Networks, Machine Learning”, First Edition, 1995.

2. Miller, W.T., Sutton, R.S., and Webrose, P.J., "Neural Networks for Control", First Edition , MIT Press, , 1996.
3. Lennart Ljung, "System Identification: Theory for the user", Second Edition, Prentice Hall, 1999.

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3.https://in.mathworks.com/help/curvefit/nonparametric-fitting.html
4.https://youtu.be/uaGkKv4D3Lw

CO-PO&PSO MAPPING:

CO\PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO12	PSO1	PSO2	PSO3
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CO2	3	3	3	3	-	-	-	-	-	-	-	-	2	2	2
CO3	3	2	2	2	-	-	-	-	-	-	-	-	2	2	2
CO4	3	2	2	2	-	-	-	-	-	-	-	-	2	2	2
CO5	3	3	3	3	-	-	-	-	-	-	-	-	2	2	2
AVG	3	2.6	2.6	2.6	-	-	-	-	-	-	-	-	2	2	2

JEE1041 ADAPTIVE CONTROL L T P C
3 0 0 3

Course Objectives:

- To impart knowledge about basic adaptive controllers.
- To impart knowledge of gain scheduling controllers.
- To make the student understand the deterministic self-tuning regulators.
- To make the student understand the stochastic and predictive self-tuning regulators.
- To make the student design simple adaptive controllers for linear systems using STR, MRAC, and Gain scheduling

Pre-Requisites: Engineering Mathematics, Basic Engineering, Control Systems

UNIT I INTRODUCTION 9

Introduction - Adaptive Schemes - The adaptive Control Problem – Applications-Parameter estimation:-LS, RLS: and ERLS

UNIT II GAIN SCHEDULING **9**

Introduction- The principle - Design of gain scheduling controllers- Nonlinear transformations - application of gain scheduling - Auto-tuning techniques: Methods based on Relay feedback.

UNIT III DETERMINISTIC SELF-TUNING REGULATORS **9**

Introduction- Pole Placement design - Indirect Self-tuning regulators - direct self-tuning regulators – Disturbances with known characteristics.

UNIT IV STOCHASTIC AND PREDICTIVE SELF-TUNING REGULATORS **9**

Introduction – Design of minimum variance controller - Design of moving average controller - stochastic self-tuning regulators.

UNIT V MODEL – REFERENCE ADAPTIVE SYSTEM **9**

Introduction- MIT rule – Determination of adaptation gain - Lyapunov theory –Design of MRAS using Lyapunov theory – Relations between MRAS and STR.

TOTAL:45 PERIODS

Course Outcomes: At the end of the course, the student will be able to

- Apply the estimation algorithm to estimate the parameters of the process.
- Apply adaptive control concepts to control a process.
- Use appropriate software tools to design adaptive controllers and analyze the process.
- Identify, formulate, and carry out research by designing suitable adaptive schemes for complex instrumentation problems.
- Apply the concepts to design adaptive control for multidisciplinary problems

TEXT BOOKS:

1. K.J. Astrom and B. J. Wittenmark, “Adaptive Control”, Second Edition, Pearson Education Inc., 2013.
2. Dan Simon, “Optimal State Estimation Kalman, H-infinity and Non-linear Approaches”, John Wiley and Sons, 2006,
3. Tangirala, A.K., “Principles of System Identification: Theory and Practice”, First Edition ,CRC Press, 2014.

4. Van der Heijden, F., Duin, R.P.W., De Ridder, D., and Tax, D.M.J., "Classification, Parameter Estimation, and State Estimation- An Engineering Approach Using MATLAB", Second Edition, John Wiley & Sons Ltd., , 2017.
5. Tao Liu and Furong Gao, "Industrial Process Identification and Control Design, Step-test and relay-experiment-based methods", First Edition, Springer- Verlag London Ltd., 2012.

REFERENCE BOOKS:

1. T. Soderstorm and Petre Stoica, "System Identification", Prentice Hall International(UK) Ltd., 1989.
2. Lennart Ljung, "System Identification: Theory for the User", Second Edition, Prentice Hall, 1999.

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4.https://www.dynalog-us.com/adaptive-robot-control.htm
5 .https://www.vlab.co.in/

CO –PO & PSO MAPPING:

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CO2	3	2	2	2	-	-	-	-	-	-	-	-	2	2	2
CO3	3	3	3	3	-	-	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	-	-	-	-	-	-	-	-	2	2	2
CO5	3	2	2	2	-	-	-	-	-	-	-	-	2	2	2
AVG	3	2	2	2	-	-	-	-	-	-	-	-	2	2	2

JEE1042 MACHINE MONITORING SYSTEM L T P C

3 0 0 3

Course Objectives:

- To familiarize the students with the concept of condition-based maintenance for effectively utilizing machines.
- To impart knowledge of artificial intelligence for machinery fault diagnosis.

- To give basic knowledge on vibration monitoring.
- To study the machinery vibrations using signal processing techniques.
- To provide knowledge on FMECA.

Pre-Requisites: Engineering Mathematics, Basic Engineering, Control Systems

UNIT I INTRODUCTION TO MACHINE CONDITION MONITORING 9

Machinery condition monitoring - Present status - Fault prognosis - Future needs.

UNIT II MACHINERY MAINTENANCE 9

Maintenance strategies – Reactive, Preventive, and Predictive – Benefits of planned maintenance – Bathtub curve – Failure Modes Effects and Criticality Analysis (FMECA).

UNIT III INTRODUCTION TO MACHINERY VIBRATION AND MONITORING 9

Characteristics of Vibration systems – Mode shapes & operational deflection shapes – Experimental modal analysis – Principles of vibration monitoring – Machinery faults diagnosed by vibration analysis.

UNIT IV SIGNAL PROCESSING IN MACHINERY MONITORING 9

FFT analysis – Time domain analysis – Time-frequency analysis – Signal filtering – Cepstrum analysis – Health condition of compressor & engine.

UNIT V MACHINE LEARNING FOR CONDITION MONITORING 9

Machine Learning: Feature extraction and feature selection methods – Feature reduction – Classification techniques – Case studies of condition monitoring in Nuclear plant components, Distillation column.

TOTAL: 45 PERIODS

Course Outcomes: At the end of the course, the student will be able to

- Identify faults in machinery.
- Choose the proper maintenance strategies and condition monitoring techniques forthe identification of failure in the machine.
- Construct a classifier model for machine learning-based fault diagnosis.
- Predict the faulty component in a machine by analyzing the acquired vibration signals.
- Analyze & build a model using modern tools.

TEXT BOOKS:

1. Cornelius Scheffer and Paresh Girdhar, "Practical Machinery Vibration Analysis and Predictive Maintenance", First Edition, Elsevier, 2004.
2. A. R. Mohanty, "Machinery Condition Monitoring: Principles and Practices", CRC Press, Taylor & Francis, 2017.
3. Davies, "Handbook of Condition Monitoring – Techniques and Methodology", First Edition, Springer, 2011.
4. Ian H. Witten, Eibe Frank, Mark A. Hall, "Data Mining: Practical Machine Learning Tools and Techniques", Third Edition , Elsevier, 2011.
5. Ferdinand van der Heijden, Robert Duin, Dick de Ridder, David M. J. Tax, "Classification, Parameter Estimation and State Estimation: An Engineering Approach Using MATLAB", Second Edition, John Wiley & Sons, 2017.

REFERENCE BOOKS:

1 Stephen Marsland, "Machine Learning: An Algorithmic Perspective", Second Edition, CRC, Press, 2014.
2. Collacot, "Mechanical Fault Diagnosis and Condition Monitoring", Second Edition, Chapman- Hall, 2011.

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CO-PO&PSO MAPPING:

CO\PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	-	-	-	-	-	-	-	-	1	2	2
CO2	3	2	2	2	-	-	-	-	-	-	-	-	1	2	2
CO3	3	3	3	3	-	-	-	-	-	-	-	-	1	2	2
CO4	2	2	1	2	-	-	-	-	-	-	-	-	1	2	2
CO5	3	3	3	2	-	-	-	-	-	-	-	-	1	2	2
AVG	2.4	2.2	2	2	-	-	-	-	-	-	-	-	1	2	2

JEE1043 COMPUTER CONTROL OF PROCESSES L T P C
3 0 0 3

Course Objectives:

- To represent the linear time-invariant System in discrete State Space form.
- To analyze the controllability, observability, and stability of a Discrete-time System.
- To estimate model parameters from input/output measurements.
- To Design Digital Controllers.
- To Design Multi-loop and Multivariable Controllers for multivariable system

Pre-Requisites: Engineering Mathematics, Basic Engineering, Control Systems

UNIT I DISCRETE STATE-VARIABLE TECHNIQUE 9

State equation of discrete data system with sample and hold – State transition equation – Methods of computing the state transition matrix – Decomposition of discrete data transfer functions – State diagrams of discrete data systems – System with zero-order hold – Controllability and observability of linear time-invariant discrete data system–Stability tests of the discrete-data system.

UNIT II SYSTEM IDENTIFICATION 9

Identification of Non-Parametric Input-Output Models: -Transient analysis–Frequency analysis– Correlation analysis– Spectral analysis – Identification of Parametric Input-Output Models:- Least Squares Method – Recursive Least Square Method.

UNIT III DIGITAL CONTROLLER DESIGN 9

Review of z-transform – Modified of z-transform – Pulse transfer function – Digital PID controller – Dead beat controller and Dahlin's controller – Kalman's algorithm, Pole Placement Controller.

UNIT IV MULTI-LOOP REGULATORY CONTROL 9

Multi-loop Control - Introduction – Process Interaction – Pairing of Inputs and Outputs -The Relative Gain Array (RGA) – Properties and Application of RGA - Multi-loop PID Controller – Biggest Log Modulus Tuning Method – De-coupler.

UNIT V MULTIVARIABLE REGULATORY CONTROL 9

Introduction to Multivariable control –Multivariable PID Controller – Multivariable Dynamic Matrix Controller – Case Studies: - Distillation Column, CSTR, and Four-tank system.

TOTAL: 45 PERIODS

Course Outcomes: At the end of the course, the student will be able to

- Develop mathematical models for discrete-time systems using state variable techniques and analyze the stability of the systems.
- Construct models from input-output data by least square and recursive least square method.
- Design different digital controllers to satisfy the required criterion.
- Design a multi-loop controller and multivariable controller for multi-variable systems.
- Design multivariable dynamic matrix controllers for industrial processes.

TEXT BOOKS:

1. Stephanopoulos, G., "Chemical Process Control -An Introduction to Theory and Practice", First Edition, Prentice Hall of India, 2015.
2. Sigurd Skogestad, Ian Postlethwaite, "Multivariable Feedback Control: Analysis and Design", Second Edition, John Wiley and Sons, 2005.
3. Dale E. Seborg, Duncan A. Mellichamp, Thomas F. Edgar, "Process Dynamics and Control", Fourth Edition, Wiley John and Sons, 2016.
4. P. Albertos and A. Sala, "Multivariable Control Systems An Engineering Approach", First Edition, Springer Verlag, 2004.
5. Bequette, B.W., "Process Control Modeling, Design and Simulation", First Edition, Prentice Hall of India, 2003.

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1. Thomas E. Marlin, "Process Control – Designing Processes and Control Systems for Dynamic Performance", Second Edition, Mc-Graw-Hill, 2000.
2. Gopal, M., "Digital Control and State Variable Methods", Fourth Edition, Tata Mc Graw Hill, 2017.

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4 https://youtu.be/49RET0N-ITY.

CO-PO&PSO MAPPING:

CO\PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

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CO3	3	3	3	3	-	-	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	-	-	-	-	-	-	-	-	2	2	2
CO5	3	3	3	3	-	-	-	-	-	-	-	-	2	2	2
AVG	3	3	3	3	-	-	-	-	-	-	-	-	2	2	2

Vertical IV – Instrumentation and Industrial Automation

JEE1019	SENSORS AND TRANSDUCERS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To study the characteristics of transducers and sensors
- To learn the various sensors used to measure various physical parameters.
- To learn the concepts of force, magnetic and heading sensors.
- To impart knowledge on optical, pressure and temperature sensors
- To provide an overview about data acquisition systems

Pre-Requisites: Basic Engineering.

UNIT I BASICS OF SENSORS AND TRANSDUCERS 6

Basics of Measurement- Classification of errors-Error analysis – Static and dynamic characteristics of transducers–Performance measures of sensors–Sensor calibration techniques – Sensor Output Signal Types

UNIT II MOTION, PROXIMITY AND RANGING SENSORS 6

Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT– RVDT – Synchro – Microsyn, Accelerometer., – GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR)

UNIT III FORCE, MAGNETIC AND HEADING SENSORS 6

Strain Gage, Load Cell, Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive–Hall Effect –Eddy Current sensor, Heading Sensors–Compass, Gyroscope, Inclinometers

UNIT IV OPTICAL, PRESSURE AND TEMPERATURE SENSORS 6

Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezo electric–Tactile sensors, Temperature–IC, Thermistor, RTD, Thermocouple. Acoustic Sensors– flow and level measurement, Radiation Sensors- Smart Sensors-Film sensor, MEMS & Nano Sensors, LASER sensors.

UNIT V SIGNAL CONDITIONING AND DAQ SYSTEMS 6

Amplification – Filtering –Sample and Hold circuits – Data Acquisition: Single channel and multichanneldata acquisition – Data logging-Applications-Automobile, Aerospace, Home

appliances, Manufacturing, Environmental monitoring, Medical diagnosis

TOTAL 30 Periods

LIST OF EXPERIMENTS

1. Displacement versus output voltage characteristics of a potentiometric transducer.
2. Characteristics of Strain gauge and Load cell.
3. Characteristics of LVDT, Hall Effect transducer and photo electric tachometer.
4. Characteristics of LDR, thermistor and thermocouple.
5. Step response characteristic of RTD and thermocouple.
6. Temperature measurements using RTD with three leads.
7. Measurement of Angular displacement using resistive and capacitive transducer.
8. Fiber optic temperature Measurement
9. Calibration of pressure gauge
10. Vacuum pressure measurement

TOTAL: 30 Periods

COURSE OUTCOMES: At the end of the course, the student will be able to

- Expertise in various calibration techniques and signal types of sensors
- Acquire the knowledge about the various sensors used to measure various physical parameters
- Interpret the concepts of force, magnetic and heading sensors
- Infer the knowledge on optical, pressure and temperature sensors
- Acquire the concepts about the data acquisition systems.

TEXT BOOKS:

1. Ernest O Doebelin, "Measurement Systems–Applications and Design", Third Edition, Tata McGraw-Hill,2018.
2. Sawney AK and Puneet Sawney," A Course in Mechanical Measurements and Instrumentation and Control", Twelth edition, Dhanpat Rai & Co, New Delhi, 2013.
3. Patranabis D, "Sensors and Transducers", Third Edition, PHI, New Delhi, 2017
4. Renganathan S., "Transducer Engineering" First Edition, Allied Publishers Limited, 2003.
5. D.V.S.Murty, "Transducers and Instrumentation",First Edition, PHI learning, 2012.

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1. Jacob Fraden, "Hand book of Modern Sensors Physics, Designs, and Applications", First edition, SpringerPublication, 2016.
2. John Turner and Martyn Hill, "Instrumentation for Engineers and Scientists", First Edition Oxford Science Publications, 1999
3. Richard Zurawski, "Industrial Communication Technology Handbook ", Second edition Press, 2015.

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4. https://youtube.com/playlist?list=PLwdnzlV3ogoXJLQ8lSGb1hsztt24l9kZZ
5. https://youtu.be/v-3TmN4HhLc

CO-PO & PSO MAPPING:

CO\PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO12	PSO1	PSO2	PSO3
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CO2	2	3	1	2	-	-	-	-	-	-	-	2	1	1	2
CO3	3	2	2	3	-	-	-	-	-	-	-	2	1	1	3
CO4	3	2	3	2	-	-	-	-	-	-	-	3	1	1	3
CO5	2	1	1	1	-	-	-	-	-	-	-	3	1	1	3
AVG	3	2	1	2	-	-	-	-	-	-	-	2	1	1	3

JEE1044 ANALYTICAL INSTRUMENTS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To impart knowledge on the basic elements of analytical instruments and their analysis methods
- To study the quantitative analysis of chemical substances by different types of spectroscopy.
- To impart fundamental knowledge on gas chromatography and liquid chromatography.
- To integrate the fundamental principles of physics as they relate to specific instrumentation used for gas analysers.
- To learn the working principle, types and applications of NMR, Mass spectroscopy

andradiation detectors.

Pre-Requisites: Sensors and Transducers

UNIT I INSTRUMENTAL ANALYSIS 9

Fundamentals of Analytical Instrumental: Elements, Signal Conditioning, Readout Devices, Methods of Analysis: Chemical Instrumental analysis, Spectral analysis, Electro analytical analysis, Instrumental methods of analysis: basic components and their classification - Ion selective electrodes - conductivity meters - pH meters.

UNIT II SPECTROPHOTOMETRY 9

Spectral methods of analysis – Beer-Lambert law – UV-Visible spectroscopy – IR Spectrophotometry - FTIR spectrophotometry – Atomic absorption spectrophotometry - Flame emission and atomic emission photometry – Construction, working principle, sources detectors and applications

UNIT III CHROMATOGRAPHY 9

General principles – classification – chromatographic behavior of solutes – quantitative determination – Gas chromatography – Liquid chromatography – High-pressure liquid chromatography – Applications.

