Dr. Mahalingam College of Engineering and Technology

(An Autonomous Institution)

Pollachi - 642 003

Curriculum and Syllabus
B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

SEMESTER I AND VIII

REGULATIONS 2014

DR MAHALINGAM

MCET

COLLEGE OF ENGINEERING AND TECHNOLOGY

Enlightening Technical Minds

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

REGULATION 2014- Revision I

Curriculum for B.E Electrical and Electronics Engineering from Semester I to VIII

SEMESTER I

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
THEORY						
141EE0101	Communication Skills–I	2	0	2	3	100
141EE0102	Engineering Mathematics– I	3	1	0	4	100
141EE0103	Engineering Physics	3	0	0	3	100
141EE0104	Engineering Graphics	1	3	0	4	100
141EE0105	C – Programming	3	0	0	3	100
141EE0106	Fundamentals of Electrical Engineering	3	0	0	3	100
PRACTICAL						
141EE0107	C Programming Laboratory	0	0	2	1	100
141EE0108	Engineering Practices Laboratory - I	0	0	2	1	100
PROFESSIONAL SKILLS						
141EE0109	Promotion of Students' Wellness	0	0	2	1	100
TOTAL		**15**	**4**	**8**	**23**	**900**

Total Hours in a Week:27

SEMESTER II

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
THEORY						
141EE0201	Communication Skills - II	2	0	2	3	100
141EE0202	Engineering Mathematics - II	3	1	0	4	100
141EE0203	Material Science	3	0	0	3	100
141EE0204	Electron Devices	3	0	0	3	100
141EE0205	Engineering Chemistry	3	0	0	3	100
141EE0206	Basics of Civil and Mechanical Engineering	3	0	0	3	100
PRACTICAL						
141EE0207	Engineering Physics and Chemistry Laboratory	0	0	2	1	100
141EE0208	Engineering Practices Laboratory – II	0	0	2	1	100
PROFESSIONAL SKILLS						
141EE0209	Sports for Wellness	0	0	2	1	100
TOTAL		**17**	**1**	**8**	**22**	**900**

Total Hours in a Week:26

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SEMESTER III

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
THEORY						
141EE0301	Transforms and Partial Differential Equations	4	0	0	4	100
141EE0302	DC Machines and Transformers	3	0	0	3	100
141EE0303	Electric Circuit Analysis	3	2	0	4	100
141EE0304	Digital Electronics	3	0	2	4	100
141EE0305	Electro Magnetic Theory	3	0	0	3	100
141EE0306	Data Structures and OOPs with C++	3	0	0	3	100
PRACTICAL						
141EE0307	DC Machines and Transformers Laboratory	0	0	4	2	100
141EE0308	Data Structures and OOPs with C++ Laboratory	0	0	4	2	100
XXXX	One Credit Course	0	0	2	1	100
PROFESSIONAL SKILLS						
141EE0309	Personal Effectiveness	0	0	2	1	100
TOTAL		**19**	**2**	**14**	**27**	**1000**

Total Hours in a Week: 35

SEMESTER IV

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
THEORY						
141EE0401	Linear Algebra and Numerical Methods	4	0	0	4	100
141EE0402	Engineering Mechanics	2	2	0	3	100
141EE0403	Synchronous and Induction Machines	3	0	0	3	100
141EE0404	Electronic Circuits	4	0	0	4	100
141EE0405	Measurements and Instrumentation	3	0	0	3	100
141EE0406	Networks and Signals	4	0	0	4	100
PRACTICAL						
141EE0407	Synchronous and Induction Machines Laboratory	0	0	4	2	100
141EE0408	Electronic Devices and Circuits Laboratory	0	0	4	2	100
XXXX	One Credit Course	0	0	2	1	100
PROFESSIONAL SKILLS						
141EE0409	Ethical and Moral Responsibility	0	0	2	1	100
TOTAL		**20**	**2**	**12**	**27**	**1000**

Total Hours in a Week: 34

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SEMESTER V

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
THEORY						
141EE0501	Generation, Transmission and Distribution	3	2	0	4	100
141EE0502	Control Systems	3	2	0	4	100
141EE0503	Microprocessor and Microcontroller	3	0	0	3	100
141EE0504	Power Electronics	2	2	0	3	100
141EE0505	Linear Integrated Circuits	3	0	0	3	100
141EE0506	Professional Elective - I	3	0	0	3	100
PRACTICAL						
141EE0507	Microprocessor and Microcontroller Laboratory	0	0	4	2	100
141EE0508	Linear Integrated Circuits Laboratory	0	0	4	2	100
XXXX	One Credit Course	0	0	2	1	100
PROFESSIONAL SKILLS						
141EE0509	Teamness and Interpersonal Skills	0	0	2	1	100
TOTAL		**17**	**6**	**12**	**26**	**1000**

Total Hours in a Week: 35

SEMESTER VI

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
THEORY						
141EE0601	Electrical Machine Design	3	2	0	4	100
141EE0602	Digital Signal Processing	3	2	0	4	100
141EE0603	Protection and Switchgear	3	0	0	3	100
141EE0604	VLSI Design	3	0	0	3	100
141EE0605	Environmental Studies	3	0	0	3	100
XXXX	Professional Elective - II	3	0	0	3	100
PRACTICAL						
141EE0606	Control and Instrumentation Lab	0	0	4	2	100
141EE0607	Power Electronics Lab	0	0	4	2	100
XXXX	One Credit Course	0	0	2	1	100
PROFESSIONAL SKILLS						
141EE0608	Campus to Corporate	0	0	2	1	100
TOTAL		**18**	**4**	**12**	**26**	**1000**

Total Hours in a Week:34

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SEMESTER VII

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
THEORY						
141EE0701	Power System Analysis and Stability	3	2	0	4	100
141EE0702	Solid State Drives	3	0	0	3	100
XXXX	Professional Elective - III	3	0	0	3	100
XXXX	Open Elective	3	0	0	3	100
PRACTICAL						
141EE0703	Power System Simulation Laboratory	0	0	4	2	100
141EE0704	Digital Control of Solid State Drives Laboratory	0	0	4	2	100
141EE0705	Innovative and Creative Project	0	0	8	4	100
TOTAL		**12**	**2**	**16**	**21**	**700**

Total Hours in a Week:30

SEMESTER VIII

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
THEORY						
XXXX	Professional Elective - IV	3	0	0	3	100
XXXX	Professional Elective - V	3	0	0	3	100
XXXX	Professional Elective - VI	3	0	0	3	100
PRACTICAL						
141EE0801	Project	0	0	20	10	200
TOTAL		**9**	**0**	**20**	**19**	**500**

Total Hours in a week:29

Total Credits-191

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PROFESSIONAL ELECTIVES

Power Engineering

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
141EE9111	Renewable Energy Sources	3	0	0	3	100
141EE9112	Digital Control of Power Electronics	3	0	0	3	100
141EE9113	High Voltage Engineering	3	0	0	3	100
141EE9114	High Voltage DC Transmission	3	0	0	3	100
141EE9115	Power Electronic Applications to Renewable Energy	3	0	0	3	100
141EE9116	Power Quality	3	0	0	3	100
141EE9117	Smart Grid	3	0	0	3	100
141EE9118	Switched Mode Power Supplies	3	0	0	3	100
141EE9119	Special Electrical Machines	3	0	0	3	100
141EE9120	Computer Aided Design of Electrical Apparatus	3	0	0	3	100
141EE9121	Power Electronic Applications in Power Systems	3	0	0	3	100
141EE9122	Electrical Energy Utilization and Conservation	3	0	0	3	100
141EE9123	Power System Operation and Control	3	0	0	3	100

Design Engineering

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
141EE9124	Communication Engineering	**3**	**0**	**0**	**3**	**100**
141EE9125	Computer Architecture	3	0	0	3	100
141EE9126	Industrial Data Communication Networks	3	0	0	3	100
141EE9127	Advanced Microprocessors	3	0	0	3	100
141EE9128	ASIC Design	3	0	0	3	100
141EE9129	Digital Image Processing	3	0	0	3	100
141EE9130	Embedded System Design	3	0	0	3	100
141EE9131	Testing of VLSI Circuits	3	0	0	3	100
141EE9132	Low Power VLSI Design	3	0	0	3	100
141EE9133	Micro Electro Mechanical Systems	3	0	0	3	100
141EE9134	CMOS Analog IC Design	3	0	0	3	100

Control & Automation

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
141EE9135	Automotive Electronics	3	0	0	3	100
141EE9136	Industrial Automation	3	0	0	3	100
141EE9137	Virtual Instrumentation	3	0	0	3	100

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Software Engineering

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
141EE9138	Java Programming	3	0	0	3	100
141EE9139	Data Base Management System	3	0	0	3	100
141EE9140	Data Mining and Analytics	3	0	0	3	100
141EE9141	Software Testing	3	0	0	3	100
141EE9142	Python Programming	3	0	0	3	100

Management Engineering

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
141EE9143	Principles of Management	3	0	0	3	100
141EE9145	Disaster Management	3	0	0	3	100
141EE9146	Engineering Economics and Cost Analysis	3	0	0	3	100

Basic Sciences

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
141EE9147	Operations Research	3	0	0	3	100
141EE9148	Probability Theory and Statistics	3	2	0	4	100
141EE9149	Discrete Mathematics	3	2	0	4	100

Open Elective

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
141OE0912	Electric and Hybrid Vehicles	3	0	0	3	100
141OE0913	Solar Energy system	3	0	0	3	100
141OE0914	Energy Auditing and Conservation	3	0	0	3	100

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SEMESTER I

Course Code : 141EE0101	Course Title : COMMUNICATION SKILLS - I (Common to ECE, EEE and EIE)	
General	L : T : P: C	2 : 0 : 2 : 3
Type: Theory	Total Contact hours:	60 Hours

Prerequisites: The student should have undergone the course(s):

- The student should have undergone English as his/her first or second language in school

Course Objectives

The course is intended to:

1. Write grammatically correct sentences in English.
2. Listen to conversations, comprehend and answer questions.
3. Speak about a process, things, about oneself and others.
4. Read passages, infer and respond to the question.
5. Write short pieces of business correspondence.

UNIT I - GRAMMAR 12

Parts of speech - Kinds of sentences – statement, interrogative, imperative and exclamatory – action word and its importance in a sentence –kinds of verbs& forms of verbs - auxiliary verbs and its importance, modal auxiliaries and its usage - Tenses and impersonal passive voices – Spelling - prepositions

UNIT II – LISTENING 12

Listening for specific information – short conversation and monologues, Telephone conversation, extended monologues, listening for gist – conversation, interview and discussion, multiple choice, gap filling, note-taking.

UNIT III – SPEAKING 12

Elements of effective speech – exchange of basic personal information –narration – talk on general topics– describing events, pictures and people – Working Mechanism of a machine.

UNIT IV – READING 12

Business articles -Advertisements – company websites – Interpreting visual information – skimming and scanning -data from email, articles, books and report- Newspaper articles – short Messages- pamphlets, brochures, flyers, leaflets and

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real-world notices – Error spotting – Cloze Test- extracting relevant information – identifying main and subordinate ideas–comprehension – making inferences – reading critically – determining fact versus opinion

UNIT V – WRITING **12**

Formal & informal emails- letter writing- leave letter, permission seeking letter- format, content, set phrases and etiquettes of e-mails and letters- fax –memo- note- reports.

Course Outcomes

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

CO1. Write grammatically correct sentences in English.
CO2. Listen to conversations comprehend, make notes and answer questions.
CO3. Speak about a process, things, about oneself and others.
CO4. Read passages, infer and respond to the question.
CO5. Write short pieces of business correspondence such as emails, letters and reports.

Text Books

1. M. Ashraf Rizvi, Effective Technical Communication, McGraw Hill Education Pvt. Ltd., New Delhi 2005.
2. BEC-Preliminary-Cambridge Handbook for Language Teachers, Second Edition, CUP 2000

Reference Books

1. Business Benchmark Guy Brook-Hart, Norman Whitby, Cambridge ESOL, 2006.
2. Richard Huseman, Business Communication-Strategies and Skills, Alger Press, 1988
3. Sylvie Donna, Teach Business English, CUP
4. Mathew Monipally, Business Communication Strategies, Orient Longman.

Web References

1. www.englishpage.com
2. https://www.ego4u.com
3. http://www.usingenglish.com
4. http://www.cambridgeenglish.org/exams/business-certificates/business-preliminary/

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Course Code : 141EE0102	Course Title :ENGINEERING MATHEMATICS – I (Common to ECE, EEE and EIE)	
General	L : T : P: C	3 : 1 : 0 : 4
Type: Theory	Total Contact hours:	60 Hours

Prerequisites: The student should have undergone the course(s):

- Nil

Course Objectives

The course is intended to:

1. Use Eigen values and Eigen vectors of a real matrix.
2. Use different testing methods to check the convergence and divergence.
3. Apply partial derivatives for functions of several variables.
4. Apply multiple integrals to find area.
5. Apply first order ordinary differential equations for solving problems.

UNIT I - MATRICES 9+3

Solution of system of equations-Eigenvalues and Eigenvectors of a real matrix – Properties of Eigenvalues and Eigenvectors – Diagonalization of symmetric matrices by orthogonal transformation– Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms- Applications to engineering problems.

UNIT II – SEQUENCES AND SERIES 9+3

Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms –Tests of convergence: Comparison test, Integral test and D'Alembert's ratio test – Alternating series –Leibnitz's test – Series of positive and negative terms – Absolute and conditional convergence.

UNIT III – FUNCTIONS OF SEVERAL VARIABLES 9+3

Partial derivatives – Homogeneous functions and Euler's theorem –Total derivative – Change of variables –Jacobian and properties – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers with single constraint.

UNIT IV – MULTIPLE INTEGRALS 9+3

Double integrals in Cartesian and polar coordinates – Change of order of integration – Area enclosed by plane curves – Change of variables from Cartesian to polar,

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spherical and cylindrical coordinates – Triple integrals- Volume of Solids.

UNIT V – ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER **9+3**

Formation of ordinary differential equation-Solution of differential equations of first order and first degree: homogeneous form, linear form and exact differential equations - Applications to engineering problems.

Course Outcomes

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

CO1. Use Eigen values and Eigen vectors of a real matrix to reduce quadratic form to canonical form.
CO2. Use different testing methods to check the convergence and divergence of infinite series.
CO3. Apply partial derivatives for functions of several variables.
CO4. Apply multiple integrals to find area of plane curves and volume of solids.
CO5. Apply first order ordinary differential equations for solving electric circuit Problems.

Text Books

1. Kreyszig.E, "Advanced Engineering Mathematics", Wiley Publications, Ninth Edition, 2014.
2. Grewal. B.S, "Higher Engineering Mathematics", Fourty First Edition, Khanna Publications, Delhi, 2011.

Reference Books

1. Glyn James, "Advanced Modern Engineering Mathematics", Third Edition, Pearson Education, 2012.
2. Peter V. O'Neil," Advanced Engineering Mathematics", Seventh Edition, Cengage Learning, 2012.
3. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008
4. Veerarajan. T, "Engineering Mathematics", Tata McGraw Hill Publishing Co, New Delhi, Fifth Edition, 2006.

Web Reference

1. http://nptel.ac.in/video.php?subjectId=122107036

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Course Code : 141EE0103	Course Title :ENGINEERING PHYSICS (Common to ECE, EEE and EIE)	
General	L : T : P: C	3 :0 : 0 : 3
Type: Theory	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- Nil

Course Objectives

The course is intended to:

1. Explain the properties, generation and applications of ultrasonics.
2. Interpret the thermal properties and their significance.
3. Identify the applications of LASER.
4. Explain the principles of fiber optics.
5. Calculate the crystal parameters and analyze different crystal structures and defects.

UNIT I - ULTRASONICS 9

Classification of sound, Ultrasonics: Properties of Ultrasonics- Magnetostriction and Piezoelectric generators - Detection -– Cavitation and its application – Velocity of ultrasonic waves using acoustical grating- Applications: SONAR-Ultrasonic inspection-NDT: Pulse echo system-Through transmission and reflection modes - Scan displays with respect to flaw detection.

UNIT II – THERMAL PHYSICS 9

Thermal expansion-thermal stress - expansion joints - bimetallic strips - modes of heat transfer -thermal conductivity- Lee's disc method for bad conductors - flow of heat through compound media - radial flow of heat- Cylindrical flow of heat - Thermal management of electronic devices and systems: Heat sink, heat pipes and electrostatic fluid acceleration.

UNIT III – LASER TECHNOLOGY 9

Laser principles: Stimulated and spontaneous emissions of radiations - Population inversion and pumping methods – Properties of lasers – Types: Nd: YAG laser, Homo-junction and Hetero-junction semiconductor lasers- Applications: Lasers in electronic industry: scribing, soldering and trimming- Holography: construction, reconstruction and applications.

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UNIT IV – FIBER OPTICS 9

Principle of light propagation in optical fibres - Numerical aperture and acceptance angle -Types of fibres: based on material, refractive index and mode of propagation - Losses in fibers- Dispersion and Attenuation- Light sources: LED - Detectors: PN, PIN and Avalanche photo diodes. Fibre optic communication system and its advantages.

UNIT V – CRYSTAL PHYSICS 9

Amorphous and Crystalline materials. Lattice - Unit cell - Bravais lattices. Crystal structures: SC, BCC, FCC and HCP – Calculation of number of atoms per unit cell, Coordination number, nearest neighbor distance, Atomic radius and packing factor-Miller indices – Interplanar distance, Crystal defects: point, line and surface defects and their influence on the electronic properties of materials.

Course Outcomes

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

CO1. Explain the properties, generation and applications of ultrasonics.
CO2. Interpret the thermal properties and their significance in electronic devices and systems.
CO3. Identify the applications of LASER in electronic industry based on its property.
CO4. Explain the principles of fiber optics in communication systems.
CO5. Calculate the crystal parameters and analyze different crystal structures and defects.

Text Books

1. M.N.Avadhanulu and P.G.Kshirsagar, "Text Book of Engineering Physics", S. Chand & Company Ltd., New Delhi, 2014.
2. R.K.Gaur and S.L.Gupta, "Engineering Physics", DhanpatRai publications, New Delhi, Eighth edition, 2011.

Reference Books

1. Balasubramaniam "Callister's Material Science and Engineering", John Wiley and Sons Inc., Second Edition, 2015.
2. Wayne Tomasi, "Electronic Communications System: Fundamentals Through Advanced", Pearson Education India, Fifth Edition, 2009.
3. Arthur Beiser, "Modern Physics", Tata McGraw-Hill Co, New Delhi, Seventh Edition,
4. V Rajendran, "Engineering Physics", Tata McGraw-Hill Co, New Delhi, 2011.

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Web References

1. http://www.physicsclassroom.com/class/thermal
2. http://nptel.ac.in/course.php?disciplineId=115
3. http://ocw.mit.edu/resources/res-6-005-understanding-lasers-and-fiberoptics-spring-2008/laser- fundamentals-i/

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Course Code : 141EE0104	Course Title :ENGINEERING GRAPHICS (Common to ECE, EEE and EIE)	
Core	L : T : P: C	1 : 3 : 0 : 4
Type: Practical	Total Contact hours:	60 Hours

Prerequisites: The student should have undergone the course(s):

- Nil

Course Objectives

The course is intended to:

1. Sketch different curves and explain its application.
2. Prepare orthographic projection.
3. Draw the projection of solids.
4. Draw the projection of sectioned solids.
5. Draw the development of surfaces of simple solids.

UNIT I - CURVES USED IN ENGINEERING PRACTICES **10**

Application of curves in Engineering. Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloids and involutes of square and circle.

UNIT II – ORTHOGRAPHIC PROJECTION **15**

First angle projection – layout of views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects. Orthographic projection of solids.

UNIT III – PROJECTION OF SOLIDS **15**

Projection of solids – Types of solids- Polyhedra and solids of revolution- Orthographic views of solids- Axis inclined to one reference plane.

UNIT IV – SECTION OF SOLIDS **10**

Sectional view -Types of section planes-True shape of section-Orthographic views of sectioned solids –Section plane inclined to one reference plane and perpendicular to the other.

UNIT V – DEVELOPMENT OF SURFACES **10**

Development of lateral surfaces of simple and truncated solids –Parallel line method - Radial Line method.

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Course Outcomes

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

CO1. Sketch different curves and explain its application.
CO2. Prepare orthographic projection from pictorial views and models.
CO3. Draw the projection of solids.
CO4. Draw the projection of sectioned solids.
CO5. Draw the development of surfaces of simple solids with cuts and slots.

Text Books

1. K. V. Natrajan, "A Text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai (2013).
2. K. Venugopal, V.A Prabhu Raja, "A Textbook of Engineering Graphics , New Age International (P) Limited.(2009)

Reference Books

1. Dhananjay A. Jolhe, "Engineering Drawing with an introduction to AutoCAD" Tata McGraw Hill Publishing Company Limited (2008).
2. BasantAgarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, (2008).
3. Cencil Jensen, Jay D. Helsel and Dennis R. Short Engineering Drawing and Design. Tata McGraw Hill Publishing Company Limited (2012).
4. John.K.C and Verghese.P.I "Machine Drawing", Jovast Publishers, Trissur, 2007.

Web References

1. http://www.engineeringdrawing.org
2. http://nptel.ac.in
3. http: //iitd.ac.in

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Course Code : 141EE0105	Course Title :C- PROGRAMMING (Common to ECE, EEE and EIE)	
Core	L : T : P: C	3 : 0 : 0 : 3
Type: Theory	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- Nil

Course Objectives

The course is intended to:

1. Comprehend the knowledge on computer systems and problem solving techniques.
2. Identify and construct program. .
3. Develop programs using arrays and strings.
4. Interpret the significance of code reusability and attain memory access through pointers.
5. Relate and justify the prominence of structures and unions.

UNIT I - INTRODUCTION **8**

Generation and Classification of Computers- Computer Systems-Basic Organization of a Computer –Computer languages-Number System – Binary – Decimal – Conversion. Need for logical analysis and thinking– Algorithm – Pseudo code – Flow Chart.

UNIT II – C PROGRAMMING BASICS **11**

Problem formulation – Problem Solving - Introduction to C programming –structure of a C program – compilation and linking processes –Identifier- Keywords -Data Types-Variables — Constant-Operators and Expressions – Managing Input and Output operations –Decision Making and Branching – Looping statements-Nested looping-Type Casting-Storage Classes. Example problems.

UNIT III – ARRAYS AND STRINGS **8**

Arrays — Declaration -Initialization – One dimensional and Two dimensional arrays-Advantages and Limitations of Arrays. String- String operations –Arrays of Strings. Simple programs- Sorting- Searching – Matrix operations.

UNIT IV – FUNCTIONS AND POINTERS **9**

Function –Built in function-User defined function— Declaration of function – definition of function-Pass by value – Pass by reference– Recursion. Pointers - Definition –

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Initialization – Pointers arithmetic –Array of Pointers-Example problems.

UNIT V – STRUCTURES AND UNIONS 9

Need for structure data type – structure definition – Structure declaration –Accessing structure elements –Array of structures–Pointer to Structure - Union - Programs using structures and Unions – Pre-processor directives.

Course Outcomes

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

CO1. Comprehend the knowledge on computer systems and problem solving techniques.
CO2. Identify and construct program using appropriate programming paradigms.
CO3. Develop programs using arrays and strings.
CO4. Interpret the significance of code reusability and attain memory access through pointers.
CO5. Relate and justify the prominence of structures and unions.

Text Books

1. PradipDey, ManasGhosh, Fundamentals of Computing and Programming in C, First Edition, Oxford University Press, 2009
2. BehrouzA.Forouzan and Richard F. Gilberg, Computer Science: A Structure program approach using *C*, Cengage Learning, 2008

Reference Books

1. Yashavant P. Kanetkar. Let Us C, BPB Publications, 2011.
2. Kernighan B.W and Ritchie D.M, The C Programming language, Second Edition, Pearson Education, 2006.
3. Byron S Gottfried, Programming with C, Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.
4. R.G. Dromey, How to Solve it by Computer, Pearson Education, Fourth Reprint, 2007.

Web References

1. http://www.w3schools.in/c
2. http://www.c4learn.com/learn-c-programming-language/
3. http://www.programmingsimplified.com/c-program-examples

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Course Code : 141EE0106	Course Title :FUNDAMENTALS OF ELECTRICAL ENGINEERING (Common to ECE, EEE and EIE)	
Core	L : T : P: C	3 : 0 : 0 : 3
Type: Theory	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- Nil

Course Objectives

The course is intended to:

1. Explain the various terminologies of electrical quantities.
2. Identify the required passive components.
3. Analyze the electrical quantities for the simple DC circuits.
4. Determine the electrical quantities for the simple AC circuits.
5. Apply domestic wiring.

UNIT I - ELECTRICAL QUANTITIES **9**

Need of S.I. Units, Definitions of electrical quantities: Charge, Resistivity, Conductivity, Voltage, Current, Power, Energy.

Fundamental Laws: Law of conservation of energy, Coulombs law.

Classification of electrical elements: Active and passive, Unilateral and Bilateral, Linear and Non-linear, Lumped and distributed.

UNIT II – PASSIVE COMPONENTS **9**

Resistor, Temperature coefficient of Resistance, Types - Fixed resistors: Carbon composition, Thin film, wire wound - variable resistors - colour coding.

Inductors: Types-Fixed Inductors and variable Inductors - chokes

Capacitors: Types -Fixed Capacitors and variable Capacitors - Dissipation factor.

UNIT III – DC CIRCUITS **9**

Circuit Laws: Ohms Law, Kirchhoff's Current Law and Voltage Law. Behavior of R, L, C in DC circuits, Series resistive circuit-Voltage division rule, Parallel resistive circuit-Current division rule and series-parallel resistive circuit.

UNIT IV – AC CIRCUITS **9**

Faradays laws of electromagnetic induction. Alternating Quantities: Time period, Cycle, frequency, Angular frequency, Expression of average value, RMS value, Form factor, peak factor of sinusoidal waveform.

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Behavior of R, L, C circuit.Power factor concepts in series RL, RC and RLC circuit. Power triangle – Active power, Reactive power and Apparent power.

UNIT V – DOMESTIC WIRING **9**

Voltage and frequency of single phase & three phase supply standards.

Types of wiring system, materials and accessories. House wiring - Stair case wiring, Fluorescent tube wiring and fan wiring.

Electrical safety-Rules for wiring, Earthing - Pipe earthing and Plate earthing.

Course Outcomes

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

CO1. Explain the various terminologies of electrical quantities.
CO2. Identify the required passive components for the given applications.
CO3. Analyze the electrical quantities for the simple DC circuits.
CO4. Determine the electrical quantities for the simple AC circuits.
CO5. Apply appropriate domestic wiring for the given specification.

Text Books

1. V.Jegatheesan, K.Vinoth Kumar &R.Saravanakumar, Basic Electrical and Electronics Engineering,Wiley India, First Edition,2011.
2. John Hiley, Keith Brown, Hughes Electrical and Electronic Technology, Pearson Education Limited, Tenth Edition,2010

Reference Books

1. T.Thyagarajan, K.P.SendurChelvi, T.R.Rangaswamy, Engineering Basics(Electrical Electronics & Computer Engineering),New Age Int. Pvt. Ltd, Second Revised Edition,1999.
2. V.K.Mehta, Rohit Mehta, Principles of Electrical Engineering, Chand & Company Ltd, 2007.
3. R. Muthusubramanian and S Salivahanan, Basic Electrical and Electronics Engineering, McGraw Hill , New Delhi, 2010
4. Giorgio Rizzoni, Fundamentals of Electrical Engineering, McGraw Hill, New Delhi, First Edition.2008

Web References

1. http://www.instructables.com/
2. http://www.allaboutcircuits.com/textbook/reference/chpt-2/resistor-color-codes/
3. http://www.electrical4u.com/fluorescent-lamp-its-working-principle/
4. http://www.edisontechcenter.org/
5. http://electronicsforu.com/
6. http://www.physicsclassroom.com/

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Course Code : 141EE0107	Course Title :C PROGRAMMING LABORATORY (Common to ECE, EEE and EIE)	
Core	L : T : P: C	0 : 0 : 2 : 1
Type: Practical	Total Contact hours:	30 Hours

Prerequisites: The student should have undergone the course(s):

- 16MAT13-Engineering Mathematics I
- 16MAT23-Engineering Mathematics II

Course Objectives

The course is intended to:

1. Infer the skills in data processing.
2. Develop program using constructs.
3. Write, compile and debug programs.
4. Apply and practice logical ability.
5. Choose appropriate programming components.

LIST OF EXPERIMENTS

1. Text formatting ,table and Mathematical equations in MS word
2. Presentation and Visualization-Chart
3. Program to evaluate an Expression using various types of operators
4. Program using decision making and branching statement
5. Program using loops
6. Program using Arrays and Strings
7. Program using Functions
8. Program using Pointers
9. Program using structures
10. Program using Files.

Course Outcomes

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

CO1. Infer the skills in data processing.
CO2. Develop program using suitable programming constructs.
CO3. Write, compile and debug programs in C language
CO4. Apply and practice logical ability to solve application oriented problems.
CO5. Choose appropriate programming components to solve real-world computing problems.

Reference Book

1. Mcgrath Mike C, C Programming in easy steps, Fourth Edition, Tata McGraw-Hill, 2013.

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Course Code : 141EE0108	Course Title :ENGINEERING PRACTICES LABORATORY – I (Electrical and Electronics) (Common to ECE, EEE and EIE)	
Core	L : T : P: C	0 : 0 : 2 : 1
Type: Practical	Total Contact hours:	30 Hours

Prerequisites: The student should have undergone the course(s):

- Nil

Course Objectives

The course is intended to:

1. Draw the basic symbols of Electrical and Electronic Components.
2. Identify the various Electrical and Electronic elements.
3. Execute soldering practice.
4. Verify basic laws and demonstrate basic wiring.
5. Apply the concepts of Electrical Engineering.

LIST OF EXPERIMENTS:

1. Symbols of Electrical and Electronic components.
2. Identification and verification of Resistor and Capacitor Values
3. Verification of Ohms law.
4. Verification of Kirchhoff's current & voltage law.
5. Soldering practice and continuity checking.
6. Measurement of Voltage and frequency using CRO.
7. Stair case wiring
8. Fluorescent Lamp wiring.
9. House wiring
10. UPS Wiring
11. Measurement of earth resistance using Megger.

Course Outcomes

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

CO1. Draw the basic symbols of Electrical and Electronic Components.
CO2. Identify the various Electrical and Electronic elements.
CO3. Execute soldering practice for Electrical and Electronics circuits.
CO4. Verify basic laws and demonstrate basic wiring.
CO5. Apply the concepts of Electrical Engineering for real time Applications.

Reference Book

1. MCET Engineering Practices Laboratory –I Manual.

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Course Code : 141EE0106	Course Title :PROMOTION OF STUDENTS' WELLNESS	
General	L : T : P: C	0 : 0 : 2 : 1
Type: PS	Total Contact hours:	30 Hours

Prerequisites: The student should have undergone the course(s):

- Nil

Course Objectives

The course is intended to:

1. Maintain physical wellbeing.
2. Maintain mental wellbeing.
3. Maintain social wellbeing.

UNIT I - PHYSICAL HEALTH

Physical structure and functions of human body – simplified physical exercises : hand exercises, Leg exercises, breathing exercises, eye exercises – kapalapathi – Maharasanas 1-2 – Massages – Acupuncture – relaxation – importance and benefits. Surya namaskar.

UNIT II – MENTAL HEALTH

Maintenance of youthfulness and life force – kayakalpa yoga – anti ageing process – benefits. Mind and its functions – mind wave frequency – meditation process – Agna, shanthi, thuriam – benefits

UNIT III – PERSONALITY DEVELOPMENT – I

Purpose of life and analysis of thought – philosophy of life – introspection – practice. Moralization of desires and neutralization of anger – practices

UNIT IV – PERSONALITY DEVELOPMENT – II

Eradication of worries and benefits of blessings – wave theory –practices. Genetic centre – purification – cause and effect theory

UNIT V – SOCIAL HEALTH

Greatness of guru – cultural education – love and compassion – fivefold culture. Greatness of friendship and social welfare – individual, family and world peace.

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Course Outcomes

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

CO1. Maintain physical wellbeing – grooming compositions (vatha , pitha, kapa)

CO2. Maintain mental wellbeing - perceptions

CO3. Maintain social wellbeing - etiquettes stress management

Text Books

1. Vethathiri Maharishi Institute for Spiritual and Intuitional Education, Aliyar ,"Value education for harmonious life (Manavalakalai Yoga)", Vethathiri Publications, Erode, I Ed. (2010)

Reference Books

1. Dr.R.Nagarathna, Dr.H.R.Nagendra, "Integrated approach of yoga therapy for positive health", Swami Vivekananda Yoga Prakashana, Bangalore, 2008 Ed.
2. Dr. R. Nagarathna, Dr.H.R.Nagendra, "New perspectives in stress management", Swami Vivekananda Yoga Prakashana, Bangalore, I Ed June 1986.