UNIT IV DISSOLVED COMPONENT AND GAS ANALYSIS 9

Dissolved oxygen analyser, sodium analyser, silica analyser, Moisture measurement, Oxygen analyser, CO monitor, NO2 analyser, H2S analyser, dust and smoke measurement, thermal conductivity type, thermal analyser, industrial analysers

UNIT V NUCLEAR MAGNETIC RESONANCE AND RADIATION TECHNIQUES 9

NMR spectrometers and its applications, Mass spectrophotometers and its applications, GM counter, Proportional counter, Scintillation counter, Detectors: Nuclear radiation detector, Solid state detector, X- ray spectroscopy.

TOTAL 45 Periods

Course Outcomes: At the end of the course, the student will be able to

- Interpret the fundamental principles of analytical instruments.
- Assess and suggest a suitable analytical method for a specific purpose, and evaluate sensitivity, important sources of interferences and errors, and also suggest alternative analytical methods for quality assurance.

- Analyse the working of gas chromatography and liquid chromatography.

- Develop critical thinking for interpreting analytical data.
- Demonstrate the working principle, types and applications of NMR, Mass spectroscopy and radiation detectors.

TEXT BOOKS:

1. Willard, H.H., Merritt, L.L., Dean, J.A., Settle, F.A., "Instrumental methods of analysis", seven Edition, CBSpublishing & distribution, 2012.
2. Braun, R.D., "Introduction to Instrumental Analysis", Pharma Book Syndicate , Singapore, 2006
3. Robert E. Sherman., "Analytical Instrumentation", Instruments Society of America, 1996.

REFERENCE BOOKS:

1. Khandpur, R.S., "Handbook of Analytical Instruments", second Edition Tata McGraw-Hill publishing Co. Ltd., 2007.
2. Ewing, G.W., "Instrumental Methods of Chemical Analysis", fifth Edition reprint, McGraw-Hill, 1985.
3. Liptak, B.G., "Process Measurement and Analysis", fifth Edition ,CRC Press, 2015
4. Abirami., "Analytical Instruments", Third Edition, Anuradha Publications.
5. Gillian McMahon., "Analytical Instrumentation", First Edition,Wiley Publications, 2007.

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3. https://www.labcompare.com/Laboratory-Analytical-Instruments
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CO-PO & PSO MAPPING:

CO\PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO12	PSO1	PSO2	PSO3
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CO2	2	3	1	2	-	-	-	-	-	-	-	2	1	1	2
CO3	3	2	2	3	-	-	-	-	-	-	-	2	1	1	3
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CO5	2	1	1	1	-	-	-	-	-	-	-	3	1	1	3

AVG	3	2	1	2	-	-	-	-	-	-	-	2	1	1	3

JEE1045	PLC PROGRAMMING	L	T	P	C
		2	0	2	3

COURSE **OBJECTIVES:**

- To know about the basics of PLC and Automation
- To provide a fundamental understanding of the PLC programming language.
- To understand the importance of SCADA and its parts.
- To impart the various types of PLC communication protocols
- To introduce types of programming languages of PLC and programming using ladderlanguage for few applications.

Pre-Requisites: Electronic Devices
Basics of C programming

UNIT I INTRODUCTION **6**

Programmable Logic Controller (PLC)- Block diagram of PLC- Programming languages of PLC Basic instruction set- Networking of PLC- Overview of safety of PLC with case studies- Process Safety Automation: Levels of process safety through use of PLCs

UNIT II BASICS OF PLC PROGRAMMING **6**

Basics of PLC programming-Ladder Logic- Relay type Instruction – Timers/ Counter Instructions- Program Control Instructions-Data manipulation and Math Instructions-Development and simulation of PLC programming with examples-FBD - IL- SFC-ST.

UNIT III SCADA **6**

Elements of SCADA system - History of SCADA, Remote Terminal Unit- Discrete control - Analog control, Master Terminal Unit- Operator interface.

UNIT IV HART AND FIELD BUS **6**

Introduction- Evolution of signal standards- HART communication protocol- communication modes- HART networks- HART commands- HART and OSI model- Field bus- Architecture-Basic requirements of field Bus standard- Field bus Topology- Interoperability-Interchangeability.

UNIT V APPLICATIONS OF PLC PROGRAMMING **6**

Exercise in Programming Languages from IEC 61131-3: Traffic Light Control- Two way-Four way – Water Level Control- Automatic Material Sorting System- Automatic Bottle

Filling System, Code Converters- DC motor Control- Alarm Circuit.

TOTAL: 30 Periods

LIST OF EXPERIMENTS:

1. Study of PLC field device interface modules (AI, AO, DI, DO modules)
2. Programming Logic Gates Function in PLC
3. PLC program to implement various Boolean functions
4. PLC program to latch and unlatch output
5. Implementing Mathematical Operations in PLC
6. Programming Jump-to-subroutine & return operations in PLC
7. PLC program to drive motor in forward and reverse direction
8. PLC program to control traffic lights and pedestrian lights
9. PLC program for a car parking system
10. Implementation of ON/OFF delay timers.

TOTAL: 30 Periods

COURSE OUTCOMES: At the end of the course, the student will be able to

- Interpret the basics and need for Automation in industries.
- Analyze the logic and flow of any particular instruction for programming using PLC languages.
- Acquire the knowledge about the SCADA architecture and its parts.
- Analyse the concepts of PLC programming and communication protocols.
- Build the logic in any of the programming languages using standards.

TEXT BOOKS:

1. Frank D. Petruzella, “Programmable Logic Controllers”, fifth Edition, McGraw- Hill, New York, 2019.

2. Stuart Boyer A, “SCADA: Supervisory control and data Acquisition”, fourth Edition, ISA- The Instrumentation, Systems, and Automation Society, 2016.

3. Bolton. W, “Programmable Logic Controllers”, sixth Edition, Elsevier Newnes publication, 2015.

4. Katariya Sanjay,” Industrial Automation Solutions for PLC, SCADA and Field Devices”, first Edition,Notion Press, 2020

5.K.S. Manoj, “Industrial Automation with SCADA Concepts, Communications and Security” , second

Edition, Notion Press, 2019

REFERENCE BOOKS:

1. John W. Webb and Ronald A. Reis, “Programmable Logic Controllers: Principles and Applications”,fifth Edition, Prentice Hall Inc., New Jersey, 2003

2.Krishna Kant, “Computer - Based Industrial Control”, second Edition, Prentice Hall, New Delhi, 2011

3. Liptak B.G., “Instrument and Automation Engineers' Handbook: Process Measurement and Analysis”,Fifth Edition, CRC Press, 2016.

4. Gary Dunning, Thomson Delmar, “Programmable Logic Controller”, third edition, Ceneage Learning, 2005.

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6. https://componentsearchengine.com/library/proteus?gclid=CjwKCAjw_ISWBhBkEiwAdqxb9o

CO-PO & PSO MAPPING:

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CO4	3	2	3	2	-	-	-	-	-	-	-	3	1	1	3
CO5	2	1	1	1	-	-	-	-	-	-	-	3	1	1	3
AVG	3	2	1	2	-	-	-	-	-	-	-	2	1	1	3

JEE1046 ADVANCED INTEGRATED AUTOMATION L T P C
3 0 0 3

COURSE OBJECTIVES:

- To learn the components of totally integrated automation system.
- To provide an overview about the human machine interface system.
- To study the basic architecture of SCADA and report generation using it.
- To impart knowledge about communication protocols in an integrated system
- To familiarize with distributed control system and its applications

Pre-Requisites: PLC Programming

UNIT I TOTALLY INTEGRATED AUTOMATION 9

Need, components of TIA systems, advantages, Programmable Automation Controllers (PAC), Vertical Integration structure.

UNIT II HUMAN MACHINE INTERFACE SYSTEMS 9

Necessity and Role in Industrial Automation, Need for Human Machine Interface (HMI) systems. Types of HMI-Text display-operator panels-Touch panels-Panel PCs-Integrated displays (PLC&HMI).Check with PLC 502 and remove.

UNIT III SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) 9

Overview – Developer and runtime packages – architecture – Tools – Tag – Internal &External graphics, Alarm logging – Tag logging – structured tags– Trends – history– Report generation, VB & C Scripts for SCADA application.

UNIT IV COMMUNICATION PROTOCOLS OF SCADA 9

Proprietary and open Protocols – OLE / OPC – DDE – Server / Client Configuration – Messaging– Recipe–User administration–Interfacing of SCADA with PLC, drive, and other field device.

UNIT V DISTRIBUTED CONTROL SYSTEMS (DCS) 9

DCS – architecture – local control unit- programming language – communication facilities – operator interface-engineering interfaces. APPLICATIONS OF DCS: Case studies of Machine automation, Process automation, Comparison between SCADA and DCS.

Total: 45 Periods

Course Outcomes: At the end of the course, the student will be able to

- Describe the components involved in totally integrated automation system
- Acquire knowledge in HMI systems and to integrate it with other systems.
- Apply SCADA and usage of C programming for report generation
- Acquire information about the usage of communication protocols in an integrated system
- Design and develop automated control system using distributed control systems.

TEXT BOOKS:

1. John.W. Webb& Ronald A. Reis, "Programmable logic controllers: Principles and Applications", first edition, Pearson publication,2015.

2. Michael P. Lukas, "Distributed Control systems", second edition, Nostrand Reinfold Company, 1995.

3. 3.Popovic.D. and BhatkarV.P, "Distributed computer control for industrial Automation", first edition,Marcel Dekker, Inc., Newyork,2001 .

4. Clarke, G., Reynders, D. and Wright, E., "Practical Modern SCADA Protocols: DNP3,4. 60870.5 andRelated Systems", first edition, Newnes publications, 2004.

5. Mc Millan, G.K., "Process /Industrial Instrument and Controls Handbook" , fifth Edition, McGraw- Hillhand book, New York, 1999

REFERENCE BOOKS:

1. Mano.M and Ciletti, "Digital Design", fourth edition, Prentice Hall, 2007

2. M.P.Groover, "Automation, Production Systems and Computer Integrated Manufacturing", fifth edition,Pearson Education, 2009

3.Himanshu Kumar, "Advanced Industrial Automation", Kindle Edition, Notion Press,2020.

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3.https://youtu.be/nM1qTzlePSo
4.https://youtu.be/nlFM1q9QPJw
5.https://youtu.be/w5eCKv6iUIk

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CO3	2	2	2	2	-	-	-	-	-	-	-	2	1	1	3
CO4	2	2	3	2	-	-	-	-	-	-	-	3	1	1	3
CO5	2	1	1	1	-	-	-	-	-	-	-	3	1	1	3
AVG	3	2	1	2	-	-	-	-	-	-	-	2	1	1	2

JEE1047 INTELLIGENT AUTOMATION L T P C
3 0 0 3

COURSE OBJECTIVES:

- To identify potential areas for automation and justify the need for automation.
- To study the concepts of Artificial Intelligence.
- To learn the methods of solving problems using Artificial Intelligence.
- To understand about the expert systems and their architectures.
- To apply the concept of AI to attain control in industrial systems.

Pre-Requisites: Applied Soft Computing

UNIT I INDUSTRIAL AUTOMATION BASICS 9

Introduction to Industrial Automation - Automation in Production System- Principles and Strategies of Automation - Basic Elements of an Automated System- Advanced Automation Functions- Levels of Automations- Production Economics - Methods of Evaluating Investment Alternatives.

UNIT II ARTIFICAL INTELLIGENCE FUNDAMENTALS 9

Introduction to Artificial Intelligence -Introduction-Foundations of AI- History of AI- Intelligent agents: Agents and Environment- Reactive agent- deliberative- goal driven- utility driven and learning agents - Artificial Intelligence programming techniques. Introduction to ML and DL Concepts.

UNIT III KNOWLEDGE AND REASONING 9

Knowledge Representation and Reasoning - Ontologies-foundations of knowledge representation and reasoning-representing and reasoning about objects- relations- event sections- time- and space- predicate logic. Representing Knowledge and reasoning in an Uncertain Domain-Bayes rule-Bayesian networksprobabilistic inference sample applications.

UNIT IV EXPERT SYSTEMS 9

Expert systems -Expert systems – Architecture of expert systems, Roles of expert systems – Knowledge Acquisition – Meta knowledge- Heuristics. Typical expert systems – MYCIN – ARTXOON.

UNIT V AI IN CONTROL SYSTEMS 9

Industrial AI applications and Case studies - Applications of Industrial AI in Monitoring optimization and control- AI applications in Industry Automation using -natural language processing-computer vision- speech recognition-computer vision.

Total: 45 Periods

Course Outcomes: At the end of the course, the student will be able to

- Acquire and understand the basics AI algorithms.
- Identify the appropriate AI methods.
- Illustrate about AI/ML/DL techniques in Industrial Automation.
- Summarize about the expert levels of automation.
- Apply the AI concepts for industrial optimization and control.

TEXT BOOKS:

1. Rich and Knight, "Artificial Intelligence", third Edition, Tata McGraw Hill, 2014.

2. M.P. Groover, “Automation, Production Systems and Computer Integrated Manufacturing”, fifth edition,Pearson Education, 2019.

3.Anuradha Srinivasa Raghavan, Vincy Joseph “Machine Learning”, first edition, Wiley

publications,2019.

4. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, second Edition, PrenticeHall, 2003.

5 .Rajiv Chopra, “Deep Learning”, first edition, Khanna Publishing House, 2018.

REFERENCE BOOKS:

1. Pascal Bornet, Ian Barkin, Jochen Wirtz , “ INTELLIGENT AUTOMATION”, first edition , Kindle publications,2020

2. M. P. Grover “Automation, Production Systems and Computer-Integrated Manufacturing” fourth Edition, Pearson Education, 2016.

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2.https://nptel.ac.in/courses/108105063

3 https://aws.amazon.com/free/machine-learning

4 https://www.tensorflow.org/

CO-PO & PSO MAPPING:

CO\PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO12	PSO1	PSO2	PSO3
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CO4	3	2	3	2	-	-	-	-	-	-	-	3	1	1	3
CO5	2	1	1	1	-	-	-	-	-	-	-	3	1	1	3
AVG	3	2	1	2	-	-	-	-	-	-	-	2	1	1	3

JEE1048	ROBOTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To study the various parts of robots and fields of robotics.
- To impart the various power sources, sensors and actuators used in the robots.
- To understand the manipulators and grippers used for the control of robots for some specificapplications.
- To educate on various path planning techniques
- To introduce the dynamics & control of manipulators

Pre-Requisites: Electrical Machines
Engineering Physics

UNIT I BASIC CONCEPTS 9

Definition and origin of robotics – different types of robotics – various generations of robots – degrees of freedom – Robot classifications and specifications- Asimov's laws of robotics – dynamic stabilization of robots

UNIT II POWER SOURCES, SENSORS AND ACTUATORS 9

Hydraulic, pneumatic and electric drives: Design and control issues – determination of HP of motor and gearing ratio – variable speed arrangements – path determination – micro machines in robotics – machine vision – ranging – laser – acoustic – magnetic, fiber optic and tactile sensors

UNIT III MANIPULATORS AND GRIPPERS DIFFERENTIAL MOTION 9

Construction of manipulators – manipulator dynamics and force control – electronic and pneumatic manipulator control circuits – end effectors – U various types of grippers – design considerations.

UNIT IV KINEMATICS AND PATH PLANNING 9

Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints–Inverse -Wrist and arm singularity - Static analysis - Force and moment Balance Solution kinematics problem – robot programming languages.

UNIT V DYNAMICS AND CONTROL AND APPLICATIONS 9

Lagrangian mechanics-2DOF Manipulator-Lagrange Euler formulation -Linear control schemes - PID control scheme-Force control of robotic manipulator. Multiple robots – machine interface – robots in manufacturing and non- manufacturing applications – robot cell design – selection of robot.

Total: 45 Periods

Course Outcomes: At the end of the course, the student will be able to

- Acquire the knowledge about the evolution of robot technology and mathematically representdifferent types of robotics systems.
- Classify the various power sources, sensors and actuators used in Robots.
- Analyze various control schemes of Robotics control.
- Analyze and to select appropriate configuration of rotor for a specific application.
- Acquire knowledge on the dynamics & control of manipulators

TEXT BOOKS:

1. Mikell P. Weiss G.M., Nagel R.N.,Odraj N.G., "Industrial Robotics", second edition, McGraw-HillSingapore, 2018.
2. Saeed B Niku, "Introduction to Robotics, Analysis, Systems, Applications", Third edition Prentice Hall, 2018.
3. John.J.Craig, "Introduction to Robotics Mechanics and Control", Fourth edition, Pearson Education,2022.

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1. Peter Mckinnon, "Robotics: Everything You Need to Know About Robotics", second Edition, Create SpaceIndependent Publishing Platform, 2016.
2. Lentin Joseph," Robot Operating System (ROS)", first Edition, A press publication, 2018.

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5. https://www.intel.com/content/www/us/en/robotics/types-and-applications.html

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CO5	2	1	1	1	-	-	-	-	-	-	-	3	1	1	3
AVG	3	2	1	2	-	-	-	-	-	-	-	2	1	1	3

JEE1049 ARTIFICIAL INTELLIGENCE FOR ROBOTICS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To study the concepts of Artificial Intelligence in robotics.
- To impart the methods of solving problems using Artificial Intelligence.
- To introduce the concepts of algorithms used for reasoning.
- To learn about different forms of learning and communication.
- To impart the knowledge of risks involved in artificial intelligence for robotics.

Pre-Requisites: Applied Soft Computing
Robotics

UNIT I INTRODUCTION **9**

History, state of the art, Need for AI in Robotics. Thinking and acting humanly, intelligent agents, structure of agents. PROBLEM SOLVING: Solving problems by searching –Informed search and exploration–Constraint satisfaction problems–Adversarial search, knowledge and reasoning– knowledge representation – first order logic.