OPERATIONAL MODALITIES

Orientation programme

Theory and practice demonstration

3 days - 7 hours /day for syllabus coverage

Follow-Up Practice

12 weeks x 2 hours/week: 24 hours

Evaluation:

Continuous evaluation:

Physical Exercises, Kaya kalpa practice, meditation	= 40 marks
Introspection (assessment of students workbook)	= 20 marks
Total	**= 60 marks**

Semester end examination:

Written test (MCQ and short answers)	= 30 marks
Physical exercises, meditation	= 50 marks
Viva-voce	= 20 marks
Total	**= 100 marks**

End semester mark out of 100 is reduced to 40 marks

The student should get a total of 50 marks put together for a pass.

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DIMENSIONS AND TOOLS IN MEASUREMENT

Dimension	Sub dimension	Measurement tools
Physical	BMI	Electronic Weighing Machine, Height Measurement
	Flexibility	Sit & Reach
	Muscle Strength	Handgrip Dynamometer
	Prakruti	Dr Ramakrishna's Prakruti Questionnaire
Mental	Perception	Critical Flicker Fusion
	Attention	Digit Letter substitution Test
		Six Letter Cancellation Test
		Stroop Test
	Memory	Digit backward & Forward
Social	Interpersonal Effectiveness & Self Concept	FIRO B
	Psychological Well Being	Short wellbeing scale
		Short Happiness scale
		Barrat Impulsive Scale

END OF SEMESTER I

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SEMESTER – II

Course Code : 141EE0201	Course Title : COMMUNICATION SKILLS - II (Common to all B.E/B.Tech Programmes)	
General	L : T : P: C	2 : 0 : 2 : 3
Type: Theory	Total Contact hours:	60 Hours

Prerequisites: The student should have undergone the course(s):
- 141EE0101- Communication Skills–I

Course Objectives
The course is intended to:

1. Write concisely and ensure accuracy through proof reading.
2. Listen to lectures and presentations, comprehend and respond.
3. Use appropriate non-verbal skills to present ideas and participate in discussions.
4. Use various reading techniques, make notes and respond.
5. Write effectively for various professional situations.

UNIT I - GRAMMAR **12**

Types of sentences – simple, compound and complex, Concord – One word substitutions, word formation, commonly confused words, idioms and phrases – Editing-punctuation, spelling - correct use of articles-usage of question tags.

UNIT II – LISTENING **12**

Listening to fill up gapped texts -Listening to identify context and Speaker's opinion-Note Taking-Listening to Conversation, to business lecturers, presentation, interviews, ted talk, pep talk, documentaries and cricket commentaries.

UNIT III – SPEAKING **12**

Non-verbal skills – importance & types - conversational practices, debate Narration, mock interview, GD - impromptu talks, story-telling, likes and dislikes, role plays & presentations on business themes.

UNIT IV – READING **12**

Exposure to different reading techniques-Intensive & Extensive reading-Reading Comprehension - speed reading-obstacles in reading- eye fixation, regression and sub- vocalization - Note Making– Jumbled Sentences – short stories and Newspaper articles.

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UNIT V – WRITING 12

Free writing on any given topic, Letter of application - content, format & Resume writing- Writing Business Letters- calling for quotations, placing orders, a letter of complaint regarding manufacturing defects, Writing Instructions-Proof Reading.

Course Outcomes

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

CO1. Write concisely and ensure accuracy through proof reading.
CO2. Listen to lectures and presentations, comprehend and respond
CO3. Use appropriate non-verbal skills to present ideas and participate in discussions.
CO4. Use various reading techniques, make notes and respond.
CO5. Write effectively for various professional situations.

Text Books

1. Meenakshi Raman &Sangeetha Sharma, Technical Communication Principles and Practice, Second edition, Oxford Higher Education, New Delhi, 2011.
2. Cambridge BEC Vantage- Practice Tests, Self-study Edition, Cambridge University Press, 2002

Reference Books

1. R C. Sharma, Krishna Mohan, Business Correspondence and Report Writing, Tata McGraw Hill Publishing Co., Ltd., New Delhi 2002
2. ShaliniVerma, Verbal, Ability and Reading Comprehension, Pearson Publications, 2013
3. Edgar Thorpe, Showick Thorpe, Objective English, Fifth Edition, Pearson Publications, 2014.
4. M. Ashraf Rizvi, Effective Technical Communication, McGraw Hill Education Pvt. Ltd., New Delhi 2005.

Web References

1. www.englishpage.com
2. http://www.cambridgeenglish.org/exams/business-certificates/business-vantage/
3. http://www.skillsyouneed.com/rhubarb/business-writing-tips.html
4. https://owl.english.purdue.edu/owl/
5. www.perfect-english-grammar.com

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BoS Chairman

Course Code : 141EE0202	Course Title :ENGINEERING MATHEMATICS - II (COMMON TO ECE, EEE AND EIE)	
General	L : T : P: C	3 : 1 : 0 : 4
Type: Theory	Total Contact hours:	60 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0102 - Engineering Mathematics– I

Course Objectives

The course is intended to:

1. Solve second and higher order ordinary differential equations.
2. Explain the concepts of vector differentiation and integration.
3. Apply the Laplace transform techniques.
4. Construct analytic functions.
5. Use the concept of complex integration.

UNIT I - DIFFERENTIAL EQUATIONS OF SECOND AND HIGHER ORDER **9+3**

Second and higher order linear differential equations with constant coefficients- Method of variation of parameters- First order simultaneous differential equations- Application to engineering problems.

UNIT II – VECTOR CALCULUS **9+3**

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields –Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem(excluding proofs) – evaluation of integrals using Green's ,Gauss's and Stoke's theorems.

UNIT III – LAPLACE TRANSFORM **9+3**

Laplace transform – Sufficient condition for existence – Transform of elementary functions – Basic properties – Transforms of derivatives and integrals of functions - Transforms of unit step function and impulse function – Transform of periodic functions-Inverse Laplace transforms -Statement of Convolution theorem -Solution of linear ODE of second order-solution to simple circuit problems.

UNIT IV – ANALYTIC FUNCTIONS **9+3**

Functions of a complex variable – Analytic functions- Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Properties of analytic functions – Harmonic conjugate – Construction of analytic functions.

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UNIT V –COMPLEX INTEGRATION 9+3

Statement and applications of Cauchy's integral theorem – Taylor's and Laurent's series expansions – Types of Singularity– Residues – Cauchy's residue theorem – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

Course Outcomes

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

CO1. Solve second and higher order ordinary differential equations.
CO2. Understand the concepts of vector differentiation and integration.
CO3. Apply the Laplace transform techniques to solve differential equations.
CO4. Use the functions of a complex variable and construct analytic functions.
CO5. Use the concept of complex integration to solve contour integrals.

Text Books

1. Kreyszig.E, "Advanced Engineering Mathematics", Wiley Publications, 9th edition, 2014.
2. Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications, Delhi, 2011.

Reference Books

1. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2012.
2. Peter V. O'Neil," Advanced Engineering Mathematics", 7th Edition, Cengage learning, 2012.
3. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.
4. Veerarajan. T, "Engineering Mathematics", Tata McGraw Hill Publishing Co, New Delhi, 5th edition, 2006.

Web Reference

1. http://nptel.ac.in/video.php?subjectId=122107036

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Course Code : 141EE0203	Course Title :MATERIAL SCIENCE (COMMON TO ECE, EEE AND EIE)	
General	L : T : P: C	3 : 0 : 0 : 3
Type: Theory	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- Nil

Course Objectives

The course is intended to:

1. Analyze the types of electron emission and electron ballistics.
2. Calculate the electrical properties of conductors and relate with superconductors.
3. Demonstrate the nature of semiconducting material.
4. Calculate the dielectric properties of materials and discuss their application.
5. Explain the properties and applications of magnetic materials.

UNIT I - ELECTRON EMISSION AND BALLISTICS 9

Electron Emission: Work function – Types of Electron Emission (Qualitative): Thermionic, Photoelectric, Field and Secondary Emissions.

Electron Ballistics: Uniform Electric Field Parallel to Electron Motion - Energy acquired by electron in the electric field – Uniform electric field perpendicular to electron motion – Motion of an electron in a uniform magnetic field – Magneto-static deflection – Electric and Magnetic fields in crossed configuration.

UNIT II – CONDUCTING AND SUPERCONDUCTING MATERIALS 9

Conducting Materials: Formation of bands (qualitative) - Classification of solids based on bands - Classical free electron theory, Expression for electrical and thermal conductivity, Wiedemann Franz law - Sources of resistivity - Mattheissen's rule – Properties and applications of low and high resistivity materials.

Superconductors: Properties – Type I & II superconductors - High temperature superconductors - Applications: – Cryotron – Josephson Effect - SQUID - Magnetic levitation.

UNIT III – SEMICONDUCTING MATERIALS 9

Elemental and compound semiconductors – Direct and indirect band gap semiconductors - Intrinsic and extrinsic semiconductors - Expression for carrier concentration in n type semiconductor - Variation of carrier concentration and Fermi level with temperature for n - type - Hall Effect: Hall coefficient in n-type extrinsic

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semiconductor, experimental determination of Hall coefficient and applications of Hall Effect - LDR - Solar Cells - Strain gauge.

UNIT IV – DIELECTRIC MATERIALS 9

Polarization - Polarizability - Polarization vector, Electrical susceptibility, Dielectric constant – Polarization mechanisms (Qualitative) -Internal Field in solids – Clausius Mossotti relation-Frequency and temperature dependence of polarization – Dielectric loss - Dielectric breakdown mechanisms - Types of Dielectrics: Active and Passive (Qualitative) – Selection of dielectric materials - Applications of Dielectrics: Capacitors and Transformers.

UNIT V –MAGNETIC MATERIALS 9

Introduction to magnetic materials – Types and Properties of Magnetic materials: Dia, Para, Ferro, Anti-ferro and Ferri magnetic materials - Domain theory of ferromagnetism - Hysteresis based on domain theory - Hard and soft magnetic materials – Properties and applications of Ferrites- Materials for permanent magnets- Magnetic storage devices: Magnetic tape – Hard disc – Magneto optical recording.

Course Outcomes

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

CO1. Analyze the types of electron emission and electron ballistics.
CO2. Calculate the electrical properties of conductors and relate with superconductors.
CO3. Demonstrate the nature of semiconducting material.
CO4. Calculate the dielectric properties of materials and discuss their application in electronic components.
CO5. Explain the properties and applications of magnetic materials.

Text Books

1. M.N.Avadhanulu and P.G.Kshirsagar, "Text Book of Engineering Physics", S. Chand & Company Ltd., New Delhi, 2014.
2. Balasubramaniam "Callister's Material Science and Engineering", John Wiley and Sons Inc., Second Edition, 2015.

Reference Books

1. S.O. Pillai," A Text Book of Solid State Physics", New Age International, Seventh Edition, 2015.
2. S.O. Kasap, "Principles of Electronics Materials and Devices", McGraw Hill Higher Education, New Delhi,Third Edition 2007.
3. V Rajendran, "Engineering Physics", Tata McGraw-Hill Co, New Delhi, 2011.

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4. P.K Palanisamy, "Materials Science", Scitech Publications, Chennai, 2007.

Web References

1. http://nptel.ac.in/courses/115102014/1
2. http://nptel.ac.in/course.php?disciplineId=115
3. .https://www.khanacademy.org/science/physics/magnetic-forces-and-magnetic-fields
4. http://physics.info/dielectrics/

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Course Code : 141EE0204	Course Title :ELECTRON DEVICES (COMMON TO ECE, EEE AND EIE)	
Core	L : T : P: C	3 : 0 : 0 : 3
Type: Theory	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0103 Engineering Physics

Course Objectives

The course is intended to:

1. Explain the characteristics of PN junction diode.
2. Differentiate the characteristics of special diodes from pn junction diodes.
3. Explain the characteristics of Bipolar junction transistors.
4. Compare and contrast the types of Field effect transistors.
5. Comprehend the operation of basic power devices and display devices.

UNIT I - SEMICONDUCTOR DIODE 9

PN junction diode- forward and reverse bias characteristics , Breakdown in PN junction diodes , Effect of temperature on PN junction diodes, Current equation, Diffusion and drift current , switching characteristics, Piecewise linear characteristics

UNIT II – SPECIAL DIODES 9

Zener diode— Characteristics of Zener diode , Avalanche and Zener breakdown , Zener diode as voltage regulator, Photo diode, Varactor diode ,Tunnel diode, Schottky Diode, PIN diode.

UNIT III – BIPOLAR JUNCTION TRANSISTORS 9

Introduction to Bipolar Junction Transistor and its types, construction and working of NPN, and PNP Transistor, Configurations of BJT – Input and output characteristics of CE, CB, CC, Applications of BJT.

UNIT IV – INTRODUCTION TO FETs 9

FET and its Types ,construction and working of n- channel and p-channel JFETs , Pinch off voltage and its significance , Construction and working of MOSFETs – Enhancement and Depletion MOSFET, Configurations of MOSFET , MOSFET as switch, Comparison of BJT with FET.

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UNIT V –POWER DEVICES AND DISPLAY DEVICES

Construction and working principle - UJT, SCR, Diac, Triac, IGBT, OLED,TFT, CCD and their applications

Course Outcomes

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

CO1. Explain the characteristics of PN junction diode.
CO2. Differentiate the characteristics of special diodes from pn junction diodes.
CO3. Explain the characteristics of Bipolar junction transistors.
CO4. Compare and contrast the types of Field effect transistors.
CO5. Comprehend the operation of basic power devices and display devices.

Text Books

1. Robert Boylestad and Louis Nashelsky, "Electron Devices and Circuit Theory" Pearson Prentice Hall, 10th edition,July 2008.
2. Millman.J&Halkias, SatyebrantaJit, "Electronic Devices & Circuits", TMH, 2nd Education, New Delhi, 2008.

Reference Books

1. Salivahanan.S, Suresh kumar.N and Vallavaraj.A, "Electronic Devices and Circuits", Second Edition, TMH, New Delhi, 2008.
2. Robert.T.Poynter, "Introducing Electronics Devices and Circuits", Pearson Education, Seventh Edition, New Delhi, 2006.
3. Streetman Ben G. and Banerjee Sanjay, "Solid State Electronic devices", PHI, SixthEdition, 2006.
4. David A. Bell, "Electronic Devices and Circuits", Oxford, Fifth Edition, April 2008.

Web References

1. http://nptel.ac.in/video.php?subjectId=117103063
2. http://nptel.ac.in/video.php?subjectId=117106091
3. www.youtube.com/watch?v=Wf19II0ts84

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Course Code : 141EE0205	Course Title :ENGINEERING CHEMISTRY (COMMON TO ECE, EEE AND EIE)	
General	L : T : P: C	3 : 0 : 0 : 3
Type: Theory	Total Contact hours:	45Hours

Prerequisites: The student should have undergone the course(s):
- Nil

Course Objectives
The course is intended to:

1. Select batteries based on the life cycle, working principle and their applications.
2. Determine the rate of corrosion of a metal and identify appropriate control techniques.
3. Explain photo physical law and spectroscopic method of chemical analysis.
4. Explain the chemistry of water and specify the water treatment process.
5. Identify the behaviour of nano-materials.

UNIT I - ELECTROCHEMISTRY AND BATTERIES 9

Cells – Types of cells– Electrochemical and electrolytic cells. Difference between electrochemical cells and Batteries. Batteries – Characteristics, Classifications of batteries, Construction, working and applications - dry cells, Lead –Acid battery, Nickel-Cadmium battery, Lithium ion battery, Hydrogen -Oxygen Fuel Cell. Battery hazards and maintenance.

UNIT II – CORROSION AND ITS CONTROL 9

Corrosion – dry and wet corrosion, galvanic corrosion and differential aeration corrosion, Factors influencing corrosion. Corrosion Control methods – Cathodic protection methods, Surface coatings – Electroplating of Silver and Electroless plating of Nickel, Paints – constituents and its functions

UNIT III – PHOTOCHEMISTRY AND SPECTROSCOPY 9

Photo physical laws – Grotthus Draper law, Stark Einstein law and Beer Lamberts law, Photo process – Fluorescence, Phosphorescence, Chemiluminescence and Photosensitization. Spectroscopy – Electromagnetic spectrum, Absorption and Emission spectroscopy – UV – Visible Spectroscopy, Flame photometry – Principle, Instrumentation and applications.

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UNIT IV – WATER TECHNOLOGY 9

Water quality parameters – Physical, Chemical and Biological characteristics of potable water, Water quality standards –WHO, Central Pollution Control Board, Hardness of water – types, expression of hardness-calcium carbonate equivalents, units of hardness, disadvantages of hard water. Water conditioning methods – Internal conditioning- Carbonate, Phosphate and Calgon Conditioning. External conditioning – demineralization, Reverse osmosis. Domestic Water Treatment.

UNIT V –NANO MATERIALS 9

Introduction – Difference between bulk and Nano materials – size dependent properties of Nano materials, Nano scale materials – Nano particles, Nano clusters, Nano rods and Nano tubes. Synthesis of Nano materials: Sol-gel process, Electro deposition, Chemical Vapor condensation and Laser ablation methods. Characterization of Nano materials – methods only, Applications of Nano materials in Electronics and communication, Energy science and medicines.

Course Outcomes

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

CO1. Select batteries based on the life cycle, working principle and their applications.

CO2. Determine the rate of corrosion of a given metal in a given environment and identify appropriate control techniques to avoid corrosion.

CO3. Explain photo physical law and spectroscopic method of chemical analysis.

CO4. Explain the chemistry of water and specify the water treatment process.

CO5. Identify the behavior of nano materials based on size.

Text Books

1. Wiley Engineering Chemistry, Second Edition, Wiley India Pvt. Ltd. New Delhi (2011).
2. P.C. Jain and Monica Jain, "Engineering Chemistry", 16th Ed., Dhanpat Rai Pub, Co., New Delhi (2004).

Reference Books

1. Larry Brown and Tom Holme, Chemistry for Engineering Students, Third Edition, Cengage Learning (2015).
2. P.W. Atkins and de Paula Julio, "Physical Chemistry", Oxford University Press, Ninth Edition. (Indian Student Edition) (2011).
3. S.S. Dara "A text book of Engineering Chemistry" S. Chand & Co. Ltd., New Delhi (2006).

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4. Charles P. Poole, Jr., Frank J. Owens "Introduction to Nanotechnology" Wiley India Pvt. Ltd. New Delhi (2003)

Web References

1. http://nptel.ac.in/courses/122101001/downloads/lec-23.pdf
2. http://nptel.ac.in/courses/118104008/
3. http://nptel.ac.in/courses/104105039/

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Course Code : 141EE0206	Course Title :BASICS OF CIVIL AND MECHANICAL ENGINEERING (Common to ECE, EEE & EIE)	
Core	L : T : P: C	3 : 0 : 0 : 3
Type: Theory	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- NIL

Course Objectives

The course is intended to:

1. Select the best material and suitable foundation.
2. Gain knowledge about the components of structures.
3. Explain the various alternate sources of energy and components.
4. Explain different manufacturing processes.
5. Discuss the construction and working of IC engines and refrigerators.

UNIT I - CIVIL ENGINEERING MATERIALS AND BUILDING COMPONENTS 9

Scope of Civil Engineering - Functions of civil Engineer and Basic areas in Civil Engineering.

Civil Engineering Materials and their properties: - Stones, bricks, sand, aggregate, cement, steel, concrete and Reinforcement cement concrete.

Sub structure: - Bearing capacity of soil – Problems with soil – Type of foundation - Selection of foundation based on soil conditions – Requirement of good foundation – Various types of foundations.

UNIT II – BUILDING COMPONENTS, HIGHWAY AND RAILWAY ENGINEERING 9

Super structure: Vertical Components such as brick masonry walls, stone masonry walls and columns – Horizontal components such as Beam, Lintels, sun shades – various types of roofs and floors.

Highway and Railway Engineering: Importance of transportation networks-classification of highways-Railway Engineering and its components- Classification of Bridges.

UNIT III – ALTERNATE SOURCES OF ENERGY, POWER PLANTS AND BOILERS 9

Types of Boilers: Simple Vertical, Babcock and Wilcox and La-Mont Boiler, Differences

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between fire tube and water tube boiler. Types of steam turbines- working of a single stage impulse and reaction turbines.

Power Plant: Classification of Power Plants- Steam - Nuclear, Diesel, and Hydro Power Plants. Solar, Wind, Tidal, Geothermal and Ocean Thermal Energy Conversion (OTEC).

UNIT IV – MANUFACTURING PROCESSES 9

Metal Casting-Foundry–Moulding and Casting Processes. Metal Forming- Forging, Rolling, Extrusion processes. Metal Joining processes - Welding, Metal machining–Turning, Milling, Drilling, Shaping.

UNIT V –THERMAL ENGINEERING 9

Refrigeration -Principle of vapour compression system – Layout of typical domestic refrigerator, Refrigerants–types and properties. Air conditioning–Definition, working principle of Window and Split type room air conditioners. Internal combustion engines–Working principle of Petrol and Diesel Engines–Two stroke and Four stroke cycles–Comparison of two stroke and four stroke engines.

Course Outcomes

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

CO1. Select the best material and suitable foundation for the required construction.
CO2. Gain knowledge about the components of structures.
CO3. Explain the various alternate sources of energy and components of a power plant.
CO4. Explain different manufacturing processes like casting, forming, welding and machining operations
CO5. Discuss the construction and working of IC engines and refrigerators.

Text Books

1. Jayagopal. L.S & Rudramoorthy.R, "Elements of Civil and Mechanical Engineering", Vikas Publishing House, NewDelhi,2010.
2. Shanmugam.GandPalanichamy.M.S,"BasicCivilandMechanicalEngineering",Tata McGrawHill PublishingCo.,NewDelhi,1996.

Reference Books

1. Bindra.S. Pand Arora.S.P,"The textbook of Building construction",DhanpatRai Publications(P)Ltd., NewDelhi,2011.
2. Civil Engineering Laboratory manual for First Year Students
3. Ananthanarayanan.P,"BasicRefrigerationandAirConditioning",TataMcGrawHill Publishing Co., NewDelhi,2003
4. Srinivasan.S, "Automotive Engineering "Tata McGrawHill Publishing Co., New Delhi, 2003.

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Web References

1. www.electrical4u.com/power-plants-types-of-power-plant/
2. www.thelibraryofmanufacturing.com/
3. www.nitw.ac.in/departments/mech/index.php/thermal-engineering-2/

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Course Code : 141EE0207	Course Title : ENGINEERING PHYSICS AND CHEMISTRY LABORATORY (Common to ECE, EEE & EIE)	
General	L : T : P: C	0 : 0 : 2 : 1
Type: Practical	Total Contact hours:	30 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0103 Engineering Physics

Course Objectives

The course is intended to:

1. Measure optical parameters of laser and optical fiber
2. Estimate electrical properties of metal and semiconductor
3. Estimate the total hardness of water
4. Measure corrosion rate of a mild metal
5. Determine concentration of a solution.

LIST OF EXPERIMENTS

PHYSICS (Any six experiments only)

1. Diode Laser-Determination of Wavelength and Particle size
2. Optical Fiber- Determination of Numerical aperture and acceptance angle
3. Lee's Disc Method – Determination of Thermal Conductivity of a bad conductor
4. Band gap of a semiconductor-Determination of Band gap of a semiconducting material
5. Characteristic of Light Dependent Resistor-Resistance –Illumination Characteristics
6. Carey Foster's Bridge-Determination of specific resistance of an alloy
7. Solar Cell- V-I Characteristics
8. Hall effect-Determination of Hall coefficient
9. Determination of dielectric constant

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CHEMISTRY (Any five experiments only)

1. Preparation of standard solutions
2. Estimation of total hardness of water by EDTA method.
3. Estimation of iron in water by colorimetric method- verification of Beer-Lambert's Law.
4. Estimation of Fe^{2+} by potentiometric titration
5. Determination of strength of acid by pH metry
6. Determination of corrosion rate by weight loss method
7. Measurement of emf of electrochemical cell – potentiometry

Course Outcomes

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

CO1. Measure optical parameters of laser and optical fiber

CO2. Estimate electrical properties of metal and semiconductor

CO3. Estimate the total hardness of water

CO4. Measure corrosion rate of a mild metal

CO5. Determine concentration of a solution through electrical method

Reference Books

1. Engineering Physics Laboratory Manual by Dr. R. Jayaraman, V. Umadevi, S. Maruthamuthu and B. Saravanakumar.
2. Engineering Chemistry Laboratory Manual by Faculty, Chemistry Department, and MCET.

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Course Code : 141EE0208	Course Title :ENGINEERING PRACTICE LABORATORY- II (Civil & Mechanical) (Common to ECE, EEE & EIE)	
Core	L : T : P: C	0 : 0 : 2 : 1
Type: Practical	Total Contact hours:	30 Hours

Prerequisites: The student should have undergone the course(s):

- Nil

Course Objectives

The course is intended to:

1. Demonstrate the basic plumbing operations.
2. Demonstrate the basic carpentry operations.
3. Explain the various fitting processes.
4. Demonstrate the various sheet metal operations.
5. Demonstrate the basic operations such as forging, moulding and welding.

LIST OF EXPERIMENTS

CIVIL ENGINEERING

1. Study of pipe line joints, its location and functions, valves, tapes, couplings, unions, reducers and elbows in house hold fittings.
2. Hands- on - exercise on basic pipe connections- mixed pipe material connections – pipe connections with different joining components
3. Study of the joints in doors, windows and furniture.
4. Hands on exercise: wood work-Joints by sawing, planning and cutting.
5. Demonstration on carpentry using power tools.

MECHANICAL ENGINEERING

1. Study of tools and joints – planning, chiselling, marking and sawing practice, different joints, use of power tools.
2. Study of tools, chipping, filing, cutting, drilling, tapping, male and female joints, and stepped joints.
3. Exercise on forging of hexagonal bolt.
4. Exercise on sand preparation and moulding making.

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5. Selection of different gauge sheets, types of joints, trays and containers.
6. Hands on exercise for making butt joints, lap joints and tee joints using arc welding

Course Outcomes

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

CO1. Demonstrate the basic plumbing operations.
CO2. Demonstrate the basic carpentry operations.
CO3. Explain the various fitting processes.
CO4. Demonstrate the various sheet metal operations.
CO5. Demonstrate the basic operations such as forging, moulding and welding.

Reference Books

1. Jeyachandran.K, Natarajan.S. & Balasubramanian.S, "A Primer on Engineering Practices Laboratory", Anuradha Publications, 2007.
2. Rajendra Prasad. A & Sarma.P.M.M.S, "Workshop Practice", Sree Sai Publication, 2002.
3. Kannaiah.P & Narayana.K.L, "Manual on Workshop Practice", Scitech Publications, 1999.

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Course Code : 141EE0209	Course Title :SPORTS FOR WELLNESS (Common to ECE, EEE and EIE)	
General	L : T : P: C	0 : 0 : 2 : 1
Type: PS	Total Contact hours:	30Hours

Prerequisites: The student should have undergone the course(s):

- Nil

Course Objectives

The course is intended to:

1. Explain the significance of physical fitness.
2. Maintain physical fitness.
3. Exhibit mental agility.

UNIT I - HEALTH

Meaning of health - Components of health - physical, mental, social, emotional, spiritual -importance of health - Personal hygiene - Heredity and environment –Adopting healthy habits

UNIT II – FITNESS & WELLNESS

Fitness and wellness – what is physical fitness - categories - components of health related physical fitness- components of skill related physical fitness-values of physical fitness – Physical fitness development.

What is wellness - importance of wellness for engineers –factors promoting wellness – Physiology and health: cardio-respiratory, muscular and nervous systems – ageing

UNIT III – FOOD & HEALTH

Energy balance and body composition – nutrients- problems of surplus and deficiency- balanced diet - good food habits for better health – hazards of junk food - food and the gunas.

UNIT IV – FITNESS & DEVELOPMENT I

Exercises related ailment and injuries - safety and precautions - first aid. Muscular strength – exercises (calisthenics): pull-up, sit-up, push-up and weight training. Explosive power – exercises: vertical jump, long jump, Cardio respiratory endurance– exercises: walking, jogging, treadmill, stair climbing, bicycling, skipping. Flexibility – exercises: stretching

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UNIT V – FITNESS & DEVELOPMENT II

Speed, agility, balance and coordination – exercises: sprint, cone drill, ladder drill, hurdle drill, ball throw - mental agility tests. Dexterity - 12 minutes cooper test – long run – adventure games Team games.

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

CO1. Explain the significance of physical fitness for healthy living
CO2. Maintain physical fitness through exercises
CO3. Exhibit mental agility

Reference Books

1. Tony Buzan, Harper Collins, The Power of Physical Intelligence (English)

2. Padmakshan Padmanabhan, Handbook of Health & Fitness, Indus Source Books, First Edition, 2014.

OPERATIONAL MODALITIES:
Orientation programme

Special lectures by invited resource persons at semester beginning

3 lectures x 4 hours = 12 hours

Follow-up practice

12 weeks x 2 hours/week = 24 hours

Evaluation

Continuous evaluation:

Physical Exercises		= 40 marks
Assessment of students workbook		= 20 marks
	Total	= 60 marks

Semester end examination:

Written test (MCQ and short answers)		= 30 marks
Physical exercises		= 50 marks
Viva-voce		= 20 marks
	Total	= 100 marks

End semester mark out of 100 is reduced to 40 marks

The student should get a total of 50 marks put together for a pass.

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MEASUREMENTS:

At the Beginning + At Semester End

SCHEDULE OF EXERCISES FOR STUDENTS WITH DIFFERENT PHYSICAL CONDITIONS

Underweight	Normal	Obese
Flexibility exercises - stretching	Flexibility exercises - stretching	- Brisk walking
Minor games -forward running relay -backward running relay - over & under relay -circle games, etc.	-Walking - Walking-cum-jogging	- Minor games
Strength Training - Calisthenics	Cardio/Functional Fitness - Skipping - Stair climbing - jogging - bicycling - long distance running	flexibility exercises - stretching - Cycling (static)
Cardio/Functional Fitness - Skipping - Stair climbing - jogging - bicycling	Agility - ladder drills - hurdle drill - cone drill	Cardio/Functional Fitness Skipping Jogging bicycling
Agility exercises - ladder drills - hurdle drill - cone drill	Strength Training -Calisthenics -gym workout for major muscles	Strength Training - Calisthenics - gym workouts
Diet Considerations	Diet considerations	Diet considerations

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Measurements		
BMI Hand grip strength test 12 m Cooper run Sit & reach	BMI 12 m Cooper run Sit & reach test Illinois agility test	BMI Body fat percentage Waist-to-hip ratio Sit&reach

END OF SEMESTER II

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SEMESTER III

Course Code : 141EE0301	Course Title :TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS (Common to EEE and EIE)	
General	L : T : P: C	4 : 0 : 0 : 4
Type: Theory	Total Contact hours:	60 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0102-Engineering Mathematics I
- 141EE0202-Engineering Mathematics II

Course Objectives

The course is intended to:

1. Compute the Fourier series expansion.
2. Calculate the Fourier transform.
3. Determine the solution of first and second order PDE.
4. Solve the one dimensional wave equation.
5. Solve one dimensional and two dimensional equations.

UNIT I - FOURIER SERIES 12

Periodic function-Fourier series-Dirichlet's conditions- Half range Fourier cosine and sine series-Parseval's identity.Application: Representation of current signals in Fourier series expansion.

UNIT II – FOURIER TRANSFORS 12

Fourier transforms-Fourier cosine and sine transforms-Inverse transforms-convolution theorem and Parseval's identity for Fourier transforms.Application to Circuit Analysis-Calculating output voltage of a circuit through Fourier transform.

UNIT III – PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations-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- Application in Circuit Theory problems.

UNIT IV – SOLUTION OF ONE DIMENSIONAL WAVE EQUATION 12

Method of separation of variables- Classification of second order linear partial differential equations, Solutions of one dimensional wave equation by Fourier series

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method. Application in Musical Instrument – Calculating Harmonics in a string.

UNIT V –SOLUTION OF ONE AND TWO DIMENSIONAL HEAT FLOW EQUATION **12**

One dimensional equation of heat conduction - Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded), Solution by Fourier series method-Application to telegraph equations.

Course Outcomes

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

CO1. Compute the Fourier series expansion for given periodic functions
CO2. Calculate the Fourier transform of an aperiodic function.
CO3. Determine the solution of first and second order PDE.
CO4. Solve the one dimensional wave equation.
CO5. Solve one dimensional and two dimensional heat flow equations.

Text Books

1. Srimanta Pal and Subodh C. Bhunia, Engineering Mathematics, Oxford University Press, New Delhi, First Edition, 2015
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India, New Delhi, Tenth edition, 2007

Reference Books

1. Grewal B.S. Higher Engineering Mathematics, Khanna Publishers, New Delhi, Fortieth Edition , 2007.
2. Bali &Iyengar, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd., New Delhi, First Edition, 2007
3. Ramanna B.V. Higher Engineering Mathematics, Tata McGraw Hill, New Delhi, Fourth Edition, 2008.
4. Veerarajan T. Engineering Mathematics for Semester III, Tata McGraw-Hill (Education) India Pvt.Ltd , New Delhi, Third Edition, 2005

Web References

1. http://nptel.ac.in/courses/111103021/
2. http://nptel.ac.in/video.php?subjectId=122107037

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Course Code : 141EE0302	Course Title : DCMACHINES & TRANSFORMERS	
Core	L : T : P: C	3 : 0 : 0 : 3
Type: Theory	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0106-Fundamentals of Electrical Engineering
- 141EE0103-Engineering Physics

Course Objectives

The course is intended to:

1. Explain the basic concepts of rotating machines.
2. Explain the constructional details, operation and performance of DC generators.
3. Explain the operation, control and applications of DC motors.
4. Explain the operation and performance of transformers.
5. Calculate the performance of DC machines and transformers.

UNIT I - BASIC CONCEPTS OF ROTATING MACHINES 7

Principles of electromechanical energy conversion – Single and multiple excited systems – MMF of distributed A.C. windings – Rotating magnetic field – Generated EMF – Torque in round rotor machine

UNIT II – DC GENERATORS 9

Constructional features of a DC machine – Principle of operation – EMF equation – Methods of excitation: Self and separately excited generators - Characteristics of series, shunt and compound generators - applications – Armature reaction - commutation – Parallel operation of DC shunt and compound generators

UNIT III – DC MOTORS 9

Principle of operation of DC motor – Back EMF and torque equation – Characteristics of series, shunt and compound motors – applications – Starting of DC motors – Types of starters – Speed control of DC series and shunt motors – Losses and efficiency

UNIT IV – TRANSFORMERS 12

Constructional details of core and shell type transformers – Principle of operation – EMF equation – Transformation ratio –Transformer on no load – Transformer on load - Equivalent circuit– Regulation –Losses and efficiency in transformers–

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Condition for maximum efficiency – All day efficiency - Parallel operation of single phase transformers – Auto transformer – Comparison with two winding transformers. Three phase transformer constructional features – Three phase transformer connections.

UNIT V –TESTING OF DC MACHINES AND TRANSFORMERS **8**

Testing of transformers: Polarity and voltage ratio tests, Load test, Open circuit and short circuit tests, Sumpner's test

Testing of DC Machines: Brake Test, Swinburne's test, Hopkinson's test, Retardation test.

Course Outcomes

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

CO1. Explain the basic concepts of electromechanical energy conversion, EMF, MMF and RMF.
CO2. Explain the constructional details of DC machine, operation and performance of DC generators.
CO3. Explain the operation, control and applications of DC motors.
CO4. Explain the operation and performance of transformers.
CO5. Calculate the performance of DC machines and transformers using different tests.

Text Books

1. Nagrath I.J Kothari D.P, "Electric Machines", Tata McGraw Hill Publishing Company Ltd, New Delhi, Fourth Edition, 2010
2. MurugeshKumar.K, "Electrical Machines Volume - I", Vikas Publishing House Pvt. Ltd, Noida, First Edition,2010

Reference Books

1. Bimbhra. P.S., "Electrical Machinery", KhannaPublishers,New Delhi, Seventh Edition , 2011..
2. Gupta. J.B., "Theory and Performance of Electrical Machines", S.K.Kataria and Sons, New Delhi, Fourth Edition, 2010
3. Theraja. B.L., Theraja. A.K. "A Textbook of Electrical Technology, Volume II(AC & DC Machines)",S.Chand& Company Ltd, New Delhi, Fifth Edition, 2006.
4. A.E.Fitzgerald, Charles Kingsley, Stephen.D.Umans, "Electric Machinery", Tata Mcgraw Hill, New Delhi, Fifth Edition, 2013.

Web References

1. http://nptel.ac.in/courses/108105017/
2. http://www.nptelvideos.in/2012/11/electrical-machines-i.html
3. http://www.nptelvideos.com/electrical_engineering/

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Course Code : 141EE0303	Course Title :ELECTRIC CIRCUIT ANALYSIS	
Core	L : T : P: C	3 : 2 : 0 : 4
Type: Theory	Total Contact hours:	75 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0103-Engineering Physics
- 141EE0106-Fundamentals of Electrical Engineering

Course Objectives

The course is intended to:

1. Analyze basic electric circuits.
2. Analyze DC and AC circuits.
3. Explain the concept of Resonance and simple coupled circuits.
4. Analyze the transient responses.
5. Differentiate three phase circuit behaviour.

UNIT I - BASIC CIRCUIT ANALYSIS 9+6

Graph representation of circuit: Tree, branch, co-tree, link and loop. Circuit Reduction: Source transformation – star to delta and reverse transformation. Mesh current and Node voltage methods of analysis for D.C and A.C circuits. Parallel RL, RC, RLC circuits excited by AC source.Principle of duality.

UNIT II – CIRCUIT THEOREMS FOR DC AND AC CIRCUITS 9+6

Superposition Theorem – Thevenin's and Norton's Theorem – Maximum power transfer theorem – Reciprocity Theorem – Compensation Theorem - Millman's Theorem – Tellegen's Theorem.

UNIT III – RESONANCE AND COUPLED CIRCUITS 9+6

Resonance: Series and Parallel - Quality factor, Resonant frequency, bandwidth and their relations. Effect of variation of Q on resonance.

Coupled circuits: Mutual inductance – Coefficient of coupling – dot convention – analysis of simple coupled circuits. Series and parallel connections of coupled coils – Tuned coupled circuits.

UNIT IV – TRANSIENT RESPONSE 9+6

Source free response of RL and RC circuits – Forced (step) response of RL and RC circuits – Source free response of RLC series circuit – Forced (step) response of RLC series circuit – Forced response of RL RC and RLC series circuit to sinusoidal

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excitation – Time constant and natural frequency of oscillation of circuits. Laplace transform application to the solution of RL, RC and RLC circuits – Initial and final value theorems and applications.

UNIT V –THREE PHASE CIRCUITS **9+6**

Three phase balanced / unbalanced voltage sources – Analysis of three phase 3 wire and 4 wire circuits with star and delta connected loads, balanced and unbalanced – phasor diagram of voltage & currents – Power and power factor measurements in three phase circuits.

Course Outcomes

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

CO1. Analyze basic electric circuits using circuit reduction, mesh and node analysis.
CO2. Analyze DC and AC circuits using circuit theorems.
CO3. Explain the concept of Resonance and simple coupled circuits.
CO4. Analyze the transient responses of RL, RC, RLC circuits using Laplace transformation technique.
CO5. Differentiate three phase circuit behavior with balanced and unbalanced three phase loads.

Text Books

1. William H. Hayt, Jack Kemmerly, Steven M. Durbin. "Engineering Circuit Analysis" Tata McGraw Hill publishers, New Delhi, Eighth Edition, 2013
2. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", McGraw Hill, New Delhi, Fifth Edition, 2013.

Reference Books

1. Chakrabati A, "Circuits Theory (Analysis and synthesis), DhanpathRai& Sons, New Delhi, Sixth Edition,2014
2. M Nahvi, Joseph Edminister, K UMA RAO "Electric circuits", Schaum's Series, Tata McGraw-Hill, New Delhi, Fifth Edition, 2010
3. Robert L. Boylestad, "Introductory Circuit Analysis" Pearson, USA, Sixteenth Edition, 2016..

Web References

1. http://nptel.ac.in/courses/117106101/
2. http://nptel.ac.in/courses/108102042/
3. www.allaboutcircuits.com

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Course Code : 141EE0304	Course Title :DIGITAL ELECTRONICS (Common to ECE and EEE)	
Core	L : T : P: C	3 : 0 : 2 : 4
Type: Theory	Total Contact hours:	75 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0204-Electron Devices

Course Objectives

The course is intended to:

1. Illustrate the number systems, Boolean laws and logic families.
2. Design combinational Circuits.
3. Design synchronous sequential circuits.
4. Design asynchronous sequential circuits.
5. Develop Verilog programming.

UNIT I - BOOLEAN ALGEBRA AND LOGIC FAMILIES 9

Number System: Review of decimal, binary, octal and hexadecimal numbers – Complements: 1's and 2's - Arithmetic operation of Signed binary Numbers –Digital Logic Gates – Universal gate Implementation.

Boolean Algebra: Basic Theorems, Properties and Simplification of Boolean functions– Representation of Boolean functions in Canonical and standard forms.

Digital Logic Families: Characteristics and operation of TTL, ECL and CMOS.

UNIT II – COMBINATIONAL LOGIC 9

Minimization Techniques:

Simplifications of Boolean expressions using K map Method and McCluskey Method.

Combinational Circuits:

Design Procedure of Adder, Subtractor, Comparators, Code converters, Encoders, Decoders, Multiplexers and De-multiplexers – System level design.

UNIT III – SYNCHRONOUS SEQUENTIAL LOGIC 9

SR Latch - Flip flops: SR, JK, T, D – Level and Edge Triggering – Analysis of sequential circuits - Design of sequential circuits with state diagram, state table, state reduction and state assignment – Registers: Shift registers – Counters: Ripple counter, Synchronous counter, Design of synchronous counter.

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UNIT IV – ASYNCHRONOUS SEQUENTIAL LOGIC 9

Analysis of Asynchronous Sequential Circuits - Design of Asynchronous Sequential Circuits with primitive flow table, state reduction and state assignment – Races, Cycles and Hazards: Static, Dynamic, Essential, Hazards elimination.

UNIT V –INTRODUCTION TO VERILOG HDL 9

Basic concepts: operators, arrays - modules and port definitions –**Modeling:** Gate level, data flow and behavioral- **Design of Combinational & Sequential circuits:** 4 bit Full Adder, 3 x 8 Decoders,8 x 3 Encoders, 4 to 1 Multiplexer, 1 to 4 De-multiplexer and Flip-flops.

Course Outcomes

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

CO1. Illustrate the number systems, Boolean laws and logic families used in digital design.
CO2. Explain the simplification techniques for design of combinational circuits.
CO3. Design synchronous sequential circuits using flip-flops.
CO4. Design asynchronous sequential circuits eliminating hazards and races.
CO5. Develop Verilog programming for design of combinational and sequential circuits.

Text Books

1. Morris Mano. M., "Digital Design", Pearson Education, Third Edition, 2001
2. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis, Volume 1", Prentice Hall Professional, Second Edition, 2003

Reference Books

1. Anil.K.Maini, "Digital Electronics", First Edition, Wiley India Pvt, Ltd., 2011
2. Donald D. Givone, "Digital Principles and Design", TMH, 2003.
3. Salivahanan. S and Arivazhagan. S.,"Digital Circuits and Design", Vikas Publishing House Pvt. Ltd, New Delhi, Fourth Edition, 2012.
4. Bhasker. J., "A Verilog HDL Primer", Second Edition, B.S. Publications, 2001

Web References

1. http://web.iitd.ac.in/~shouri/eel201/lectures.php
2. http://www.learnabout-electronics.org//Digital/dig10.php
3. http://nptel.ac.in/courses/117103064/
4. http://www.ni.com/example/14493/en/
5. http://www.electrical4u.com/digital-electronics/
6. http://www.allaboutcircuits.com/textbook/digital/

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LAB COMPONENT

LIST OF EXPERIMENTS:

1. Simplification of the Boolean expression using K Map and its implementation.
2. Design of full adder and subtractor using logic gates.
3. Design of Encoder using logic gates.
4. Design of Multiplexer using logic gates.
5. Design of binary counter.
6. Simulation of Shift registers.
7. Design of Simple Programs for Combinational circuits using verilog HDL and verify using simulation.
8. Design of Simple Programs for Synchronous Sequential Circuits using verilog HDL and verify using simulation.

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Course Code : 141EE0305	Course Title :ELECTRO MAGNETIC THEORY	
Core	L : T : P: C	3 : 0 : 0 : 3
Type: Theory	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0102-Engineering Mathematics I
- 141EE0202-Engineering Mathematics II

Course Objectives

The course is intended to:

1. Interpret different co-ordinate systems, vector operations and its use for Stokes and Divergence theorems..
2. Explain the laws and concepts of electrostatics and its boundary conditions
3. Explain the laws and concepts of magneto statics and its boundary conditions.
4. Explain time varying electromagnetic fields using Maxwell's equations in integral and differential form
5. Explain electromagnetic wave propagation and attenuation in various medium.

UNIT I - VECTOR ANALYSIS 9

Definition of scalar and vector, scalar and cross product of vectors, Introduction to co–ordinate systems and its types, Gradient of a scalar, Divergence and curl of a vector, illustrative examples – Stokes and Divergence theorem.

UNIT II – ELECTROSTATICS 9

Definition of electric charge, Coulomb's Law – Electric field intensity – Field due to point and line and sheet charges – Electric flux density , Gauss's law and application – Electric potential, Boundary Conditions for Electric Field- Properties of Conductors - Current and current density – continuity of current –Polarization in dielectrics - electric dipole – Potential and field due to an electric dipole.

Capacitance – Capacitance of coaxial cable with single and multiple dielectric, capacitance of isolated sphere, capacitance of two conductor transmission line- Electrostatic energy storage and energy density.

UNIT III – MAGNETOSTATICS 9

Definition of magnetic flux, magnetic field intensity, Lorentz Law of force, Biot–savart Law , Ampere's Law and applications , Magnetic field due to straight conductors, circular loop,– Magnetic flux density (B) , Magnetic potential, Boundary conditions, Torque on closed circuits – Magnetization, Lifting force of a magnet

Inductance – Inductance of Solenoids, Toroids, Transmission lines and Cables -

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Mutual Inductance – Magneto-static energy storage and energy density

UNIT IV – ELECTRODYNAMIC FIELDS 9

Faraday's law – Stationary and motional EMFs - conduction and displacement current densities – Maxwell's equations in differential and integral forms- Relation between circuit theory and field theory.

UNIT V –ELECTROMAGNETIC WAVES 9

Electromagnetic waves: wave equations – wave parameters: velocity, intrinsic impedance and propagation constant - waves in free space, conductors, lossy and lossless dielectrics – skin depth - Poynting vector and Poynting theorem, standing wave ratio.

Course Outcomes

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

CO1. Explain the laws of electrostatics, its behavior on various geometries of conductors and the boundary conditions.

CO2. Explain the electric dipole, capacitance of different configurations and energy density of capacitance.

CO3. Explain the laws of magneto statics, its behavior on various geometries of conductors and the boundary conditions.

CO4. Explain time varying electromagnetic fields using Maxwell's equations in integral and differential form.

CO5. Explain electromagnetic wave propagation and attenuation in various medium.

Text Books

1. John D. Kraus and Daniel A. Fleisch, "Electromagnetic with Applications", Tata McGraw Hill, New Delhi..Fifth Edition, 2010.
2. W. H. Hayt and John A. Buck, "Engineering Electromagnetics", Tata McGraw Hill, New Delhi, Sixth Edition, 2014.

Reference Books

1. Gangadhar K.A. and Ramanathan P.M., "Electromagnetic Field Theory", Khanna Publishers, New Delhi, Fifth Edition, 2013
2. J.A. Buck and W. H. Hayt, "Problems and Solutions in Electromagnetics", Tata McGraw Hill, New Delhi, First Edition, 2010
3. Joseph A. Edminister, "Theory and Problems of Electromagnetic Schaum's Outline Series", Tata McGraw Hill Inc, Fifth Edition, New Delhi, 2010..
4. N.N.Rao, "Elements of Engineering Electromagnetic", Prentice Hall of India, New Delhi Sixth Edition, 2010

Web References

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1. http://openems.de/start/index.php
2. http://nptel.iitm.ac.in

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Course Code : 141EE0306	Course Title :DATA STRUCTURES AND OBJECT ORIENTED PROGRAMMING WITH C++ (Common to ECE & EEE)	
Core	L : T : P: C	3 : 0 : 0 : 3
Type: Theory	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0105-C Programming

Course Objectives

The course is intended to:

1. Describe the basic programming constructs.
2. Explain the object oriented features like Inheritance, Polymorphism.
3. Implement linear data structures & its applications.
4. Implement non-linear data structure and its applications.
5. Explore various classification and clustering methods.

UNIT I - PRINCIPLES OF OBJECT ORIENTED PROGRAMMING 9

Introduction - Tokens - Control Structures –Functions In C++ - Classes and Objects - Constructors and Destructors - Operators Overloading - Type Conversions.

UNIT II – ADVANCED OBJECT ORIENTED PROGRAMMING 9

Inheritance - Extending Classes - Virtual Functions and Polymorphism – Managing Console I/O Operations-File Handling - Exception Handling.

UNIT III – LINEAR DATA STRUCTURES 9

Algorithm Analysis - Abstract Data Types - List ADT- Array and Linked List Implementation – Types - Stack ADT-Queue ADT - Sorting Techniques: Insertion sort - Merge sort - Quick sort - Searching Techniques: Linear Search – Binary Search.

UNIT IV – TREES AND GRAPHS 9

Trees: Binary Trees - Binary Search Tree ADT- AVL Trees - Graph Algorithms: Topological Sort - Single Source Shortest Path Algorithm - Dijkstra's Algorithm - All Pairs Shortest Path Algorithm - Floyd's Algorithm-Minimum Spanning Tree - Prim's and Kruskal's Algorithm.

UNIT V –DATA ANALYTICS 9

Introduction to Data Mining and Analytics – Association: Apriori Algorithm -

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Classification: Decision Tree – Bayes – Rule-Based – Clustering: Cluster Analysis – Partitioning Methods – Hierarchical Methods – Density-Based Methods.

Course Outcomes

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

CO1. Describe the basic programming constructs in C++.
CO2. Explain the object oriented features like Inheritance, Polymorphism.
CO3. Implement linear data structures such as List, Stack, Queue and Sorting /Searching & its applications.
CO4. Implement non-linear data structure such as Trees, Graphs and its applications.
CO5. Explore various classification and clustering methods for Data Analytics

Text Books

1. Balagurusamy.E, "Object Oriented Programming with C++", Tata McGraw Hill, New Delhi ,Fourth Edition, 2008.(UNIT -I, II)
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education Asia, New Delhi, Third Edition, 2007(UNIT -III, IV)
3. JiaweiHan, Micheline Kamber, Jian Pei "Data Mining Concepts and Techniques", Elsevier, Third Edition, 2012. (Unit V)

Reference Books

1. Alfred V. Aho, John E. Hopcroft and Jeffry D. Ullman, Data Structures and Algorithms, Pearson Education, New Delhi, 2006
2. Sahni, "Data Structures Using C++", The McGraw-Hill, New Delhi, 2006
3. Seymour, "Data Structures", The McGraw-Hill, New Delhi, 2007
4. Robert Lafore, Object oriented programming in C++, Galgotia Publication, New Delhi, Third Edition,2001
5. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, Second Edition,2007.

Web References

1. http://www.tutorialspoint.com/cplusplus/cpp_object_oriented.html
2. http://www.nptel.ac.in/syllabus/syllabus.php?subjectId=106106127
3. http://www.cosc.canterbury.ac.nz/mukundan/dsal/appldsal.html
4. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html.
5. http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms
6. https://www.edx.org/course/subject/data-analysis-statistics
7. https://www.coursera.org/courses?languages=en&query=data%20analytics

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Course Code : 141EE0307	Course Title : DC MACHINES & TRANSFORMERS LABORATORY	
Core	L : T : P: C	0 : 0 : 4 : 2
Type: Practical	Total Contact hours:	60 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0208-Engineering Practices Laboratory II

Course Objectives

The course is intended to:

1. Compare the performance of DC generators.
2. Compare the performance of DC Motors.
3. Predict the performance of DC Machine.
4. Determine the performance of single phase transformers.
5. Predict the performance of single phase transformers.

LIST OF EXPERIMENTS: **60**

1. Open circuit and load characteristics of self and separately excited DC shunt generators.
2. Load characteristics of DC compound generator with differential and cumulative connection.
3. Load characteristics of DC shunt and series motor by brake test.
4. Speed control of DC shunt motor using armature and field control method.
5. Predetermination of efficiencies as Generator and Motor from Swinburne's test
6. Hopkinson's test on DC motor – generator set.
7. Load test on single-phase transformer.
8. Open circuit and short circuit tests on single phase transformer.
9. Sumpner's test on transformers.
10. Separation of no-load losses in single phase transformer.

Course Outcomes

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

CO1. Compare the performance of different types of DC generators.
CO2. Compare the performance of different types of DC Motors.
CO3. Predict the performance of DC Machine by back to back test.
CO4. Determine the performance of single phase transformers by direct tests.
CO5. Predict the performance of single phase transformers by indirect tests.

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Reference Books

1. D. P. Kothari , B. S. Umre "Laboratory Manual for Electrical Machines", I K International Publishing House Pvt. Ltd , 2014.
2. "DC Machines & Transformer Laboratory Manual" prepared by Department of Electrical and Electronics Engineering.

Web References

1. http://iitg.vlab.co.in/?sub=61&brch=168
2. http://em-iitr.vlabs.ac.in/index.php?section=List%20of%20experiments

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Course Code : 141EE0308	Course Title : DATA STRUCTURES AND OBJECT ORIENTED PROGRAMMING WITH C++ LABORATORY (Common to ECE & EEE)	
Core	L : T : P: C	0 : 0 : 4 : 2
Type: Practical	Total Contact hours:	60 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0106-C Programming Laboratory

Course Objectives

The course is intended to:

1. Implement object oriented concepts.
2. Implement linear and non-linear data structures.
3. Implement sorting methods.
4. Implement searching methods.
5. Implement classification and clustering methods.

LIST OF EXPERIMENTS **60**

1. Basic Programs for C++ Concepts using classes and objects.
2. Basic Programs for C++ Concepts using Inheritance, Constructors, Destructors, Polymorphism
3. Array based implementation of List ADT
4. Array based implementation of Stack ADT and Queue ADT
5. Linked list implementation of Singly / Double Linked List
6. Implementation of Binary Search Tree
7. Implementation of Dijkstra's / Floyd's Algorithms
8. Implementation of Prim's / Kruskal's Algorithms
9. Implementation of Sorting / Searching Algorithms
10. Implementation of Classification / Clustering Method

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Course Outcomes

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

CO1. Implement object oriented concepts.
CO2. Implement linear and non-linear data structures.
CO3. Implement sorting methods.
CO4. Implement searching methods.
CO5. Implement classification and clustering methods.

Reference Book

1. "Data Structures and Object Oriented Programming with C++" Lab Manualprepared by Department of Computer Science Engineering.

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Course Code : 141EE0309	Course Title : PERSONAL EFFECTIVENESS	
General	L : T : P: C	0 : 0 : 2 : 1
Type: PS	Total Contact hours:	30 Hours

Course Objectives

The course is intended to:

1. Identify the strengths, weaknesses and opportunities.
2. Set goals for academics, career, and personal aspirations.
3. Establish the road map for goals.
4. Apply time management techniques.
5. Create time and pursue activities of self-interest.

UNIT I - THE IMPORTANCE OF ENVISIONING 6

Importance of positive self-perception – Principle of dual creation (Everything gets created twice – Envisioning) - Understanding vision and mission statements - Writing personal mission statements – 'Focus' as a way of life of most successful people – Importance of goal setting –Importance of planning and working to time

UNIT II – FUNDAMENTAL PRINCIPLES OF GOAL SETTING AND WORKING TO TIME 7

Clarifying personal values, interests and orientations – Awareness of opportunities ahead – Personal SWOT analysis - Principles driving goal setting: Principle of response and stimuli, Circle of influence and circle of concern, what you see depends on the role you assume

UNIT III – GOAL SETTING AND ACTION ORIENTATION 7

Potential obstacles to setting and reaching your goals - Five steps to goals setting: SMART goals, Inclusive goals, Positive stretch, Pain vs. gain, Gun-point commitment – Importance of action orientation - Converting goals to actionable tasks – Establishing road map – UsingGantt chart for planning and progress

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UNIT IV – TIME MANAGEMENT - TOOLS AND TECHNIQUES 6

Pareto 80-20 principle of prioritization – Time quadrants as a way to prioritize weekly tasks – The glass jar principle - Handling time wasters – Assertiveness, the art of saying 'NO' – Managing procrastination

UNIT V – PUTTING INTO PRACTICE 4

Practical's: Using the weekly journal – Executing and achieving short term goals – Periodic reviews

Course Outcomes

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

CO1. Identify the strengths, weaknesses and opportunities
CO2. Set well-articulated goals for academics, career, and personal aspirations
CO3. Establish the road map to realize the goals
CO4. Apply time management techniques to complete planned tasks on time
CO5. Create time and pursue activities of self-interest that add value

Course handouts (compiled by PS team, MCET)

1. Learner's workbook
2. Personal efficiency Journal
3. Reading material for Personal Effectiveness

Further Reading

1. Stephen R Covey, "First things first", Simon & Schuster UK, Aug. 1997.
2. Sean Covey, "Seven habits of highly effective teenagers", Simon & Schuster UK, 2004.
3. College student's guide to time management (e-book)
4. Michael S Dobson, Susan B Wilson, "Goal setting" (e-book)

Operational modality

Enablement through learning workshops	Conducted by external experts and trained internal faculty	2 days7 hours each	14 hours

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Progress monitoring (face to face interaction with student and checking workbook/Journal	Internal faculty	1 hour per week for a minimum of 10 weeks	10 hours
Mid semester reinforcement-workshop	External expert	1 day	6 hours
Total			30 hours
No: of credits			1

Assessments

Assessment	Details	Weightage	Administration	By Whom	When
Knowledge Test*	Multiple choice questions (20)	20%	Pen and paper	Internal team	Immediately after the initial workshop
Final comprehensive Knowledge test*	Multiple choice questions (40)	30%		Internal team	End of semester
Scenario based knowledge test*	Multiple choice scenario responses (15)	30%	Pen and paper	Internal team	Immediately after mid-semester reinforcement

Review of student journal	Student held journal with enough pages for the whole semester	10%	Student journals to be reviewed	Trained Internal faculty	Once in a week.
Review of student journal by external expert		10%	Student journal comprehensive review	External expert and Internal reviewer	End of semester

END OF SEMESTER III

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SEMESTER IV

Course Code : 141EE0401	Course Title :LINEAR ALGEBRA AND NUMERICAL METHODS (Common to EEE and EIE)	
General	L : T : P: C	4 : 0 : 0 : 4
Type: Theory	Total Contact hours:	60Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0102-Engineering Mathematics I
- 141EE0202-Engineering Mathematics II

Course Objectives

The course is intended to:

1. Explain the basic concepts of vector spaces.
2. Formulate orthonormal basis.
3. Solve the system of equations & Calculate the dominant Eigen value.
4. Predict the unknown values from the given set of data & Compute derivatives and integrals.
5. Solve ordinary and partial differential equations

UNIT I - VECTOR SPACES 12

System of linear equations -Vector spaces- Subspace of a vector space- -basis and dimension of vector space —linear combination and spanning sets of vectors -linear independence and linear dependence of vectors— Row space, Column space and Null space- Rank and nullity of subspaces. Applications to linear equations: Simple electrical network problems to find loop current using Kirchhoff's voltage law.

UNIT II – ORTHOGONALITY AND INNER PRODUCT SPACES 12

Inner product of vectors: length of a vector, distance between two vectors, and orthogonality of vectors-Orthogonal projection of a vector-Gram-Schmidt process to produce orthogonal and orthonormal basis -Inner product spaces- Fourier approximation of continuous functions using inner product spaces.

UNIT III – SOLUTION OF EQUATIONS AND CURVE FITTING 12

Solution of system of linear equations-Direct method: Gaussian elimination method,

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Iterative methods: Gauss-Seidel - sufficient conditions for convergence. Power method to find the dominant Eigen value and the corresponding Eigen vector. Non-linear

equation: Newton method, order of convergence. Curve fitting: Method of least squares.

UNIT IV – INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION **12**

Unequal intervals: Lagrange's interpolation, Equal intervals: Newton's forward, backward interpolation – Numerical Differentiation. Numerical Integration – Trapezoidal rule – Simpson's 1/3 rule

UNIT V –NUMERICAL SOLUTION OF ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS **12**

Solution of first order ordinary differential equations: Taylor's series, Euler's method, Runge-Kutta method of fourth order- Multistep method: Adam's method.

Classification of Partial differential equations- Numerical solution of Laplace equation and Poisson equation by Liebmann's method - solution of one dimensional heat flow equation - Bender - Schmidt recurrence relation.

Course Outcomes

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

CO1. Explain the basic concepts of vector spaces.
CO2. Apply inner product of vectors to produce an orthonormal basis.
CO3. Solve the linear, non-linear equations and calculate the dominant Eigen value.
CO4. Predict the unknown values from the given set of data and apply numerical techniques to find derivatives and to evaluate integrals.
CO5. Solve ordinary and partial differential equations using numerical techniques.

Text Books

1. David C Lay, Linear Algebra and its Applications, , Pearson Education, New Delhi, Third Edition 2009.
2. Simantha Pal and Subodh C. Bhunia, Engineering Mathematics, Oxford University Press, New Delhi, First Edition., 2015.

Reference Books

1. Gilbert Strang, Linear algebra and its Applications, Cengage Learning India Private Limited, New Delhi,Fourth Edition, 2012.
2. Jain M. K., Iyengar, S. R. and Jain, R. K, Numerical Methods for Scientific and Engineering Computation, New age International Publications,New Delhi, Fifth Edition, 2007.
3. Gerald C.F., and Wheatley P.O., Applied Numerical Analysis, Pearson Education, New Delhi .Sixth Edition, 2006.

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4. Grewal, B.S. and Grewal, J. S., Numerical methods in Engineering and Science,Khanna Publishers, New Delhi, Sixth Edition,2004

Web References

1. http://nptel.ac.in/courses/122104018/node2.html
2. http://nptel.ac.in/courses/111105038/

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Course Code : 141EE0402	Course Title :ENGINEERING MECHANICS	
Core	L : T : P: C	2 : 2 : 0 :3
Type: Theory	Total Contact hours:	60 Hours

Prerequisites: The student should have undergone the course(s):

- Nil

Course Objectives

The course is intended to:

1. Determine the equilibrium condition of particles.
2. Construct free-body diagrams and calculate the unknown forces.
3. Calculate geometric properties such as centroids and moment of inertia.
4. Analyze the effect of dry friction.
5. Calculate and plot the motion of a particle

UNIT I - BASICS AND EQUILIBRIUM OF PARTICLES **6+6**

Forces – system of forces - concurrent forces in plane and space- resultant - problems involving the equilibrium of a particle-free body diagram-equilibrium of particle in space.

UNIT II – EQUILIBRIUM OF RIGID BODIES **6+6**

Rigid bodies-two dimensional structure-moment of force about an axis-moment of a couple-equivalent system of coplanar forces-Rigid body in equilibrium-problems involving equilibrium of rigid body-types of supports-reactions of beams

UNIT III – PROPERTIES OF SURFACES AND SOLIDS **6+6**

Centroids of areas, composite areas, determination of moment of inertia of plane figures, polar moment of inertia-radius of gyration – mass moment of inertia of simple solids.

UNIT IV – FRICTION **6+6**

Characteristics of dry friction, law of dry friction, theory of friction- free body diagram

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for equilibrium and impending motion conditions. Equilibrium conditions involving dry friction, problems involving ladder, wedge. Problems in impending motion condition involving dry friction at some points.

UNIT V –DYNAMICS OF PARTICLES 6+6

Kinematic parameters - displacement, velocity, acceleration and time. Types of motion- uniform, non-uniform motion, motion of particles in plane - Rectilinear and curvilinear motion of particles-normal and tangential component-motion of projectile - Relative motion- Dependent motion.Kinetics of particles-D'Alemberts principle-works energy and impulse momentum method.

Course Outcomes

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

CO1. Use the laws of mechanics to determine the equilibrium condition of particles.