UNIT II PLANNING **9**

Planning with forward and backward State space search – Partial order planning – Planning graphs– Planning with propositional logic – Planning and acting in real world.

UNIT III REASONING **9**

Uncertainty – Probabilistic reasoning–Filtering and prediction–Hidden Markov models–Kalman filters– Dynamic Bayesian Networks, Speech recognition, making decisions.

UNIT IV LEARNING **9**

Forms of learning – Knowledge in learning – Statistical learning methods –reinforcement learning, communication, perceiving and acting, Probabilistic language processing, perception.

UNIT V AI IN ROBOTICS **9**

Robotic perception, localization, mapping- configuring space, planning uncertain movements, dynamics and control of movement, Ethics and risks of artificial intelligence in robotics.

Total: 45 Periods

Course Outcomes: At the end of the course, the student will be able to

- Identify problems that are amenable to solution by AI methods.
- Acquire the appropriate AI methods to solve a given problem.
- Formalise a given problem in the language/framework of different AI methods.
- Apply and implement basic of AI algorithms.
- Design and carry out an empirical evaluation of different algorithms on a problem formalisation, and state the conclusions that the evaluation supports.

TEXT BOOKS:

1. Stuart Russell, Peter Norvig, "Artificial Intelligence: A modern approach", first edition, Pearson Education, India,2003.

2. Negne vitsky, M, "Artificial Intelligence: A guide to Intelligent Systems",first edition, Harlow: Addison-Wesley, 2002.

3. David Jefferis, "Artificial Intelligence: Robotics and Machine Evolution", Crabtree Publishing Company, 1992.

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5. Francis X. Govers, "Artificial Intelligence for Robotics", standard edition, Packt Publishing Limited,2018.

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1. Mc Millan, G.K., “Process /Industrial Instrument and Controls Handbook”, fifth Edition, McGraw- Hillhand book, New York, 1999
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CO5	2	1	1	1	-	-	-	-	-	-	-	3	1	1	3
AVG	3	2	1	2	-	-	-	-	-	-	-	2	1	1	3

JEE1050 **INDUSTRY 4.0** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To study about an introduction to Industry 4.0 and its applications.
- To gain deep insights into how smartness is being harnessed from data.
- To get information about robotics and its security.
- To understand the cloud computing organizations.
- To familiarize in Industry 4.0 in various applications.

Pre-Requisites: Internet of Things

UNIT I INTRODUCTION **9**

Introduction to Industry 4.0 The Various Industrial Revolutions - Digitalization and the Networked Economy - Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0 - Comparison of Industry 4.0 Factory and Today's Factory.

UNIT II INTEGRATED IoT **9**

Road to Industry 4.0 - Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services - Smart Manufacturing - Smart Devices and Products - Smart Logistics – Smart Cities -Predictive Analytics

UNIT III ROBOTICS AND SECURITY 9

System, Technologies for enabling Industry 4.0 – Cyber Physical Systems – Robotic Automation and Collaborative Robots - Support System for Industry 4.0 - Mobile Computing - Cyber Security

UNIT IV CLOUD COMPUTING 9

Role of data, information, knowledge and collaboration in future organizations – Resource based view of a firm - Data as a new resource for organizations - Harnessing and sharing knowledge in organizations - Cloud Computing Basics -Cloud Computing and Industry 4.0

UNIT V CASE STUDY AND APPLICATIONS 9

Industry 4.0 case studies - Opportunities and Challenges - Future of Works and Skills for Workers inthe Industry 4.0 Era - Strategies for competing in an Industry 4.0 world – Society 5.0

Total: 45 Periods

Course Outcomes: At the end of the course, the student will be able to

- Acquire the insights of Industry 4.0.
- Compare the smartness in smart factories, smart cities, smart products and smart services.
- Analyze the outlines of the various robotic systems used in a manufacturing plant and theirrole in an Industry 4.0 world.
- Describe a strategic framework to exploit new technologies to enable cloud-based systems.
- Apply industry 4.0 concepts to real time applications.

TEXT BOOKS:

1. Alasdair Gilchrist, “Industry 4.0: The Industrial Internet of Things”, A press, 2016.

2. Lan Gibson, David W. Rosen and Brent Stucker, “Additive Manufacturing Technologies RapidPrototyping to Direct Digital Manufacturing”, Springer, 2010

3. ArsheepBahga, Internet of Things: A Hands-on Approach”, Orient Blackswan Private Limited - NewDelhi,2015

4. Andreas Gebhardt, “Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling, RapidManufacturing”, Hanser Publisher, 2011

5. J. Chanchaichujit, A. Tan, Meng, F., Eaimkhong, S. “Healthcare 4.0 Next Generation Processes withthe Latest Technologies”, Palgrave Pivot, 2019.

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1.Bahga and V. Madisetti, “Internet of Things, A hands-on approach”, first edition, Create

SpaceIndependent Publishing Platform, 2014.
2. Bahga and V. Madisetti, “Cloud Computing”, first edition, Create Space Independent PublishingPlatform, 2013
3. M. Skilton and F. Hovsepian, “the 4th Industrial Revolution: Responding to the Impact of ArtificialIntelligence on Business”, Springer Nature, 2017.

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4 https://www.epicor.com/en-in/blog/learn/what-is-industry-4-0/
5 https://www.iare.ac.in/sites/default/files/IoT_LECTURE_NOTES_MODIFIED_0.pdf
6 https://nptel.ac.in/courses/10610614

CO-PO & PSO MAPPING:

CO\PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	-	-	-	-	-	-	-	2	1	1	2
CO2	2	3	1	2	-	-	-	-	-	-	-	2	1	1	2
CO3	3	2	2	3	-	-	-	-	-	-	-	2	1	1	3
CO4	3	2	3	2	-	-	-	-	-	-	-	3	1	1	3
CO5	2	1	1	1	-	-	-	-	-	-	-	3	1	1	3
AVG	3	2	1	2	-	-	-	-	-	-	-	2	1	1	3

JEE1011 HIGH VOLTAGE DIRECT CURRENT TRANSMISSION

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To impart knowledge about the Planning of DC power transmission and comparison with AC power transmission
- To study about HVDC converters.
- To provide knowledge about HVDC system control techniques.
- To teach the necessity of reactive power requirement and design of filters.
- To inculcate knowledge about Power flow in HVDC systems under steady state

Prerequisites: Transmission & Distribution

UNIT I INTRODUCTION TO HVDC 9

DC Power transmission technology–Comparison of AC and DC transmission–Application of DC transmission–Description of DC transmission system–Planning for HVDC transmission–Modern trends in HVDC technology–DC breakers–Operating problems– HVDC transmission based on VSC –Types and applications of MTDC systems

UNIT II ANALYSIS OF HVDC CONVERTERS 9

Line commutated converter -Analysis of Graetz circuit with and without overlap –Pulse number– Choice of converter configuration – Converter bridge characteristics– Analysis of a 12 pulse converters–Analysis of VSC topologies and firing schemes

UNIT III CONVERTER AND HVDC SYSTEM CONTROL 9

Principles of DC link control–Converter control characteristics–System control hierarchy– Firing angle control–Current and extinction angle control–Starting and stopping of DC link–Power control –Higher level controllers –Control of VSC based HVDC link.

UNIT IV REACTIVE POWER AND HARMONICS CONTROL 9

Reactive power requirements in steady state–Sources of reactive power–Static Var systems-Reactive power Control during transients-Generation of harmonics–Design of AC and DC filters–Carrier Frequency and RI noise

UNIT V POWER FLOW ANALYSIS IN AC/DC SYSTEMS 9

Modelling of DC links-Solution of DC load flow–Per unit System for DC quantities- Solution of AC-DC Power flow, Power flow analysis–case study

Total: 45 Periods

COURSE OUTCOMES: At the end of the course, the student will be able to

- Describe the basic concepts about the planning of DC power transmission and its comparison with AC Power transmission.
- Formulate and solve mathematical problems related to rectifier and inverter control methods.
- Interpret the different types of converter control techniques.
- Outline the concepts of reactive power management, harmonics and design of filters.
- Comprehend the importance of power flow in HVDC system under steady state

.

TEXT BOOKS:

1.Padiyar, K.R., "HVDC power transmission system", Second Edition, New Age International (P) Ltd. New Delhi, 2010.

2.JosArrillaga, "HighVoltage Direct Current Transmission", The Institution of Engineering and Technology, 2008.

3.Kamakshaiah.S, Kamaraju.V, "HVDC Transmission", Tata McGraw Hill Education Private Limited, New Delhi, 2011

4.Nilanjan Ray Chaudhuri, "Integrating Wind Energy to Weak Power Grids using High Voltage Direct Current Technology", Springer, 2019.

5.DraganJovcic, "High Voltage Direct Current Transmission Converters, Systems and DC Grids",John Wiley & Sons Ltd, 2019

REFERENCE BOOKS :

1. Kundur P., "Power System Stability and Control", McGraw-Hill,1993.

2.Colin Adamson and Hingorani NG, "High Voltage Direct Current Power Transmission", Garraway Limited, London, 1960

3.Edward Wilson Kimbark, "Direct Current Transmission", Vol.I, Wiley interscience, New York,1971

4.Minxiao Han and Aniruddha M.Gole,"Modelling and Simulation of HVDC Transmission", The Institution of Engineering and Technology, 2020.

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5.https://youtu.be/BszRwKj7rtc

CO-PO & PSO MAPPING:

CO\PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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CO2	2	3	1	2	-	1	-	-	-	-	1	2	2	1	2
CO3	3	2	2	3	-	1	-	-	-	-	-	2	3	1	3
CO4	3	2	3	2	-	1	-	-	-	-	-	3	3	1	3
CO5	2	1	1	1	-	1	-	-	-	-	1	3	2	1	3
AVG	3	2	1	2	-	1	-	-	-	-	-	2	2	1	3

JEE1014 **ELECTRIC ENERGY GENERATION, UTILIZATION AND CONSERVATION**

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To study the principle, design of illumination systems and energy efficiency lamps**.**
- To impart knowledge on refrigeration and air conditioning
- To understand the different methods of electric heating and electric welding.
- To provide an overview of electric traction systems and their performance.
- To introduce the concepts of domestic wiring connection and Earthing

Prerequisites : Basic Engineering

UNIT I ILLUMINATION 9

Importance of lighting – properties of good lighting scheme – laws of illumination – photometry - types of lamps – lighting calculations – basic design of illumination schemes for residential, commercial, street lighting, factory lighting and flood lighting- LED lighting and energy efficient lamps. Case Study - Analysis of insufficient lighting in Substation, Replacement of conventional lights by led lights

UNIT II REFRIGERATION AND AIR CONDITIONING 9

Refrigeration-Domestic refrigerator and water coolers - Air-Conditioning-Various types of air-conditioning system and their applications, smart air conditioning units - Energy Efficient motors: Standard motor efficiency, need for efficient motors, Motor life cycle, Direct Savings and payback analysis, efficiency evaluation factor.

UNIT III HEATING AND WELDING 9

Introduction - advantages of electric heating – modes of heat transfer - methods of electric heating - resistance heating - arc furnaces - induction heating - dielectric heating - electric welding – types - resistance welding - arc welding - power supply for arc welding - radiation welding.

UNIT IV ELECTRIC TRACTION 9

Merits of electric traction – requirements of electric traction system – supply systems – mechanics of train movement – traction motors and control – braking – recent trends in electric traction.

UNIT V DOMESTIC UTILIZATION OF ELECTRICAL ENERGY 9

Domestic utilization of electrical energy – House wiring , Induction based appliances, Online and OFF line UPS, Batteries - Power quality aspects – nonlinear and domestic loads – Earthing system for Domestic, Industrial and Substation.

Total: 45 Periods

COURSE OUTCOMES: At the end of the course, students will able to

- Implement the energy saving concepts and design efficient way of illumination schemes for residential, commercial and sports purposes.
- Gain knowledge on refrigeration and air conditioning systems.
- Classify the different methods of electric heating and welding.
- Realize the appropriate type of electric supply system as well as to evaluate the performance of traction systems.
- Do domestic wiring connection and debug any faults occurred

TEXT BOOKS:

1. C.L.Wadhwa, “Generation, Distribution and Utilisation of Electrical Energy”, Seventh Edition ,New Age international Pvt. Ltd, 2016 .
2. Dr. Uppal S.L. and Prof. S. Rao, 'Electrical Power Systems', Fifteenth Edition, Khanna Publishers, New Delhi, 2014.
3. J.B.Gupta, “Utilisation Electric power and Electric Traction”, Twelth Edition , S.K.Kataria and sons, 2013.

4. D.P.Kothari, K.C.Singal, Rakesh Ranjan, "Renewable Energy Sources and Emerging Technologies", Third Edition, PHI Learing Private Limited, 2022.
5. S C Bhatia, Sarvesh Devraj, " Industrial Energy Conservation, Volume I-II" , First Edition ,Wood head Publishing India in Energy , 2018.

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1.R.K.Rajput, "Utilisation of Electric Power", second Edition , Laxmi publications ,2016.

2. H.Partab, " Art and Science of Utilisation of Electrical Energy", Dhanpat Rai and Co., New Delhi-2004.

3.N.V. Suryanarayana, "Utilisation of Electric Power", Second Edition, New Age International Limited, 2014

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4. https://youtu.be/Fv0Di_a_JbY
5. https://youtu.be/TvNyBocu1do
6. https://youtu.be/cvQ5tss5sfA

CO-PO & PSO MAPPING:

CO\PO, PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	1	-	-	-	-	-	2	3	-	2
CO2	2	3	3	-	-	1	-	-	-	-	-	2	2	1	-
CO3	1	2	3	-	-	1	-	-	-	-	-	1	2	1	-
CO4	3	1	2	2	-	1	-	-	-	-	-	1	3	1	2
CO5	3	1	2	-	2	1	-	-	-	-	-	2	3	1	1
AVG	3	2	2	1	-	1	-	-	-	-	-	2	3	1	2

JEE1007	POWER SYSTEM TRANSIENTS	L T P C
		3 0 0 3

COURSE OBJECTIVES:

- To provide an overview of the nature of power system transients and their effects on power systems
- To study the generation of switching transients phenomena.
- To provide the knowledge about the lightning phenomena and its protection methods.
- To inculcate knowledge about the concept of travelling waves and their effects.
- To impart knowledge of load rejection and different software packages to analyse about transients

Prerequisites: Power System Analysis

UNIT I INTRODUCTION TO TRANSIENTS 9

Review and importance of the study of transients – causes for transients. RL circuit transient with sine wave excitation-double frequency transients-basic transforms of the RLC circuit transients. Different types of power system transients – effect of transients on power systems

UNIT II SWITCHING TRANSIENTS 9

Over voltages due to switching transients – resistance switching and the equivalent circuit for interrupting the resistor current – load switching and equivalent circuit – waveforms for transient voltage across the load and the switch – normal and abnormal switching transients. Current suppression – current chopping - effective equivalent circuit. Capacitance switching – effect of source regulation – capacitance switching with a restrike, with multiple restrikes. Illustration for multiple restriking transients –Ferro resonance.

UNIT III LIGHTNING TRANSIENTS 9

Review of the theories in the formation of clouds and charge formation – rate of charging of thunder clouds mechanism of lightning discharges and characteristics of lightning strokes – model for lightning stroke- factors contributing to good line design – protection using ground wires –tower footing resistance –Interaction between lightning and power system

UNIT IV TRAVELING WAVES ON TRANSMISSION LINE 9

Computation of transients-transient response of systems with series and shunt lumped para meters and distributed lines. Traveling wave concept–step response- Bewley's lattice diagram–standing waves and natural frequencies –reflection and refraction of travelling waves

UNIT V TRANSIENTS IN INTEGRATED POWER SYSTEM 9

The short line and kilometric fault-distribution of voltages in a power system-Line dropping and load rejection-voltage transients on closing and reclosing lines-over voltage induced by faults–switching surges on integrated system Qualitative application of EMTP for transient computation-case studies on simulation of various types of transients using EMTP and insulation co-ordination

Total: 45 Periods

COURSE OUTCOMES: At the end of the course, the student will be able to

- Review the concepts of power system transients.
- Comprehend the different issues related to resistance switching, capacitance switching, and load switching.
- Explain the mechanism of lighting strokes and also discuss about the protection of lighting surges.
- Gain knowledge on the propagation, reflection and refraction of travelling waves.
- Acquire knowledge on the impact of voltage transients caused by faults, circuit breaker action and load rejection on integrated power systems.

TEXT BOOKS:

1. Allan Greenwood, 'Electrical Transients in Power Systems', Second Edition, Wiley Inter Science, New York, 1991.

2. PritindraChowdhari, "Electromagnetic transients in Power System", Second Edition, John Wiley and Sons Inc., 2009

3. J.L.Kirtley,"Electric Power Principles, Sources, Conversion, Distribution and use", First Edition,Wiley, 2010.

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1. Heydt.G.T., "Electric Power Quality", Second Edition, Starsina Circle Publications,1994

2. Naidu. M.S and Kamaraju.V, "High Voltage Engineering", Fifth Edition, Tata Mc Graw Hill, 2013.

3. Begamudre . R.D, "Extra High Voltage AC Transmission Engineering", Fourth Edition, New age International (P) Ltd., New Delhi, 2009

4. Hase.Y, "Hand book of Power System Engineering ", Wiley India, 2012.

5. Ramanujam. R., "Computational Electromagnetic Transients: Modelling, Solution Methods and Simulation", IK International Publishing House pvt.Ltd , 2014.

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5.https://youtu.be/1L2uAFO7l1A

6.https://youtu.be/1jIH5_RT1Cw

CO-PO & PSO MAPPING:

CO\PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2	-	-	-	-	-	-	-	2	2	-	1
CO2	2	2	2	2	-	-	-	-	-	-	-	1	3	-	2
CO3	2	2	2	2	-	-	-	-	-	-	-	2	3	-	3
CO4	3	3	3	3	2	-	-	-	-	-	-	1	3	-	2
CO5	2	3	3	3	2	-	-	-	-	-	-	2	2	-	3
AVG	2	3	3	2	1	-	-	-	-	-	-	2	3	-	2

JEE1010 POWER QUALITY L T P C
3 0 0 3

COURSE OBJECTIVES:

- To impart knowledge about power quality issues
- To study the concepts of Mitigation techniques of various power quality events.
- To learn the concepts of Harmonics in power systems.
- To educate about passive filters and compensation techniques
- To study about monitoring of power quality

Prerequisites: Power system analysis, Power System Transients

UNIT I INTRODUCTION TO POWER QUALITY 9

Terms and definitions & Sources – Overloading, under voltage, over voltage - Concepts of transients - Short duration variations such as interruption - Long duration variation such as sustained interruption - Sags and swells - Voltage sag - Voltage swell - Voltage imbalance–Voltage fluctuations-Power frequency variations-Wave form Distortion-International standards of power quality– CBEMA & ITI curves

UNIT II VOLTAGE SAG AND SWELL 9

Estimating voltage sag performance – Thevenin's equivalent source - Analysis and calculation of various faulted condition-Estimation of the sag severity-Mitigation of voltage sag, Static transfer switches and fast transfer switches.-Motor-Starting Sags- Transient Over voltages-Capacitor switching–Lightning-Ferro resonance-Mitigation of voltage swell

UNIT III HARMONICS 9

Harmonic sources from commercial and industrial loads - Locating harmonic sources – Power system response characteristics- Harmonics Vs transients. Effect of harmonics – Harmonic distortion - Voltage and current distortions - Harmonic indices - Interharmonics– Resonance Harmonic distortion evaluation, IEEE and IEC standards - Devices for Controlling Harmonic Distortion.

UNIT IV PASSIVE POWER COMPENSATORS 9

Principle of Operation of Passive Shunt and Series Compensators-Analysis and Design of Passive Shunt Compensators - Simulation and Performance of Passive Power Filters - Limitations of Passive Filters -Parallel Resonance of Passive Filters with the Supply System and Its Mitigation – Fundamentals of load compensation–voltage regulation & power factor correction–Introduction to FACTS

UNIT V POWER QUALITY MONITORING AND CUSTOM POWER DEVICES 9

Monitoring considerations - Monitoring and diagnostic techniques for various power quality problems - Quality measurement equipment - Assessment of Power Quality Measurement Data - Harmonic / spectrum analyzer - Flicker meters Disturbance analyzer - Applications of expert systems for power quality monitoring. Principle & Working of DSTATCOM – DSTATCOM in Voltage control mode, current control mode, DVR Structure – Rectifier supported DVR – DC Capacitor supported DVR-Unified power quality conditioner

Total: 45 Periods

COURSE OUTCOMES: At the end of the course, the student will be able to

- Identify the various power quality issues.
- Apply and analyse the causes & mitigation techniques of various Power quality events.
- Gain knowledge on harmonics and its controlling devices.
- Design the passive filters and compensation techniques.
- Use the equipment's required for measuring the quality of power.

TEXT BOOKS:

1.Roger.C .Dugan, Mark.F. Mc Granagham, Surya Santoso, H.WayneBeaty, "Electrical Power Systems Quality", Third Edition, McGrawHill, 2012

2.JosArrillaga, Neville R.Watson, "Power System Quality Assessment", Wiley, 2003

3.Bhim Singh, Ambrish Chandra, Kamal Al-Haddad," Power Quality Problems & Mitigation Techniques" John Wiley & Sons, 2015.

REFERENCE BOOKS :

1.G.T.Heydt, "Electric Power Quality", second Edition , Starsina CirclePublications,1994

2. M.H.J Bollen, "Understanding Power Quality Problems: Voltage Sags and interruption", Wiley,1999

3. Alexander Kusko, "Power Quality in Electrical Systems", McGraw-Hill Publications,2007

4. Arindam Ghosh "Power Quality Enhancement Using Custom Power Devices", Kluwer Academic Publishers, 2002

5.Derek A. Paice , "Power Electronics Converter Harmonics :Multipulse Methods for Clean Power",Wiley,1999.

6.Ewald Fuchs, Mohammad A. S. Masoum, "Power Quality in Power Systems and Electrical Machines", Elseveir academic press publications, 2011

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4.https://www.youtube.com/watch?v=n46aDV2h-gs

5.https://www.youtube.com/watch?v=Sw-YoBMGMuQ

CO-PO& PSO MAPPING:

CO\PO, PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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CO2	3	3	2	2	-	-	-	-	-	-	-	2	3	-	2
CO3	3	3	2	2	1	-	-	-	-	-	-	3	3	-	2
CO4	2	3	1	1	1	-	-	-	-	-	-	2	3	-	2
CO5	2	2	1	1	1	-	-	-	-	-	-	3	3	-	2
AVG	2	3	1	1	1	-	-	-	-	-	-	2	3	-	2

JEE1009 FLEXIBLE AC TRANSMISSION SYSTEMS L T P C

3 0 0 3

COURSE OBJECTIVES:

- To understand the concept of flexible AC transmission and the associated problems.
- To know the necessity of static devices for shunt control.
- To study the operation of controllers for enhancing the transmission capability.
- To provide knowledge on voltage source converter based FACTS controller.
- To Impart knowledge on Emerging FACTS controller and its coordination

Prerequisites: Power Quality

UNIT I INTRODUCTION OF FACTS 9

Basic types of FACTS controllers, benefits from FACTS controllers - Real and reactive power control electrical power transmission lines – loads & system compensation – Uncompensated transmission line– shunt and series compensation.

UNIT II STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS 9

Voltage control by SVC – Advantages of slope in dynamic characteristics – Influence of SVC on system voltage – Design of SVC voltage regulator–TCR-FC-TCR-Modeling of SVC for power flow and fast transient stability**–** Applications: Enhancement of transient stability - Steady state power transfer–Enhancement of power system damping.

UNIT III THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS 9

Operation of the TCSC–Different modes of operation–Modelling of TCSC, Variability reactance model– Modelling for Power Flow and stability studies. Applications: Improvement of the system stability limit–Enhancement of system damping.

UNIT IV VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS 9

Static Synchronous Compensator (STATCOM)–Principle of operation–V-I Characteristics. Applications: Steady state power transfer-enhancement of transient stability-prevention of voltage instability. SSSC-operation of SSSC and the control of power flow–modelling of SSSC in load Flow and transient stability studies-Dynamic voltage restorer (DVR).

UNIT V ADVANCED FACTS CONTROLLERS AND CO- ORDINATION OF FACTS CONTROLLERS 9

Interline DVR (IDVR) - Unified Power flow controller (UPFC) - Interline power flow controller (IPFC) - Unified Power quality conditioner (UPQC). FACTs Controller interactions – SVC–SVC interaction-co-ordination of multiple controllers using linear control techniques.

Total: 45 Periods

COURSE OUTCOMES: At the end of the course, the student will be able to

- Relate real and reactive power Control in electrical power transmission lines and the importance of FACTS devices
- Design and model the shunt controller SVC for transient stability condition.
- Interpret the control circuits of series controller TCSC for various functions like transient stability Enhancement and power oscillation damping
- Analyse the performance of VSC based FACTS devices
- Acquire knowledge on advanced FACTS Controller, interactions and its Coordination

TEXT BOOKS:

1.MohanMathur, R., Rajiv. K. Varma, "Thyristor – Based Facts Controllers for Electrical Transmission Systems", IEEE press and John Wiley & Sons, Inc, 2002.

2.NarainG.Hingorani,Laszio.Gyugyl,"Understanding FACTS Concepts and Technology of Flexible AC Transmission System", StandardPublishers,Delhi2001

3.Padiyar. K.R.,"FACTS Controllers in Power Transmission and Distribution", New Age International (P) Limited, Publishers, New Delhi,

REFERENCE BOOKS:

1.John . A.T., "Flexible AC Transmission System", Institution of Electrical and Electronic Engineers (IEEE), 1999.

2.2008Miller.T.J.E, "Power Electronics in power systems" ,First Edition,Newnes,2001

3.Sood . V.K., "HVDC and FACTS controllers–Applications of Static Converters in Power System" , Kluwer Academic Publishers, 2004.

4.Singh, S.N., "Electric Power Generation Transmission and Distribution" , PHI, New Delhi, 2003.

5.Narain G. Hingorani, "High power Electronics and Flexible AC Transmission Systems", IEEE High Power Engineering Review, 1998.

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4.https://youtu.be/4JYxtQo1nKM
5.https://youtu.be/OgWdcBe5urE
6.https://youtu.be/VfZzaY2YC70

CO-PO & PSO MAPPING:

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CO3	1	2	2	2	1	-	-	-	-	-	-	-	3	2	3
CO4	2	1	3	2	1	-	-	-	-	-	-	-	3	1	3
CO5	2	2	2	2	2	-	-	-	-	-	-	-	3	2	3
AVG	2	2	2	2	1	-	-	-	-	-	-	-	3	2	3

JEE1051 UNDER GROUND CABLE ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVES :

- To impart knowledge on power cable characteristics and its applications.
- To provide knowledge about cable architecture and cable standards.
- To study about the types of distribution cables and its applications.
- To know about cables used in Transmission System
- To impart knowledge on cable fault detection, rectification, testing and maintenance.

Prerequisites: Transmission and Distribution

UNIT I INTRODUCTION TO ELECTRICAL POWER CABLES 9

Development of Underground Cables - Electric Lighting- Distribution of Energy for Lighting- Paper Insulated Cables - Underground Residential Distribution - Medium Voltage Cable Development.

UNIT II CABLE ARCHITECHTURE AND CABLE CHARACTERISTICS 9

Architecture of Underground Cabling System - Basic Dielectric Theory of Cable – Conductors - Armour and Protective Finishes - Cable Characteristics: Electrical Fundamentals of Electrical Insulation Materials - Electrical Properties of Cable Insulating Materials - Cable Standards and Quality Assurance - Cable design parameters- Current Carrying Capacity - Short-circuit Ratings.

UNIT III SUPPLY DISTRIBUTION SYSTEMS AND CABLES 9

Supply Distribution Systems - Distribution Cable Types, Design and Applications - Paper Insulated Distribution Cables - PVC Insulated Cables - Polymeric Insulated Distribution Cables for 6-30 kV - Manufacture of Distribution Cables - Joints and Terminations for Distribution Cables - Testing of Distribution Cables.

UNIT IV TRANSMISSION SYSTEMS AND CABLES 9

Basic Cable Types for A.C. Transmission - Gas Pressure Cables - High Pressure Fluid-filled Pipe Cables - Polymeric Insulated Cables for Transmission Voltages - Techniques for Increasing Current Carrying Capacity - Transmission Cable Accessories and Jointing for Pressure assisted and Polymeric Cables.

UNIT V CABLE INSTALLATION, TESTING, MAINTENANCE 9

Installation of Transmission Cables -Splicing, Terminating, and Accessories - Sheath Bonding and Grounding-Testing of Transmission Cable Systems - Underground System Fault Locating - Field Assessment of Power Cable Systems- Condition monitoring tests – PD measurements.

Total: 45 Periods

COURSE OUTCOMES: At the end of the course, the student will be able to

- Understand the fundamental of underground cable system.
- Gain knowledge on the architecture, physical and electrical characteristics of the underground cable.
- Explain the different types of cables used in distribution system.
- Acquire knowledge on Underground cables used in transmission system
- Outline the methodology used for cable fault detection, rectification, testing and maintenance

TEXT BOOKS:

1. William Thue, 'Electrical Power Cable Engineering', Third Edition, CRC Press Taylor & Francis Group, 2017.
2. G. F. Moore, "Electric Cables Handbook", Third edition, Blackwell Science Ltd, 2017.
3. Chowdhury S.P. and Crossley P, "Microgrids and Active Distribution Networks" The Institution of Engineering and Technology, London, U.K, 2009

REFERENCE BOOKS:

1. Leonard L. Grigsby, "Electrical Power Cable Engineering" , Third Edition, CRC Press, ,2012.
2. Christian Flytkjaer Jensen, Online Location of Faults on AC Cables in Underground Transmission Systems (Springer Theses), 2014.
3. R. W. Deltenre, J. J. Schwarz, and H. J. Wagnon, ''Underground cable fault location: A handbook to TD- 153,'' BDM Corp., Albuquerque, NM, USA, Final Rep. EPRI EL-363, 1977. [Online]. Available: https://www.osti.gov/servlets/purl/7233049, doi: 10.2172/7233049, January 1997.

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4. **https://youtu.be/Xh9WcieJChI**
5. **https://youtu.be/30DLpesnDDk**
6. **https://youtu.be/su2wlj877Kc**

CO-PO & PSO MAPPING:

CO\PO ,PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	2	-	-	-	-	-	2	-	3
CO2	3	2	-	-	-	-	2	-	-	-	-	-	3	-	3
CO3	3	2	-	-	-	-	2	-	-	-	-	-	3	-	3
CO4	3	2	-	-	-	-	2	-	-	-	-	-	2	-	3
CO5	3	2	3	-	-	-	2	-	-	-	-	-	3	3	3
AVG	3	2	1				2	-	-	-	-		3	1	3

JEE1013 DISTRIBUTED GENERATION AND MICROGRIDS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To provide an overview on the various conventional and non-conventional energy resources
- To illustrate the concept of distributed generation.
- To accord the basic knowledge about the impact of grid integration.
- To study the concept of micro grid and its configuration
- To learn the power quality issues in micro grids.

Prerequisites : Power system, Renewable Energy systems

UNIT I INTRODUCTION TO CONVENTIONAL AND NON-CONVENTIONAL ENERGY RESOURCES 9

Conventional power generation: advantages and disadvantages, Energy crises, Non-conventional energy (NCE) resources: review of Solar PV, Wind Energy systems, Fuel Cells, micro-turbines, biomass, and tidal sources.

UNIT II DISTRIBUTED GENERATIONS (DG) 9

Concept of distributed generations, topologies, selection of sources, regulatory standards/ frame work, Standards for interconnecting Distributed resources to electric power systems: IEEE1547.DG installation classes, security issues in DG implementations. Energy storage elements: Batteries, ultra-capacitors, fly wheels.

UNIT III IMPACT OF GRID INTEGRATION 9

Requirements for grid interconnection, limits on operational parameters, : voltage, frequency, THD, response to grid abnormal operating conditions, islanding issues. Impact of grid integration with NCE sources on existing power system: reliability, stability and power quality issues.

UNIT IV MICROGRIDS 9

Concept and definition of micro grid, micro grid drivers and benefits, review of sources of micro grids, typical structure and configuration of a micro grid, AC and DC micro grids, Power Electronics interfaces in DC and AC micro grids, communication infrastructure, modes of operation and control of micro grid: grid connected and is landed mode, Active and reactive power control, protection issues, anti-islanding schemes: passive, active and communication-based techniques.

UNIT V POWER QUALITY ISSUES IN MICRO GRIDS 9

Power quality issues in micro grids- Modelling and Stability analysis of Micro grid, regulatory standards -IEEE519 standard, Micro grid economics, Introduction to smart micro grids

Total: 45 Periods

COURSE OUTCOMES: At the end of the course, the student will be able to

- Acquire knowledge on the various conventional and non-conventional energy resources
- Comprehend the concept of distributed generation
- Gain knowledge about the impact of grid integration.
- Interpret the micro grid configuration and its benefits
- To explicate the power quality issues in micro grids

TEXT BOOKS:

1.Tomás Gómez Román, José Pablo Chaves-Áila , " Integration of Renewable and Distributed Energy Resources in Power Systems", Mdpi AG publisher 2020

2. AmirnaserYezdani, and RezaIravani, “Voltage Source Converter sin Power Systems: Modeling, Control and Applications”, IEEE John Wiley Publications, 2009.
3. DorinNeacsu, “Power Switching Converters: Medium and High Power”, CRC Press, Taylor &Francis,2006.
4. Chetan Singh Solanki, “Solar Photo Voltaics”, Third Edition , PHI learningPvt.Ltd.,NewDelhi, ,2015

REFERENCE BOOKS:

1. Chowdhury S.P. and Crossley P, “Microgrids and Active Distribution Networks” The Institution of Engineering and Technology, London, U.K, 2009
2. ManwellJ.F,“Wind Energy Explained, theory design and applications”, J.G.McGowan Wiley publication, 2009.
3. Hall D.D. and Grover R.P.,“Bio mass Regenerable Energy”, John Wiley, NewYork,1987.
4. NikosHatziargyriou , “Micro grids: Architectures and Control”, Wiley-IEEE Press, 2014
5. John T widel land Tony Weir, “Renewable Energy Resources” ,Taylor and Francis Publications, 2005
6. GodfreyBoyle , “ Renewable Energy- Power for a sustainable future”, Third edition, Oxford University Press, 2013.