CO2. Construct free-body diagrams and calculate the unknown forces necessary to ensure static equilibrium

CO3. Calculate geometric properties such as centroids and moment of inertia

CO4. Analyze the effect of dry friction in contact surfaces (ladder ,wedge)

CO5. Calculate and plot the motion of a particle

Text Books

1. R.C. Hobbler, Engineering Mechanics: Combined Statics & Dynamics, Prentice Hall, New Delhi, Twelth Edition,2009.
2. F.P. Beer, and Jr. E.R Johnston, Vector Mechanics for Engineers – Statics and Dynamics, Tata McGraw-Hill Publishing Company, New Delhi, Tenth Edition,2012

Reference Books

1. James L. Meriam and L.GlennKraige, "Engineering Mechanics (Statics and Dynamics)", John Wiley & Sons, Third Edition, 2008.
2. Shames.I.H, and Krishna MohanaRao.G, "Engineering Mechanics (Statics and Dynamics)", Dorling Kindersley (India) Pvt. Ltd. Pearson Education, 200Z
3. S. Rajasekaran and G. Sankarasubramanian, Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., New Delhi, Fourth Edition,2005.

Web References

1. http://nptel.ac.in/courses/122104018/node2.html
2. http://nptel.ac.in/courses/111105038/

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Course Code : 141EE0403	Course Title :SYNCHRONOUS AND INDUCTION MACHINES	
Core	L : T : P: C	3 : 0 : 0 : 3
Type: Theory	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0103-Engineering Physics
- 141EE0302-DC Machines and Transformers
- 141EE0305-Electro Magnetic Theory

Course Objectives

The course is intended to:

1. Explain the terminology, principles and theory of operation of generators.
2. Explain the working, performance and applications of motors.
3. Interpret the construction types, losses, efficiency, parameters of motors.
4. Select the different starting and speed control methods.
5. Discuss the construction, principle of operation and applications of motors.

UNIT I - SYNCHRONOUS GENERATOR 11

Introduction - stationary armature - types - EMF equation – armature reaction – voltage regulation – pre-determination of regulation by EMF, MMF, and ZPF methods. Load characteristics – parallel operation – synchronizing torque, reactance and power – load sharing – alternator on infinite bus bar – two reaction theory analyses – predetermination of voltage regulation for salient pole machines.

UNIT II – SYNCHRONOUS MOTOR 9

Theory of operation – phasor diagrams - variations of current and power factor with excitation –selection of starting methods – hunting and methods of suppression – power angle relations – V and inverted V curves – application as phase modifier

UNIT III – THREE PHASE INDUCTION MOTOR 10

Constructional details – types of rotors – principle of operation – production of RMF – torque equation – torque slip characteristics – maximum torque – slip for maximum power – effect of rotor resistance – losses and efficiency - induction generators -

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performance calculation: Testing – load test – no load and blocked rotor tests, circle diagram – separation of no load losses

UNIT IV – STARTING AND CONTROL OF THREE PHASE INDUCTION MOTOR 7

Selection of starting methods: DOL, stator resistance, auto transformer, rotor resistance and star–delta starters. Selection of speed control methods: Speed control by change of frequency, V/F ratio, number of poles and change of slip– Electrical Braking: Cogging – crawling - plugging - regenerative and dynamic braking.

UNIT V –SINGLE PHASE INDUCTION MOTOR AND SPECIAL MACHINES 8

Constructional details of single phase induction motor – double field revolving theory – equivalent circuit. Selection of self-starting methods: Types of Single phase induction motor -Split phase, capacitor start, capacitor start capacitor run, permanent split capacitor, shaded pole starting methods – starting and running characteristics – applications. **Special Machines:** Hysteresis motor, Eddy current motor, Universal Motor, Reluctance motor, BLDC motor.

Course Outcomes

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

CO1. Explain the terminology, principles and theory of operation of synchronous generator

CO2. Explain the working, performance and applications of synchronous motors

CO3. Interpret the construction types, losses, efficiency, parameters and applications of three phase Induction motors

CO4. Select the different starting and speed control methods for three phase induction motors

CO5. Discuss the construction, principle of operation and applications of single phase induction motors

Text Books

1. Nagrath I.J Kothari D.P, "Electric Machines", Tata McGraw Hill publishing company Ltd, New Delhi, Third Edition,2010.
2. Murugesh Kumar, K, "Induction & Synchronous Machines", Vikas publishing house Pvt. Ltd.,Noida,First Edition, 2000

Reference Books

1. Bimbhra. P.S., "Electrical Machinery", Khanna Publishers, New Delhi, Seventh Edition, 2011.

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2. Gupta. J.B., "Theory and Performance of Electrical Machines", S.K. Kataria and Sons, New Delhi,Fourth Edition, 2010.
3. Theraja. B.L., Theraja. A.K. "A Textbook of Electrical Technology, Volume II (AC & DC Machines)", ,S.Chand& Company Ltd, New Delhi, Fifth Edition, 2006
4. A.E.Fitzgerald, Charles Kingsley, Stephen.D.Umans, "Electric Machinery", Tata Mcgraw Hill, New Delhi, Fifth Edition, 2013.

Web References

1. http://www.nptelvideos.in/2012/11/basic-electrical-technology.html
2. http://www.nptelvideos.in/2012/11/electrical-machines-i.html
3. http://www.nptel.ac.in/courses/108106072/

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Course Code : 141EE0404	Course Title :ELECTRONIC CIRCUITS	
Core	L : T : P: C	4 : 0 : 0 : 4
Type: Theory	Total Contact hours:	60Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0203-Material Science
- 141EE0204-Electron Devices

Course Objectives

The course is intended to:

1. Explain the operation of power supplies.
2. Compare different types of biasing.
3. Explain the performance of transistor amplifiers.
4. Classify the power amplifiers and explain their operation.
5. Explain the operation of oscillators and multivibrators.

UNIT I - RECTIFIER CIRCUITS AND POWER SUPPLIES 12

Half wave, full wave and Bridge rectifiers with resistive load, Analysis for output voltage and ripple voltage with simple capacitive filter, electronically regulated DC power supplies-line and load regulation, SMPS.

UNIT II – TRANSISTOR BIASING 12

Need for biasing-Operating Point- Variation of operating point- Load Line-Stability factor- Different types of biasing circuits for BJT-Fixed bias, Feedback bias and Self bias-Biasing of JFET and MOSFET.

UNIT III – TRANSISTOR AMPLIFIERS 12

Cascade amplifiers – direct coupled and capacitor coupled two stage CE amplifiers, Cascode amplifiers, Differential amplifier, Darlington Pair, Tuned Amplifiers – single tuned, and double tuned amplifiers, Frequency response of amplifiers.

UNIT IV – POWER AMPLIFIERS 12

Classification of Power amplifiers - Class A- direct and Transformer coupled amplifiers, Class B - Push-pull & Complementary symmetry amplifiers, Conversion efficiency calculations, cross over distortion – Class AB amplifier - Power transistor heat sink design.

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UNIT V –OSCILLATORS AND WAVE SHAPING CIRCUIT 12

Conditions for oscillations – LC oscillators –Hartley and Colpitt oscillators -RC oscillators– Phase shift and Wein bridge , Crystal oscillators, Clipper, Clamper, Multivibrators – Astable, Monostable and Bistable.

Course Outcomes

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

CO1. Explain the operation of power supplies with filters.
CO2. Compare different types of biasing of BJT, JFET and MOSFET
CO3. Explain the performance of transistor amplifiers with their frequency response.
CO4. Classify the power amplifiers and explain their operation.
CO5. Explain the operation of oscillators and multivibrators.

Text Books

1. Robert L.Boylestad, Louis Nasheisky, "Electronic Devices and Circuit Theory", Pearson Education, New Delhi, Ninth Edition, 2007.
2. S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, "Electronic Devices and Circuits" by, Tata McGraw Hill, New Delhi, Second Edition 2008.

Reference Books

1. Jacob Milliman, et al, "Pulse, Digital & Switching Waveforms by, TMH, New Delhi, Second Edition 2008. Floyd, "Electronic Devices", Pearson Education, New Delhi, Sixth Edition, 2002.
2. B.P. Singh and Rekha Singh, "Electronic Devices and Integrated Circuits", Pearson Education, New Delhi, 2006.
3. Sedra and Smith, "Microelectronic Circuits", Oxford University Press, New Delhi, Sixth Edition, 2011.
4. David A. Bell, "Solid State Pulse Circuits" Prentice Hall of India , New Delhi, Fourth Edition,1992.

Web References

1. http://nptel.ac.in/courses/117108038/1
2. http://nptel.ac.in/courses/117107094/27
3. http://nptel.ac.in/courses/117101106/6

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Course Code : 141EE0405	Course Title: MEASUREMENTS AND INSTRUMENTATION	
Core	L : T : P: C	3 : 0 : 0 : 3
Type: Theory	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0103-Engineering Physics
- 141EE0303-Electric Circuit Analysis

Course Objectives

The course is intended to:

1. Explain the fundamentals and working of Instruments.
2. Explain different measurement schemes.
3. Measure the values of electrical elements.
4. Explain different storage and display devices.
5. Explain the different types of transducers and elements of data acquisition

UNIT I - STANDARDS AND INDICATING INSTRUMENTS 9

SI units , Standards, Functional elements of an instrument, Static and dynamic characteristics, D' Arsonval Galvanometer , Errors in measurement , Principle of operation and constructional details of moving coil, moving iron, dynamometer type Instruments, errors and compensations.

UNIT II – MEASUREMENT OF POWER AND ENERGY 9

Dynamometer type wattmeter, LPF wattmeter – Errors and compensation. Measurement of energy in single and three phase circuits, Induction type energy meter , Errors and compensation, Calibration, Maximum demand meter, power factor meter, Instrument transformers.

UNIT III – BRIDGES & POTENTIOMETERS 9

Resistance measurement: Kelvin double bridge, Wheatstone bridge, Megger
Measurement of inductance and capacitance: Maxwell, Anderson, and Schering bridge. Hay's bridge, Wien bridge.

DC potentiometers: Crompton's type, Vernier type

AC potentiometers : drysdale polar potentiometers.

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UNIT IV – STORAGE AND DISPLAY DEVICES 9

Magnetic disk and tape, Recorders, digital plotters and printers, CRT display, digital CRO, DSO, LED, LCD & dot matrix display, Smart meters (AMI)- Data Loggers.

UNIT V –TRANSDUCERS AND DATA ACQUISITION SYSTEMS 9

Classification of transducers, Selection and specification of transducers , Resistive, capacitive & inductive transducers, Piezoelectric, optical and digital transducers , Elements of data acquisition system.

Course Outcomes

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

CO1. Explain the fundamentals and working of Indicating Instruments.
CO2. Explain different measurement schemes for measuring power and energy.
CO3. Determine the values of electrical elements using suitable bridges and potentiometers.
CO4. Explain different storage and display devices.
CO5. Explain the different types of transducers and elements of data acquisition.

Text Books

1. Sawhney A K, "A Course in Electrical and Electronic Measurement and Instrumentation", DhanpatRai& Sons, New Delhi, Nineteenth Revised Edition, Reprint 2014.
2. Doebelin E O and Dhanesh N Manik, "Measurement Systems", McGraw-Hill, New Delhi, Sixth Edition 2012

Reference Books

1. David A. Bell, "Electronic Instrumentation and Measurements", Oxford University Press, New Delhi, 2012.
2. Gupta. J. B., "A Course in Electrical and Electronic Measurements", S. K. Kataria& Sons, New Delhi, Tenth Edition, 2013.
3. Kalsi. H.S., "Electronic Instrumentation", Tata McGraw Hill, New Delhi, Second Edition Sixth Reprint 2006.
4. R.K.Rajput, "Electrical and Electronic Measurements and Instrumentation", S Chand & Company-New Delhi, Second Edition, 2008.

Web References

1. http://nptel.ac.in/courses
2. www.edx.org
3. www.coursera.com

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Course Code : 141EE0406	Course Title: NETWORKS AND SIGNALS	
Core	L : T : P: C	4 : 0 : 0 : 4
Type: Theory	Total Contact hours:	60 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0303-Electric Circuit Analysis

Course Objectives

The course is intended to:

1. Determine the various network quantities.
2. Synthesize RL, RC and LC networks.
3. Design a constant K & M-Derived filter.
4. Classify the type of signals & systems and Perform operation.
5. Analyze Discrete time systems.

UNIT I - TWO PORT NETWORK 12

Network functions – Poles and zeros of network functions –Properties of Driving point and transfer Functions– Two port parameters- Z,Y,h,g and ABCD, A'B'C'D' – Interrelationship of different Parameters, Interconnection of Two port Networks– T and π Representation–Analysis of ladder and lattice networks.

UNIT II – RELIABILITY AND SYNTHESIS OF NETWORKS 12

Hurwitz polynomial – Positive real functions – Properties of LC,RC and RL driving point functions — Synthesis of driving point LC,RC and RL functions – Foster and Cauer form

UNIT III – FILTERS 12

Classification of Filters- Filter Networks-Characteristic Impedance in Pass band and Stop band- Design of constant K, M derived filters- Band pass filter- Band Elimination filter.

UNIT IV – CLASSIFICATION OF SIGNALS AND SYSTEMS 12

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 - Typical signal processing operations: Linear convolution, Circular Convolution, Correlation

UNIT V –ANALYSIS OF SIGNALS 12

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Sampling of CT signals, Sampling Theorem, Effect of under Sampling- Aliasing- Reconstruction of CT signal from Samples- Fourier Series representation of DT periodic signals (DTFS)- properties, Representation of DT aperiodic signals by Fourier Transform (DTFT), properties.

Course Outcomes

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

CO1. Determine the various quantities of two port network
CO2. Synthesize RL, RC and LC networks by Foster and Cauer form
CO3. Design a constant K & M-Derived filter
CO4. Classify the type of signals & systems and Perform operation on signals
CO5. Analyze discrete time systems.

Text Books

1. Sudhakar A and Shayam Mohan S P, "Circuits and Networks - Analysis & Synthesis", Tata McGraw Hill, New Delhi, Fifth Edition, 2015.
2. Alan V.Oppenheim, Alan S.Willsky and S. Hamid Nawab, "Signals and Systems", Prentice Hall of India, New Delhi, Second Edition, 2010.

Reference Books

1. R FrankilnF.Kuo, "Network Analysis and Synthesis "Wiley India, Second Edition, Students Edition, 2009.
2. M.E. Van Valkenberg, "Introduction to Modern Network Synthesis" Wiley Eastern; 1986.
3. S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', Tata McGraw Hill, New Delhi, Fourth Edition, 2011.
4. S. Salivahanan, A. Vallavaraj, C. Gnanapriya, 'Digital Signal Processing', Tata McGraw Hill, New Delhi, Second Edition, 2011.

Web References

1. http://nptel.ac.in/courses/108102042/
2. http://www.nptelvideos.in/2012/11/networks-signals-and-systems.html

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Course Code : 141EE0407	Course Title :SYNCHRONOUS AND INDUCTION MACHINES LABORATORY	
Core	L : T : P: C	0 : 0 : 4 : 2
Type: Practical	Total Contact hours:	60 Hours

Prerequisites: The student should have undergone the course(s):

- Nil

Course Objectives

The course is intended to:

1. Predetermine the regulation.
2. Perform the load characteristics.
3. Predetermine the performance.
4. Demonstrate the working of starters.
5. Demonstrate the parallel operation.

LIST OF EXPERIMENTS **60**

1. Load test on three phase Alternator
2. Regulation of three phase alternator by EMF and MMF methods.
3. Regulation of three phase salient pole alternator by slip test.
4. Parallel operation of three-phase alternators.
5. Determination of V and Inverted V Curves of Synchronous Motor.
6. No load and blocked rotor test on a three phase induction motor.
7. Demonstrate the working of different types of starters, and speed control techniques for three phase induction motor.
8. No load and blocked rotor test on a three phase induction motor -Circle diagram
9. Load test on a three phase and single phase induction motor.
10. No load and blocked rotor test on single phase induction motor.

Course Outcomes

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

CO1. Predetermine the regulation of three phase alternators.
CO2. Perform the load characteristics of synchronous and induction machines.
CO3. Predetermine the performance of Induction machines.
CO4. Demonstrate the working of AC machine starters.
CO5. Demonstrate the parallel operation of three phase Alternators.

Reference Books

1. Gupta. J.B., "Theory and Performance of Electrical Machines", S. K. Kataria and Sons, 2010

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2. "Synchronous And Induction Machines Laboratory Manual" prepared by Department of Electrical and Electronics Engineering

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Course Code : 141EE0408	Course Title :ELECTRON DEVICES AND CIRCUITS LABORATORY	
Core	L : T : P: C	0 : 0 : 4 : 2
Type: Practical	Total Contact hours:	60 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0203-Material Science
- 141EE0204-Electron Devices

Course Objectives

The course is intended to:

1. Demonstrate the characteristics.
2. Demonstrate the settings, configurations and measurement.
3. Obtain the frequency response.
4. Construct and test different application oriented electronic circuits.
5. Demonstrate any application circuit.

LIST OF EXPERIMENTS **60**

1. a) V-I characteristics of P-N junction diode
   b) Zener diode as a voltage regulator.
2. Half wave and full wave rectifiers and the effect of filters on the wave.
3. Settings, configurations and measurement using Function Generator and CRO.
4. Drain current - drain voltage and Drain current – gate bias characteristics of JFET.
5. Input and output characteristics of BJT in CE configuration
6. Frequency response curve for single stage CE amplifier.
7. Response of a Single Tuned Amplifier
8. Characteristics of a RC Oscillator
9. Characteristics of a LC Oscillator
10. Clipper and Clamper.
11. Multivibrator.
12. Mini Project – Simulation

Course Outcomes

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

CO1. Demonstrate the characteristics of diodes and transistors.

CO2. Demonstrate the settings, configurations and measurement of Function Generator and CRO

CO3. Obtain the frequency response of amplifiers

CO4. Construct and test different application oriented electronic circuits using hardware.

CO5. Demonstrate any application circuit using software.

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Reference Books

1. "Handbook of experiments in Electronics and Communication Engineering" , S. Poorna Chandra Rao and B.Sasikala, Vikas publishing house (P) Ltd, New Delhi 2003.
2. Lab manual prepared by the Department.

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Course Code : 141EE0409	Course Title: ETHICAL AND MORAL RESPONSIBILITY	
General	L : T : P: C	0 : 0 : 2 : 1
Type: PS	Total Contact hours:	30 Hours

Prerequisites: The student should have undergone the course(s):

- Nil

Course Objectives

The course is intended to:

1. Articulate the importance of ethical and moral responsibilities.
2. Explain the fundamental aspects of ethics and morality.
3. Validate one's appropriate and inappropriate behaviors.
4. Elaborate code of conduct.
5. Explain the importance of professional practices.

UNIT I - ETHICAL PRACTICES – IMPORTANCE **8***

Why ethical practices; The current day scenario of ethical practices – parents, society, politics & business; Awareness of skewedness of information – news, advertisements and other media; The need for ethical and moral responsibility on a personal level; Handling oneself amidst peer pressure and societal pressure;

UNIT II – ETHICAL PRACTICES – FUNDAMENTALS **6***

Morality & Ethics; Moral issues, inquiry, moral dilemmas; Moral autonomy – Kohlberg's theory and Gilligan's refinement; Theories on "right action" – virtue ethics, utilitarianism, duty ethics, rights ethics – resolving moral dilemmas; justifying moral obligations;

UNIT III – CODES OF CONDUCT **8***

Importance of code of conduct and its role; Evolving draft Code of conduct for different roles – son/daughter, student, future employee & citizen; Reflection on real time incidences at the college.

Engineers as responsible experimenters; Faith of the Engineer (ABET); Pledge and

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Code of ethics as per National Society of Professional Engineers (NSPE); Code of Ethics of Institution of Engineers (India); Case studies and discussions in professional context

UNIT IV – PROFESSIONAL PRACTICES AT WORK **8***

Transition from a student to a professional; Importance of professional practices at work; Integrity as the topmost virtue of a professional; Self-awareness: Where competence ends and professionalism takes over; Professional qualities;

Need to align oneself to culture & values of organizations; Need to embrace diversity in organizations.

*- Includes review sessions

Course Outcomes

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

CO1. Articulate the importance of ethical and moral responsibilities.
CO2. Explain the fundamental aspects of ethical practices
CO3. Validate one's appropriate and inappropriate behaviors in various roles.
CO4. Elaborate code of conduct of professional bodies.
CO5. Explain the importance of professional practices as a future employee/entrepreneur.

Assessments

Assessment	Details	Wt:	Administration	When
Class room participation	Group assignments presentation; Case discussions participation	70%	Continuous assessment in class	During class
Knowledge test	Multiple choice questions	10%	Pen and Paper	End of course
Scenario based assessments	Multiple choice questions	20%	Pen and Paper	End of course

No. of hours & credits:

Enablement through class room lecture, case discussions and group presentations	Conducted by trained internal faculty	30 hours – 1 credit
At least two guest lectures	Delivered by senior people from Industries/Government organizations	

Course handouts (compiled by Professional Skills team, MCET)

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1. Instructor's Manual (for the faculty)
2. Learner's workbook (for the student)

Reference Books

1. Mike W Martin & Roland Schinzenger, "Ethics in Engineering", Latest Edition, Tata McGraw-Hill
2. Code of conduct document, MCET student handbook
3. Gail D Baura, "Engineering Ethics - an industrial perspective", Academic Press, Elsevier,
4. SubratoBagchi, "The professional - Defining the new standard of Excellence at work", Penguin Books India.

END OF SEMESTER IV

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SEMESTER V

Course Code : 141EE0501	Course Title: GENERATION, TRANSMISSION AND DISTRIBUTION	
Core	L : T : P: C	3 : 2 : 0 : 4
Type: Theory	Total Contact hours:	75 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0303- Electric Circuit Analysis
- 141EE0305- Electro Magnetic Theory

Course Objectives

The course is intended to:

1. Explain the concept of power generation.
2. Compute the transmission line parameters.
3. Determine the performance and mechanical design
4. Compute the voltage distribution in insulator and dielectric stress in cables.
5. Determine the voltage of AC and DC distributors.

UNIT I - POWER GENERATION **9+3**

Generation, transmission and distribution Scenario of India - types of generation: conventional- thermal power plant, hydro power plant, nuclear power plant-concept of distributed generations: solar, wind and hybrid systems-load capacity factor - connected load factor - load duration curve - selection of units-economics of power generation-types of tariff.

UNIT II – TRANSMISSION LINE PARAMETERS **9+9**

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 transposition- application of self and mutual GMD- skin and proximity effects- interference with neighboring communication circuits-economic choice of power transmission-types of conductors and rating.

UNIT III – ANALYSIS OF TRANSMISSION LINES **9+6**

Transmission lines: types-short line, medium line and long line- equivalent circuits, attenuation constant, phase constant, surge impedance- transmission efficiency and voltage regulation-surge-impedance loading, load ability limits based on thermal loading, angle and voltage stability considerations-introduction to shunt and series compensation-Ferranti effect and corona loss -calculation of sag and tension.

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UNIT IV – INSULATORS AND CABLES 9+6

Insulators: types, voltage distribution in insulator string, improvement of string efficiency-underground cables: constructional features of LT and HT cables, capacitance, dielectric stress and grading, thermal characteristics -IEEE recommended practice for cables.

UNIT V - DISTRIBUTION SYSTEM 9+6

Feeders, distributors and service mains - radial and ring main systems - calculation of voltage in distributors with concentrated and distributed loads, A.C. single phase and three phase distribution systems- IEEE recommended practice for distribution systems-voltage classification standards-overview of Indian grid system.

Course Outcomes

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

CO1. Explain the structure of power system, sources of electrical energy, various factors of load curves, tariffs.

CO2. Compute the transmission line parameters.

CO3. Determine the performance and mechanical design of various types of transmission lines.

CO4. Compute the voltage distribution in insulator and dielectric stress in cables.

CO5. Determine the voltage at various load points of AC and DC distributors.

Text Books

1. Wadhwa, C.L., "Electrical Power Systems", Sixth Edition, New age International, 2014.
2. M.L. Soni, Gupta, Bhatnagar, Chakrabarthy, "A Text book on Power Systems Engineering", DanpatRai& Sons, 2010 Edition.

Reference Books

1. S.N. Singh, "Electric Power Generation, Transmission and Distribution", Prentice Hall of India Pvt. Ltd, Second Edition, 2010.
2. B.R. Gupta, "Generation of Electrical Energy", S. Chand & Company Ltd, fourth edition, 2014.
3. Leonard L. Grigsby, "Electric Power Generation, Transmission and Distribution", CRC Press, Third Edition, 2012.
4. HaadiSaadat, "Power System Analysis", TATA Mcgraw Hill, Third Edition, 2010.
5. V.K.Mehta, Rohit Mehta," Principles of Power System", S Chand & Co Ltd, Fourth Edition, 2011.

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Web References

1. nptel.ac.in/courses/108102047
2. www.tangedco.gov.in
3. http://www.enernoc.com
4. https://standards.ieee.org/findstds/standard/power_and_energy_all
5. http://www.nrldc.org/docs/documents/articles/gridmgmtoverview_nov2007_electricalindia.pdf

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Course Code : 141EE0502	Course Title: CONTROL SYSTEMS (Common to EEE & EIE)	
Core	L : T : P: C	3 : 2 : 0 : 4
Type: Theory	Total Contact hours:	75 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0303 Electric Circuit Analysis
- 141EE0406 Networks and Signals

Course Objectives

The course is intended to:

1. Model electrical and mechanical systems.
2. Determine the time response and time domain specifications.
3. Analyze the given first order and second order systems.
4. Analyze the system stability.
5. Design compensator.

UNIT I - CONTROL SYSTEM MODELING **9+6**

Basic Elements of Control System – Open loop and Closed loop systems - Transfer function, Modelling of Electrical systems, mechanical systems: Translational and rotational systems- Transfer function of armature and field controlled DC motor- Block diagram reduction Techniques – Signal flow graph

UNIT II – TIME RESPONSE ANALYSIS **9+6**

Standard test signals - Time response of first order systems - Impulse and Step Response analysis of second order systems – Time Domain specifications - Steady state errors and error constants – Effects of P, PI, PD and PID Controllers on the system's response

UNIT III – FREQUENCY RESPONSE ANALYSIS **9+6**

Frequency Response – Bode Plot: Gain margin, Phase margin, gain & phase crossover frequency-Polar Plot: Gain margin, Phase margin, - Frequency Domain specifications from the plots – correlation between time domain and frequency domain specifications

UNIT IV – STABILITY ANALYSIS **9+6**

Stability, Routh-Hurwitz Criterion, Concept of Root Locus Technique, Construction of Root Locus, Effects of adding poles and zeros – Nyquist Stability Criterion

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UNIT V - COMPENSATOR DESIGN

9+6

Performance criteria – Lag, lead and lag-lead networks – Compensator design using bode plots. Compensator Design using MATLAB.

Course Outcomes

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

CO1. Model electrical and mechanical systems using transfer function

CO2. Determine the time response and time domain specifications of first order and second order systems

CO3. Analyze the given first order and second order system with their frequency domain specifications.

CO4. Analyze the stability of the given system.

CO5. Design compensator using bode plot technique

Text Books

1. J. Nagrath and M. Gopal, 'Control Systems Engineering', New Age International Publishers, Fifth Edition 2009.
2. Benjamin C. Kuo, 'Automatic Control systems',Tenth Edition Pearson Education, New Delhi, 2017.

Reference Books

1. Norman S. Nise, 'Control Systems Engineering', Fifth Edition, John Wiley, New Delhi, 2009.
2. SamarajitGhosh, 'Control systems Theory and Applications ',Second Edition Pearson Education, New Delhi, 2012.
3. M. Gopal, 'Control Systems, Principles and Design', Fourth Edition Tata McGraw Hill, New Delhi, 2012.
4. K. Ogata, 'Modern Control Engineering', Pearson Education India, Fifth Edition New Delhi, 2015.
5. Richard C.Dort and Robert H.Bishop, "Modern Control Systems ", Pearson Prentice Hall ,Thirteenth Edition 2016

Web References

1. http://nptel.ac.in/courses/108101037/
2. https://www.tutorialspoint.com/control_systems/control_systems
3. http://lpsa.swarthmore.edu/Root_Locus/RLocusExamples.html
4. https://in.mathworks.com/help/control/examples/compensator-design-for-systems-represented-by-frequency-response-data.html

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Course Code : 141EE0503	Course Title: MICROPROCESSOR AND MICROCONTROLLER (Common to ECE & EEE)	
Core	L : T : P: C	3 : 0 : 0 : 3
Type: Theory	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 140EE0303–Digital Electronics

Course Objectives

The course is intended to:

1. Explain the basic architecture of microprocessor.
2. Choose appropriate technique to interface the peripheral devices with microprocessor.
3. Write PIC18/PIC16 microcontroller programs.
4. Develop on-chip peripheral's programs.
5. Design a microcontroller system.

UNIT I - MICROPROCESSOR ARCHITECTURE 9

Evolution of Microprocessor, Introduction to 8 bit Microprocessor: ALU – Registers - System buses – Memory –Data Format - Opcode format - Addressing modes - Instruction sets and Computer languages - Internal operation of microprocessor, 8086 architecture

UNIT II – 8086 PERIPHERALS INTERFACING 9

External Memory interfacing, Parallel Peripheral Interface, Keyboard/Display controller, USART, Interrupt controller, DMA controller .

UNIT III – PIC MICROCONTROLLER AND PROGRAMMING 9

PIC18FX Pin connection, Architecture: WREG register – File register – Status register, I/O Ports, Data type and Time delay in C , Logical operation, Data sterilization, Program ROM Allocation, Data RAM allocation, Introduction to MPLAB IDE.

UNIT IV – INTERRUPTS AND TIMER 9

Programming Timer and Counter, Basics of Serial communication: Serial port programming, Interrupt: Timer Interrupt - External Hardware Interrupts - Serial Communication Interrupts, ADC characteristics: ADC Programming, Compare and Capture Mode - PWM Programming

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UNIT V - SYSTEM DESIGN AND APPLICATION 9

LCD interfacing, Keyboard interfacing, SPI bus protocol, DS1306 RTC interfacing and programming, Relay and opto-isolator, stepper motor interfacing, DC motor interfacing, PWM motor control with CCP.

Course Outcomes

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

CO1. Explain the basic architecture of microprocessor

CO2. Choose appropriate technique to interface the peripheral devices with microprocessor

CO3 Write PIC18/PIC16 microcontroller programs using Embedded C.

CO4. Develop programs for on-chip peripherals

CO5. Design a system using microcontroller

Text Books

1. R.S.Gaonkar,"Microprocessor Architecture, Programming and Applications with the 8085", Fifth Edition, Prentice Hall, 2002.
2. Muhammad Ali Mazidi, RolinD.Mckinlay, Danny Causery,"PIC Microcontroller and Embedded systems using assembly and C PIC18", Pearson international edition, 2008.

Reference Books

1. A.K Ray , K.M.Bhurchandi ,"Advanced Microprocessors and Peripherals" Third Edition McGraw Hill Education 2012
2. Douglas V.Hall, "Microprocessor and Interfacing, Programming and Hardware", Revised Second Edition, Tata McGraw Hill, Indian Edition 2007.
3. Krishna Kant, "Microprocessor and Microcontroller Architecture, Programming and System Design using 8085, 8086, 8051 and 8096", PHI, 2011.
4. John B Peatman, "Designing with PIC Micro Controller", 1 st Edition, Pearson, 2003.
5. MykePredko, "Programming and Customizing the PIC Microcontroller" 3rd edition Tata McGraw hill 2008.

Web References

1. http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/microcontrollers/micro/ui/TOC.htm
2. https://www.tutorialspoint.com/microprocessor/microprocessor_8086_overview.htm
3. http://www.microchip.com/design-centers/microcontrollers
4. https://electrosome.com/category/tutorials/pic-microcontroller/hi-tech-c/

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Course Code : 141EE0504	Course Title: POWER ELECTRONICS (Common to EEE & EIE)	
Core	L : T : P: C	2 : 2 : 0 : 3
Type: Theory	Total Contact hours:	60 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0204 - Electron Devices
- 141EE0303-Electric Circuit Analysis.

Course Objectives

The course is intended to:

1. Explain various power switching devices.
2. Compute the performance parameters.
3. Identify a DC-DC converter.
4. Explain the operation of inverters and harmonic reduction.
5. Describe the operation of AC voltage controller and cyclo converter

UNIT I - POWER SWITCHES **6+6**

Power Diode: reverse recovery characteristics, types

SCR: Two transistor model, turn-on methods, commutation techniques, dynamic behavior, types, series and parallel connection, UJT trigger circuit, protection circuits: over voltage and over current and snubber circuits, losses and cooling

TRIAC & GTO: Construction, dynamic behavior and driver circuit

MOSFET& IGBT: Construction, dynamic behavior and driver circuit

UNIT II – CONTROLLED RECTIFIERS **6+6**

Controlled Rectifiers: 1 pulse, 2 pulse, 3 pulse and 6 pulse converters with R and RL loads, dual converter, performance parameters, estimation of average load voltage and effect of source impedance.

UNIT III – DC CONVERTERS **6+6**

Choppers: Principle of step-up and step-down operation, Time ratio control and current limit control, types, forced commutation techniques (voltage, current and load).

Switching regulators: Operation of Buck, Boost and Buck-boost regulators.

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6+6

UNIT IV – INVERTERS

Inverter: single-phase half and full bridge, three-phase six step VSI and CSI, Control: voltage control of single phase inverter, output AC voltage control and harmonic reduction.

UNIT V - AC-AC CONVERTERS 6+6

AC voltage controller: types of control - on-off, phase angle control and sequence control, Single phase: With R and RL loads, Three phase: Star and Delta connected loads.

Cycloconverter: single phase and three phase cyclo converters

Course Outcomes

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

CO1: Explain the operation of various power switching devices and their dynamic characteristics

CO2: Compute the performance parameters of controlled rectifiers

CO3: Identify a DC-DC converter for a given application

CO4:Explain the modulation techniques of PWM inverter and harmonic reduction methods

CO 5: Describe the operation of AC voltage controller and cyclo converter

Text Books

1. Muhammad H. Rashid, "Power Electronics: Circuits, Devices and Applications", Pearson Education, Third Edition (reprint), 2011.
2. P. S. Bimbhra, "Power Electronics", Khanna Publishers, Third Edition, 2004.

Reference Books

1. Ned Mohan, T.M.Undeland, W.P.Robbins, "Power Electronics: Converters, Applications and Design", John Wiley and Sons, Third Edition (reprint), 2009.
2. Joseph Vithayathil, "Power Electronics: Principles and Applications",Tata McGraw-Hill, New Delhi,2010.
3. M.D.Singh and K.B.Khanchandani, 'Power Electronics', Tata McGraw Hills Publishing Company Limited, Second Edition, 2006.
4. Philip T. Krein, 'Elements of Power Electronics', Oxford University Press, First Edition, 2012.
5. Cyril W Lander: Power Electronics, Third Edition, McGraw Hills International Editions,1993.

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Web References

1. http://nptel.ac.in/courses/108101038/1
2. http://www.nptelvideos.in/2012/11/industrial-drives-power-electronics.html
3. http://cusp.umn.edu/power_electronics.php
4. http://ecee.colorado.edu/copec/book/slides/slidedir.html

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Course Code : 141EE0505	Course Title: LINEAR INTEGRATED CIRCUITS	
Core	L : T : P: C	3 : 0 : 0 : 3
Type: Theory	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0204 - Electron Devices
- 141EE0404 - Electronic Circuits

Course Objectives

The course is intended to:

1. Explain the fabrication process of Linear ICs.
2. Describe the construction and characteristics of operational amplifier
3. Discuss the applications of operational amplifier.
4. Discuss the working principle of comparators and data converters.
5. Explain the working of special function ICs.

UNIT I - IC FABRICATION 9

IC classification - Fundamentals of monolithic ICs –Basic Planar Processes - Construction of a typical Integrated circuit– Active and Passive Components of ICs: Monolithic transistors, Monolithic diodes, Integrated Resistors, Integrated Capacitors and Inductors. Thin and Thick film Technology

UNIT II – CIRCUIT CONFIGURATION AND CHARACTERISTICS OF OPAMP 9

Block Diagram of Op-amp - Current mirror and Current source - Widlar current source -Wilson current source - Ideal Op-amp characteristics and its equivalent circuit – DC characteristics - AC characteristics – Concept of frequency compensation-methods of improving slew rate

UNIT III – APPLICATIONS OF OPAMP 9

Ideal Inverting and Non-inverting amplifier - Voltage Follower - Adder– Subtractor - Instrumentation Amplifier - Integrator – Differentiator – Precision rectifiers: Half wave and Full wave rectifier - Fundamentals of Log and Antilog Amplifiers - Low Pass & High Pass Butterworth Filters - Sine wave generators.

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UNIT IV – COMPARATORS AND CONVERTERS 9

Basic Comparators – Zero crossing detectors – Schmitt trigger– Window detector – DAC: specifications - weighted resistor type, R-2R Ladder type. ADC: Specifications - Flash type - Successive Approximation type - Dual Slope type.

UNIT V - SPECIAL FUNCTION ICs AND ITS APPLICATIONS 9

Timer IC 555 – Astable and Monostable multivibrators - Voltage Controlled Oscillator (VCO)- PLL IC 565: Principle of operation -Application of PLL for AM, FM and FSK demodulation -

Voltage regulators-IC 78XX, IC79XX, IC LM317, general purpose regulator IC 723

Course Outcomes

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

CO1. Explain the fabrication process of Linear ICs.

CO2. Describe the construction and characteristics of operational amplifier

CO3. Discuss the applications of operational amplifier.

CO4. Discuss the working principle of comparators and data converters.

CO5. Explain the working of Timers, PLL circuits, Voltage regulator ICs.

Text Books

1. D. Roy Choudhery, Sheil B. Jain, Linear Integrated Circuits, Second Edition, New Age publishers, 2010.
2. RamakantA.Gayakwad, Op-amps and Linear Integrated Circuits, Fourth Edition, Pearson Education, 2009, PHI.

Reference Books

1. Robert F.Coughlin, Fredrick F. Driscoll, 'Op-amp and Linear ICs', PHI Learning, Sixth Edition, 2012.
2. Jacob Millman, Christos C.Halkias, "Integrated Electronics - Analog and Digital circuits system", Tata McGraw Hill, 2003
3. James M. Fiore, Op Amps and Linear Integrated Circuits Concepts and Applications,
   Second Edition, Cengage Learning 2012.
4. S. Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", Third Edition, TMH, 2003
5. David A. Bell, "Op-amp & Linear ICs", Second Edition, Prentice Hall of India,

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2005

Web References

1. http://www.nptel.ac.in/courses/Webcourse-contents/IIT ROORKEE/Analog%20circuits/index.htm
2. http://www.555-timer-circuits.com
3. http://www.technologystudent.com/elec1/elecex.htm
4. http://freevideolectures.com/Course/2915/Linear-Integrated-Circuits#

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Course Code : 141EE0507	Course Title : MICROPROCESSOR AND MICROCONTROLLER LAB (Common to EEE & ECE)	
Core	L : T : P: C	0 : 0 : 4 : 2
Type: Practical	Total Contact hours:	60 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0304 - Digital Electronics

Course Objectives

The course is intended to:

1. Execute Assembly Language program.
2. Design PIC Microcontroller experimental setup.
3. Develop Timer's / counter's program.
4. Test serial communication.
5. Design real time system.

LIST OF EXPERIMENTS **60**

8086 Microprocessor

1. Simple Arithmetic Programming using 8086
2. Interfacing 8255 and 8279 with 8086

PIC16FXX/18FXX Microcontroller

1. Study of IDE
2. Building a PIC16FXX/18FXX Microcontroller based CPU in PCB.
3. Control the LED using switch
4. Buzzer interfacing using Timer/Counter
5. Relay interfacing using transistor driver circuit
6. Transmission and Reception of a byte using on chip serial port
7. Read the temperature sensor value using ADC and display it in LCD
8. Speed and direction control of DC motor

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Course Outcomes

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

CO1. Execute Assembly Language programming to interface 8255 & 8279 using 8086.

CO2. Design the experimental setup for PIC16FXX/18FXX microcontroller board.

CO3. Develop a program for operation of Timers / counters.

CO4. Test the serial communication using on chip serial port.

CO5. Design the real time system using PIC16FXX/18FXX

Reference Book

1. "Microprocessor and Microcontroller Lab" Manual,Department of Electrical and Electronics, MCET, Pollachi.

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Course Code : 141EE0508	Course Title :LINEAR INTEGRATED CIRCUITS LABORATORY	
Core	L : T : P: C	0 : 0 : 4 : 2
Type: Practical	Total Contact hours:	60 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0408 Electronic Devices and Circuits Laboratory
- 141EE0505 Linear Integrated Circuits

Course Objectives

The course is intended to:

1. Design basic electronic circuits.
2. Examine frequency response characteristics of filters.
3. Design op-amp circuits for open and closed loop applications.
4. Analyze the application of PLL.
5. Verify the output of multi-vibrators and power supplies.

LIST OF EXPERIMENTS **60**

1. Design of Inverting, Non inverting and differential amplifiers.
2. Design of Integrator and Differentiator.
3. Design of Instrumentation amplifier.
4. Design of Active low-pass and High-pass filters.
5. Design of RC Phase shift and Wien bridge oscillators using op-amp.
6. Design of comparator applications.
7. Design of weighted resistor and R-2R ladder type DACs.
8. Design of Frequency Multiplier using PLL IC565
9. Design of Astable and Monostable multivibrators using NE555 Timer
10. Design of DC power supply using LM723.

Course Outcomes

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

CO1. Design basic electronic circuits using op-amps and verify their outputs.

CO2. Examine frequency response characteristics of filters.

CO3. Design op-amp circuits for open and closed loop applications and verify their outputs.

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CO4. Analyze the application of PLL.

CO5. Verify the output of multi-vibrators and power supplies.

Reference Book

1. "Linear Integrated Circuits Laboratory" Manual prepared by Department of Electrical and Electronics Engineering, MCET, Pollachi.

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Course Code : 141EE0509	Course Title: TEAMNESS AND INTERPERSONAL SKILLS	
General	L : T : P: C	0 : 0 : 2 : 1
Type: PS	Total Contact hours:	30 Hours

Course Objectives

The course is intended to:

1. Be aware of attitudinal, behavioral and emotional aspects of self.
2. Learn continuously and be in harmony with self.
3. Understand others' preferences, values, roles & contexts.
4. Identify barriers to harmonious relationships.
5. Work collaboratively as a team.

UNIT I - HARMONY WITH SELF

Importance of learning about self continuously; Approaches to learn about self: introspection, being open to feedback, critical incidences as opportunities; Understanding life stages and challenges associated with them; Healthy ways of handling self in response to life's challenges;

Instruments/inventories to understand self and others: A) Know your temperament, B) Mayer Briggs Type Indicator, C) Interpersonal Needs Inventory

UNIT II – HARMONY WITH OTHERS

Importance of living in harmony with others; What it takes to live in harmony with others; Understanding preferences, values, roles and contexts of others; Approaches to navigating through differences between self and others;

Barriers to harmonious relationships - Perceptions, Judgments, and Emotional instability; Ways to handle each of the barriers; Importance of reaching-out to others

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UNIT III – GROUP DYNAMICS AND CONFLICTS RESOLUTION

Group dynamics: overt and covert processes at micro and macro levels; Understanding the basis of conflicts; Understanding one's own conflict handling style; Methods to handling conflicts effectively.

UNIT IV – WORKING IN TEAMS

Effectiveness in communication; Forming – storming – norming and performing model; Competition vs collaboration – impact of both on team tasks; TEAM Questionnaire – components of a healthy team and approaches to improving them.

Course Outcomes

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

CO1. Be aware of attitudinal, behavioral and emotional aspects of self

CO2. Prefer to learn continuously about self and be in harmony with self

CO3. Understand others' preferences, values, roles & contexts and be in harmony with others

CO4. Identify barriers to harmonious relationships and derive ways to handle them

CO5. Work collaboratively as a team to deliver expected outcomes

MODE OF DELIVERY:

1. A 2-day learning workshop
    1. Activities (experiential learning)
    2. Audio visuals (affective learning)
    3. Case discussions (cognitive learning)
    4. Instruments/questionnaires (reflective learning)

Guided by Learner's workbook.

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2. Continuous learning guided by learning journal, and reviews by faculty

3. Half-day reinforcement session towards the end of the semester

EVALUATION:

Sl. No.	Evaluation	Criterion	Total marks		Remarks
1	Continuous Evaluation	KT SKT Evaluation during workshop Weekly review of journal	KT SKT Work book Journal	- 10 marks - 15 marks - 20 marks - 30 marks	KT=Knowledge Test SKT=Scenario based Knowledge Test
			Total	- 75 marks	
2	End semester Evaluation	Comprehensive Examination and Viva voce	KT & SKT, short questions Viva voce	- 10 marks - 15 marks	Conducted for 25 marks
			Total	- 25 marks	
		Total marks for the course	100 marks		
		Condition for clearing the course	50 marks as a whole; but student should have attended the ESE.		

END OF SEMESTER V

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SEMESTER VI

Course Code : 141EE0601	Course Title: ELECTRICAL MACHINE DESIGN	
Core	L : T : P: C	3 : 2 : 0 : 4
Type: Theory	Total Contact hours:	75 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0302- DC Machines and Transformers
- 141EE0403- Synchronous and Induction Machines

Course Objectives

The course is intended to:

1. Explain the design considerations for rotating and static electrical machines.
2. Apply the design procedure for DC machine.
3. Apply the design procedure for transformer.
4. Calculate the design parameters of an induction motor.
5. Calculate the design parameters of synchronous machines.

UNIT I - INTRODUCTION 9+6

Considerations and limitations in design - concept of magnetic circuit – MMF calculation for various types of electrical machines – real and apparent flux density of rotating machines – leakage reactance calculation: transformers, induction and synchronous machine - continuous, short time and intermittent periodic rating - insulation classes

UNIT II – D.C. MACHINES 9+6

Output equation – main dimensions – choice of specific loadings - choice of number of poles – armature design – design of field poles and field coil – design of commutator and brushes

UNIT III – TRANSFORMERS 9+6

Output rating: single phase and three phase transformers – optimum design of transformers – design of core, yoke and windings: core type and shell type – design of tanks and cooling tubes of transformers

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UNIT IV – THREE PHASE INDUCTION MOTORS 9+6

Output equation – main dimensions – choice of specific loadings -design of stator– design of rotor: squirrel cage and slip ring rotor – performance calculation from designed data

UNIT V - SYNCHRONOUS MACHINES 9+6

Output equation – main dimensions – choice of specific loadings- short circuit ratio – design of stator and rotor: cylindrical pole and salient pole machines – design of field coil – cooling of turbo alternators.

Course Outcomes

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

CO1. Explain the design considerations for rotating and static electrical machines with particular reference to magnetic circuit and the thermal rating of machines

CO2. Apply the design procedure for various parts of DC machine

CO3. Apply the design procedure for winding, core and cooling tubes of transformer

CO4. Calculate the design parameters for stator and rotor of an induction motor

CO5. Calculate the design parameters for stator and rotor of synchronous machines

Text Books

1. A.K.Sawhney, 'A Course in Electrical Machine Design', Dhanpatrai and Sons, Delhi, 2014
2. R.K.Agarwal, 'Principles of Electrical Machine Design', S.K.Kataria and Sons,Delhi, 2015

Reference Books

1. Shanmugasundaram, A., Gangadharan G. and Palani R., 'Electrical Machine Design Data Book', New Age InternationalPublishers,Delhi, 2015
2. S.K. Sen, 'Principles of Electrical Machine Design with Computer Programmes'Oxford and IBH Publishing Co.Pvt Ltd., New Delhi, 2010
3. .V.N. Mittle and A. Mittle, 'Design of Electrical Machines', Standard Publications Distributors, Delhi, 2013
4. Rajput R K, 'Electrical Machines', Laxmi Publications,2016
5. M.V.Deshpande "Design and Testing of Electrical Machine Design" Wheeler Publications, 2010

Web References

1. http://www.motor-engineer.net/engineering-center/learn/tutorial-electric-machine-design-hendershot/
2. http://nptel.ac.in/courses/108106023/
3. https://www.youtube.com/watch?v=2nHOHG65VlM&index=2&list=PLJk8qW6_q

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Course Code : 141EE0602	Course Title: DIGITAL SIGNAL PROCESSING	
Core	L : T : P: C	3 : 2 : 0 : 4
Type: Theory	Total Contact hours:	75 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0406-Networks and Signals

Course Objectives

The course is intended to:

CO1. Analyze the discrete time systems.

CO2. Compute Discrete Fourier Transform.

CO3. Design Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) digital filters.

CO4. Analyze the effects of finite word length.

CO5. Apply filters.

UNIT I – DISCRETE TIME SYSTEM ANALYSIS **9+6**

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z transform - application to discrete systems - Stability analysis, frequency response –Convolution using Z-transform- Introduction to DFT – Properties of DFT.

UNIT II – FAST FOURIER TRANSFORM **9+6**

FFT algorithms – Radix-2 FFT algorithms – Decimation in Time (DIT-FFT) and Decimation in Frequency (DIF-FFT) algorithms – DFT analysis of sinusoidal signals. Fast convolution- overlap save method – overlap add method

UNIT III – DESIGN OF DIGITAL FILTERS **9+6**

IIR design: Approximation of analog filter design - Butterworth and Chebyshev; digital design using impulse invariant and bilinear transformation - Warping, prewarping - Frequency transformation.

FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. FIR & IIR filter realization – Parallel & cascade forms.

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UNIT IV – FINITE WORD LENGTH EFFECTS 9+6

Number representations – Quantization – Truncation and Rounding– Quantization noise – Oversampling A/D and D/A Conversion – Quantization of filter coefficients – Effects of finite word length on digital filters – Finite word length effects in FFT algorithms

UNIT V – APPLICATIONS

9+6

Filter design based on Pole/zero – Parametric resonators and equalizers – Notch and Comb filters –Applications of adaptive filtering to equalization.

Course Outcomes

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

CO1. Analyze the discrete time systems using Z and Fourier transforms

CO2. Compute Discrete Fourier Transform of a given discrete time sequence using FFT.

CO3. Design Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) digital filters for a given specification

CO4. Analyze the effects of finite word length on filter implementation

CO5. Apply the design of filters for real time applications

Text Books

1. John G. Proakis & Dimitris G. Manolakis, "Digital Signal Processing – Principles, Algorithms & Applciations", Fourth Edition, Pearson Education/ Prentice Hall, 2007
2. S. Salivahanan, A. Vallavaraj, C. Gnanapriya, 'Digital Signal Processing', Tata McGraw Hill, New Delhi, Second Edition, 2010.

Reference Books

1. Emmanuel C. Ifeachor & Barrie. W. Jervis, "Digital Signal Processing", Second Edition, Pearson Education, Prentice Hall, 2002
2. Sophocles J. Orfanidis, "Introduction to Signal Processing, Prentice Hall, 1996
3. Li Tan, "Digital Signal Processing: Fundamentals and Applications", Academic Press, 2008
4. Johnny R. Johnson, "Introduction to Digital Signal Processing", Prentice-Hall International, 1989
5. Lonnie C. Ludeman, "Fundamentals of digital signal processing", Harper and Row, 1986.
6. Allan V. Oppenheim & Ronald W. Schafer, "Discrete Time Signal Processing", Prentice Hall, Third Edition, 2009

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Web References

1. http://www.dspguide.com/pdfbook.htm (free on-line text in pdf format).
2. www.dspguru.com
3. www.ti.com

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Course Code : 141EE0603	Course Title: PROTECTION AND SWITCHGEAR	
Core	L : T : P: C	3 : 0 : 0 : 3
Type: Theory	Total Contact hours:	45Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0307- DC Machines and Transformers Laboratory
- 141EE0403 - Synchronous and Induction Machines
- 141EE0501 -Generation, Transmission and Distribution

Course Objectives

The course is intended to:

1. Explain the various protection schemes.
2. Explain the types of relays and relay settings.
3. Explain the different types of protection.
4. Describe the different types of circuit breakers.
5. Explain the insulation coordination.

UNIT I - INTRODUCTION TO PROTECTIVE SCHEMES AND OVER VOLTAGES 9

Principles and need for protective schemes - Nature and cause of faults - Types of fault - Power system earthing - Zones of protection and essential qualities of protection - Current limiting reactors - CTs and PTs and their applications in protection schemes.

Surge: Switching surges - Lightning phenomenon - Protections against lightning - Lightning arresters – Types: Rod arrester, Horn gap arrester, Multi gap arrester, Expulsion type lightning arrester, valve type lightning arrester - Surge absorbers.

UNIT II – PROTECTIVE RELAYS 9

Definition - Requirement of relays - Universal relay torque equation - Non directional and directional over current relays - Earth fault relays - Distance relays: Impedance, Mho and Reactance relays - Differential relays - Negative sequence relays - Under frequency relays - Introduction to static relays - Microprocessor and computer based protective relaying.

UNIT III – APPARATUS AND LINE PROTECTION 9

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Alternator: modified scheme of differentia relay, circulating current protection scheme, balanced earth fault protection. Transformer: differential protection, balanced earth fault protection, buchholz's relay. Bus bar: frame leakage protection, circulating current protection Motor protection: short circuit protection, stalling protection- Feeder Protection: Pilot (Translay) relay, Power line carrier communication, Carrier and Microwave pilot relays.

UNIT IV – CIRCUIT BREAKERS AND ARC INTERRUPTION **9**

Functions of switchgear - Elementary principles of arc extinction - Arc control devices - Recovery voltage and restriking voltage - Current chopping and capacitance current breaking - Bulk oil, Low oil, Air break, Air blast, and Sulphur hexafluoride(SF_6) and Vacuum circuit breakers - HVDC breakers – Rating - Testing of circuit breakers.

UNIT V - INSULATION CO-ORDINATION AND IE STANDARDS **9**

Definition - Determination of line insulation - Insulation levels of sub-station equipment – insulation levels at sub stations with protective zones-insulation coordination-BIL-statistical methods for insulation coordination- Introduction to Indian Electricity rules.

Course Outcomes

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

CO1: Explain the various protection schemes for faults and over voltages.

CO2: Explain the types of relays and relay settings used in power system.

CO3: Explain the different types of protection for apparatus and lines

CO4: Describe the different types of circuit breakers.

CO5: Explain the insulation coordination between equipment and protective devices.

Text Books

1. Soni M L, Gupta P V, Bhatnagar U S and Chakrabarti A, "A Text Book on Power Systems Engineering", DhanpatRai & Co Ltd., Delhi, 2010.
2. V.K.Mehta, Rohit Mehta," Principles of Power System", Fourth Edition, S Chand & Co Ltd, 2011

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Reference Books

1. Sunil S Rao, "Switchgear Protection and Power Systems", thirteenth Edition, Khanna Publishers, Delhi, 2008.
2. Wadhwa, C.L., "Electrical Power Systems", Sixth Edition, New age International, 2014
3. Badri Ram, Vishwakarma D N, "Power System Protection and Switch Gear", Tata McGraw Hill Education Private Limited, New Delhi, 2011.
4. Ravindranath B and Chander M, "Power System Protection and Switchgear", New Age International Ltd., New Delhi, 2011
5. S.L.Uppal, "Electrical Power Systems", Khanna Publishers, 2009

Web References

1. http://www.accessengineeringlibrary.com/
2. http://www.nptel.ac.in/downloads/108101039/
3. http://nptel.ac.in/courses/Webcourse-contents/IIT%20Bombay
4. http://www.studiecd.dk/
5. https://www.elprocus.com/

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Course Code : 141EE0604	Course Title: VLSI DESIGN (Common to ECE, EEE & EIE)	
Core	L : T : P: C	3 : 0 : 0 : 3
Type: Theory	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0304 Digital Electronics
- 141EE0404 Electronic Circuits

Course Objectives

The course is intended to:

1. Analyze the VLSI design flow and CMOS design processes.
2. Analyze MOS transistors and CMOS inverter.
3. Design CMOS digital circuits.
4. Develop VHDL Programs.
5. Categorize the faults identified in VLSI circuit testing.

UNIT I - INTRODUCTION 9

VLSI Design process: Design specification- design entry – functional simulation – planning, placement and routing – timing simulation, fabricating into chip- CMOS processing technologies - nWell - pWell - Twin tub - Silicon on insulator.

UNIT II – MOS TRANSISTORS AND INVERTERS 9

Basic MOS Transistors and Operation: NMOS enhancement transistor - PMOS enhancement transistor - Threshold Voltage-Derivation of drain current- Channel length modulation- Body Effect –Trans conductance – MOSFETs as Switches - CMOS Inverter – Latch-up in CMOS Circuit - Power dissipation in CMOS Circuits.

UNIT III – LOGIC DESIGN WITH CMOS 9

Combinational Circuit Design: Logic gates in static CMOS - Transistor sizing – Stick diagram, Layout diagrams and design rules – Rationed circuits: Pseudo NMOS – cascode voltage switch logic - Dynamic CMOS logic: domino logic, dual rail domino logic –Transmission gate - pass-transistor circuits - Scaling of MOSFETs and its effects.

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UNIT IV – VHDL PROGRAMMING FOR SUBSYSTEM DESIGN 9

Introduction to VHDL: Entities, architectures, signals, variables and constants – inertial and transport delay - arrays–operators - functions – procedures – packages and libraries - Types of modeling: Structural, dataflow and behavioral modeling – VHDL programs for simple adders and multipliers –Test Bench - FPGA: Architecture and programming technologies.

UNIT V - TESTING OF DIGITAL CIRCUITS 9

Need for testing – Failures and Faults – Modeling of faults : Stuck at faults – Bridging faults – Break and transistor stuck on / open faults– Delay faults –Temporary faults – Design for testability : Ad-hoc testing, Scan design, BIST, IDDQ testing, Boundary scan.

Course Outcomes

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

CO1. Analyze the VLSI design flow and CMOS design processes with appropriate fabrication technologies.

CO2. Analyze MOS transistors and CMOS inverter with relevant characteristics.

CO3. Design various digital circuits using appropriate CMOS logic styles.

CO4. Develop VHDL Programs for various digital logic circuits using data path elements.

CO5. Categorize the faults in VLSI circuits using suitable testing methods.

Text Books

1. Weste and Harris, "CMOS VLSI Design" Pearson Education, Third Edition, 2005.
2. Charles H.Roth, "Digital System design using VHDL", Thomson business information India Pvt Ltd, 2006
3. Neil H.E. Weste and Kamran Eshraghian, "Principles of CMOS VLSI Design", Pearson Education ASIA, Second Edition, 2000

Reference Books

1. John P.Uyemura "Introduction to VLSI Circuits and Systems", John Wiley and Sons, Inc., 2002.
2. Eugene D.Fabricius, "Introduction to VLSI Design", McGraw Hill International Edition, 1990.
3. Pucknell, "Basic VLSI Design", Prentice Hall of India Publication, 1995.

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4. Wayne Wolf, "Modern VLSI Design System on chip", Pearson Education,2002
5. P.K. Lala, "Digital Circuit Testing and Testability", Academic Press, 2002

Web References

1. http://nptel.ac.in/courses/117106093/1
2. http://nptel.ac.in/courses/106103116/41
3. https://www.youtube.com/watch?v=VUSTLyPtPgk

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Course Code : 141EE0605	Course Title: ENVIRONMENTAL STUDIES (Common to all B.E., B.Tech., programmes)	
Core	L : T : P: C	3 : 0 : 0 : 3
Type: Theory	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- NIL

Course Objectives

The course is intended to:

1. Describe the multidisciplinary nature of environmental studies
2. Explain the importance of ecosystem and biodiversity
3. Identify the causes and propose suitable methods of control for various types of environmental pollution.
4. Describe the importance of environmental protection in social and global context.
5. Explain the relationship between environment and human beings.

UNIT I - MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES 9

Definition, scope and importance; Need for public awareness; Natural resources and associated problems - Forest resources, Water resources, Mineral resources, Food resources, Energy resources, Land resources; Role of individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

UNIT II – ECOSYSTEMS AND BIODIVERSITY 9

Concept of an ecosystem; Structure and function of an ecosystem; Producers, consumers and decomposers; Energy flow in the ecosystem; Ecological succession; Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of the following ecosystem - Forest, Grassland, Desert, Aquatic; Biodiversity and its conservation: Introduction; Biogeographically classification of India; Value of biodiversity; Biodiversity at global, national and local levels; India as a mega diversity nation; Threats to biodiversity; Endangered and endemic species of India; Conservation of biodiversity : In-situ and Ex-situ conservation.

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UNIT III – ENVIRONMENTAL POLLUTION 9

Definition; Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution; Solid waste Management: Causes, effects and control measures of urban and industrial wastes; Role of an individual in prevention of pollution; Pollution case studies; Disaster management : floods, earthquake, cyclone and landslides

UNIT IV – SOCIAL ISSUES AND THE ENVIRONMENT 9

From Unsustainable to Sustainable development; Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Environmental ethics: issues and possible solutions; Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation ; Consumerism and waste products; Environment Protection Act; Air Act; Water Act ; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation; Public awareness.

UNIT V - HUMAN POPULATION AND THE ENVIRONMENT 9

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; Case studies; Field work – Visit to a local area to document environmental assets – river/forest/grassland/hill/mountain; Visit to a local polluted site – Urban/Rural/Industrial/Agriculture; Study of simple ecosystems – pond, river, hill, slopes, etc.

Course Outcomes

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

CO1. Describe the multidisciplinary nature of environmental studies.

CO2. Explain the importance of ecosystem and biodiversity.

CO3. Identify the causes and propose suitable methods of control for various types of environmental pollution

CO4. Describe the importance of environmental protection in social and global context

CO5. Explain the relationship between environment and human beings.

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Text Books

1. Benny Joseph, "Environmental Studies", Tata McGraw Hill, New Delhi, 2006.
2. Mackenzie Davis and Susan Masten, "Principles of Environmental Engineering and Science", Mc-Graw Hill, Third Edition, 2014.

Reference Books

1. Trivedi R.K. "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media.
2. Cunningham, W.P.Cooper., T.H. Gorhani, "Environmental Encyclopedia", Jaico Publishing House, Mumbai, 2001.
3. Rajagopalan. R, "Environmental Studies - From Crisis to Cure", Oxford University Press, 2005.

Web References

1. http://nptel.ac.in/courses/122102006

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Course Code : 141EE0606	Course Title :CONTROL AND INSTRUMENTATION LAB	
Core	L : T : P: C	0 : 0 : 4 : 2
Type: Practical	Total Contact hours:	60 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0405 Measurements and Instrumentation
- 141EE0502 Control Systems

Course Objectives

The course is intended to:

1. Determine the transfer function.
2. Simulate the response and stability of system.
3. Calibrate the measuring device.
4. Measure the values of passive elements.
5. Measure frequency, phase, Magnetic Losses, temperature and displacement.

LIST OF EXPERIMENTS **60**

Control Experiments

1. Determination of transfer function of AC Servomotor.
2. Determination of transfer function of Armature Controlled DC Motor.
3. Determination of transfer function of Field Controlled DC Motor.
4. Simulation of first order and second order systems.
5. Design and Simulation of compensator for Armature and Field Controlled DC Motor.

Instrumentation Experiments

6. Measurement of R, L & C using bridges.
7. Calibration of single phase energy meter.
8. Measurements on supply systems frequency& phase measurement (Lissajous

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pattern of CRO)

9. Measurements on Magnetic system (B-H loop and Magnetic Losses)
10. Transducer based experiments (Temperature and displacement)

Course Outcomes

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

CO1: Determine the transfer function of a DC and AC motor.

CO2: Simulate the response and stability of linear first order and second order system.

CO3: Calibrate the measuring device.

CO4: Measure the values of Resistance, Inductance and Capacitance using suitable bridges.

CO5: Measure frequency, phase, Magnetic Losses, temperature and displacement using appropriate instruments.

Reference Book

1. "Control and Instrumentation Lab" Manual prepared by Department of Electrical and Electronics Engineering, MCET, Pollachi.

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Course Code : 141EE0607	Course Title :POWER ELECTRONICS LABORATORY	
Core	L : T : P: C	0 : 0 : 4 : 2
Type: Practical	Total Contact hours:	60 Hours

Prerequisites: The student should have undergone the course(s):

- Nil

Course Objectives

The course is intended to:

1. Analyze the transient characteristics.
2. Simulate and analyze the output of ac-dc converters.
3. Simulate and analyze the output of dc-dc converters.
4. Simulate and analyze the output of dc-ac converters.
5. Simulate and analyze the output of ac-ac converters.

LIST OF EXPERIMENTS60

1. Determine the turn on and turn off time of MOSFET,SCR and also draw it's characteristics.
2. Model the Single phase half and full converter using simulation and validate the result using hardware.
3. Model the Three phase half and full converter using simulation and validate the result using hardware.
4. Model the Single phase inverter using simulation and validate the result using hardware.
5. Model the Three phase inverter using simulation and validate the result using hardware.
6. Model the Step up chopper using simulation and validate the result using hardware.
7. Model the Step down chopper using simulation and validate the result using by hardware.
8. Model the Four quadrant chopper using simulation and validate the result using hardware.
9. Model the single phase AC voltage controller using simulation and validate the result using hardware.
10. Model the single phase Cycloconverter using simulation and validate the result using hardware.
11. Model the MPPT tracking control for solar PV applications using simulation and validate the result using hardware.

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Course Outcomes

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

CO1: Analyze the transient characteristics of MOSFET and SCR

CO2: Simulate and analyze the output of ac-dc converters

CO3: Simulate and analyze the output of dc-dc converter

CO4: Simulate and analyze the output of dc-ac converters

CO5: Simulate and analyze the output of ac-ac converters

Reference Book

1. "Power Electronics Lab Manual" prepared by Department of Electrical and Electronics Engineering, MCET, Pollachi.