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5. https://youtu.be/4D2HzRBDg14
6. https://youtu.be/3DmThppGRv4

CO-PO & PSO MAPPING:

CO\PO, PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	1	-	-	-	-	-	-	2	3	2	2
CO2	2	3	1	2	1	-	-	-	-	-	1	2	2	2	2
CO3	2	2	2	2	1	-	-	-	-	-	1	2	2	1	2
CO4	1	1	2	2	1	-	-	-	-	-	-	-	2	1	2
CO5	1	1	2	2	1	-	-	-	-	-	-	1	2	2	1
AVG	2	2	2	2	1	-	-	-	-	-	1	2	2	1	2

JEE1016	SMART GRID	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To provide an overview on the concepts of smart grid and its present developments.
- To study about smart grid technologies
- To familiarize with various smart meters and advanced metering infrastructure
- To learn the power quality management in smart grids
- To introduce the concepts about LAN, WAN and Cloud Computing for smart grid applications

UNIT I INTRODUCTION TO SMART GRID 9

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, National and International Initiatives in Smart Grid.

UNIT II SMART GRID TECHNOLOGIES 9

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/VAR control, Fault Detection, Isolation and service restoration, Outage management.

UNIT III SMART METERS AND ADVANCED METERING INFRASTRUCTURE 9

Introduction to Smart Meters, Advanced Metering infrastructure(AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit (PMU), Intelligent Electronic Devices(IED) & their application for monitoring & protection.

UNIT IV POWER QUALITY MANAGEMENT IN SMART GRID 9

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.

UNIT V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS 9

Local Area Network(LAN), House Area Network(HAN), Wide Area Network(WAN), Broad band over Power line(BPL),IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

Total: 45 Periods

COURSE OUTCOMES: At the end of the course, the student will be able to

- Interpret the concepts of smart grid and its present developments.
- Acquire knowledge on smart grid technologies
- Gain knowledge about different smart meters and advanced metering infrastructure.
- Evaluate power quality management in Smart Grids
- Explain the concepts of LAN, WAN and Cloud Computing for Smart Grid applications.

TEXT BOOKS:

1. Shunmugalatha .A ,Chandrasekar.T , Ashok Kumar .B ,Rajeswari.J, "Smart Grids", Technical Publication , 2021
2. JamesMomoh, "Smart Grid– fundamentals of design and analysis", John Wiley and Sons,2012
3. JanakaEkanayake, "Smart Grid-Technology and Applications", John Wiley and Sons,2012
4. ClarkW.Gellings,"TheSmartGrid-Enabling energy efficiency and demand response" , CRC press, 2009.

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1. Fereidoon P.Sioshansi, "Smart grid-integrating renewable, distributed and efficient energy", Elsevier, 2012
2. StuartBorlase," Smart Grids, Infratructure, technology and solutions", CRC press ,2013
3. Vehbi C. Gungor ,DilanSahin, TaskinKocak, SalihErgüt, ConcettinaBuccella, Carlo Cecati, and Gerhard P. Hancke, "Smart Grid Technologies: Communication Technologies and Standards" IEEE Transactions On Industrial Informatics, Vol.7,No.4, November2011.
4. Xi Fang, Satyajayant Misra, GuoliangXue, and DejunYang , "SmartGrid –The New and Improved Power Grid: A Survey" ,IEEE Transaction on Smart Grids,vol.14,2012.

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3. https://youtu.be/JwRTpWZReJk
4. https://youtu.be/XVK6eseBcjQ
5. https://youtu.be/tbi8LyvN2CM
6. https://youtu.be/MX_9srBXj1w

CO-PO&PSO MAPPING:

CO\PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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CO2	2	3	3	2	1	-	-	-	-	-	1	2	2	1	2
CO3	2	2	-	2	1	-	-	-	-	-	1	2	2	1	2
CO4	1	1	2	3	1	-	-	-	-	-	-	-	2	1	2
CO5	1	1	2	3	1	-	-	-	-	-	-	1	2	2	1
AVG	2	2	2	2	1	-	-	-	-	-	1	2	2	1	2

Vertical VI – Electric Vehicle Technology

JEE1052	ELECTRIC VEHICLE ARCHITECTURE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn about the history and evolution of Electric Vehicle
- To study about the Electric Vehicle Architecture
- To know about the details and specifications for Electric Vehicles
- To understand the concepts of Power components and braking systems
- To understand the need and role of suspension systems

UNIT I INTRODUCTION TO HYBRID ELECTRICAL VECHICLE 9

Introduction-History-Comparison with electrical and hybrid electrical vehicle-Construction and working of PHEV- Block diagram and components-Charging mechanisms-Advantages of PHEVs.

UNIT II VEHICLE ARCHITECTURE AND SIZING 9

Electric Vehicle History, and Evolution of Electric Vehicles. Series, Parallel and Series parallel Architecture, Micro and Mild architectures. Mountain Bike – Motorcycle - Electric Cars and Heavy Duty EVs. - Details and Specifications.

UNIT III VEHICLE MECHANICS 9

Vehicle mechanics- Roadway fundamentals, Laws of motion, Vehicle Kinetics, Dynamics of vehicle motion, propulsion power, velocity and acceleration, Tire –Road mechanics, Propulsion System Design.

UNIT IV POWER COMPONENTS AND BRAKES 9

Power train Component sizing- Gears, Clutches, Differential, Transmission and Vehicle Brakes. EV power train sizing , HEV Power train sizing - Example.

UNIT V ECONOMIC & ENVIRONMENTAL IMPACT ANALYSIS 9

Introduction to Vehicle Selection, Life Cycle Cost Analysis, LCC Data Requirements, LCC Sensitivity Analysis, Environmental Impact Analysis - GHG Emissions in the Vehicle

Production Phase, GHG Emissions in the Vehicle Operation Phase, GHG Emissions in the Vehicle End-of-Life Phase, Environmental Impact Analysis Data Requirements

TOTAL: 45 Periods

COURSE OUTCOMES: At the end of the course, the student will be able to

- Summarize the History and Evolution of EVs, Hybrid and Plug-In Hybrid EVs
- Describe the concepts related to architecture and sizing of Electric Vehicles
- Analyze Electric vehicle mechanics
- Describe the various Electric Vehicle components
- Analyze the details and Specifications of suspension system

TEXT BOOKS:

1. Ali Emadi, "Advanced Electric Drive Vehicles", CRC Press, First edition 2017.

2. Bob Brant, SethLeitman ,"Build Your Own Electric Vehicle" , Third Edition , McGraw Hill, 2013.

3.Mehrdad Ehsani, YiminGao, Sebastian E. Gay, Ali Emadi, “Modern Electric, Hybrid Electric andFuel Cell Vehicles: Fundamentals, Theory and Design”, CRC Press, 2004.

REFERENCE BOOKS:

1. Mark Warner, "The Electric Vehicle Conversion Handbook: How to Convert Cars, Trucks, Motorcycles, and Bicycles - Includes EV Components, Kits, and Project Vehicles", HP Books, 2011.

2. , Shashank Arora, AlirezaTashakoriAbkenar, Shantha Gamini Jayasinghe, Kari Tammi, "Heavy-duty Electric Vehicles from Concept to Reality", Elsevier Science, 2021.

3. Bhoi,SanjeevikumarPadmanaban, Jens Bo Holm, Nil Patel, Akash Kumar " Electric Vehicles Modern Technologies and Trends", Nielsen Springer, 2020

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3.https://www.csie.ntu.edu.tw/~cyy/courses/assembly/12fall/lectures/handouts/lec08_ARMarch.pdf

4.https://www.youtube.com/watch?v=J4fhE4Pp55E&list=PLGs0VKk2DiYypuwUUM2wxzcI9B

CO - PO & PSO MAPPING :

CO\PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO12	0PSO1	PSO2	PSO3
CO1	2	2	1	2	2	2	1	-	-	-	-	2	2	2	2
CO2	2	2	1	2	1	2	-	-	-	-	-	2	2	2	1
CO3	1	2	2	2	2	1	1	-	-	-	-	1	2	2	2
CO4	2	2	2	2	2	1	1	-	-	-	-	2	2	2	2
CO5	2	1	1	1	1	2	2	-	-	-	-	2	2	1	1
AVG	2	2	2	2	2	2	1	-	-	-	-	2	2	2	2

JEE1053 ENERGY STORAGE SYSTEM FOR E-MOBILITY L T P C
3 0 0 3

COURSE OBJECTIVES:

- To present an overview of Electric vehicles (EV), and their architecture.
- To study the EV system.
- To demonstrate the basics of battery energy storage systems and super capacitor storage systems.
- To demonstrate the basics of Fuel cell and Hydrogen storage systems.
- To demonstrate the basics of battery testing and management systems.

UNIT I INTRODUCTION TO STORAGE & ELECTRIC VEHICLES 9

General background on alternative energy sources & sustainability - Overview of energy storage systems – Introduction to electric-based transportation, Overview of electric vehicles, Vehicle dynamics, sizing components, Fuel economy, emissions & electric mileage calculations – Applications –Land, space, and marine.

UNIT II SYSTEM COMPONENTS OF EV 9

Classification of electric vehicles (EV) - General architecture, Layout & System components- Battery storage, Transmission system – Modelling of multimode electrically variable transmission .

UNIT III BATTERY STORAGE SYSTEMS 9

Principle of operation of Lithium-ion battery, battery components & design, electrode, battery modules & packs, Advanced batteries, double layer & super capacitors for transportation applications, Design of battery & super capacitors for large vehicles.

UNIT IV FUEL CELL AND HYDROGEN STORAGE SYSTEMS 9

Introduction to fuel cell – Types, Operation, Modelling & characteristics, proton exchange membrane (PEM) fuel cell for E-mobility, solid oxide fuel cell – Design of Fuel cell vehicles. Hydrogen storage system – solid state hydrogen storage tanks, gas phase hydrogen storage tanks, cryogenic & liquid phase hydrogen storage tanks.

UNIT V BATTERY TESTING & MANAGEMENT SYSTEMS 9

Charging methods of battery – constant voltage, constant current and hybrid – Battery power testing for various vehicles - Battery management system & controls – Active & passive cooling of battery - Battery life & safety impacts – Code & standards.

TOTAL: 45 Periods

COURSE OUTCOMES: At the end of the course, the student will be able to

- Understand the concept of electric vehicle and energy storage systems.
- Describe the working and components of Electric Vehicle and Hybrid Electric Vehicle.
- Illustrate the operation of storage systems such as battery and super capacitors.
- Analyze the various energy storage systems based on fuel cells and hydrogen storage.
- Design and develop the battery management systems.

TEXT BOOKS:

1. Mehrdad Ehsani, YiminGao, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", Second Edition, CRC Press, 2010.

2. Chris Mi, M. Abul Masrur, David Wenzhong Gao, "Hybrid Electric Vehicles Principles And Applications With Practical Perspectives", Wiley Publication, 2011.

3. Iqbal Hussain, "Electric and Hybrid Vehicles: Design Fundamentals", Second Edition', CRC Press, Taylor & Francis Group, 2011.

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1. James Larminie, John Lowry, "Electric Vehicle Technology Explained", Wiley, 2003.

2. Sheldon S. Williamson, "Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles", Springer, 2013.

3. C.C. Chan and K.T. Chau, "Modern Electric Vehicle Technology", OXFORD University Press, 2001.

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3. https://www.allaboutcircuits.com/technical-articles/introduction-to-the-c-programminglanguage- for-embedded-applications/
4. https://onlinecourses.nptel.ac.in/

CO - PO & PSO MAPPING :

CO\ PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	2	-	1	2	-	-	-	-	-	2	3	-	-
CO2	3	2	2	1	1	-	1	-	-	-	-	2	3	3	3
CO3	3	2	2	1	1	1	-	-	-	-	-	2	3	1	-
CO4	3	2	2	2	-	-	2	-	-	-	-	2	3	-	1
CO5	3	2	3	2	2	2	2	-	-	-	-	2	3	3	3
AV G	3	2	2	1	1	1	1	-	-	-	-	2	3	1	1

JEE1054 POWER CONVERTER FOR ELECTRIC VEHICLE DRIVE SYSTEMS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To review the drive cycles and requirements of EVs
- To know the working of motors used in Electric Vehicle
- To analyze and model the buck/boost converter operation and to design the same
- To learn the simulation basics of control systems
- To derive transfer functions for DC-DC converters

UNIT I ELECTRIC VEHICLE DYNAMICS **9**

Standard drive cycles -Dynamics of Electric Vehicles-Tractive force-Maximum speed, torque, power, energy requirements of EVs.

UNIT II MOTORS FOR ELECTRIC VEHICLES **9**

Introduction – Speed And Torque control of above and below rated speed-Speed control of EV in the constant power region of electric motors. DC Motors, Induction Motor, Permanent Magnet Synchronous Motors (PMSM), Brushless DC Motors, Switched Reluctance Motors (SRMs) - Choice of electric machines for EVs.

UNIT III BASICS OF SIMULATION IN CONTROL SYSTEMS **9**

Transfer Function-How to build transfer function, identify Poles, zeros, draw time response plots, bode plot (Bode Plots for Multiplication Factors, Constant, Single and Double Integration Functions, Single and Double Differentiation Functions, Single Pole and Single Zero Functions).

UNIT IV MODELING OF DC-DC CONVERTERS **9**

Overview of PWM Converter Modelling -Power Stage Modelling - PWM Block Modelling – Voltage Feedback Circuit and Small-Signal Model of PWM Converter - Averaging Power Stage Dynamics - Average Models for buck/boost Converter - Small-Signal Model of Converter Power Stage - Frequency Response of Converter.

UNIT V POWER STAGE TRANSFER FUNCTIONS OF DC – DC CONVERTERS **9**

Power Stage Transfer Functions of buck-boost Converter in CCM Operation, Input-to-Output Transfer Function, Duty Ratio-to-Output Transfer Function, Load Current-to-Output Transfer Function.

TOTAL: 45 PERIODS

COURSE OUTCOMES: At the end of the course, the student will have to

- Use appropriate electric machine for electric vehicle application
- Compute transfer function with factors such as constant, integral, differential, first order factor and second order factor (both numerators & denominators)

- Design buck, boost and buck-boost converter.
- Compute a power stage transfer functions for DC-DC converters
- Simulate DC-DC converters and to obtain gain margin and phase margin.

TEXT BOOKS :

1. Teuvo Suntio, Tuomas Messo, Joonas Puukko, "Power Electronic Converters", Kindle Edition, 2017.
2. Randall Shaffer, "Fundamentals of Power Electronics with MATLAB", Second Edition, Lakshmi publications, 2013,
3. Dean Frederick and Joe Cho, "Feedback Control problems using MATLAB and the Control system tool box", First Edition, Cengage learning, 2000.

REFERENCE BOOKS:

1. Ali Emadi, "Handbook of Automotive Power Electronics and Motor Drives", First Edition, Taylor & Francis, 2005.
2. Atif Iqbal, Shaikh Moinoddin, Bhimireddy Prathap Reddy, "Electrical Machine Fundamentals with Numerical Simulation using MATLAB/SIMULINK", First Edition, Wiley,2021.
3. Md. Rabiul Islam,Md. Rakibuzzaman Shah, Mohd. Hasan Ali, "Emerging Power Converters for Renewable Energy and Electric Vehicles Modeling, Design, and Control", First Edition, CRC Press, 2021.
4. Iqbal Hussain, “Electric and Hybrid Vehicles: Design Fundamentals”, Third Edition, CRC Press, Taylor & Francis Group, 2021.

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3.https://www.csie.ntu.edu.tw/~cyy/courses/assembly/12fall/lectures/handouts/lec08_ARMarch.pdf
4.https://www.youtube.com/watch?v=J4fhE4Pp55E&list=PLGs0VKk2DiYypuwUUM2wxzcI9B

CO - PO & PSO MAPPING :

CO\ PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	2	1	2	-	1	2	-	-	-	-	-	2	3	-	-
CO2	3	2	2	2	1	-	1	-	-	-	-	2	3	3	3

CO3	3	2	2	1	1	1	-	-	-	-	-	2	2	1	-
CO4	3	2	1	2	-	-	2	-	-	-	-	2	3	-	1
CO5	3	1	3	2	2	2	2	-	-	-	-	2	3	3	3
AVG	3	2	2	1	1	1	1	-	-	-	-	2	3	1	1

JEE1055 **VEHICLE DYNAMICS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- Understand the dynamics of vehicle ride under different riding condition.
- Present a problem oriented in depth knowledge of Vehicle Dynamics.
- Address the underlying concepts and methods behind Vehicle Dynamics
- Calculate and refer the loads and forces associated to the vehicles.
- Analyze the behaviour of the vehicles under acceleration, ride and braking

UNIT I BASICS OF VEHICLE DYNAMICS **9**

History, vehicle classifications, fundamental approaches to vehicle dynamics modelling; SAE Vehicle axis system, Forces & moments affecting vehicle, Earth Fixed coordinate system, Dynamic axle loads, Equations of motion, transmission characteristics, vehicle performance, Brake proportioning, braking efficiency.

UNIT II ACCELERATION PERFORMANCE: **9**

Power train components; power and traction limited acceleration; transverse weight shift; front wheel drive vs rear wheel drive vs. all-wheel drive vehicles

UNIT IV BRAKING PERFORMANCE: **9**

Braking force analysis; brake design and analysis; federal regulation on braking performance; antilock braking system; wheel lock-up; tire/road friction; safety and maintenance issues in braking

UNIT IV ROAD LOADS: **9**

Wind drag and car body design, rolling resistance; breakdowns of total road loads; gas mileage analysis and driving styles; Aerodynamics

UNIT V TIRE AND TIRE DYNAMICS **9**

Tire specifications and constructions; tire motion analysis; tire force analysis; tire contact stress analysis; tire vibration analysis; tire models

Total: 45 Periods

COURSE OUTCOMES: At the end of the course, the student will have to

- Analyze the basic of vehicle dynamics.
- Understand acceleration in electric vehicle to understand the vehicle dynamics under various conditions.
- Analyze braking performance in electric vehicle to understand the vehicle dynamics under these conditions.
- Articulate road loads dynamics in electric vehicles.
- Articulate tire dynamics in electric vehicles.