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Course Code : 141EE0608	Course Title: CAMPUS TO CORPORATE	
General	L : T : P: C	0 : 0 : 2 : 1
Type: PS	Total Contact hours:	30 Hours

Prerequisites: The student should have undergone the course(s):

- Nil

Course Objectives
The course is intended to:

1. Display gratitude and social responsibility.
2. Understand various business environments.
3. Explain the transition from a campus mindset to corporate mindset.
4. Be prepared to the work culture.
5. Choose to be presentable and agile.

UNIT I - GRATITUDE AND SOCIAL RESPONSIBILITY

Importance of gratitude; Finding opportunities to give back to society; Responsible behavior in public places; Volunteerism during calamities; Social relevancy during engineering design and manufacturing – how social issues could be tackled by engineering solutions;

UNIT II – THE WORLD OF BUSINESS (GET TO THE SPECIFICS OF BEHAVIORAL RESPONSES TO CERTAIN SPECIFIC ONTEXTS)

World of business - Perceptions vs reality; Various business types - B2B, B2C, & other business models; Various industry verticals – fundamentals, dynamics & nuances; Nature of work as per various functions – Sales & Marketing, Service, Research & Development, Production etc; Self-reflective questionnaire to identify the fitment to a particular field/function;

UNIT III – TRANSITION FROM A CAMPUS MINDSET TO CORPORATE MINDSET

ROCK as an acronym (Responsibility, Ownership, Contribution, Knowledgeable (continuous learning)); Responsibility – ways in which responsibility should be demonstrated; Ownership – owning one's career, owning mistakes, desisting from complaining; Contribution – focus on creating value, giving more than receiving

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(salary & perks); Knowledgeable(continuous learning) – learning just begins after campus, aspects of learning mindset, various opportunities to learn and how they can be utilized at work;

UNIT IV – PREPAREDNESS TO ADAPT TO WORK CULTURE

Skills to get through selection process – Interview conversations, resume writing, group discussion & presentation;

Handling Cultural differences; Handling Gender dynamics; Alignment to Ethics and values; Alignment to work processes & code of conduct; Handling multiple (often conflicting) demands; Handling peer influence; Conducting sensitively with subordinates, peers & boss; Managing personal finance; Maintaining work-life balance – work & social life, hobbies etc;

UNIT V - PRESENTABLE AND AGILE

Dressing & grooming – Reasons for good dressing & grooming; Professional etiquette – what is etiquette, professional etiquette vs social etiquette, Aspects of professional etiquette; Wellness – Healthy eating habits, Importance of sleep, Importance of fitness; Importance of cleanliness of surroundings – desk, work area, place of stay (5S);

Course Outcomes
At the end of the learning program, learners will be able to

CO1. Display gratitude and social responsibility

CO2. Understand various business environments – industry & function wise

CO3. Explain the transition from a campus mindset to corporate mindset

CO4. Be prepared to adapt to the future work culture

CO5. Choose to be presentable and agile

MODE OF DELIVERY:

1. A 2-day learning workshop guided by Learner's workbook.
2. Continuous learning guided by learning journal, and reviews by faculty

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ASSESSMENTS AND EVALUATION:

Assessment	Details	Weigh tage	Administratio n	By Whom	When
Workbook record assessment	Assess the necessary elements to be entered in the workbook	20%	Individual workbooks reviewed by the faculty		Immediately after the learning workshop
Initial Knowledge Test and Scenario based knowledge test	Multiple choice questions (20)	25%	Pen and paper,	Internal team	Immediately after the learning workshop
Review of student journal	Student held journal for the whole semester	30%	Individual journals reviewed by the faculty	Trained faculty members	Once in a week.
Final Knowledge test and Scenario based knowledge test	Multiple choice questions (40)	10%		Internal team	End of semester
Review of student journal by external expert		15%	Student journal comprehensive review	Trained faculty members	End of semester

END OF SEMESTER VI

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SEMESTER VII

Course Code : 141EE0701	Course Title: POWER SYSTEM ANALYSIS AND STABILITY	
Core	L : T : P: C	3 : 2 : 0 : 4
Type: Lecture& Tutorial	Total Contact hours:	75 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0501- Generation, Transmission and Distribution
- 141EE0401- Linear Algebra and Numerical Methods

Course Objectives

The course is intended to:

1. Model the power system under steady state operating condition
2. Apply numerical methods to solve the power flow problem
3. Model and analyze the system under faulted conditions
4. Model and analyze the transient behavior of power system when it is subjected to fault
5. Analyze the stability of the system

UNIT I - PER UNIT REPRESENTATION

9+6

Single line diagram - Need for system planning and operational studies–Different types of power system analysis-per phase and per unit analysis- Generator, transformer, transmission line and load representation for Different power system studies -Primitive network-construction of Y-bus: Inspection and singular transformation methods –Z-bus: bus building algorithm.

UNIT II – POWER FLOW ANALYSIS

9+6

Statement of power flow problem-classification of buses-development of power flow modelling of complex variables form-iterative solution using Gauss-Seidel method-power flow model in polar form –iterative solution using Newton-Raphson method

UNIT III – FAULT ANALYSIS– BALANCED FAULTS

9+6

Short circuit analysis: Importance, assumptions -analysis using Thevenin's theorem and Z-bus -computations of short circuit capacity, post fault voltage and currents-Symmetrical components.

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UNIT IV – FAULT ANALYSIS–UNBALANCED FAULTS 9+6

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, Analysis of open circuit faults.

UNIT V - STABILITY ANALYSIS 9+6

Need for stability analysis in power system planning and operation- classification of power system stability-angle and voltage stability–Single Machine Infinite Bus (SMIB) system: - Equal area criterion -determination of critical clearing angle and time-Development of swing equation -solution of swing equation by modified Euler method and Runge - Kutta fourth order method

Course Outcomes

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

CO1: Construct bus admittance matrix for power system network.

CO2: Apply numerical methods for power flow analysis.

CO3: Analyze the fault in the power system under balanced conditions.

CO4: Analyze the fault in the power system under unbalanced conditions.

CO5: Analyze the stability of power system when it is subjected to a fault.

Text Books:

1. John J.Grainger and W.D.StevensonJr.,'Power System Analysis' ,Tata McGraw-Hill, 2010.
2. HadiSaadat, 'Power System Analysis', Tata McGraw Hill Education Pvt.Ltd., New Delhi,2011.

Reference Books:

1. NagrathI.J.and Kothari D.P.,' Modern Power System Analysis', Tata McGrawHill, third Edition,20011.
2. Kundur P., 'Power System Stability and Control, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2010.
3. J.Duncan Glover "Power System Analysis and Design", fifth Edition, Global Engineering Publisher, 2012.
4. T.K Nagsarkar,"Power System Analysis', second Edition, Oxford Press, 2014.
5. Gangadhar K.A, "Electric Power System – Analysis, Stability and Protection",Khanna Publishers, New Delhi, Second Edition,2009

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Web References:

1. http://nptel.ac.in/courses/108105067/
2. www.elect.mrt.ac.lk/EE423_%20Fault_Analysis_Notes.pdf
3. www.elcomhu.com/Electrical/Power%20System%20Stability/stability%20slides.pdf.
4. www.textofvideo.nptel.iitm.ac.in/108102047/lec26.pdf
5. www.electrical4u.com/load-flow-or-power-flow-analysis/.

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Course Code : 141EE0702	Course Title: SOLID STATE DRIVES	
Core	L : T : P: C	3 : 0 : 0 : 3
Type: Lecture	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0302 DC Machines and Transformers
- 141EE0403 Synchronous and Induction Machines
- 141EE0504 Power Electronics

Course Objectives

The course is intended to:

1. Understand the functions and load torque characteristics of different types of drives
2. Explain the working of rectifier and chopper fed dc motor drives
3. Summarize the different types of speed controls of induction motor drives
4. Outline the working of synchronous and BLDC motor drives
5. Understand the functions of digital technique in speed control of drives

UNIT I - ELECTRIC DRIVES 9

Parts of Electrical drives – Classification of electric drives - Typical load torque characteristics – Selection of motor power rating - Thermal model of motor for heating and cooling - Classes of duty cycle– Multi quadrant operation

UNIT II – DC MOTOR DRIVES 9

Single and three phase controlled rectifier fed separately excited dc motor drives for continuous duty– Chopper fed drives: Class A, B, C, D and E–Applications: DC traction using chopper

UNIT III – INDUCTION MOTOR DRIVES 9

Stator Control: Stator voltage, frequency and v/f control - VSI fed induction motor drives – Rotor Control:Statickramer and scherbius drives –Introduction to vector controlled induction motor drives -Applications: Paper mills

UNIT IV – SYNCHRONOUS AND BLDC MOTOR DRIVES 9

Scalar control of synchronous motor drive: True synchronous mode and self-control mode of operations– Marginal angle control and power factor control - BLDC motor drives

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UNIT V - DIGITAL TECHNIQUE IN SPEED CONTROL 9

Closed loop control of electric drive- Digital technique in speed control of electric drive system– Advantages and limitations-Microprocessor based control of drives – DSP based control of drives

Course Outcomes

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

CO1: Explain the functions and characteristics of drives.

CO2: Analyze the various modes of operation of power converter fed dc motor drives

CO3: Explain the functions of converters in induction motor drive control

CO4: Explain the functions of converters for synchronous and BLDC motor drives

CO5: Discuss the role of digital technique in speed control of drives

Text Books:

1. Dubey.G.K, "Fundamental of Electrical Drives", Narosa publishing House, New Delhi, Second Edition, 2013.
2. BimalK.Bose. "Modern Power Electronics and AC Drives", Pearson Education, First Edition, 2002.

Reference Books:

1. R.Krishnan,"Electric motor drives Modeling, analysis and control", Pearson Education, New Delhi, 2003.
2. VedamSubrahmanyam - Thyristor control of Electrical Drives - Tata McGraw Hill Publishers, 2002.
3. Muhammad H. Rashid, "Power Electronics : Circuits, Devices and Applications", 3rd Edition, Pearson India,2014
4. Karl Johan Astrom, Bjorn Wittenmark, "Computer Controlled Systems: Theory and Applications", 3rd edition edition, Dover Publications Inc, 2012
5. Nisit K. De, Prasanta K. Sen, "Electric Drives", Prentice Hall of India, New Delhi,2006.

Web References:

1. http://www.nptel.ac.in/courses/108108077/2
2. http://nptel.ac.in/courses/108106072/8
3. http://www2.nkfust.edu.tw/~tuky/servo/PDF/Ch4.pdf
4. http://www.nptelvideos.in/2012/11/industrial-drives-power-electronics.html

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Course Code : 141EE0703	Course Title :POWER SYSTEM SIMULATION LABORATORY	
Core	L : T : P: C	0 : 0 : 4 : 2
Type: Practical	Total Contact hours:	60 Hours

Prerequisites: The student should have undergone the course(s):

- Nil

Course Objectives

The course is intended to:

1. To study the modeling and parameter estimation of transmissions lines
2. To study the various methods used for solving load flow analysis.
3. To calculate fault current during various fault conditions.
4. To study the dynamics and transient analysis of power systems.
5. To understand the concept of economic dispatch.

List Of Experiments: **60**

1. Computation of performance and modeling of transmission lines.
2. Formation of bus admittance matrix
3. Formation of bus impedance matrix
3. Load flow analysis by Gauss Seidal method.
4. Load flow analysis by Newton Raphson method.
5. Symmetrical and unsymmetrical fault analysis.
6. Simulation of electromagnetic transients in power systems
7. Transient and small signal stability analysis of single machine infinite bus system
8. Transient stability analysis of multi machine power system.
9. Scheduling economic dispatch in power system.
10. Load frequency dynamics of single area and two area system.

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Course Outcomes

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

CO1: Develop a program to compute the characteristic parameters of transmission line and to build power system network matrices.

CO2: Develop a program to analyze the load flow for a given power system network.

CO3: Develop a program to calculate the fault current at various fault conditions.

CO4: Simulate and find solutions related with transient stability problem

CO5: Develop a program to solve economic dispatch problem and to simulate the load frequency dynamics of a power system.

Reference Books:

1. "Power System Simulation Lab" Manual prepared by Department of Electrical and Electronics Engineering, MCET, Pollachi.

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Course Code : 141EE0704	Course Title :DIGITAL CONTROL OF SOLID STATE DRIVES LABORATORY	
Core	L : T : P: C	0 : 0 : 4 : 2
Type: Practical	Total Contact hours:	60 Hours

Prerequisites: The student should have undergone the course(s):

- Nil

Course Objectives

The course is intended to:

1. Simulate the model for speed control of dc motor drives using suitable converters
2. Simulate the model for speed control of induction motor and synchronous motor drives using suitable converters
3. Control the speed of dc motor and ac motor drives using suitable converters
4. Develop the DSP based program for speed control of induction motor drives
5. Control the speed of induction motor drives using FPGA

60

List of Experiments:

1. Simulation of closed loop control of converter fed DC motor.
2. Simulation of closed loop control of chopper fed DC motor.
3. Simulation of VSI fed three phase induction motor drive.
4. Simulation of three phase synchronous motor drive.
5. Simulation of AC voltage controller fed three phase induction motor.
6. (i) Generation of constant PWM using TMS320F28335

   (ii) Generation of firing pulses for three phase inverter using TMS320F28335/ TMS320F2812/ SPARTAN 6A/ CORTEX M4

   (iii) Generation of sine PWM using TMS320F28335
7. Speed control of DC motor using three phase controlled rectifier.
8. Speed control of 3 Phase induction motor using PWM inverter.
9. DSP based closed loop drive for induction motor.
10. Induction motor speed control using FPGA.

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Course Outcomes

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

CO1. Develop the simulation model for speed control of dc motor drives using suitable converters
CO2. Develop the simulation model for speed control of induction motor and synchronous motor drives using suitable converters
CO3. Demonstrate the speed control concepts on dc motor and ac motor drives using suitable converters
CO4. Apply the programming knowledge on DSP for speed control of induction motor drives
CO5. Apply the programming knowledge on FPGA for speed control of induction motor drives.

Reference Books:

1. "Solid State Drives Lab",Manual prepared by Department of Electrical and Electronics Engineering, MCET, Pollachi.

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PROFESSIONAL ELECTIVES

Power Engineering

Course Code :141EE9111	Course Title: RENEWABLE ENERGY SOURCES	
Elective	L : T : P: C	3 : 0 : 0 : 3
Type: Theory	Total Contact hours:	45 Hours

Pre-requisites: The student should have undergone the course(s):

- Nil

Course Objectives

The course is intended to:

1. Explain the solar energy conversion systems.
2. Explain the fundamentals of wind energy conversion.
3. Describe the conversion process of bio-energy.
4. Describe the renewable sources.
5. Summarize the new energy sources.

UNIT I - SOLAR ENERGY 9

Solar radiation - its measurements - solar thermal flat plate collectors, concentrating collectors – Applications: heating, desalination, hydrogen production, cooking.

Principle of photovoltaic conversion of solar energy- conversion efficiency and power output- solar cell module - Advantages, applications: battery charger, domestic lighting, street lighting and water pumping-power generation schemes- Current scenario.

UNIT II – WIND ENERGY 9

Principles of wind power -Wind Energy Conversion Systems – Wind data and energy estimation- site selection characteristics - Wind Energy generators and its performance - horizontal and vertical axis types - Wind Energy Storage – Applications – Hybrid systems-safety and environmental aspects -Current scenario

UNIT III – BIO-ENERGY 9

Principles of Bio-Energy – biomass conversion: Wet and dry process – Photosynthesis – Biogas Generation- factors affecting gas generation – Classification of biogas plants – Biogas from plant wastes- Urban waste to energy conversion –Design of community biogas plant –methods for maintaining bio gas production – Biomass as energy – thermal gasification – Pyrolysis- Current scenario.

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UNIT IV – OTEC, TIDAL, GEOTHERMAL AND HYDEL ENERGY 9

Ocean energy resources - principles of ocean thermal energy conversion systems - ocean thermal power plants –Tidal power: Principals and components –Geothermal energy: Introduction, estimation, sources, exploration and environmental issues - Small hydroelectric: Development, Classification, limitations and advantages - Turbines and generators for hydroelectric power generation- Current scenario.

UNIT V - NEW ENERGY SOURCES 9

Hydrogen: Production, storage, transport and utilization–Safety and management-Applications: aircraft, fuel cells, motor vehicles- Fuel cell: Classification, fuels for fuel cells, efficiency, V-I characteristics, Fuel cell power plant, Environmental effects - Current scenario

Course Outcomes

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

CO1: Explain the solar thermal energy collection and solar photovoltaic energy conversion system.
CO2: Explain the fundamentals of wind energy conversion and their applications.
CO3: Describe the conversion process of biomass and biogas into energy.
CO4: Describe the renewable sources like ocean thermal, geo thermal and hydel energy.
CO5: Summarize the new energy sources like hydrogen and fuel cell

Text Books

1. G.D. Rai, "Non-Conventional Energy Sources", Khanna Publishers, Fifth Edition, 2016.
2. B.H.Khan, "Nonconventional Energy Resources", Tata McGraw Hill,First Edition, 2006..

Reference Books

1. Kreith, F and Kreider, J. F., "Principles of Solar Engineering", McGraw-Hill, Second Edition 2000.
2. Godfrey Boyle, "Renewable Energy: Power for a Sustainable Future", Oxford University Press, Third Edition, 2012.
3. Sukhatme, S.P., "Solar Energy", Tata McGraw Hill, Third Edition, 2009.
4. Hart, A.B., and Womack, G. J., "Fuel Cells: Theory & Applications", Prentice Hall,1997.
5. D.P. Kothari, K. C. Singal, Rakesh Ranjan, "Renewable Energy Sources and Emerging Technologies", PHI Learning Pvt. Ltd, Second Edition, 2011.

Web References

1. www.mnre.gov.in
2. http://nptel.ac.in/downloads/108108078/
3. http://www.nise.res.in/
4. http://www.cea.nic.in/

HOD-Electrical and Electronics Engineering
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For BoS Chairman

Course Code :141EE9112	Course Title: DIGITAL CONTROL OF POWER ELECTRONICS	
Core / Elective: Elective	L : T : P: C	3 : 0 : 0 : 3
Type: Lecture	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0502 Control Systems
- 141EE0504 Power Electronics
- 141EE0503 Microprocessor and Micro controllers
- 141EE0602 Digital Signal Processing

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Course Objectives

The course is intended to:

1. Understand the architecture and addressing modes of PIC 16C7X microcontroller.
2. Study the peripherals of PIC 16C7X
3. Understand the architecture and addressing modes of TMS320F2812 processor
4. Study the peripherals of TMS320F2182 processor
5. Apply control logics to converter and drives applications using PIC 16C7X and TMS320F2182.

UNIT I - PIC 16C7X MICROCONTROLLER 9

Architecture memory organization – Addressing modes – Instruction set – Programming Techniques – simple programs

UNIT II – PERIPHERALS OF PIC 16C7X 9

Timers – interrupts – I/O ports – I^2C bus for peripheral chip access – A/D converter – UART.

UNIT III – TMS320F2812 DSP 9

Introduction- System configuration registers - Memory Addressing modes – Instruction set Programming techniques – simple programs

UNIT IV – PERIPHERALS OF TMS320F2812 DSP 9

General purpose Input/output (GPIO) Functionality- Interrupts - A/D converter-Event Managers (EVA, EVB) - PWM signal generation.

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UNIT V - APPLICATIONS OF PIC AND SIGNAL PROCESSORS 9

Voltage regulation of DC-DC converters- Stepper motor and DC motor control- Clarke's and Parks transformation-Space vector PWM- Control of Induction Motors and PMSM

Course Outcomes

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

CO1. Describe the architecture, addressing modes and Instruction set of PIC 16C7X microcontroller

CO2. Explain the peripherals of PIC 16C7X and their importance to power converter applications.

CO3. Describe the architecture and addressing modes of TMS320F2812 digital signal Processor

CO4. Explain the peripherals of TMS320F2812 and their importance to power converter applications

CO5. Implement simple switching logics for power converters using PIC 16C7X and TMS320F2812

Text Books:

1. John B.Peatman, 'Design with PIC Microcontrollers,' Eighth Edition, Pearson Education, Asia 2009
2. Hamid A.Toliyat, Steven Campbell, 'DSP based electromechanical motion control', CRC Press, 2003

Reference Books:

1. Bar Ba C 'Programming and Application of a DSP to Control and Regulate Power Electronic Converters: Programming in C++'Anchor Academic Publishing, 2014
2. Luca Corradini, DraganMaksimović, Paolo Mattavelli, Regan Zane, 'Digital Control of High-Frequency Switched-Mode Power Converters' IEEE press,Wiley , 2015
3. Simone Buso, Paolo Mattavelli, 'Digital Control in Power Electronics', Morgan and Claypool Publisher, 2006
4. Ali Emadi, AlirezaKhaligh, ZhongNie, Young Joo Lee, 'Integrated Power Electronic Converters and Digital Control' CRC press, 2009
5. Fang Lin Luo, Hong Ye ,Muhammad H Rashid" ,Digital Power Electronics and Applications", Elsevier Academic Press, 2005

Web References:

1. http://www.ti.com/lit/ds/symlink/tms320f2812.pdf
2. http://www.ti.com/lit/an/spraab3/spraab3.pdf
3. http://digitalassets.lib.berkeley.edu/techreports/ucb/text/EECS-2006-22.pdf
4. http://ecee.colorado.edu/~ecen5807/course_material/digital/

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HOD-Electrical and Electronics Engineering
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Pollachi - 642 003.

Course Code :141EE9113	Course Title: HIGH VOLTAGE ENGINEERING	
Core / Elective: Elective	L : T : P: C	3 : 0 : 0 : 3
Type: Lecture	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0501 Generation, Transmission and Distribution
- 141EE0504 Power Electronics

Course Objectives

The course is intended to:

1. To understand the transient overvoltage and insulation coordination in power systems
2. To study the various types of breakdown in gases, liquids and solids
3. To gain knowledge in the concepts of high voltage and high current generating techniques
4. To study the different techniques for high voltage and high current measurements
5. To identify the suitable high voltage testing methods for electrical power apparatus

UNIT I - OVERVOLATGES PHENOMENONAND INSULATION COORDINATION 8

Natural causes of over voltages - Lightning phenomena - Over voltages due to switching Surges-temporary over voltages - System faults and other abnormal conditions – Principles of Insulation Co-Ordination

UNIT II – ELECTRICAL BREAKDOWN IN GASES,LIQUIDS AND SOLIDS 10

Classical gas laws - Ionization processes – Townsend's Criterion - Paschen's law – Streamer theory - Breakdown in non-uniform fields and corona discharges – Practical considerations in using gases for insulation purposes - Vacuum insulation. Classification and characteristics of liquid dielectrics-Conduction and breakdown in pure and commercial liquids.Intrinsic breakdown in solids -Electromechanical breakdown - Thermal breakdown –Breakdown of solids in practice- Breakdown in composite dielectrics..

UNIT III – GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS 9

Generation of high DC voltage: Voltage doubler, Voltage Multiplier, Van de GraaffGenerator –Generation of Alternating voltages: Cascade, Resonant transformer, High frequency AC-Generation of impulse voltages and impulse currents – Tripping and control of Impulse Generators

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UNIT IV – MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS 9

Measurement of high DC voltages, high AC voltages and impulse voltages - Measurement of high DC currents, high AC currents and impulse currents - CRO for impulse voltage and current measurement - Digital techniques in high voltage measurement.

UNIT V - HIGH VOLTAGE TESTING OF ELECTRICAL POWER APPARATUS 9

Testing of Insulator, Bushings, Isolators, Circuit breakers, Cables, Transformers, Surge Arresters – Non-Destructive Insulation Test Technique: Partial Discharge measurement - Radio interference measurement- IS 2026 (Part 1): Power transformer(overview).

Course Outcomes

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

CO1. Explain the transient overvoltage and insulation coordination in power systems.

CO2: Discuss the various types of breakdown in gases, liquids and solids.

CO3: Infer the concepts of high voltage and high current generating techniques.

CO4: Describe the different techniques for high voltage and high current measurements.

CO5: Explain the suitable high voltage testing methods for electrical power apparatus.

Text Books:

1. M.S. Naidu and V. Kamaraju, "High Voltage Engineering", McGraw Hill, 5th Edition, 2013.
2. Kuffel, E and Zaengl, W.S, "High Voltage Engineering Fundamentals", Pergamon Press, Oxford, London, Second Edition, 2000

Reference Books:

1. Wadhwa C.L "High Voltage Engineering" New Age International, Third Edition, 2012.
2. Dieter Kind, Kurt Feser, "High Voltage Test Techniques", SBA Electrical Engineering Series, New Delhi,Second Edition, 2001
3. RavindraArora and Wolfgang Mosch, "High Voltage and Electrical Insulation Engineering",IEEE Press Series on Power Engineering, 2011
4. Rakosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", Wiley Eastern Ltd., New Delhi, fourth Edition 2011
5. Alston, L.L, "High Voltage Technology", Oxford University Press, London, 1968.

Web References:

1. http://nptel.ac.in/courses/108104048/ui/TOC.htm
2. http://www.cpri.in/
3. http://www.rle.mit.edu/cehv/

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HOD-Electrical and Electronics Engineering
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Course Code :141EE9114	Course Title: HIGH VOLTAGE DC TRANSMISSION	
Core / Elective: Elective	L : T : P: C	3 : 0 : 0 : 3
Type: Lecture	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0501 Generation, Transmission and Distribution
- 141EE0504 Power Electronics

Course Objectives

The course is intended to:

1. Understand the concept, planning of DC power transmission
2. Analyze HVDC converters and system control
3. Study about the HVDC protection system
4. Analyze harmonics and design of filters
5. Learn the testing procedures and the application of HVDC system

UNIT I - INTRODUCTION 7

DC Power transmission technology -Comparison of AC and DC transmission — HVDC: Description, DC links, Planning, Application and current trends– Global scenario.

UNIT II – HVDC SYSTEM CONTROL 9

Principles of DC link control – converter control &bridge characteristics of 12 Pulse converters– system control: firing angle control, individual phase control and equidistant phase control – comparison – current and extinction angle control – starting and stopping of DC link – power control

UNIT III – MTDC & PROTECTION 9

Introduction to Multi terminal HVDC Systems , Types of faults – commutation failure –arc through and misfire – Basics of protection – DC reactors – voltage and current oscillations – circuit breakers – over voltage protection – switching surges – lightning surges – lightning arresters for DC systems

UNIT IV – HARMONICS AND FILTERS 11

Sources of harmonics in HVDC systems –harmonic distortion factor – types and design of filter : AC & DC filter– Smoothing reactors – Corona and radio interference effects –IEEE standard 1124-2003: DC Side Harmonic Performance of HVDC Transmission Systems

UNIT V - HIGH VOLTAGE TESTING OF ELECTRICAL POWER APPARATUS 9

Introduction of DC cables –DC insulation – Practical dielectrics – Dielectric stress consideration – Economics of DC cables compared with AC cables-applications

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Course Outcomes

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

CO1. Explain the general aspects of HVDC transmission
CO2. Explain the converter configurations and control methods used in HVDC.
CO3. Compare the converter faults and its protection schemes
CO4. Design a suitable filter for harmonic elimination
CO5. Explain the types, application of cables in HVDC system

Text Books:

1. Padiyar, K. R., "HVDC power transmission system", Third edition ,Wiley Eastern Limited, New Delhi 2014
2. Edward Wilson Kimbark, "Direct Current Transmission", Vol. I, Reprint Wiley interscience, New York,London, Sydney, 2001

Reference Books:

1. Chan-Ki Kim, Vijay K. Sood, Gil-Soo Jang, Seong-Joo Lim, Seok-Jin Lee HVDC Transmission: Power Conversion Applications in Power Systems, First edition Wiley 2009
2. Arrillaga, J., "High Voltage Direct Current Transmission", Revised Second Edition ,PeterPregrinus, London, 1998.
3. Rakosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", , Fourth Edition New AgeInterantional (P) Ltd., New Delhi 2011
4. Kamakshaiah, "HVDC Transmission " , First Edition Tata Mcgraw hill, 2011
5. DraganJovcic, Khaled Ahmed, "HVDC: High Voltage Direct Current Transmission line", First Edition, Wiley 2015

Web References:

1. nptel.ac.in/courses/108104048.
2. nptel.ac.in/courses/108104013/
3. nptel.iitg.ernet.in/ElecEngg/Electrical%20PDFs
4. www.standards.ieee.org

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HOD-Electrical and Electronics Engineering
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Course Code :141EE9115	Course Title: POWER ELECTRONIC APPLICATIONS TO RENEWABLE ENERGY	
Core / Elective: Elective	L : T : P: C	3 : 0 : 0 : 3
Type: Lecture	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0504 Power Electronics

Course Objectives

The course is intended to:

1. Provide knowledge about the stand alone and grid connected systems
2. Design different power converters for solar based system
3. Classify the types of WECS
4. Analyze and comprehend the various operating modes of wind electrical generators
5. Explain the need for hybrid system

UNIT I - INTRODUCTION 7

Global scenario: solar PV, Wind – Solar PV: Basics, Types: Standalone and Grid connected SPPs - Wind: Aerodynamic factors & types of Wind power system

UNIT II – PV SYSTEM CONVERSION 9

Block diagram of PV System, components, MPPT tracking components &Controlling algorithms, Factors affecting PV output, Power converters for Solar: DC Power conditioning converters – AC power conditioners line commutated converters (inversion mode) - Boost and buck-boost converters- selection Of inverter, battery sizing, array sizing — synchronized operation with grid supply Solar- Economic aspect – Efficiency and performance

UNIT III – WIND ENERGY 9

Fixed speed systems: 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

Variable speed systems : 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

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UNIT IV – POWER CONVERTERS IN WECS 11

AC voltage controllers, Interleaved boost converters, Two level Voltage source converters, Three level Neutral point clamped converters, PWM current source Converters , Control of grid connected inverter: Generator-Side Control Grid side Control, Future trends in wind conversion system converters.

UNIT V - HYBRID SYSTEM 9

Wind / Solar PV integrated systems – Need for Hybrid Systems- Types &range of Hybrid system- selection of power conversion ratio – Optimization of system components in hybrid power system

Course Outcomes

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

CO1. Classify the types of PV and Wind energy system
CO2. Explain the components &converters required for PV.
CO3. Describe the operation of various generators available for WECS
CO4. Explain the Converters needed for WECS
CO5.Explain the types of hybrid system and its components

Text Books:

1. Mukund R. Patel "Wind and Solar Power Systems: Design, Analysis, and Operation", Second Edition, Taylor and Francis, 2005
2. Bin Wu, Yongqiang Lang, NavidZargari, Samir Kouro:,"Power Conversion and Control of Wind Energy Systems ",First Edition ,Wiley,2011

Reference Books:

1. S.N.Bhadra, D. Kastha, & S. Banerjee ,"Wind Electrical Systems", First Edition , Oxford University Press, 2009
2. Rashid .M. H "Alternate Energy in power electronics", First Edition ,Academic press, 2015
3. Remus Teodorescu, Marco Liserre, Pedro Rodriguez, "Grid Converters for Photovoltaic and Wind Power Systems " Second Edition ,Wiley,2011
4. Rashid .M. H "power electronics Hand book", Third Edition, Academic press, 2001
5. Fang Lin Luo, Ye Hong, "Renewable Energy Systems: Advanced Conversion Technologies and Applications" First Edition, CRC press 2013

Web References:

1. nptel.ac.in/courses/108108078/pdf/chap6/teach_slides06.pdf
2. nptel.ac.in/courses/108105058/24
3. nptel.ac.in/downloads/108105053/
4. web.mit.edu/solardecathlon/power/SDPV31306.ppt

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Course Code:141EE9116	Course Title: POWER QUALITY	
Elective	L:T:P:C	3:0:0:3
Type: Theory	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 141EEC504 - Power Electronics

Course Objectives

The course is intended to:

1. Explain the concepts of basic power quality problems and standards.
2. Explain the voltage sag mitigation techniques.
3. Explain the sources of transient over voltages and its method of protection
4. Explain the different types of wave form distortion and devices for controlling harmonics.
5. Outline the need for power quality monitoring

UNIT I - INTRODUCTION 6

Definitions: Power quality, Voltage quality – Power quality issues: Short duration voltage variations, Long duration voltage variations, Transients, Waveform distortion, Voltage imbalance, Voltage fluctuation and Power frequency variations – Sources and Effects of power quality problems – Power quality terms – CBEMA and ITI curves – IEEE and IEC Standards.

UNIT II - VOLTAGE SAGS AND INTERRUPTIONS 9

Sources of sags and Interruptions – Estimating Voltage Sag Performance – Motor Starting sag – Voltage Sag Mitigation – Economic Evaluation of Different ride-through Alternatives.

UNIT III - TRANSIENT OVERVOLTAGES 10

Sources of Transient Overvoltage: Capacitor Switching, Lightning, Ferro resonance – Principle of Overvoltage Protection – Devices for Overvoltage Protection – Utility capacitor-switching Transients – Lightning Protection – Switching transients with load – Computer analysis tools for Transients: PSCAD, EMTP

UNIT IV - WAVEFORM DISTORTION 10

Harmonics: Types, Harmonic Distortion, Harmonics indices, Voltage Vs Current distortion, Harmonics Vs Transients, Harmonics Evaluation – Sources and Effects of

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harmonic distortion – System response characteristics – Principles of controlling harmonics –Harmonic Standards– Devices for Controlling harmonics: Passive Filter and Active Power filter.

UNIT V - POWER QUALITY MONITORING **10**

Power quality monitoring: Need for power quality monitoring, Monitoring considerations – Power quality measurement tools – Assessment of PQ measurement data – Expert system for PQ monitoring - Planning, Conducting and Analyzing power quality survey.

Course Outcomes

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

CO1. Explain the concepts of basic power quality problems & its characteristics.
CO2. Explain the voltage sag mitigation techniques.
CO3. Explain the sources of transient over voltages and its method of protection.
CO4. Explain the different types of wave form distortion. and devices for controlling harmonics.
CO5. Outline the need for power quality monitoring

Text Books

1. Roger C. Dugan, Mark, F. Mc Granaghan and H.Wayne Beaty, "Electrical Power Systems Quality", 3rd Edition, McGraw-Hill, New York, 2009
2. Barry W. Kennedy, "Power Quality Primer", McGraw-Hill, New York, 2000.
3. Jos Arrillaga, Neville R. Watson "Power System Harmonics", 2nd Edition Wiley-Blackwell 2003

Reference Books

1. Math H. J. Bollen, "Understanding Power Quality Problems: Voltage Sags and Interruptions", IEEE Press, New York, 2000.
2. Sankaran. C, "Power Quality", CRC Press, Washington, D.C., 2002
3. Aravindam Ghosh, "Power Quality Enhancement using Custom Power Devices" Kluwer Academic Publishers, 2002.

Web References

1. https://www.bchydro.com/.../power_quality_application_guide_adjustabl...
2. www.gentec.ca/stock/eng/power-quality-technical-application-guide.pdf
3. http://samples.sainsburysebooks.co.uk/9780470754238_sample_390210.pdf

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Course Code :141EE9117	Course Title: SMART GRID	
Core / Elective: Elective	L : T : P: C	3 : 0 : 0 : 3
Type: Lecture	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0501 Generation, Transmission and Distribution

Course Objectives

The course is intended to:

1. Study about smart grid technologies and their benefits.
2. Familiarize the concepts of various monitoring system.
3. Study about different smart meters and advanced metering infrastructure.
4. Understand the various communication technologies and protocols used for smart grid.
5. Identify the application areas and energy storage devices for smart grid.

UNIT I - INTRODUCTION TO SMART GRID 9

Evolution of Electric Grid - Difference between conventional & Smart Grid - Need for Smart Grid - Smart grid drivers: functions, opportunities, challenges and benefits - Concept of Resilient &Self-Healing Grid - Present development & International policies in Smart Grid

UNIT II – WIDE AREA MONITORING SYSTEM 9

Fundamentals of synchro phasor technology - concept and benefits of wide area monitoring system - Structure and functions of Phasor Measuring Unit (PMU) and Phasor Data Concentrator (PDC) - Operational experience and Blackout analysis using PMU

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 - Intelligent Electronic Devices (IED) for monitoring & protection.

UNIT IV – INFORMATION AND COMMUNICATION TECHNOLOGY 9

Overview of smart grid communication system - Radio communication - Mobile communication - Power line communication - Optical fibre communication - Communication protocol for smart grid

UNIT V - SMART GRID APPLICATIONS 9

Overview and concept of renewable integration - Micro grids - Advanced Energy Storage Technology: Flow battery, Fuel cell, SMES, Super capacitors - Plug–in Hybrid electric Vehicles

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Course Outcomes

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

CO1: Explain the basic concepts of smart grid.
CO2: Discuss the concepts of wide area monitoring system.
CO3: Demonstrate the functions of various smart meters.
CO4: Explain the various communication technologies used in smart grid.
CO5: Discuss the various applications of smart grid.

Text Books:

1. James Momoh, "Smart Grid: Fundamentals of design and analysis", John Wiley & sons Inc, IEEE press, First edition, 2012.
2. JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", John Wiley & sons Inc, First edition, 2012

Reference Books:

1. Fereidoon Perry Sioshansi "Smart Grid: Integrating Renewable, Distributed & Efficient Energy" Elsevier, First edition, 2012.
2. Stuart Borlase "Smart Grid: Infrastructure, Technology and Solutions", CRC Press, First edition, 2012
3. Ali Keyhani, Mohammad N. Marwali, Min Dai, "Integration of Green and Renewable Energy in Electric Power Systems", Wiley, First edition, 2009
4. Pengwei Du, Ning Lu, "Energy storage for smart grids: planning and operation for renewable and variable energy resources" Elsevier, First edition, 2015
5. Quang-Dung Ho, YueGao, GowdemyRajalingham, Tho Le-Ngoc, "Wireless Communications Networks for the Smart Grid", Springer International Publishing , First edition, 2014

Web References:

1. http://www.iitk.ac.in/ime/anoops/for15/ppts/Day-2%20IITK/Smart%20Grid%20Concept%20&%20Deployment-%20Dr.%20Saikat%20Chakrabarty.pdf
2. https://www.uvm.edu/~phines/classes/ee217/2015-fall/
3. https://www.iitmandi.ac.in/srvsg/files/VG_SG.pdf
4. https://www.smartgrid.gov/the_smart_grid/

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Course Code :141EE9118	Course Title: SWITCHED MODE POWER SUPPLIES	
Core / Elective: Elective	L : T : P: C	3 : 0 : 0 : 3
Type: Lecture	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0502 Control Systems
- 141EE0504 Power Electronics

Course Objectives

The course is intended to:

1. Study the different types of non-isolated and isolated DC-DC converters
2. Understand the voltage mode and current mode control of DC-DC converters
3. Understand the necessity of resonant converters and its types.
4. Derive the converter transfer functions and controller for DC-DC converters.
5. Understand the design of power converters.

UNIT I - DC/DC CONVERTERS 9

Basic topologies of buck, boost converters, buck-boost converters, and cuk converter, isolated DC/DC converter topologies—forward, and fly-back converters, half and full bridge topologies, modelling of switching converters.

UNIT II – CURRENTMODE AND CURRENT FED TOPOLOGIES 9

Voltage mode and current mode control of converters, peak and average current mode control, its advantages and limitations, voltage and current fed converters.

UNIT III – RESONANT CONVERTERS 9

Need for resonant converters, types of resonant converters, methods of control, phase modulation technique with ZVS in full-bridge topology, series resonant converter and resonant transition converter.

UNIT IV – CONVERTER TRANSFER FUNCTIONS & CONTROLLER DESIGN 9

Application of state-space averaging to switching converters, derivation of converter transfer functions for buck, boost, and fly-back topologies.

Controller Design

Introduction, mechanisms of loop stabilization, shaping E/A gain vs. frequency characteristic, conditional stability in feedback loops, stabilizing a continuous mode forward converter and discontinuous mode fly-back converter, feed-back loop stabilization with current mode control, the right-half plane zero.

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UNIT V - POWER CONVERTER DESIGN 9

Design of filter inductor & capacitor, and power transformer, Ratings for switching devices, current transformer for current sensing, design of drive circuits for switching devices, considerations for PCB layout.

Course Outcomes

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

CO1: Explain isolated and non-isolated DC-DC converters and their operation in continuous conduction mode and discontinuous conduction mode

CO2: Apply current control and voltage control methods to regulate the output power

CO3: Explain the necessity of Resonant Converters and apply it to the full bridge topology

CO4: Evaluate the controller stability for the given DC-DC converter

CO5: Design power circuit for given specifications

Text Books:

1. Ned Mohan Tore M. Undeland,"Power Electronics: Converters, Applications, and Design", Third Edition, John Wiley & Sons, 2007.
2. Abraham I. Pressman, "Switching Power Supply Design", McGraw Hill International, Third Edition, 2009.

Reference Books:

1. Philip T Krein, "Elements of Power Electronics", Second Edition, Oxford Press,2014
2. P.C. Sen,"Modern Power Electronics", Second Edition, S. Chand-2005.
3. Andrzej M. Trzynadlowski,"Introduction to Modern Power Electronics", Second Edition, illustrated Publisher John Wiley & Sons, 2015
4. Muhammad H. Rashid, "Power Electronics: Circuits, Devices, and Applications", Seventh Editon, Pearson,2009
5. Christophe Basso, "Switch-Mode Power Supplies SPICE Simulations and Practical Designs" Second Edition,McGraw Hill , 2014

Web References:

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-334-power-electronics-spring-2007/lecture-notes/
2. http://ecee.colorado.edu/~ecen5807/notes.html
3. http://nptel.ac.in/courses/108108036/
4. http://nptel.ac.in/courses/108105066/21
5. www.peg.ee.iisc.ernet.in/people/faculty/vram/smpc/smpcbook.pdf

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Course Code :141EE9119	Course Title: SPECIAL ELECTRICAL MACHINES	
Core / Elective: Elective	L : T : P: C	3 : 0 : 0 : 3
Type: Lecture	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0403 Synchronous and Induction Machines.
- 141EE0504 Power Electronics

Course Objectives

The course is intended to:

1. Prepare the students to have a basic knowledge of construction, classifications and principles of stepper motor with driver circuits.
2. Understand about the switched reluctance motor and its controllers.
3. Empower students to understand the construction, operation and characteristics of permanent magnet brushless dc motors.
4. Expose the students to the concepts of working, characteristics, controls of permanent magnet synchronous motors.
5. Study the operation, performance, control of servo and commutator motors.

UNIT I - STEPPER MOTORS 9

Construction – Principle of operation – Classifications: Variable reluctance, Hybrid – Single and multi stack motors– Theory of torque predictions – Linear and non linear analysis – Characteristics – Drive circuits and closed loop controls - Applications.

UNIT II – SWITCHED RELUCTANCE MOTORS 9

Construction – Principle of working – Torque Equation – Power controllers:Two switching devices per phase, Dump and Split link – Microprocessor based control – Sensor less control.

UNIT III – PERMANENT MAGNET BRUSHLESS DC MOTOR 9

Permanent Magnet materials – Magnetic Characteristics - Principle of operation – Types–Torque equations – Power controllers – Motor characteristics - DSP based control - Applications.

UNIT IV – PERMANENT MAGNET SYNCHRONOUS MOTORS 9

Principle of operation – EMF and torque equations –Phasor diagram – Converter Volt-ampere requirements – Torque speed characteristics –controlmethods - Applications.

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UNIT V – SERVO AND COMMUTATOR MOTORS

Servo motors: Construction, Operation, Classifications, Characteristics, Control and applications Commutator motors: Construction, Principle of operation, Characteristics, Applications of Universal, repulsion and linear induction motors.

Course Outcomes

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

CO1: Summarize the Construction, Classifications and Principles of Stepper motor with driver circuits

CO2: Explain the basic principle of switched reluctance motor and its controllers

CO3: Outline the Construction, operation and characteristics of permanent magnet brushless dc motors

CO4: Describe the working, characteristics, controls of permanent magnet synchronous motors

CO5: Explain the operation, performance, control of servo and commutator motors

Text Books:

1. E. G. Janardanan'Special Electrical Machines' PHI Learning Pvt. Ltd, 2014
2. K. Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.

Reference Books:

1. T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1995.
2. Sen. P. C 'Principles of Electrical Machines and Power Electronics', John Willey& Sons, 2008
3. T. J. E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press,1989.
4. Dubey. G. K. 'Fundamentals of Electric Drives', Alpha Science International Limited, 2008.
5. Bimbhra. P. S 'Generalized Theory of Electrical Machines', Khanna Publishers, 2013.

Web References:

1. http://nptel.ac.in/courses/112103174/16
2. http://www.ti.com/lit/an/spra420a/spra420a.pdf
3. http://www.electrical4u.com/permanent-magnet-dc-motor-or-pmdc-motor/
4. https://www.britannica.com/technology/electric-motor/Permanent-magnet-motors#ref152176

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Course Code :141EE9120	Course Title: COMPUTER AIDED DESIGN OF ELECTRICAL APPARATUS	
Core / Elective: Elective	L : T : P: C	3 : 0 : 0 : 3
Type: Lecture	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0302 DC Machines and Transformers
- 141EE0403 Synchronous and Induction Machines
- 141EE0601 Electrical Machine Design

Course Objectives

The course is intended to:

1. Explain the basics of computer aided design aspects
2. Formulate problems and governing equations for CAD design
3. Solve the Problem for field computation using Finite Element analysis
4. Distinguish the linear and non-linear problems of electrostatic and magneto static fields
5. Design the electrical apparatus using finite element package

UNIT I - INTRODUCTION 9

Review on electromagnetic theory – Basic field equations, calculation of field distribution, inductance, capacitance, force and torque, Review on conventional electrical machine design methodology – computer aided design aspects - advantages.

UNIT II – CAD PACKAGES 9

Numerical methods for solving field problems, recent developments, problem formulation – governing equations – modelling – boundary conditions and material characteristics.

UNIT III – FINITE ELEMENT ANALYSIS 9

Mathematical formulation for 2-D planar and axial symmetry problems – discretization – shape functions – element and global matrices/vectors – solution – post processing.

UNIT IV – FIELD ANALYSIS USING FEA 9

Electrostatics, Magneto statics – linear and non-linear problems, permanent magnet, eddy current analysis, calculation of force/torque.

UNIT V - DESIGN EXAMPLES 9

Design of cylindrical magnetic devices, transformer, Rotating machines

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Course Outcomes

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

CO1: Understand the basics of computer aided design aspects
CO2: Problems and governing equations for CAD design can be formulated
CO3: Solve the Problem for field computation using Finite Element analysis
CO4: Distinguish the linear and non-linear problems of electrostatic and magneto static fields
CO5: Design the electrical apparatus using finite element package

Text Books:

1. Sheppard.J.Salon "Finite Element Analysis of Electrical Machines", Springer International Edition, First Indian Reprint, 2007
2. Nicola Bianchi "Electrical Machine Analysis using Finite Elements", Taylor & Francis, 2005

Reference Books:

1. K.J.Binns, P.J. Lawrenson, C.W. Trowbridge, "The analytical and numerical solution of electrical and magnetic fields", John Wiley & Sons, 1993.
2. Nathan Ida, Joao P A Bastos, "Electromagnetics and calculation of fields", Springer Verlag, Second Edition, 1997.
3. P P. Silvester, Ferrari, "Finite Elements for Electrical Engineers", Cambridge University Press, Third Edition, 1996.
4. M V K Chari, P PSilvester, "Finite Elements in Electrical and Magnetic Field problems", John Wiley, 1980.
5. S.S.Rao, "The Finite Element Method in Engineering", Elsevier,2011.
6. J.N.Reddy, "An Introduction to the Finite Element Method", McGrawHill International Editions, Third illustrated edition, 2006.

Web References:

1. www.electrical-engineering-portal.com
2. http://nptel.iitm.ac.in/courses.php
3. http://nptel.iitm.ac.in/course/108106023/
4. http://nptel.ac.in/courses/108101090

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Course Code :141EE9121	Course Title: POWER ELECTRONIC APPLICATIONS IN POWER SYSTEMS	
Core / Elective: Elective	L : T : P: C	3 : 0 : 0 : 3
Type: Lecture	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0504 Power Electronics
- 141EE0701 Power System Analysis and Stability

Course Objectives

The course is intended to:

1. Impart knowledge on the fundamental concepts of power systems
2. Discuss about the various compensation methods of transmission lines
3. Discuss the operation of conventional reactive power compensators
4. Understand the operation of emerging reactive power compensators
5. Discuss the concepts of HVDC& control

UNIT I - POWER SYSTEM FUNDAMENTALS 9

Reactive power control-conventions used in power engineering-Basic source/load relationships-complex power, apparent power,real and reactive power-leading and lagging loads-power factor correction-compensation and voltage control-control of power and frequency-three phase systems-power flow and measurement-polyphase transformers-harmonics

UNIT II – TRANSMISSION SYSTEM COMPENSATION 9

Uncompensated lines-uncompensated lines under load-compensated transmission lines-static shunt compensation-series compensation.

UNIT III – CONVENTIONAL REACTIVE POWER COMPENSATORS 9

Principles of shunt and series compensation. Shunt Compensation: Methods of Var generation: Thyristor controlled reactor (TCR),Thyristor switched capacitor (TSC), Fixed capacitor- Thyristor controlled reactor (FC-TCR). Series Compensation :Thyristor Switched Series Capacitor (TSSC), Thyristor Controlled Series Capacitor (TCSC).

UNIT IV – CUSTOM POWER DEVICES 9

Introduction to custom power devices-Network reconfiguring devices-load compensation using DSTATCOM-Voltage regulation using DSTATCOM-Protective sensitive loads using DVR - Static Synchronous Series Compensator (SSSC) - unified power flow controller-Unified power quality conditioner-custom power park-status of application of CP devices

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UNIT V - HVDC TRANSMISSION 9

Introduction to HVDC transmission, Comparison between HVAC and HVDC systems -3-pulse, 6-pulse, and 12-pulse converters-Advanced concepts in conventional HVDC applications-HVDC based on voltage source inverters-Multilevel VSC's and HVDC- Harmonics in HVDC Systems, Harmonic elimination: AC and DC filters.

Course Outcomes

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

CO1: Summarize the fundamental concepts of power systems
CO2: Explain the compensation methods of transmission lines
CO3: Describe the operation of conventional reactive power compensators
CO4: Summarize the operation of emerging reactive power compensators
CO5: Explain the concepts of High voltage DC Transmission & control

Text Books:

1. E. Acha, T.J.E.Miller, "Power Electronic Control in Electrical Systems", Newnes, First Edition, 2002
2. R.MohanMathur& Rajiv K.Varma "Thyristor-Based FACTS Controllers For Electrical Transmission Systems", Wiley , Second Edition,2011.

Reference Books:

1. NarinG.Hingorani, "Power Electronics in Electric Utilities: Role of Power Electronics in Future power systems", Proc. of IEEE, Vol.76, no.4, April 1988.
2. Colin Adamson and N.G.Hingorani ," High Voltage Direct Current Power Transmission", Garraay Limited, first Edition, 1960.
3. K. R. Padiyar , " HVDC Power Transmission System", Wiley Eastern Limited, Third Edition,2011.
4. N.G.Hingorani, "Understanding FACTS: Concepts and Technology of FACTS Systems", IEEE Press,First Edition, 2000.
5. ArindamGhosh,Gerardledwich,"Power Quality Enhancement Using Custom Power Devices ",Kluwer academic publishers, first Edition,2002.

Web References:

1. http://nptel.ac.in/courses/108104013/
2. http://nptel.ac.in/courses/108104052/26
3. http://nptel.ac.in/courses/108101040/20

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Course Code :141EE9122	Course Title: ELECTRICAL ENERGY UTILIZATION AND CONSERVATION	
Core / Elective: Elective	L : T : P: C	3 : 0 : 0 : 3
Type: Lecture	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0302 DC Machines and Transformers
- 141EE0702 Solid State Drives

Course Objectives

The course is intended to:

1. Understand the need for traction system
2. Introduce the energy saving concept by different ways of illumination
3. Understand the different methods of electric heating and electric welding
4. Introduce knowledge on Solar Radiation and Solar Energy Collectors
5. Introduce concepts of Wind Energy and its utilization

UNIT I - ELECTRIC TRACTION 11

Requirements of traction system - Systems of traction - Systems of track electrification - Speed-Time curves - Tractive effort - Power of traction motor - Specific energy consumption – Block Diagram of Modern Locomotive – Main and Auxiliary Power supply circuits – Current Collection Systems -Motors for traction - Starting and speed control - Electric braking.

UNIT II – ELECTRIC HEATING AND WELDING 8

Electric heating: Merits, types: Resistance,Induction,Dielectric- Temperature control - induction furnace - Choice of voltage and frequencies for Dielectric heating.
Welding:Equipment's, types – Resistance, Arc, Laser, Ultrasonic.

UNIT III – ILLUMINATION 8

Nature of light - Luminous intensity - Illumination - Brightness - Lamp efficiency - Luminous efficiency - Laws of illumination - Electrical sources of light - Fluorescent lamp, Incandescent lamp, Sodium Vapour lamp, Mercury Vapour lamp, CFL and LED lighting systems - Polar curves - Calculation of illumination - Indoor and outdoor Lighting schemes-standards (IS).

UNIT IV – ECONOMIC ASPECTS OF UTILISATION 9

PF improvement - Load curves - Load factors - Its improvement – Depreciation – Tariff: Types, time-of-use - Demand side Management –Peak clipping – Peak shifting – valley filling - Use of off-peak energy.

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UNIT V - ENERGY MANAGEMENT & AUDIT 9

Definition, Energy audit- need, Types of energy audit, - Energy management (audit) approach-standards(ISO)- understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments. Overview of energy conservation practices.

Course Outcomes

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

CO1: Explain the concepts of Electric Traction
CO2: Classify the different types of electric heating and welding.
CO3: Compute the energy saving of various illumination systems
CO4: Determine the electricity cost by different types of tariff
CO5: Explain the concepts of energy management and audit

Text Books:

1. Uppal S.L, Rao.S" Electrical Power System", Khanna Publishers, New Delhi, fifteenth Edition, 2009.
2. F. Kerith, D.Y. Goswami, "Energy Management and Conservation Handbook", CRC Press, 2008.

Reference Books:

1. Wadhwa C L, "Generation, Distribution and Utilization of Electrical Energy" New Age International Publishers, New Delhi, fourth Edition, 2012.
2. Taylor E.O. and VVL Rao, "Utilization of Electric Energy", Orient Longman, New Delhi, third Edition,2007
3. Suryanarayanan, N.V., "Utilization of Electric Power Including Electric Drives and Electric Traction", New Age International Publishers, New Delhi, second Edition 2014
4. Abbi Y P, Shashank Jain, "Handbook on Energy Audit and Environment Management", Teri Press, New Delhi, 2006
5. Albert Thumann, "Handbook of Energy Audits", seventh Edition, 2007

Web References:

1. https://www.beeindia.gov.in/
2. http://nptel.ac.in/courses/113104058/mme_pdf/Lecture38.pdf
3. http://www.bis.org.in/sf/pow/etd.pdf
4. www.electrical4u.com/laws-of-illumination/
5. https://energy.gov/energysaver/electric-resistance-heating

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Course Code :141EE9123	Course Title: POWER SYSTEM OPERATION AND CONTROL	
Core / Elective: Elective	L : T : P: C	3 : 0 : 0 : 3
Type: Lecture	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0501 Generation, Transmission and Distribution
- 141EE0701 Power System Analysis and Stability

Course Objectives

The course is intended to:

1. An overview of power system operation and control.
2. Study the economic operation of power system.
3. Model power frequency dynamics and to design power frequency controller.
4. Model reactive power -voltage interaction and the control actions to be implemented for maintaining the voltage profile against varying system load.
5. Learn about SCADA and its application for real time operation and control of power systems.

UNIT I - INTRODUCTION 8

Structure of power system – load and load duration curves – load forecasting– components of system load: base load, load factor, diversity factor and important terms for deciding the type and rating of the generating plant with related problems – reserve: requirements, installed reserves, spinning reserves, cold reserves, and hot reserves.

UNIT II – ECONOMIC DISPATCH & UNIT COMMITMENT 8

Economic dispatch: incremental cost curve, co-ordination equations, solution by direct method and λ-iteration method (No derivation of loss coefficients) – base point–participation factors.

Unit commitment: constraints-methods: priority ordering, dynamic programming.

UNIT III – ACTIVEPOWER & FREQUENCY CONTROL 11

Speed governing system: transfer function model – load frequency control of single area system: static & dynamic response – AGC in isolated and interconnected power systems – modelling of tie line – representation of two area system: static and dynamic response, frequency bias tie line control – selection of bias factor.

UNIT IV – REACTIVEPOWER & VOLTAGE CONTROL 11

Generation and absorption of reactive power – methods of voltage control: excitation control, shunt and series reactor, series and shunt capacitor, synchronous condenser, static VAR systems, tap changing transformers – comparisons of different types of compensating equipment for transmission systems.Excitation system: characteristics,

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modelling of excitation system – types: DC, AC.

UNIT V - POWER SYSTEM SECURITY&SCADA 7

Power system security: Factors and operating states – recent trends in real time control of power systems – introduction to state estimation.
SCADA: Energy control centers, EMS functions.

Course Outcomes

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

CO1: Determine the load pattern of the generating station
CO2: Estimate the economic load dispatch and unit commitment for a given generator and load specifications
CO3: Design a power-frequency controller for the given specification
CO4: Explain reactive power-voltage interaction for maintaining the voltage profile of a system
CO5: Explain computer applications for secured power system operations.

Text Books:

1. PrabhaKundur, 'Power Stability and Control', Tata McGraw Hill Publishing Company Ltd., NewDelhi, First edition, 2006.
2. Allen. J. Wood and Bruce F. Wollenberg, 'Power Generation, Operation and Control', John Wiley & Sons, Third edition, 2013

Reference Books:

1. Nagrath I.J., KothariD.P.,"Power System Engineering", Tata MCGraw Hill Publication,Fourth Edition, 2011.
2. Sivanagaraju, G.Sreenivasan- "Power System Operation & Control", Pearson Education India, First Edition, 2010.
3. N.V.Ramana, "Power System Operation and Control," Pearson Education India, First Edition, 2011.
4. Olle.I.Elgerd, 'Electric Energy Systems theory – An introduction', Tata McGraw Hill Education Pvt. Ltd., NewDelhi,SecondEdition, 2012.
5. P.Venkatesh, B.V.Manikandan, S.Charles Raja, 'Electrical Power Systems: Analysis, Security and Deregulation', PHI Learning Pvt., Ltd., 2012 Edition.

Web References:

1. http://nptel.ac.in/courses/108104052.
2. http://nptel.ac.in/courses/108106022/LECTURE%207.pdf
3. http://www.pse.pl/uploads/kontener/UCTE_Operation_Handbook_Appendix1.pdf.
4. http://electrical-engineering-portal.com/how-reactive-power-is-helpful-to-maintain-a-system- healthy.
5. http://home.iitk.ac.in/~saikatc/EE632_files/Ps_security.pdf

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Course Code :141EIE9124	Course Title: COMMUNICATION ENGINEERING	
Elective	L : T : P: C	3 : 0 : 0 : 3
Type: Theory	Totall Contact hours:	45 Hours

Pre-requisites: The student should have undergone the course(s):

- 141EE0204 Electron Devices
- 141EE0404 Electronic Circuits

Course Objectives

The course is intended to:

1. Summarize the basic concepts of modulation systems.
2. Discuss the different types of transmission medium
3. Explain different digital modulation schemes
4. Illustrate the different network protocols.
5. Describe the basic elements of optical fiber communication strategies

UNIT I – MODULATION SYSTEMS 9

Need for Modulation - Principles of amplitude modulation – Frequency spectrum — power relations – generation of AM — DSB, DSB/SC, SSB; Demodulation – Envelop/diode detector - Superhet Receiver; Generation (Armstrong method) and detection (Foster Seely Discriminator) of FM and PM – Frequency spectrum – power relations.

UNIT II – TRANSMISSION MEDIUM 9

Transmission lines – Types, equivalent circuit, losses, standing waves, impedance matching, bandwidth; radio propagation – Ground wave and space wave propagation, critical frequency, maximum usable frequency, path loss, white Gaussian noise

UNIT III – DIGITAL COMMUNICATION 9

Pulse modulation: PAM, PWM, PPM; Concept of Sampling - Sampling theorem – PCM - Digital T carrier system - Digital Radio System - Digital modulation: ASK, FSK, PSK

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UNIT IV – DATA COMMUNICATION AND NETWORK PROTOCOL

Data Communication codes - Error detection and correction codes - Serial and parallel interface -
Telephone network - Data modem - ISDN, LAN, ISO -OSI seven layer architecture for WAN

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UNIT V - OPTICAL FIBER COMMUNICATION

General Fiber optic communication system – Advantages – optical fiber waveguides – transmission theory, Principle of Light propagation through fiber- fiber profiles and configuration-Losses of optical fiber communication - Light sources and detectors-Transmission techniques – multichannel transmission technique, Power line carrier communications.

Course Outcomes

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

- CO1. Summarize the basic concepts of AM, FM transmission and reception
- CO2. Discuss the different types of transmission medium
- CO3. Explain different digital modulation schemes
- CO4. Illustrate the different network protocols used in communication systems
- CO5. Describe the basic elements of optical fiber communication strategies

Text Books

1. Wayne Tomasi, 'Electronic Communication Systems', Pearson Education, Third Edition,2001.
2. Roy Blake, 'Electronic Communication Systems', Thomson Delmar, Second Edition, 2002.

Reference Books

1. William Schweber, 'Electronic Communication Systems', Prentice Hall of India, 2002.
2. G. Kennedy, 'Electronic Communication Systems', McGraw Hill, Fourth Edition, 2002.
3. J.G.Proakis, M.Salehi, "Fundamentals of Communication Systems", Pearson Education 2006.
4. Gerd Keiser, "Optical Fiber Communication", McGraw Hill ,Third Edition, 2000.
5. Behrouz A. Forouzan, "Data Communication and Networking", Fourth Edition, TMH, 2011

Web References

1. http://nptel.ac.in/courses/117105077/
2. http://nptel.ac.in/courses/117102059/
3. http://nptel.ac.in/courses/117101002/download/lec01.pdf
4. http://nptel.ac.in/courses/106105082

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Course Code:141EE9125	Course Title: COMPUTER ARCHITECTURE (Common to ECE, EEE & EIE)	
Elective	L : T : P: C	3 : 0 : 0 : 3
Type: Theory	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0503 - Microprocessor and Microcontroller

Course Objectives

The course is intended to:

1. Identify the various computer system modules.
2. Design high speed Arithmetic and logic unit.
3. Analyze the occurrence of hazards.
4. Classify various memories used in computer system.
5. Analyze the data transfer modes.

UNIT I - BASIC STRUCTURE OF COMPUTERS 9

Functional units- Basic Operational Concepts, Bus Structures, Software Performance – Memory locations and addresses – Memory operations – Instruction and instruction sequencing – addressing modes – assembly language – Basic I/O operations, Stacks and queues

UNIT II - ARITHMETIC UNIT 9

Addition and subtraction of signed numbers – Design of fast adders – multiplication of positive numbers- signed operand multiplication and fast multiplication – Integer division, Floating point numbers and operations.

UNIT III - BASIC PROCESSING UNIT 9

Fundamental concepts – Execution of a complete Instruction – Multiple bus organization – Hardwired control – micro programmed control, Pipelining – Basic concepts – data hazards – instruction hazards – influence on Instruction sets – Data path and control consideration, Superscalar operation.

UNIT IV - MEMORY SYSTEM 9

Basic concepts – semiconductor RAMs, ROMs – Speed, size and cost – cache memories - Performance consideration – Virtual memory- Memory Management requirements, Secondary storage.

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UNIT V - I/O ORGANIZATION 9

Accessing I/O devices – Interrupts – Direct Memory Access – Buses – Interface circuits – Standard I/O Interfaces (PCI, SCSI, and USB)

Course Outcomes

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

- CO1. Identify the various modules of the computer system.
- CO2. Design high speed Arithmetic and logic unit to perform various arithmetic operations
- CO3. Analyze the occurrence of hazards during the execution of machine instructions.
- CO4. Classify various memories used in computer system based on their characteristics.
- CO5. Analyze the data transfer modes of I/O devices through different buses.

Text Books

1. Carl Hamacher, Safwat Zaky, Zvonko Vranesic, "Computer Organization", Tata McGraw-Hill Education Pvt. Ltd, Fifth Edition 2011.
2. William Stallings, "Computer Organization and Architecture – Designing for Performance" , Eighth Edition, Pearson Education, 2010.