TEXT BOOKS :

1. Thomas Gillespie , "Fundamentals of Vehicle Dynamics", SAE Publication, 2021
2. Mike Blundell and Damian Harty, "The Multibody systems Approach to Vehicle Dynamics", Elsevier, 2004.
3. Hans Pacejka, "Tire and Vehicle Dynamics", Elsevier, 2012

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1. Reza N. Jazar, "Vehicle Dynamics, Theory and Application", Springer, 2009, ISBN 978-0-387-74243-4, e ISBN. 978-0-387-74244-1.
2. W.F. Milliken and D.L. Milliken, "Race Car Vehicle Dynamics", SAE, 1995, ISBN 1-56091-526-9.

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CO - PO & PSO MAPPING :

CO\PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
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CO3	3	2	1	2	-	1	3	-	-	-	-	2	3	1	3
CO4	3	2	2	2	1	1	3	-	-	-	-	2	3	1	3
CO5	3	2	2	2	2	1	3	-	-	-	-	2	3	2	3
AVG	3	2	2	2	1	1	3	-	-	-	-	2	3	1	3

JEE1056 ELECTRIC VEHICLE CHARGING SYSTEMS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To know the charging station and standards
- To learn the concepts of power converters in charging
- To find the charging scheme in renewable based EV charging
- To demonstrate the wireless power transfer technique
- To design & simulate power factor correction circuits

UNIT I CHARGING STATIONS AND STANDARDS 9

Introduction-Charging technologies- Conductive charging, EV charging infrastructure, International standards and regulations - Inductive charging, need for inductive charging of EV, Modes and operating principle, Static and dynamic charging, various level of charging, International standards and regulations

UNIT II POWER ELECTRONICS FOR EV CHARGING 9

Layouts of EV Battery Charging Systems-AC charging-DC charging systems- Power Electronic Converters for EV Battery Charging- AC–DC converter with boost PFC circuit, with bridge and without bridge circuit

UNIT III EV CHARGING USING RENEWABLE AND STORAGE SYSTEMS 9

Introduction- - EV charger topologies , EV charging/discharging strategies - Integration of EV charging-home solar PV system , Operation modes of EVC-HSP system , Control strategy of EVCHSP system - fast-charging infrastructure with solar PV and energy storage.

UNIT IV WIRELESS POWER TRANSFER 9

Introduction - Inductive, Magnetic Resonance, Capacitive types. Wireless Chargers for Electric Vehicles -– Benefits of WPT. - WPT Operation Modes - Standards for EV Wireless Chargers, SAE J2954, IEC 61980. ISO 19363

UNIT V POWER FACTOR CORRECTION IN CHARGING SYSTEM 9

Need for power factor correction- Boost Converter for Power Factor Correction, Sizing the Boost Inductor, Average Currents in the Rectifier and calculation of power losses.

TOTAL: 45 PERIODS

COURSE OUTCOMES: At the end of the course, the student will have to

- To illustrate various charging techniques and to know charging standards and regulations.
- To demonstrate the working o DC-DC converters used for charging systems and principles
- To illustrate the advantages of renewable system based charging systems
- To demonstrate the principles of wireless power transfer.
- To analyze the standards for wireless charging
- To design and simulate boost converter based power factor correction.

TEXT BOOKS :

1. Miao Wang Ran Zhang Xuemin (Sherman) Shen, "Mobile Electric Vehicles Online Charging and Discharging", First Edition , Springer, 2016.
2. Alicia Triviño-Cabrera, José M. González-González, José A. Aguado, "Wireless Power Transferor Electric Vehicles: Foundations and Design Approach", First Edition, Springer Publisher, 2020.
3. Nil Patel, Akash Kumar Bhoi, Sanjeevikumar Padmanaban, Jens Bo Holm-Nielsen, "Electric Vehicles Modern Technologies and Trends", First Edition, Springer Publisher, 2021.

REFERENCE BOOKS:

1. Rajiv Singh, Sanjeevikumar Padmanaban, Sanjeet Dwivedi, Marta Molinas and Frede Blaabjerg, "Cable Based and Wireless Charging Systems for Electric Vehicles, Technology and control, management and grid integration", First Edition , IET, 2021.
2. James D Halderman,"Electric and Hybrid Electric Vehicles", First Edition Pearson, 2022.
3. Ali Emadi,"Handbook of Automotive Power Electronics and Motor Drives", Taylor & Francis, 2005.

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1. https://nptel.ac.in/courses/117106111
2. https://onlinecourses.nptel.ac.in/noc20_cs15/preview
3.https://www.csie.ntu.edu.tw/~cyy/courses/assembly/12fall/lectures/handouts/lec08_ARMarch.pdf
4.https://www.youtube.com/watch?v=J4fhE4Pp55E&list=PLGs0VKk2DiYypuwUUM2wxzcI9B

CO - PO & PSO MAPPING :

CO\PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	2	1	2	-	-	-	-	3	3	2	2
CO2	3	3	3	3	1	1	2	-	-	-	-	3	3	3	3
CO3	3	2	2	2	2	1		-	-	-	-	2	3	3	3
CO4	3	3	3	3	1	1	2	-	-	-	-	1	3	3	3
CO5	3	2	2	2	2	1	-	-	-	-	-	2	3	3	3
CO6	3	3	3	3	2	1	2	-	-	-	-	2	3	3	3
AVG	3	3	3	3	2	1	2	-	-	-	-	2	3	3	3

JEE1057 GRID INTEGRATION OF ELECTRIC VEHICLES L T P C
3 0 0 3

COURSE OBJECTIVES:

- To know the basic details of V2G
- To study the benefits of V2G
- To study the challenges of V2G

- To learn EV & V2G on the smart grids renewable energy systems
- To know the grid integration

UNIT I DEFINITION AND STATUS OF V2G 9

Defining Vehicle to Grid (V2G) - History and Development of V2G. Incorporating V2G to the EV, Auditing and Metering, V2G in Practice, V2G - Power Markets and Applications. Electricity Markets and V2G Suitability, Long-Term Storage, Renewable Energy, Energy yield assessment and demand side assessment

UNIT II BENEFITS OF V2G 9

Benefits of V2G, Technical Benefits: Storage Superiority and Grid Efficiency, Economic Benefits: EV Owners and Societal Savings, Environment and Health Benefits: Sustainability in Electricity and Transport, Other Benefits.

UNIT III CHALLENGES TO V2G 9

Technical Challenges - Battery Degradation, Charger Efficiency, Aggregation and Communication, V2G in a Digital Society. The Economic and Business Challenges to V2G - Evaluating V2G Costs and Revenues - Regulatory and Political Challenges to V2G , V2G and Regulatory Frameworks .

UNIT IV IMPACT OF EV AND V2G 9

Introduction - Types of Electric Vehicles - Motor Vehicle Ownership and EV Migration - Impact of Estimated EVs on Electrical Network - Impact on Drivers and the Smart Grid - Standardization and Plug-and-Play - IEC 61850 Communication Standard and IEC 61850-7-420 Extension.

UNIT V GRID INTEGRATION AND MANAGEMENT OF EVs 9

Introduction - Machine to Machine (M2M) in distributed energy management systems - M2M communication for EVs - M2M communication architecture (3GPP) - Electric vehicle data logging - Scalability of electric vehicles -M2M communication with scheduling.

Total: 45 Periods

Course Outcomes: At the end of the course, the student will have to

- Explain the concepts related with V2G

- Study the grid connection of 3 phase Q inverter
- Explain the technical, economics. business, regulatory & political challenges related with V2G
- Demonstrate the impact of EV and V2G on smart grid and renewable energy system
- Explain the concept of grid integration and management of EVs.

TEXT BOOKS:

1. Ali Emadi, "Advanced Electric Drive Vehicles", First Edition, CRC Press, 2017.

2. Sumedha Rajakaruna , Farhad Shahnia and Arindam Ghosh,"Plug In Electric Vehicles in Smart Grids, Charging Strategies", First Edition, Springer, 2015.

3. Nand Kishor, Jesus Fraile-Ardanuy, "ICT for Electric Vehicle Integration with the Smart Grid" , IET 2020.

REFERENCE BOOKS:

1. Junwei Lu and Jahangir Hossain, "Vehicle-to-Grid: Linking Electric Vehicles to the Smart Grid", First Edition , IET, 2015.

2. Lance Noel, Gerardo Zarazua de Rubens Johannes Kester, Benjamin K. Sovacool, Vehicleto, "Grid A Socio technical Transition Beyond Electric Mobility", First Edition , 2019.

WEB SITE REFERENCES:

1. https://nptel.ac.in/courses/117106111
2. https://onlinecourses.nptel.ac.in/noc20_cs15/preview
3.https://www.csie.ntu.edu.tw/~cyy/courses/assembly/12fall/lectures/handouts/lec08_ARMarch.pdf
4.https://www.youtube.com/watch?v=J4fhE4Pp55E&list=PLGs0VKk2DiYypuwUUM2wxzcI9B

CO - PO & PSO MAPPING :

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CO2	3	3	1	1	3	1	2	-	-	-	-	-	3	2	1
CO3	3	3	3	1	2	1	2	-	-	-	-	-	3	2	1
CO4	3	3	2	1	2	1	2	-	-	-	-	-	3	2	2
CO5	3	3	2	1	2	1	2	-	-	-	-	-	3	2	1
AVG	3	3	2	1	2	1	2	-	-	-	-	-	3	2	1

JEE1058	BATTERY MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the various battery parameters measurement
- To understand basic battery management system functionality
- To understand battery charge balancing
- To estimate state of charge of the battery
- To estimate state of health of the battery

UNIT I MEASUREMENT OF BATTERY PARAMETERS 9

Cell Voltage Measurement, Current Measurement, Current Sensors Current Sense Measurements, Synchronization of Current and Voltage, Temperature Measurement, Measurement Uncertainty and Battery Management, System Performance

UNIT II BATTERY MANAGEMENT SYSTEM FUNCTIONALITY 9

Charging, Strategies, CC/CV Charging Method, Target Voltage Method, Constant Current Method, Thermal Management, Operational Modes

UNIT III CHARGE BALANCING 9

Balancing Strategies, Balancing Optimization, Charge Transfer Balancing, Flying Capacitor, Inductive Charge Transfer Balancing, Transformer Charge Balancing, Dissipative Balancing, Balancing Faults

UNIT IV STATE-OF-CHARGE ESTIMATION ALGORITHMS 9

Challenges, Definitions, Coulomb Counting, SOC Corrections, OCV Measurements, Temperature Compensation, Kalman Filtering, Other Observer Methods.

UNIT V STATE-OF-HEALTH ESTIMATION ALGORITHMS 9

State of Health, Mechanisms of Failure, Predictive SOH Models Impedance Detection, Passive Methods, Active Methods, Capacity Estimation, Self-Discharge Detection Parameter Estimation, Dual-Loop System, Remaining Useful Life Estimation

Total**: 45 Periods**

COURSE OUTCOMES: At the end of the course, the student will have to

- Review various battery parameters measurement
- clarify the basic information about battery management system functionality
- Detail the need for charge balancing
- Estimate the state of charge of the battery.
- Estimate the state of health of the battery.

TEXT BOOKS:

1. H. J. Bergveld, "Battery management systems : design by modelling", University Press Facilities,Eindhoven,2001.
2. Phillip Weicker, "A Systems Approach to Lithium-Ion Battery Management", artech house, 2014.
3. Gregory L. Plett, "Battery Management Systems: Battery Modeling", Artech house, 2015

REFERENCE BOOKS:

1. M. Barak (Ed.), T. Dickinson, U. Falk, J.L. Sudworth, H.R. Thirsk, F.L. Tye, "Electrochemical Power Sources: Primary & Secondary Batteries", IEE Energy Series 1, A. Wheaton &Co, Exeter, 1980.
2. C.C Chan, K.T Chau, "Modern Electric Vehicle Technology", Oxford University Press Inc., New York, 2001.

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2. https://onlinecourses.nptel.ac.in/noc20_cs15/preview
3.https://www.csie.ntu.edu.tw/~cyy/courses/assembly/12fall/lectures/handouts/lec08_ARMarch.pdf
4.https://www.youtube.com/watch?v=J4fhE4Pp55E&list=PLGs0VKk2DiYypuwUUM2wxzcI9B

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CO2	3	3	2	2	2	3	1	-	-	-	-	3	3	3	3
CO3	3	3	3	3	1	2	1	-	-	-	-	3	3	2	3
CO4	3	3	3	3	2	2	2	-	-	-	-	3	3	3	3
CO5	3	3	3	3	3	2	1	-	-	-	-	3	3	3	3
AVG	3	3	3	3	2	2	1	-	-	-	-	3	3	3	2

JEE1059 TESTING OF ELECTRIC VEHICLES L T P C

3 0 0 3

COURSE OBJECTIVES:

- To know various standardization procedures
- To learn the testing procedures for EV & HEV components
- To know the functional safety and EMC
- To realize the effect of EMC in EVs
- To study the effect of EMI in motor drives and in DC-DC converter system
-

UNIT I EV STANDARDIZATION 9

Introduction - Current status of standardization of electric vehicles, electric Vehicles and Standardization - Standardization Bodies Active in the Field – Standardization activities in countries like Japan. The International Electro Technical Commission - Standardization of Vehicle Components.

UNIT II TESTING OF ELECTRIC AND HYBRID ELECTRIC VEHICLES 9

Test Procedure Using M-G Set, electric motor, controller, application of Test Procedure, Analysis of Test Items for the Type Test - Motor Test and Controller Test (Controller Only). - Test Procedure Using Eddy Current Type Engine Dynamometer, Test Strategy, Test Procedure, Discussion on Test Procedure. Test Procedure Using AC Dynamometer.

UNIT III FUNDAMENTALS OF FUNCTIONAL SAFETY AND EMC 9

Functional safety life cycle - Fault tree analysis - Hazard and risk assessment – software development - Process models - Development assessments - Configuration management – Reliability - Reliability block diagrams and redundancy - Functional safety and EMC - Functional safety and quality - Standards - Functional safety of autonomous vehicles.

UNIT IV EMC IN ELECTRIC VEHICLES 9

Introduction - EMC Problems of EVs, EMC Problems of Motor Drive, EMC Problems of DC-DC Converter System, EMC Problems of Wireless Charging System, EMC Problem of Vehicle Controller, EMC Problems of Battery Management System, Vehicle EMC Requirements-

UNIT V EMI IN MOTOR DRIVE AND DC-DC CONVERTER SYSTEMS 9

Overview -EMI Mechanism of Motor Drive System, Conducted Emission Test of Motor Drive System, IGBT EMI Source, EMI Coupling Path, EMI Modelling of Motor Drive System. EMI in DC-DC Converter, EMI Source, The Conducted Emission High-Frequency, Equivalent Circuit of DC-DC Converter System, EMI Coupling Path

Total: 45 Periods

COURSE OUTCOMES: At the end of the course, the student will have to

- Describe the status and other details of standardization of EVs
- Illustrate the testing protocols for EVs and HEV components
- Analyze the safety cycle and need for functions safety for EVs
- Analyze the problems related with EMC for EV components.
- Evaluate the EMI in motor drive and DC-DC converter system.

TEXT BOOKS:

1. Ali Emadi, “Handbook of Automotive Power Electronics and Motor Drives”, First Edition, Taylor & Francis, 2005.
2. Li Zhai,"Electromagnetic Compatibility of Electric Vehicle", First Edition, Springer, 2021.
3. Kai Borgeest, "EMC and Functional Safety of Automotive Electronics", First Edition, IET, 2018.

REFERENCE BOOKS:

1. Druce Archam beault, colin branch, Omar M.Ramachi, "EMI/EMC Computational Modeling Handbook", Second Edition , Springer, 2012.
2. Beate Müller, Gereon Meyer,"Electric Vehicle Systems Architecture and Standardization Needs, Reports of the PPP European Green Vehicles Initiative", Springer, 2015.

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2. https://onlinecourses.nptel.ac.in/noc20_cs15/preview
3.https://www.csie.ntu.edu.tw/~cyy/courses/assembly/12fall/lectures/handouts/lec08_ARMarch.pdf
4.https://www.youtube.com/watch?v=J4fhE4Pp55E&list=PLGs0VKk2DiYypuwUUM2wxzcI9B

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CO3	3	1	1	2	1	2	2	-	-	-	-	2	3	3	2
CO4	3	1	1	2	1	2	1	-	-	-	-	1	3	3	2
CO5	3	1	1	2	2	2	2	-	-	-	-	3	3	3	3
AVG	3	1	1	2	1	2	2	-	-	-	-	2	3	3	2

OPEN ELECTIVE I

SEMESTER IV

		L	T	P	C
JEE9001	ELECTRICAL SAFETY ENGINEERING	3	0	0	3

COURSE OBJECTIVES:

- To expose the students to electrical hazards
- To impart knowledge on prevention of electrical shocks
- To create awareness about various first aid methods
- To impart knowledge on Electrical safety in hazardous areas
- To study about Electrical safety management

UNIT I INTRODUCTION 9

General Back ground-Objectives of safety and security measures-Hazards associated with electric current and voltage-principles of electrical safety- Approaches to Prevent Accidents-Fire Prevention and Fire Fighting-Objectives and scope of IE act and IE rules-General requirements for electrical safety as per IE rules

UNIT II ELECTRICAL SHOCKS AND THEIR PREVENTION 9

Primary and Secondary Electric Shocks-Occurrence of Electric Shock-Shocks Due to Flash overs/Spark-overs- Lightning Strokes on Overhead Transmission Lines and Outdoor Substations - Safety Precautions in Small LV Installations, Residential Buildings, Shops – Safety Procedures in Electrical Plant Installation and description of Earthing System-Equipment Earthing -Substation Earthing.

UNIT III FIRSTAID 9

Introduction- Removal of Contact with Live Conductor- First Principles of Actions after Electric Shock-Artificial Respiration-Schafer's Prone Pressure Method-Silvester's Method-Nielson's Arm-lift Back-pressure Method-Mouth to Mouth Method-Use of Artificial Resuscitator-External Cardiac Massage-Cardiac Pulmonary Resuscitation-First aid treatment of Heat Exhaustion and heat stroke.

UNIT IV ELECTRICAL SAFETY IN HAZARDOUS AREAS 9

Introduction-Classification of Hazardous zones-causes of sparks and flash overs in electrical plants and machines-functional requirements of electrical equipment and installations for hazardous area/zones-classification of equipment/enclosure for hazardous locations.

UNIT V ELECTRICAL SAFETY MANAGEMENT 9

Introduction-Principles of safety management-management's safety policy-safety organization-organization charts for construction phase of a project, maintenance mode of a plant and for safety department – safety auditing-training and supervision-annual reports – motivation to managers, supervisors and employees.

TOTAL:45PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1: To understand Electrical safety, IE act and IE rules.
CO2: To acquire knowledge on prevention of electrical shocks
CO3: To acquire knowledge about various first aid measures.
CO4: To Familiarize with electrical safety in hazardous areas.
CO5: To Know about safety management.

TEXT BOOKS:

1. S.Rao, R.K.Jain and H.L.Saluja, "Electrical Safety, Fire Safety and Safety Management", Khanna Publishers, Second Edition, 2012.
2. W.F.Cooper, "Electrical Safety Engineering", Butterworth and Company, London, Third Edition, 2013

REFERENCES:

1. J.Cadick, D.Neitzel and A.Winfield, "Electrical Safety Hand Book", Mc Graw Hill 1.An Education, Fourth Edition 2012.
2. J.Maxwell Adams, "Electrical Safety-A Guide to the Causes and Prevention of Electric Hazards", The Institution of Electric Engineers, First Edition 3rd Reprint, 2009.
3. Martha J. Boss and Gayle Nicoll, "Electrical Safety-Systems, Sustainability and Steward ship", CRC Press, First Edition, 2015.

JEE9002	DESIGN ESTIMATION AND COSTING OF ELECTRICAL SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To emphasize the estimation and costing aspects of all electrical equipment, installation and designs on the cost viability.
- To design and estimation of electrical installation for buildings and small industries
- To study transmission and distribution lines
- To study various types of substations
- To design illumination schemes

UNIT I DESIGN CONSIDERATIONS OFELECTRICAL INSTALLATIONS 9

Electric Supply System, Three phase four wire distribution system, Protection of Electric Installation against over load, short circuit and Earth fault, Earthing, General requirements of electrical installations, testing of installations, Indian Electricity rules, Neutral and Earth wire, Types of loads, Systems of wiring, Service connections, Service Mains, Sub-Circuits, Location of Outlets, Location of Control Switches, Location of Main Board and Distribution board, Guide lines for Installation of Fittings, Load Assessment, Permissible voltage drops and sizes of wires, estimating and costing of Electric installations.

UNIT II ELECTRICAL INSTALLATION FOR DIFFERENT TYPES OF BUILDINGS AND SMALL INDUSTRIES 9

Electrical installations for residential buildings–estimating and costing of material, Electrical installations for commercial buildings, Electrical installations for small industries.

UNIT III OVERHEAD AND UNDERGROUND TRANSMISSION AND DISTRIBUTION LINES 9

Introduction, Supports for transmission lines, Distribution lines–Materials used, Underground cables, Mechanical Design of overhead lines, Design of underground cables.

UNIT IV SUBSTATIONS 9

Introduction, Types of substations ,Outdoor substation–Pole mounted type, Indoor substations –Floor mounted type.

UNIT V DESIGN OF ILLUMINATIONS CHEMES 9

Introduction, Terminology in illumination, laws of illumination, various types of light sources, Practical lighting schemes LED, CFL and OCFL differences.

TOTAL: 45PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1: To understand the design considerations of electrical installations.
CO2: To Design electrical installation for buildings and small industries.
CO3: To acquire knowledge of various transmission and distribution lines.
CO4: To understand various types of substations
CO5: To Identify and design the various types of light sources for different applications.

TEXT BOOKS:

1. K.B.Raina, S.K.Bhattacharya, "Electrical Design Estimating and Costing", New Age International Publisher, second edition, 2010.
2. Er.V.K.Jain, Er.Amitabh Bajaj, "Design of Electrical Installations", Laxmi Publications (P) Ltd, first edition, 01-Apr-2012

REFERENCES:

1. Code of practice for Electrical wiring installations, Indian Standard Institution, IS: 732-1983.
2. Guide for Electrical layout in residential buildings, Indian Standard Institution, IS:4648-1968.
3. Electrical Installation buildings Indian Standard Institution, IS:2032.
4. Code of Practice for selection, Installation of Maintenance off use (voltage not exceeding 650V), Indian Standard Institution,IS:3106-1966.
5. Code of Practice for earthling, Indian Standard Institution, IS:3043-1966.
6. Code of Practice for Installation and Maintenance of induction motors, Indian Standard Institution, IS: 900-1965.
7. Code of Practice for electrical wiring, Installations (system voltage not exceeding 650 Volts), Indian Standard Institution, IS: 2274-1963.
8. Gupta J. B., Katson, Ludhiana", "Electrical Installation, estimating and costing", S.K.Kataria and sons, 2013..

JEE9003	ELECTRICAL MACHINES AND DRIVES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To impart knowledge on the following to pics

- Principle of operation, construction and working of DC machines and Transformers
- Principle of operation, construction and working of AC machines
- Characteristics and Speed control methods of motors
- Power electronic devices, Rectifiers, Choppers, Inverters, Cyclo converters and AC voltage regulators
- Electric drive characteristics, DC motor drives, Induction motor drive and Synchronous motor drive

UNIT I DC MACHINES AND TRANSFORMER 9

Introduction to Electrical Machines-Principle of Operation, Construction, Working, Types and Applications of DC Generator, DC motors and Transformer- EMF equation of DC Generator and Transformer-Torque equation of DC motor

UNIT II AC MACHINES 9

Principle of Operation, Construction, Working, Types and Applications of Three phase Induction Motor, Alternator, Synchronous motors and Single phase induction motors.

UNIT III SPEED CONTROL OF MOTORS 9

Torque/Speedcharacteristics,speedcontrolmethodsandStartersofDCmotors,Threephaseinduction motors and Synchronous motors

UNIT IV INTRODUCTION TO POWER ELECTRONICS 9

Power electronic devices–Power diode, SCR, IGBT, and Power MOSFET-Rectifiers-Choppers- Inverters-Cyclo converter-AC Voltage Regulator

UNIT V ELECTRIC DRIVES 9

Electric drive-Drive characteristics-Converter/Chopper fed DC motor drive-Induction motor drive-Synchronous motor drive

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1: To explain the Principle of operation, construction and working of DC machines and Transformers

CO2: To acquire the knowledge on Principle of operation, construction and working of AC Machines

CO3: To analyze the characteristics and speed control methods of motors

CO4: To understand Power electronic devices, Rectifiers, Choppers, Inverters, Cyclo converters and AC voltage regulators

CO5: To gain knowledge about electrical drives

TEXTBOOKS:

1. B.L.Theraja and A.KTheraja, "A Text book of Electrical Technology Volume-IIAC and DC Machines", 23rd edition, S Chand & Company Pvt.Ltd , 2013
2. Muhammad.H.Rahid, "Power Electronics Circuits, Devices and Applications",3rd edition, Pearson, 2012
3. G.K.Dubey, "Fundamentals of Electrical Drives", Narosa Publishing House Pvt.Ltd., 2nd Edition, 2010
4. Bimal K.Bose "Modern Power Electronics and AC Drives", Prentice Hall of India, 2ndEdition, 2010

REFERENCES:

1. V.K.Mehta, "Principles of Electrical Machines", S Chand & Company Pvt. Ltd, 2nd
   3. An Edition, 2014
2. P.S.Bimbhra, "Power Electronics", 6th edition Khanna Publishers, 2013
3. Vedam Subramanyam, "Electric Drives Concepts and Applications", 2nd Edition, McGraw Hill, 2016
4. Theodore Wildi, "Electrical Machines, Drives and power systems, 6th edition, Pearson Education, 2015

OPEN ELECTIVE II

SEMESTER V

JEE9004	INDUSTRIAL ELECTRONICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To get an overview of various power semi-conductor devices and their switching characteristics.
- To introduce the operation and characteristics of controlled rectifiers.
- To study the operation and characteristics of DC-to-DC converters
- To learn the working of single and three phase inverters.
- To study the working of AC to AC converters

UNIT I POWERDEVICES 9

Layer diagram, switching characteristics of BJT, MOSFET and IGBT-Layer diagram, V-I characteristics, turn on and turn off mechanisms of SCR

UNIT II CONTROLLED RECTIFIERS 9

Introduction to full wave bridge rectifier–Operation and Characteristics of Single phase and three phase–Half controlled and fully controlled converters–Applications-light dimmer, Excitation system.

UNIT III DC-DC CONVERTERS 9

Principle, modes of operation, performance para meters and characteristics of Buck Regulator, Boost Regulator, Buck- Boost Regulator and Chopper classification – Class A, B, C, D, E Choppers, Applications-Battery operated vehicles.

UNIT IV INVERTERS 9

Voltage Source Inverter (VSI) –Single and three phase–Voltage Source Inverters (VSI) - Voltage control using PWM–Current Source Inverter (CSI)-Applications –UPS.

UNIT V AC-AC CONVERTERS 9

Phase control–Integral Cycle Control–working and characteristics of Single phase AC Chopper-working of Single phase and three phase cyclo converters-Applications – welding.

TOTAL: 45PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1: To acquire knowledge on power devices
CO2: To understand the operation and characteristics of various controlled rectifiers
CO3: To understand various modes of operation of DC-DC converters.
CO4: To gain knowledge about the working of inverters
CO5: To acquire knowledge on AC to AC converters

TEXT BOOKS:

1. G.K.Mithal, "Industrial Electronics", Khanna Publishers, Delhi, 2000.
2. David A.Bell, "Electronic Devices and Circuits", 5th Edition, Oxford University Press, 2008.

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1. Salivahanan Electronic devices and Circuits, second edition, Tata McGraw Hill International, 2011.
2. G.M.Chute and R.D.Chute, "Electronics in Industry", McGraw Hill Ltd, Tokyo, 1995.
3. F.D.Petruzulla, "Industrial Electronics", McGrawHill ,Singapore,1996.
4. M.H. Rashid – Power Electronics circuits, devices and applications- third edition Prentice Hall of India New Delhi,2007.
5. Erickson, RobertW, "Fundament als of Power Electronics", Springer, second edition, 2010.

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2. https://www.sciencedirect.com/topics/engineering/d-c-to-d-c-converter
3. https://learnabout-electronics.org/PSU/psu30.php
4. https://www.electronics-tutorials.ws/power/switch-mode-power-supply.html
5. https://link.springer.com/chapter/10.1007/978-3-642-52454-7_6

JEE9005	MEASUREMENTS AND INSTRUMENTATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the basic functional elements of instrumentation
- To learn the fundamentals of electrical and electronic instruments
- To educate on the comparison between various measurement techniques
- To impart various storage and display devices
- To get an overview about various transducers and the data acquisition systems

UNIT I INTRODUCTION 9

Functional elements of an instrument–Errors in measurement–-Statistical evaluation of measurement data-Standards and calibration-Principle and types of analog and digital voltmeters, ammeters

UNIT II ELECTRICAL AND ELECTRONICS INSTRUMENTS 9

Principle and types of multimeters–Construction and principle of Single and three phase watt meters and energy meters – Magnetic measurements – Determination of B-H curve and measurements of iron loss –Instrument transformers

UNIT III COMPARATIVE METHODS OF MEASUREMENTS 9

D.C & A.C potentiometers, DC bridges – Wheat stone, Kelvin's Double bridge, AC bridges -Maxwell, Anderson and Schering bridges. Interference and screening –Electrostatic and electromagnetic interference

UNIT IV STORAGE AND DISPLAY DEVICES 9

Magnetic disk and tape–Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD– Data Loggers

UNIT V TRANSDUCERS 9

Classification and Selection of transducers–Resistive, capacitive and inductive transducers– Piezoelectric, optical and digital transducers– Smart sensors.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the student will be able

CO1: To acquire knowledge on Basic functional elements of instrumentation
CO2: To understand the concepts of Fundamentals of electrical and electronic instruments
CO3: To distinguish between various measurement techniques
CO4: To gain knowledge on Various storage and display devices
CO5: To understand the concepts Various transducers and the data acquisition systems

TEXT BOOKS:

1. Sawhney A.K.,"A Course in Electrical & Electronic Measurements & Instrumentation", Seventh Edition, Dhanpat Rai and Co., 2015.
2. Gupta J.B.,"A Course in Electronic and Electrical Measurements", S.K. Kataria & Sons, Delhi ,2013
3. Doebelin E.O.and Manik D.N., "Measurement Systems –Applications and Design", Special Indian Edition, Tata McGraw Hill Education Pvt.Ltd.,2007

REFERENCE BOOKS:

1. Kalsi H.S., "Electronic Instrumentation", III Edition,McGrawHill,2017.
2. Murthy D.V.S., "Transducers and Instrumentation" ,Second Edition, Prentice Hall of India Pvt Ltd, 2015.
3. David Bell, "Electronic Instrumentation & Measurements", Third Edition, Oxford University Press, 2013.
4. Martin Reissland, "Electrical Measurements", First edition, New Age International (P) Ltd., Delhi, 2001.
5. Alan S.Morris, Principles of Measurements and Instrumentation, Third Edition, Butterworth-Heinemann, 2003

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4. https://www.youtube.com/watch?v=I5k66ESHJHM
5. https://nptel.ac.in/courses/108/105/108105153/

JEE9006	ANALOG CONTROL SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To provides an overview about the methods of representation of systems and to derive their transfer function models.
- To provide adequate knowledge in the time response of systems.
- To accord basic knowledge in obtaining the frequency responses of systems.
- To learn the concept of stability of control system.
- To study the three various ways of designing compensation for a control system

UNIT I SYSTEMS AND THEIR REPRESENTATION 9

Introduction to open and closed loop systems–Electrical analogy of mechanical systems– Transfer function —Block diagram reduction techniques – Signal flow graphs

UNIT II ELEMENTS AND TIME RESPONSE 9

Basic elements in control systems-Synchros–AC and DC servo motors, Time response–Time domain specifications–Types of test input–I and II order system response–P, PI, PID controllers.

UNIT III FREQUENCY RESPONSE 9

Frequency response–Bode plot–Polar plot – Determination of closed loop response from open loop response– Correlation between frequency domain and time domain specifications

UNIT IV STABILITY OF CONTROL SYSTEM 9

Characteristics equation–Location of roots in S plane for stability–Routh Hurwitz criterion Root locus construction–Gain margin and phase margin–Nyquist stability criterion

UNIT V COMPENSATOR DESIGN 9

Performance criteria–Lag, lead and lag-lead networks –Compensator design using bode plots

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1: To acquire knowledge on systems and their representation
CO2: To perform time response analysis
CO3: To understand the frequency response
CO4: To gain the knowledge on the stability of control system
CO5: To acquire knowledge on compensator design

TEXT BOOKS:

1. I.J.Nagrath and M.Gopal, 'Control Systems Engineering', New Age International Publishers, 2003.
2. Benjamin C.Kuo, Automatic Control systems, Pearson Education, New Delhi, 2003.

REFERENCE BOOKS:

1. Dorf R.C. and Bishop R.H., "Modern Control systems", Addison–Wesley, 1995
2. Norman S.Nise,Control Systems Engineering, John Wiley, New Delhi, 2007.
3. Samarajit Ghosh, Control systems, Pearson Education, New Delhi, 2004
4. M.Gopal, 'Control Systems, Principles and Design', TMH, New Delhi, 2002
5. K.Ogata, 'Modern Control Engineering', 4th edition, PHI, NewDelhi, 2002.

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3. https://www.udemy.com/course/control-systems-engineering/
4. 4.https://www.electrical4u.com/control-engineering-historical-review-and-types-of-control- engineering/
5.https://www.youtube.com/watch?v=XMfH2P2Fc6Q

OPEN ELECTIVE III

SEMESTER VI

JEE9007	RENEWABLE ENERGY SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To impart knowledge on current and future role of renewable energy sources.
- To study about wind energy potential, wind power plants and grid connectivity
- To accord basic knowledge on solar thermal and solar PV systems
- To learn about biomass and its economic aspects, geothermal energy resources
- To introduce concepts of various ocean energy technologies

UNIT I RENEWABLE ENERGY SOURCES 9

Environmental consequences of fossil fuel use, Importance of renewable sources of energy, Sustainable Design and development, Types of RE sources, Limitations of RE sources, Present Indian and international energy scenario of conventional and RE sources

UNIT II WIND ENERGY 9

Power in the Wind – wind energy potential - performance characteristics-Types of Wind Power Plants (WPPs)–horizontal and vertical axis wind mills-Components of WPPs-Working of WPPs–Site selection of WPPs-Grid integration issues of WPPs

UNIT III SOLAR THERMAL SYSTEMS 9

Solar Radiation, Radiation Measurement, Solar Thermal Power Plant, Central Receiver Power Plants, Solar Ponds -Thermal Energy storage system with PCM

UNIT IV SOLAR PV SYSTEMS 9

Solar Photo voltaic systems: Basic Principle of SPV conversion – Types of PV
Systems- Types of Solar Cells –Photo voltaic cell concepts-IV Characteristics, Efficiency and Quality of the Cell, Series and parallel connections-maximum power point tracking, Aplications.

UNIT V OTHER ENERGY SOURCES 9

Bio mass resources –Energy from Bio mass: conversion processes-Types of Biomass Plants –Geothermal Energy: Basics, Direct Us-Tidal Energy: Energy from the tides, Barrage and Non Barrage Tidal power systems. Wave Energy: Energy from waves, wave power devices. Ocean Thermal Energy Conversion (OTEC)- Fuel cell :Principle of working- various types and construction.

TOTAL:45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1: To recognize current and possible future role of renewable energy sources
CO2: To assess the wind energy potential and understand the wind energy systems
CO3: To gain knowledge on solar thermal and solar PV systems
CO4: To acquire knowledge on biomass and Geothermal energy
CO5: To identify various ocean energy technologies and opportunities

TEXT BOOKS:

1. Twidell & Wier, “Renewable Energy Resources”, CRC Press (Taylor & Francis), 2011
2. D.P. Kothari, K.C Singal, Rakesh Ranjan,“Renewable Energy Sources and Emerging Technologies”, PHI Learning Pvt. Ltd, New Delhi, 2013.
3. Scott Grinnell, “Renewable Energy & Sustainable Design”, CENGAGE Learning, 2016.
4. Rai G.D.- “Non-Conventional Energy Sources”-Khanna Publishers-2010

REFERENCE BOOKS:

1. Tiwari and Ghosal, “Renewable energy resources”, Narosa Publishing House, 2007
2. Ramesh R & Kumar K.U, “Renewable Energy Technologies”, Narosa Publishing House, 2004
3. Mittal K M, “Non, Conventional Energy Systems”, Wheeler Publishing Co.Ltd, 2003
4. Chetan Singh Solanki, "Solar Photo voltaic Fundamentals, Technologies and Application”, PHI Learning Pvt.,Ltd., 2009.
5. Jha.A.R, “Solar Cell Technology and Applications”, CRC Press, 2010

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1. mnre.gov.in
2. https://www.youtube.com/watch?v=qSWm_nprfqE
3. https://www.youtube.com/channel/UCMV3aTOwUtG5vwfH9_rzb2w
3.4.https://www.youtube.com/watch?v=-HhdR9YRGxI
5.https://www.youtube.com/watch?v=9tfLJ4taTKI

JEE9008	INTELLIGENT CONTROLLERS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To expose the students to the concepts of feed forward neural networks.
- To provide adequate knowledge about feedback neural networks
- To provide adequate knowledge about fuzzy and neuro-fuzzy systems
- To provide comprehensive knowledge of fuzzy logic control to real time systems.
- To provide adequate knowledge of genetic algorithms and its application to economic dispatch and unit commitment problems.

UNIT I ARCHITECTURES –ANN 9

Introduction–Biological neuron–Artificial neuron–Neuron model–Supervised and unsupervised learning-Single layer–Multi layer feed forward network–Learning algorithm-Back Propagation network.

UNIT II NEURAL NETWORKS FOR CONTROL 9

Feedback networks–Discrete time Hop field networks–Transient response of continuous time system–Applications of artificial neural network-Process identification–Neuro controller for Inverted pendulum.

UNIT III FUZZY SYSTEMS 9

Classical sets–Fuzzy sets–Fuzzy relations–Fuzzification– Defuzzification–Fuzzy rules Membership function–Knowledge base–Decision-making logic–Introduction to neuro fuzzy system- Adaptive fuzzy system.

UNIT IV APPLICATION OF FUZZY LOGIC SYSTEMS 9

Fuzzy logic control: Home heating system-liquid level control-aircraft landing-inverted pendulum– fuzzy PID control, Fuzzy based motor control.

UNIT V GENETICAL GORITHMS 9

Basic concept of Genetic algorithm and detail algorithmic steps - adjustment of free Parameters -Solution of typical control problems using genetic algorithm- Concept on some other search techniques like tabu search and ant colony search techniques for solving optimization problems.

TOTAL:45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1: To understand the over view of artificial neural network and training algorithms.
CO2: To analyze problems to formulate models and develop control Schemes using Neuro controller systems
CO3: To design fuzzy controller for non-linear systems.
CO4: To apply genetic algorithm for optimization applications.
CO5: To use modern IT tool boxes to simulate case studies

TEXT BOOKS:

1. Laurance Fausett, Engle wood Cliffs, N.J., 'Fundamentals of Neural Networks', Pearson Education,1992.
2. TimothyJ.Ross,'Fuzzy Logic with Engineering Applications', Tata McGraw Hill, 3rd Edition 2010..
3. S.N.Sivanandam and S.N.Deepa, Principles of Soft computing, Wiley India Edition, 2ndEdition, 2013

REFERENCE BOOKS:

1. Simon Haykin, 'Neural Networks', Pearson Education, 2003.
2. JohnYen & Reza Langari, 'Fuzzy Logic–Intelligence Control & Information', Pearson Education, NewDelhi, 2003.
3. M.Genand R,Cheng, Genetic algorithms and optimization, Wiley Series in Engineering Design and Automation, 2000.
4. Hagan, Demuth, Beale, "Neural Network Design", Cengage Learning, 2012.
5. N.P.Padhy, "Artificial Intelligence and Intelligent Systems", Oxford, 2013.
6. William S.Levine, "Control System Advanced Methods, "The Control H and book CRC Press 2011.

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JEE9009	INTODUCTION TO SMPS AND UPS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To familiarize with the operation and characteristics of power semiconductor devices.
- To study about various modes of operation of DC-DC Converters.
- To learn the operation of Switched Mode Power Supply
- To accord knowledge about working and control of inverters
- To impart knowledge on power conditioning circuits and UPS

UNIT I POWER SEMI CONDUCTOR DEVICES 9

Layer diagram, Static and switching characteristics of BJT, MOSFET and IGBT - Layer diagram, V-I characteristics, turn on and turn off mechanisms of SCR.

UNIT II DC-DC CONVERTERS 9

Principle, modes of operation, performance parameters and characteristics of Buck Regulator, Boost Regulator, Buck-Boost Regulator and Resonant Converters

UNIT III SWITCHED MODE POWER CONVERTERS 9

Principle, modes of operation and characteristics of Fly back Converter, Forward Converter, Bridge converters, Push-Pull Converter and SMPS with multiple outputs

UNIT IV DC-AC CONVERTERS 9

Single phase and three phase inverters, control using various techniques,-Introduction to multilevel inverter concept.

UNIT V POWER CONDITIONERS, UPS AND FILTERS 9

Introduction-Power line disturbances-Power conditioners–UPS: off line UPS, Online UPS– Filters: Voltage filters, Series-parallel resonant filters, filter for PWM VSI, current filter, DC filters

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

CO1: To understand the operations and characteristics of various power semi conductor devices
CO2: To understand various modes of operation of DC-DC converters
CO3: To gain knowledge about SMPS system
CO4: To understand the working and control of inverters
CO5: To acquire knowledge on Power conditioning circuit, filters and UPS

TEXT BOOKS:

1. Simon Ang, Alejandro Oliva," Power-Switching Converters", Third Edition, CRC Press, 2010.
2. Kjeld Thorborg, "Power Electronics– In theory and Practice", Overseas Press, First Indian Edition 2005

REFERENCE BOOKS:

1 M.H. Rashid– Power Electronics hand book, Elsevier Publication, 2001
2. Philip T Krein, "Elements of Power Electronics", Oxford University Press
3. NedMohan, Tore.M. Undeland, William. P.Robbins, Power Electronics converters,
Applications and design-Third Edition-John Wiley and Sons-2006124
4. M.H. Rashid – Power Electronics circuits, devices and applications- third edition Prentice Hall of India New Delhi, 2007.
5. Erickson, Robert W, "Fundamentals of Power Electronics", Springer, second edition, 2010

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2. https://www.sciencedirect.com/topics/engineering/d-c-to-d-c-converter
3. https://learnabout-electronics.org/PSU/psu30.php
4. https://www.electronics-tutorials.ws/power/switch-mode-power-supply.html
5. https://link.springer.com/chapter/10.1007/978-3-642-52454-7_6

OPEN ELECTIVE IV
SEMESTER VII

JEE9010	INTRODUCTION TO E-VEHICLES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the fundamental concepts, principles of electric vehicles.
- To provide knowledge about various aspects of electric and hybrid drive train and their configuration
- To learn different types of machines used for E-vehicle applications.
- To study the operation of drives for electric vehicles
- To comprehend proper energy storage systems for vehicle applications

UNIT I ELECTRIC VEHICLES AND VEHICLE MECHANICS 9

Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), Engine ratings, Comparisons of EV with internal combustion Engine vehicles, Fundamentals of vehicle mechanics.

UNIT II ARCHITECTURE OF EV's AND POWER TRAIN COMPONENTS 9

Architecture of EV's and HEV's – Plug-n Hybrid Electric Vehicles (PHEV)- Power train components and sizing, Gears, Clutches, Transmission and Brakes.

UNIT III ELECTRIC MACHINES FOR E VEHICLE APPLICATIONS 9

DC machines, induction machines, permanent magnet synchronous machines, switched reluctance machines and synchronous reluctance machines- configuration, control and application in E-Vehicle.

UNIT IV CONTROL OF DC AND AC DRIVES 9

DC/DC chopper based four quadrant operations of DC drives – Inverter based V/f Operation (motoring and braking) of induction motor drive system – Induction motor and permanent motor-based vector control operation – Switched reluctance motor (SRM) drives.

UNIT V BATTERY ENERGY STORAGE SYSTEM 9

Battery Basics, Different types, Battery Parameters, Battery modeling, Traction Batteries, Fuel cell – Characteristics- Types, hydrogen Storage Systems and Ultra capacitors.

TOTAL : 45 PERIODS

COURSE OUTCOMES: At the end of the course, the student will be able

- To understand the fundamental concepts, principles of electric vehicles
- To gain knowledge about various topologies of drive trains.
- To acquire knowledge on different types of machine used for E-vehicle applications
- To identify and apply the drives for electric vehicles
- To understand the battery energy storage systems for E- vehicles

TEXT BOOKS:

1.Iqbal Hussain, "Electric and Hybrid Vehicles-Design Fundamentals", CRC Press, Third Edition, 2021.
2.MehrdadEhsani, YiminGao, and Ali Emadi, "Modern Electric, Hybrid and Fuel Cell Vehicles: Fundamentals", CRC Press,2019.

REFERENCES:

1. James Larminie, “Electric Vehicle Technology Explained”, John Wiley & Sons, 2015.
2. Sandeep Dhameja, “Electric Vehicle Battery Systems”, Newnes, 2012
3. Chris Mi, MA Masrur, and D W Gao, "Hybrid Electric Vehicles- Principles and Applications with Practical Perspectives", Wiley,2017.

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JEE9011 OPTICAL FIBERS AND LASER TECHNOLOGY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To expose the students to the basic concepts of optical fibers and their properties.
- To provide adequate knowledge about the Industrial applications of optical fibers.
- To expose the students to the Laser fundamentals.
- To study about Industrial application of lasers.
- To impart knowledge on holography and medical applications of Lasers.

UNIT I OPTICAL FIBRES AND THEIR PROPERTIES 9

Introduction to optical fibers - Numerical aperture - Dispersion - Different types of fibers and their properties - Light Sources for fiber optics, coupling, splicing and connectors.

UNIT II INDUSTRIAL APPLICATION OF OPTICAL FIBERS 9

Fiber optic sensors: Types of fiber optics sensor, Intrinsic sensor- Temperature/ Pressure sensor, Extrinsic sensors, Phase Modulated Fiber Optic Sensor and Displacement sensor (Extrinsic Sensor)– Different types of modulators: Electro-optic modulator (EOM) – Interferometric method of measurement of length – Moire fringes

UNIT III LASER FUNDAMENTALS 9

Fundamental characteristics of lasers – Level Lasers: Two-Level Laser, Three Level Laser, Quasi Three and four level lasers –Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping – Types of lasers; – Gas lasers, solid lasers, liquid lasers and semiconductor lasers.

UNIT IV INDUSTRIAL APPLICATION OF LASERS 9

Laser for measurement of distance, length, velocity, acceleration, Laser for measurement of Atmospheric Effect: Types of LIDAR, Construction And Working, and LIDAR Applications –Laser Heating, Laser Welding, Laser Melting.

UNIT V HOLOGRAM AND MEDICAL APPLICATIONS 9

Holography: Basic Principle, Holography vs. photography, Principle Of Hologram Recording,– Holography for non-destructive testing –Medical applications of lasers, Laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery.

TOTAL: 45 PERIODS

COURSE OUTCOMES: At the end of the course, the student will be able

CO1: To understand the principle, transmission, dispersion and attenuation characteristics of optical fibers.

CO2: To apply the gained knowledge on optical fibers for its use as communication medium and as sensor as well which have important applications in production, manufacturing industrial and biomedical applications.

CO3: To understand laser theory and laser generation system.
CO4: To gain knowledge of laser theory for the selection of lasers for a specific Industrial application.
CO5: To acquire knowledge about holography and medical applications of Lasers.

TEXT BOOKS:

1. Singal.T.L, 'Optical Fiber Communication', Cambridge University Press, 2017
2. Senior J.M., 'Optical Fiber Communication – Principles and Practice', Prentice Hall of India,2010.
3. Wilson.J, and Hawkes J.F.B., 'Introduction to Opto Electronics', Prentice Hall of India, 2001.
4. Eric Udd, William .B., and Spillman, Jr., "Fiber Optic Sensors: An Introduction for Engineers and Scientists ", John Wiley & Sons, 2011.

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1. Keiser.G, 'Optical Fiber Communication', McGraw Hill, 2017.
2. ArumugamM, 'Optical Fiber Communication and Sensors', Anuradha Agencies, 2012.
3. John F. Ready, "Industrial Applications of Lasers", Academic Press, Digitized in 2008.
4. Monte Ross, 'Laser Applications', McGraw Hill, 1968.
5. John and Harry, "Industrial lasers and their application", McGraw-Hill, 2002.

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JEE9012	ENERGY MANAGEMENT AND SCADA	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To provide an overview about energy management functions.
- To study the methods to perform the economic analysis of energy management.
- To enhance the knowledge in lighting and cogeneration.
- To learn the concept of supervisory control and data acquisition.
- To interpret the application of SCADA in power systems

UNIT I ENERGY MANAGEMENT FUNCTIONS 9

Need for energy management – energy management program - Energy accounting – Energy monitoring-Targeting and Reporting – Energy audit process-Energy Management Centers and their Functions- Architectures of Centers and their Functions-Energy performance assessment of HVAC system

UNIT II ECONOMIC ANALYSIS 9

Important concepts in an economic analysis, Electricity tariff - Electrical Load Management and Maximum Demand Control - Systems and equipment, Electric motors, Transformers - Capacitors - Energy efficiency analysis on electrical power system, motor and transformer.

UNIT III LIGHTING AND COGENERATION 9

Concept of lighting systems – the task and the working space - Light sources – ballasts –luminaries - Lighting controls - Optimizing lighting energy, lighting and energy standards - Forms of cogeneration – Feasibility of cogeneration - Energy performance analysis of lighting and cogeneration.

UNIT IV SUPERVISORY CONTROL AND DATA ACQUISITION 9

SCADA - Functional requirements and Components - General features, Functions and Applications, Benefits - Various SCADA architectures - SCADA Communication: various industrial communication technologies.

UNIT V SCADA APPLICATIONS 9

SCADA Applications: Utility Applications - Transmission and distribution sector-Operations, Monitoring, Analysis and improvement - Substation automation structure - Substation automation architecture - Introduction to wide area protection.

TOTAL: 45 PERIODS

COURSEOUTCOMES:

- To understand the fundamentals of energy management functions
- To gain knowledge and apply the economic analysis for energy consumption calculations
- To acquire knowledge on lighting and cogeneration.
- To understand the working and operation of supervisory control and data acquisition.
- To familiarize the application of SCADA in powersystems

TEXT BOOKS:

1. Chaudari.M.A, Chaudari.S.M, ASARKAR.S.A, "Energy Conservation And Audit", NiraliPrakashan, 2019
2. WayneC.Turner,SteveDoty"Energy Management Handbook", The Fairmont Press,6thEdition,2007.
3. Amit K. Tyagi, "Handbook on Energy Audits and Management", Tata Energy Research Institute,2ndreprint,2003.
4. Stuart A. Boyer:"SCADA Supervisory Control and Data Acquisition", Instrument Society of America Publications, USA, The Instrumentation system and Automation Society, 4th Edition,2010.

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1. Venkataseshaiah P., Sharma K.V. Energy Management and conservation" , Dream tech Press, 2020.
2. Gordon Clarke, Deon Reynders" Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems", Newnes An imprint of Elsevier Publications,1st Edition,2004.
3. Mini S Thomas, John Douglas McDonald, " Power system SCADA and smart grid" CRC Press, 2015.
4. Murphy W.R, McKay G., "Energy Management", Butterworths Publications, London,1982.
5. Trivedi P.R., Jolka B.R., "Energy Management", Common Wealth Publishers, New Delhi, 1997.
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5. **https://youtu.be/nlFM1q9QPJw**
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