Reference Books

1. David A. Patterson and John L. Hennessey, "Computer organization and design", Morgan Kauffman, 2014.
2. Vincent P. Heuring, Harry F. Jordan, "Computer System Architecture", Second Edition, Pearson Education, 2005.
3. Govindarajalu B, "Computer Architecture and Organization, Design Principles and Applications", Second edition, Tata McGraw Hill, New Delhi, 2010.
4. AharonYadin, " Computer Systems Architecture", Chapman and Hall/CRC, 2016

Web References

1. http://nptel.ac.in/courses/106102062/
2. https://www.c.s.upenn.edu/~milom/cis501-Fall11/lectures/00_intro.pdf
3. https://inspirit.net.in/books/academic/Computer%20Organisation%20and%20Architecture%208e%20by%20William%20Stallings.pdf
4. http://www.nptelvideos.in/2012/11/computer-architecture.html
5. http://www.learnerstv.com/Free-Computer-Science-Video-lectures-ltv086-Page1.html

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CourseCode: 141EE9126	Course Title: INDUSTRIAL DATA COMMUNICATION NETWORKS (Common to EEE & EIE)	
Core/Elective: Elective	L : T : P : C : M	3 : 0 : 0 : 3 : 100
Type: Lecture	Total Contact Hours: 45	

Prerequisites: The student should have undergone the course(s):

Nil

Course Objectives
The course is intended to::

1. Enumerate the layers of the OSI model and TCP/IP.
2. Summarize the different types of industrial Ethernet.
3. Describe the different standards of industrial protocol.
4. Explain the different types of field bus technology.
5. Illustrate the wireless communication standards and Satellite networks.

UNIT I OSI REFERENCE MODEL 9

ISO-OSI model – Layers in the OSI model – Peer to Peer Process –TCP/IP Protocol Suite– TCP/IP comparison with OSI model – Types of TCP/IP addressing

UNIT II INDUSTRIAL ETHERNET 9

Introduction – IEEE Standards – Ethernet MAC layer – IEEE 802.2 and Ethernet SNAP – OSI and IEEE 802.3 standard. Ethernet transceivers, Ethernet types, switches and switching hubs, 10 Mbps Ethernet, 100 Mbps Ethernet, Gigabit Ethernet.

UNIT III INDUSTRIAL DATA COMMUNICATION PROTOCOL 9

Serial communication Standards: RS232, 422 and 485 – Protocol Structure Overview – Example Function codes. ASCII based protocol - Modbus protocol – Overview. HART Protocol – Overview – Layers

UNIT IV FIELD BUS TECHNOLOGY 9

AS-i Bus - Protocol Stack - CAN bus – Overview – Layers - Profibus – Overview – Protocol Stack. FIP and World FIP - Foundation Field Bus – Layers – Error Detection and Diagnostics – Redundancy

UNIT V WIRELESS COMMUNICATION 9

Wireless LANs – IEEE 802.11 standard – Blue Tooth Communication - Wireless WANs – Cellular Telephony: 1G, 2G, 3G and 4G/LTEE – Satellite Networks.

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Course outcomes:

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

CO 1: Enumerate the layers of the OSI model and TCP/IP.
CO 2: Summarize the different types of industrial Ethernet.
CO 3: Describe the different standards of industrial protocol.
CO 4: Explain the different types of field bus technology.
CO 5: Illustrate the wireless communication standards and Satellite networks.

Text Books:

1. Behrouz A Forouzan, 'Data Communications and Networking', Tata McGraw-Hill, 2013.
2. William Buchanan, 'Computer Buses- Design and Application', CRC Press, 2000.

Reference Books

1. Theodore S Rappaport, 'Wireless Communications: Principles and Practice', Prentice Hall PTR, Second Edition, 2010.
2. Stallings,W., "wireless Communication and networks", second Edition, Prentice Hall of India, 2005.
3. Steve Mackay, Edwin Wright and Deon Reynders, 'Practical Industrial data Networks: Design, Installation and Trouble Shooting', Elsevier International Projects Ltd., 2004.
4. Nader. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall Publishers, 2010.
5. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill Publisher, 2011.

Web References:

1. http://nptel.ac.in/courses/106105082/
2. http://nptel.ac.in/downloads/106105080/
3. http://sine.ni.com/nips/cds/view/p/lang/en/nid/208382
4. http://www.fieldbusinc.com/

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CourseCode: 141EE9127	Course Title: ADVANCED MICROPROCESSORS (Common to EEE & EIE)	
Core/Elective: Elective	L : T : P : C : M	3 : 0 : 0 : 3 : 100
Type: Lecture	Total Contact Hours: 45	

Prerequisites: The student should have undergone the course(s):

- 141EE0503 Microprocessor and Microcontroller

Course Objectives

The course is intended to::

1. Explain the basic concepts of advanced microprocessors
2. Describe the architecture of Pentium processors.
3. Discuss the concepts and architecture of RISC processor.
4. Describe the concepts of the Superscalar Processors
5. Explain the architecture programming and interfacing of advanced microprocessors.

UNIT I MICROPROCESSOR ARCHITECTURE **9**

Instruction Set – data formats -addressing modes-memory hierarchy-register file-cache—virtual memory and paging-segmentation- pipelining- instruction pipeline—pipeline hazard-instruction level parallelism-reduced instruction set- RISC VS CISC

UNIT II PENTIUM MICROPROCESSORS **9**

Introduction to Pentium Microprocessor- real and production mode operation- software model of Pentium – function description –registers-data organization- summary of the 80286,80386, and 80486- cpu architecture –bus operation-pipelining-branch

UNIT III RISC PROCESSORS I **9**

PowerPC620 – Instruction fetching – Branch Prediction – Fetching – Speculation, Instruction Dispatching –dispatch stalls – Instruction Execution – Issue stalls- Execution Parallelism– Instruction completion – Basics of P6 micro architecture – Pipelining – Memory subsystem.

UNIT IV RISC PROCESSORS II (SUPERSCALAR PROCESSORS) **9**

Intel i960 – Intel IA32- MIPS R8000 – MIPS R10000 – Motorola 88110 – Ultra SPARC processor- SPARC version 8 – SPARC version 9.

UNIT V PC HARDWARE OVERVIEW **9**

Functional Units & Interconnection, New Generation Mother Boards 286 to Pentium 4 Bus Interface- ISA- EISA- VESA- PCI- PCIX. Peripheral Interfaces and Controller, Memory and I/O Port Addresses.

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Course Outcomes

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

CO1. Explain the basic concepts of advanced microprocessors
CO2. Describe the architecture of Pentium processors.
CO3. Discuss the concepts and architecture of RISC processor.
CO4. Describe the concepts of the Superscalar Processors
CO5.Explainthearchitecture programming and interfacing of advanced microprocessors

Text Books:

1. B.B.Brey The Intel Microprocessor 8086/8088 /80186/80188, 80286, 80386, 80 486PENTIUM, PENTIUM Pro, PII, PIII & IV Archietecture, Programming & Interf acing, Pearson Education ,2004.
2. John Paul Shen, Mikko H.Lipasti, "Modern Processor Design", Tata Mcgraw Hill,2006.

References:

1. Daniel Tabak , "Advanced Microprocessors", McGrawHill.Inc., Edition 2 1995
2. James L. Antonakos , " The Pentium Microprocessor", Pearson Education, 1997.
3. Gene .H.Miller, "Micro Computer Engineering", Pearson Education , 2003.
4. Douglas V.Hall, "Microprocessors and Interfacing", Tata McGraw Hill, II Edition 2006
5. Mohamed Rafiquzzaman, "Microprocessors and Microcomputer Based System Design", II Edition, CRC Press, 2007.

Web References:

1. http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/microcontrollers/micro/ui/TOC.htm
2. https://ee641dm.wordpress.com/study-materials/
3. https://www.tutorialspoint.com/microprocessor/index.html

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Course Code: 141EE9128	Course Title: ASIC DESIGN (Common to ECE,EEE & EIE)	
Core/Elective: Elective	L : T : P : C : M	3 : 0 : 0 : 3 : 100
Type: Lecture	Total Contact Hours: 45	

Prerequisites: The student should have undergone the course(s):

- 141EE0304 Digital Electronics
- 141EE0604 VLSI Design

Course Objectives

The course is intended to::

1. Explain the different types of ASICs and logic cells used in ASIC design.
2. Explain the architecture of various programmable logic cells.
3. Explain the interconnects in programmable logic cells and design software.
4. Develop a digital circuit using HDL.
5. Explain the various functional blocks in an ASIC.

UNIT I INTRODUCTION TO ASICS 9

Types of ASICs - Design flow – CMOS transistors- CMOS Design rules –Combinational logic Cell - Sequential logic cell - Transistor as Resistor - Transistor parasitic capacitance - Library cell design.

UNIT II PROGRAMMABLE ASICS, LOGIC CELLS AND I/O CELLS 9

Anti fuse - Static RAM - EPROM and EEPROM technology - Actel ACT - Xilinx LCA, Xilinx I/O blocks –- Altera MAX 5000 - Altera FLEX.

UNIT III ASIC INTERCONNECT AND DESIGN SOFTWARE 9

Actel ACT -Xilinx LCA - Xilinx EPLD - Altera MAX 5000 - Altera FLEX –Design systems - Logic Synthesis - Half gate ASIC -Low level design language - PLA tools

UNIT IV LOGIC SYNTHESIS 9

A logic synthesis example:- Adder and MUX units, FSM synthesis in VHDL, Memory synthesis in VHDL.

UNIT V FLOOR PLANNING, PLACEMENT AND ROUTING 9

Floor planning, Placement, Routing- Global routing, detailed routing, special routing, Parasitic extraction, LVS and DRC.

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

CO1: Explain the different types of ASICs and logic cells used in ASIC design.
CO2: Explain the architecture of various programmable logic cells.
CO3: Explain the interconnects in programmable logic cells and design software.
CO4: Develop a digital circuit using HDL.
CO5: Explain the various functional blocks in an ASIC.

Text Books:

1. Michael John Sebastian Smith"Application Specific Integrated Circuits" Pearson Education 2006.
2.Norman G. Einspruch, "Application Specific Integrated Circuit (ASIC) Technology", Academic Press, 2012.

References:

1. Morris Mano.M, "Digital Design", Pearson Education Pvt.Ltd, Third Edition , 2013.
2. Douglas L. Perry, "VHDL: Programming by Example", McGraw-Hill, Fourth Edition,2002.

Web references:

1. www.vlsi.wpi.edu/cds/explanations/lvs.html
2. http://www.eng.auburn.edu/
3. http://www.geoffknagge.com/fyp/index.shtml#asic

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Course Code:141EE9129	Course Title: DIGITAL IMAGE PROCESSING (Common to ECE,EEE & EIE)	
Elective	L:T:P:C	3:0:0:3
Type: Theory	Total Contact hours:	45Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0406 – Networks and Signals.
- 141EE0602 - Digital signal Processing

Course Objectives

The course is intended to:

1. Analyze the digital images in frequency domain.
2. Analyze the given Digital Image by applying various filtering techniques.
3. Analyze the given digital images using restoration model.
4. Select the techniques for segmenting digital images.
5. Apply the various compression schemes.

UNIT I - DIGITAL IMAGE FUNDAMENTALS 9

Elements of digital image processing systems, Digital Camera, Elements of visual perception, brightness, contrast, hue, saturation, Mach band effect, Color image fundamentals - RGB,HSI models, Image sampling, Quantization, 2D transforms - DFT, DCT, KLT and SVD

UNIT II - IMAGE ENHANCEMENT 9

Spatial Domain techniques: Intensity transformations, contrast stretching, Histogram equalization and specification techniques, Smoothing filters, sharpening filters, gradient and Laplacian. Frequency domain techniques: Smoothening filters, sharpening filters and Homomorphic filtering

UNIT III - IMAGE RESTORATION 9

Model of Image restoration process - Noise models- Restoration in the presence of noise (both spatial and frequency domain) Linear Image restoration techniques: Inverse filtering- Wiener filtering. Restoration from projections: Projections and the Radon transform

UNIT IV - IMAGE SEGMENTATION 9

Edge detection, Edge linking-Region based segmentation – Region growing – Region

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splitting and Merging. Clustering techniques: K-means clustering. Basic Morphological operations for Image Processing.

UNIT V - IMAGE COMPRESSION 9

Need for data compression - Classification of Image compression schemes - Run length coding Huffman coding - Arithmetic coding - LZW coding, Transform based compression – Image compression standards

Course Outcomes

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

CO1. Analyze the digital images in frequency domain by applying 2D transforms.
CO2. Analyze the given Digital Image by applying various filtering techniques in both spatial and frequency domains.
CO3. Analyze the given digital images using an appropriate restoration model.
CO4. Select the appropriate techniques for segmenting digital images.
CO5. Apply the various compression schemes for the given image.

Text Books

1. Rafael C.Gonzalez and Richard E. Woods, "Digital Image Processing", Second Edition, Pearson Education, 2002.
2. Anil K. Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 2009

Reference Books

1. Dr. Jayaraman, S., Essakirajan, S., and Veerakumar, T.,"Digital Image Processing", Tata McGraw Hill, New Delhi, 2012.
2. David Salomon, "Data Compression – The Complete Reference", Third Edition, Springer Verlag New york, 2004.
3. William K-Pratt, "Digital Image Processing", Fourth Edition, John Wiley and Sons, 2007.
4. Kenneth R.Castleman, "Digital Image Processing", Pearson Education, 1996.

Web References

1. https://en.wikipedia.org/wiki/Digital_image_processing
2. www.tutorialspoint.com/dip/
3. www.imageprocessingplace.com/
4. nptel.ac.in/courses/117105079/

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Course Code:141EE9130	Course Title: EMBEDDED SYSTEM DESIGN	
Elective	L:T:P:C	3:0:0:3
Type: Theory	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0304 - Digital Electronics
- 141EE0503 - Microprocessor and Microcontroller

Course Objectives

The course is intended to:

1. Discuss the ARM Processor Architecture.
2. Design ARM processor Peripherals.
3. Examine the significance of operating systems
4. Select the suitable communication technique.
5. Analyze the system architecture.

UNIT I - INTRODUCTION TO EMBEDDED SYSTEM AND ARM PROCESSOR 9

Definition of Embedded System, Features of Embedded System ,Types of Embedded System , List of Embedded System Devices, LPC 2148 ARM Block diagram, Memory and on chip peripheral devices, ARM 7 TDMI-S, Debug and Emulation Trace facility, Memory Map – Memory re-map and Boot Block, CPU registers, Modes of Operation, PSW, Instruction set, Assembly Language Program for Addition, Subtraction, Multiplication and Division.

UNIT II - ARM PROCESSOR INTERFACING TECHNIQUES 9

GPIO register map – Pin Connect Block, 8 bit LEDs, 8bit Switches, Buzzer, Relay, Stepper Motor interfaces, Timer/Counter, Vector Interrupt Controller (VIC), PWM - generating single ended PWM , ADC - Temperature sensor interfacing.

UNIT III - REAL TIME OPERATING SYSTEMS 9

Tasks and states, scheduling, Inter Process Communication- Semaphore(s), Shared data problem, Priority Inversion Problem and Deadlock Situations, Message Queues, Mailboxes, Pipes, Introduction to µC OS II, Porting of µC OS II, RTOS functions – OS_STK – OS_EVENT – OSInit() –OSStart() – OSTaskCreate() – OSTaskDel() – OSSemCreate() – OSSemPend() –OSSemPost() - OSTimeDly(), Application programs using the above Functions.

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UNIT IV - COMMUNICATION DEVICES AND BUS STANDARDS 9

I/O Devices: Types and Examples of I/O devices, Synchronous, Iso-synchronous and Asynchronous Communications from Serial Devices, Internal Serial-Communication Devices: SPI, UART - Timer and Counting Devices – Serial Communication using: 'I²C'- 'CAN'- Advanced I/O Serial high speed buses

UNIT V - SYSTEM DESIGN TECHNIQUES 9

Design Methodologies, Requirement Analysis, Specification, System Analysis and Architecture Design. Design Examples: Telephone PBX- System Architecture - Ink jet printer - Hardware Design and Software Design- Personal Digital Assistants- Set-top Boxes.

Course Outcomes:

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

CO1. Discuss the ARM Processor Architecture with programming concepts
CO2. Design ARM processor Peripherals using Embedded 'C' Concept
CO3. Examine the significance of operating systems in embedded system design
CO4. Select the suitable communication technique to interface peripherals and sensors
CO5. Analyze the system architecture using existing product design

Text Books

1. Rajkamal, "Embedded Systems Architecture, Programming and Design, Tata McGraw-Hill, First reprint 2003
2. Wayne Wolf, "Computers as Components: Principles of Embedded Computing System Design" Morgan Kaufman Publishers, First Indian Reprint 2001

Reference Books

1. David E. Simon, "An Embedded Software Primer", Pearson Education Asia, First Indian Reprint, 2000
2. K.V.K.K.Prasad "Embedded /Real-Time Systems: Concepts, Design and Programming", Dream Tech, Wiley 2003
3. Andrew N Sloss, Dominic Symes and Chris Wright, "ARM System Developer's Guide Designing and optimizing system Software", Morgan Kaufmann publisher, Elsevier-2004
4. Steve Furber, "ARM System –On –Chip architecture", Addision Wesley, 2000
5. Dave, "Embedded Systems: Concepts Design and Programming", First edition, Pearson Ecucation, 2015

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Course Code: 141EE9131	Course Title: TESTING OF VLSI CIRCUITS (Common ECE & EEE)	
Core/Elective: Elective	L : T : P : C : M	3 : 0 : 0 : 3 : 100
Type: Lecture	Total Contact Hours: 45	

Prerequisites: The student should have undergone the course(s):

- 141EE0304 Digital Electronics
- 141EE0604 VLSI Design

Course Objectives

The course is intended to::

1. Identify the faults in the digital circuits.
2. Create Test Patterns for combinational logic circuit. (Ap)
3. Create Test Patterns for sequential logic circuit(Ap)
4. Explain the different testability techniques for Testing.
5. Explain various BIST Architecture and test algorithms.

UNIT I TESTING AND LOGIC SIMULATION 9

Introduction to testing – Faults in Digital Circuits – Modeling of faults – Logical Fault Models – Fault detection and redundancy – Fault equivalence and fault Location – Fault dominance – Logic simulation – Types of simulation – Delay models – Gate Level Event – driven simulation.

UNIT II TEST GENERATION FOR COMBINATIONAL CIRCUITS 9

Test generation for combinational logic circuits – Testable combinational logic circuit design.

UNIT III TEST GENERATION FOR SEQUENTIAL CIRCUITS 9

Test generation for sequential circuits – design of testable sequential Logic circuits.

UNIT IV DESIGN FOR TESTABILITY 9

Design for Testability – Ad-hoc design – generic scan based design – classical scan based design – system level DFT approaches.

UNIT V SELF TEST AND TEST ALGORITHMS 9

Built-In-Self-Test – test pattern generation for BIST – Circular BIST – BIST Architectures – Testable Memory Design – Test Algorithms – Test generation for Embedded RAMs.

Course outcomes:

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

CO1. Identify the faults in the digital circuits.
CO2. Create Test Patterns for combinational logic circuit. (Ap)
CO3. Create Test Patterns for sequential logic circuit(Ap)
CO4. Explain the different testability techniques for Testing.
CO5. Explain various BIST Architecture and test algorithms

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Text Books:

1. M.Abramovici, M.A.Breuer and A.D. Friedman, "Digital systems and Testable Design",Jaico Publishing House, 2002.
2.P.K. Lala, "Digital Circuit Testing and Testability", Academic Press, 2002.

References:

1. M.L.Bushnell and V.D.Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers, 2002.
2. A.L.Crouch, "Design Test for Digital IC's and Embedded Core Systems", Prentice Hall International, 2002.
3. Robert J., Jr. Feugate, stevan M. McIntyre, "Introduction to VLSI Testing", Prentice Hall International, 1988.
4. Angela Krstic and Kwang-Ting Cheng "Delay fault testing for VLSI Circuits", Kluwer Academic Publishers, 1998
5. Mike Tien and Chien Lee, "High-Level Test Synthesis of Digital VLSI Circuits", Artech House, Inc., 1997

Web References

1. http://onlinelibrary.wiley.com/doi/10.1002/0471457787.fmatter/pdf
2. http://nptel.ac.in/courses/106103016/30
3. www.cs.colostate.edu/~malaiya/530/08/resources.html

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Course Code: 141EE9132	Course Title: LOW POWER VLSI DESIGN (Common to ECE & EEE)	
Core/Elective: Elective	L : T : P : C : M	0 : 0 : 3 : 2 : 100
Type: Lecture	Total Contact Hours: 45	

Pre-requisites: The student should have undergone the course(s):

- 141EE0204 Electron Devices
- 141EE0304 Digital Electronics
- 141EE0604 VLSI Design

Course Objectives

The course is intended to::

1. Explain the sources and the effect of MOS device parameters on power dissipation.
2. Discuss the circuit and logic level low power design techniques.
3. Explain the power reduction design techniques in clock networks and busses
4. Explain the techniques involved in low power memory design.
5. Explain the concepts of software design for low power.

UNIT I INTRODUCTION TO LOW POWER DISSIPATION 9

Need for low power VLSI chips, Physics of power dissipation in CMOS devices. Sources of power dissipation in Digital Integrated circuits, Basic principles of low power design-probabilistic power analysis - random logic signal - probability and frequency - power analysis techniques - signal entropy.

UNIT II CIRCUIT AND LOGIC LEVEL LOW POWER DESIGN TECHNIQUES 9

Circuit - transistor and gate sizing - pin ordering - network restructuring and reorganization - adjustable threshold voltages - logic-signal gating - logic encoding. Pre-computation logic.

UNIT III SPECIAL LOW POWER VLSI DESIGN TECHNIQUES 9

Power reduction in clock networks -single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip and package co-design of clock network , CMOS floating node - low power bus - delay balancing, Switching activity reduction - parallel voltage reduction - operator reduction -Adiabatic computation

UNIT IV LOW POWER MEMORY DESIGN 9

Basics of SRAM - Memory cell – Pre-charge and equalization circuit. Sense amplifier - Output latch - Low power SRAM technologies - types of DRAM - Basics of DRAM - Cell refresh circuit – HVG – BBG – BVG – RVG - VDC

UNIT V SOFTWARE DESIGN AND POWER ESTIMATION 9

Low power circuit design style - Software power estimation – co- design for low power.

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Course Outcomes:

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

CO1. Explain the sources and the effect of MOS device parameters on power dissipation.

CO2. Discuss the circuit and logic level low power design techniques.

CO3. Explain the power reduction design techniques in clock networks and busses.

CO4. Explain the techniques involved in low power memory design.

CO5. Explain the concepts of software design for low power.

Text Books:

1. Kiat-Seng Yeo, Kaushik Roy, "Low Voltage Low Power VLSI Subsystems", Tata Mc-GrawHill, 2009.

2.GaryYeap "Practical Low Power Digital VLSI Design", Springer US, Kluwer Academic
Publishers, 2002.

3.Kaushik Roy, Sharat C. Prasad, "Low power CMOS VLSI circuit design", Wiley Inter science Publications",1987.

References:

1. Rabaey, Pedram, "Low power design methodologies" Kluwer Academic, 1997.
2. Chandrasekaran, A.P., Broadersen.R.W, "Low Power Digital CMOS VLSI Design", Kluwer 1995.
3. DimitriosSoudris, Christians Pignet, Costas Goutis, "Designing CMOS Circuits for Low Power", Kluwer, 2002
4. AbdelatifBelaouar, Mohamed.I.Elmasry, "Low power digital VLSI design", Kluwer, 1995
5. James B.Kulo, Shih-Chia Lin, "Low voltage SOI CMOS VLSI devices and Circuits", John Wiley and sons, inc. 2001.

Web References:

1.nptel.ac.in/courses/106105034/12
2.www.nptelvideos.com/course.php?id=422
3.http://www.youtube.com/watch?v=ruclwamT-Ro&list

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CourseCode: 141EE9133	Course Title : MICRO ELECTRO MECHANICAL SYSTEMS
Core/Elective: Elective	L : T : P : C : M – 3 : 0 : 0 : 3 : 100
Type: Lecture	Total Contact Hours: 45

Pre-requisites: The student should have undergone the course(s):

- 141EE0103 Engineering Physics
- 141EE0203 Material Science

Course Objectives

The course is intended to:

1. Explain the characteristics of material and MEMS fabrication process
2. Describe the various electrostatic sensors and actuators
3. Describe the various piezoelectric sensors and actuators
4. Explain the process involved in micromachining
5. Explain the applications of MEMS in Optics and RF

UNITI INTRODUCTION 9

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication – Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

UNIT II SENSORS AND ACTUATORS-I 9

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors – Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph – Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys

UNIT III SENSORS AND ACTUATORS- II 9

Piezoresistive sensors – Piezoresistive sensor materials – Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

UNITIV MICROMACHINING 9

Silicon Anisotropic Etching – Anisotrophic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas

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Phase Etchants – Case studies – Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process – Assembly of 3D MEMS – Foundry process.

UNIT V OPTICAL AND RF MEMS 9

Optical MEMS, - System design basics – Gaussian optics, matrix operations, resolution. Case studies, MEMS scanners and retinal scanning display, Digital Micro mirror devices. RF Memes – design basics, case study – Capacitive RF MEMS switch, performance issues.

Course Outcomes

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

CO 1. Explain the MEMS fabrication process and material characteristics.
CO 2. Describe the various electrostatic sensors and actuators
CO 3. Describe the various piezoelectric sensors and actuators
CO 4. Explain the process involved in micromachining.
CO 5. Explain the applications of MEMS in Optics and RF

Text Books

1. Stephen Santuria," Microsystems Design", Kluwer publishers, 2001.

2. Foundations of MEMS by Chang Liu (2nd edition), 2011

References

1.Tai Ran Hsu," MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2008.
2.Gabriel M. RebeizRfMems: Theory Design and Technology, John Wiley & Sons, 2003
3. Sergey Edward Lyshevski, "MEMS and NEMS: Systems, Devices, and Structures" CRC Press, 2002
4. NadimMaluf," An introduction to Micro electro mechanical system design", Artech House, 2000.
5. Mohamed Gad-el-Hak, editor," The MEMS Handbook", CRC press Baco Raton, 2000.

Web References

1.https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-777j-design and fabrication-of-microelectromechanical-devices-spring-2007/lecture notes/07lecture02. Pdf
2. http://nptel.ac.in/courses/117105082/
3. http://www.learnerstv.com/Free-engineering-Video-lectures-ltv122-Page1.htm

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Course Code: 141EE9134	Course Title: CMOS ANALOG IC DESIGN (Common to ECE & EEE)	
Core/Elective: Elective	L : T : P : C : M	3 : 0 : 0 : 3 : 100
Type: Lecture	Total Contact Hours: 45	

Pre-requisites: The student should have undergone the course(s):

- 141EE0404 Electronic Circuits
- 141EE0505 Linear Integrated Circuits
- 141EE0604 VLSI Design

Course Objectives:

The course is intended to:

1. Analyze the concept of CMOS Technology and Analog MOSFET models.
2. Analyze the basic Analog MOS circuits.
3. Construct an amplifier and switching circuits using CMOS.
4. Design an Op-amp and various nonlinear circuits using Op-amp.
5. Compare the performance of different forms of data conversion techniques.

UNIT I INTRODUCTION TO CMOS TECHNOLOGIES AND ANALOG MOSFET MODELS 9

MOSFET- Structure, MOSFET Capacitances, Threshold Voltage , IV Characteristics , SPICE modeling , DC equations, Short Channel MOSFET . MOS Passive Elements – Capacitors and Resistors, Temperature and Voltage dependence of Capacitors and Resistors. Analog MOSFET models - Low frequency model , High frequency model , Temperature effects , Noise in MOSFET.

UNIT II ANALOG MOS MODELING 9

Current Mirror, Current sources, Self biasing techniques, Band gap voltage references, Beta multiplier based references. Common Drain and Common Gate amplifiers, Voltage dividers.

UNIT III DIFFERENTIAL AMPLIFIERS AND DYNAMIC ANALOG CIRCUITS 9

Differential Amplifier – Source coupled pair, Source cross coupled pair, Cascode load, Wide swing differential amplifiers. Dynamic Analog Circuits –MOSFET switch, Switched capacitor circuit.

UNIT IV CMOS OPAMP AND NON LINEAR CIRCUITS 9

Operational Amplifiers – Basic CMOS Op-amp, Operational Trans conductance amplifier, Differential output Op-amp. Non Linear Analog Circuits – CMOS comparator, Analog multiplier, Level shifting circuit, Multiplier using squaring circuit

UNIT V MIXED SIGNAL CIRCUITS 9

Data Conversion Fundamentals – Analog Vs Discrete time signal, Converting analog to digital signal - Sample and hold circuit, mixed signal layout issues. Data Conversion Architecture – DAC, ADC.

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Course Outcomes:

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

CO1: Explain the concept of CMOS Technology using MOSFET structure.
CO2: Explain the basic Analog circuits using CMOS technology
CO3: Construct an amplifier and switching circuits using CMOS.
CO4: Design an Op-amp and various nonlinear circuits using Op-amp.
CO5: Compare the performance of different forms of data conversion techniques using mixed signal MOSFET circuits

Textbooks:

1. Jacob Baker.R., Li.H.W., and Boyce.D.E., CMOS Circuit Design ,Layout and Simulation, Prentice-Hall of India,1998.
2. Mohammed Ismail and Terri Faiz, Analog VLSI Signal and Information Process,McGraw-Hill Book company,1994.

References:

1. Paul R. Gray and Meyer.R.G., Analysis and design of Analog Integrated circuits, John Wiley and Sons inc., USA, Third Edition, 1993.
2. David. A. Johns and Martin. K., Analog Integrated Circuit Design, Wiley, 1997.
3. MalcomR.Haskard, LanC.May, "Analog VLSI Design - NMOS and CMOS ", Prentice Hall, 1998.
4. Jose E.France, YannisTsividis, "Design of Analog-Digital VLSI Circuits for Telecommunication and signal Processing ", Prentice Hall, 1994
5. Randall L Geiger, Phillip E. Allen, Noel K.Strader, "VLSI Design Techniques for Analog and Digital Circuits ", McGraw Hill International Company, 1990.

Web References:

1. http://nptel.ac.in/courses/117101105/
2. http://www.nptel.ac.in/syllabus/117101006/
3. http://www.people.rit.edu /iffeee/basic-analog-circuits.pdf

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Control & Automation

Course Code:141EE9135	Course Title: AUTOMOTIVE ELECTRONICS (Common to ECE,EEE & EIE)	
Elective	L:T:P:C	3:0:0:3
Type:Theory	Total Contact hours:	45

Prerequisites: The student should have undergone the course(s):

- 141EE0302 – DC machines and Transformers
- 141EE0403 – Synchronous and Induction Machines
- 141EE0405 - Measurements and Instrumentation

Course Objectives:

The course is intended to:

1. Explain the mechanical systems of automobiles.
2. Describe the electronic system in automobiles.
3. Summarize the embedded hardware and software modules.
4. Outline the embedded system applications in automobiles.
5. Explain the different communication protocols in embedded system for automobile.

UNIT I - AUTOMOTIVE MECHANICAL SYSTEMS 9

Vehicle Systems: Power Train System (Air System, Fuel System (Carburettor & Diesel Fuel Injection, Ignition System, Exhaust System and other Auxiliary Systems (Cooling, Lubrications & Electrical Systems)), Transmission System (Front, Rear & 4 wheel Drive, Manual, Automatic Transmission, Differential). Braking System (Drum, Disc, Hydraulic, Pneumatic), Steering System (Rack and Pinion, Power Steering)

UNIT II - ELECTRONICS IN AUTOMOTIVE SYSTEMS 9

Performance (Speed, Power, and Torque), Control (Emission, Fuel Economy, Drivability, and Safety) & Legislation (Environmental legislation for pollution & Safety Norms). Overview of Vehicle Electronic Systems: Basic electrical components and their operation in an automobile: Power train subsystem (Starting systems, Charging systems - Ignition systems – Electronic fuel control), Chassis subsystem (ABS, TCS, &ESP) – Comfort and safety subsystems (Night Vision, Airbags, Seatbelt Tensioners, Cruise Control-Lane-departure-warning, Parking).

UNIT III - INTRODUCTION TO EMBEDDED SYSTEMS 9

Review of Embedded Hardware - Review of Software Module: IDE- Getting Started: Creating new project, creating new files, adding files to project, compile, build, debug and simulation of a project. Embedded system programming: Uploaders, ISP, ROM Emulators, In-Circuit Emulators. Debug Interfaces: BDM and JTAG - Embedded RTOS.

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UNIT IV - EMBEDDED SYSTEM IN AUTOMOTIVE APPLICATIONS 9

Gasoline / Diesel systems, various sensors used in system – Electronic transmission control - Vehicle safety system – Electronic control of braking and traction – Body electronics – Infotainment systems – Navigation systems – System level tests – Software calibration using engine and vehicle dynamometers – Environmental tests for Electronic Control Unit - Application of Control elements and control methodology in Automotive System.

UNIT V - EMBEDDED SYSTEM COMMUNICATION PROTOCOLS 9

Introduction to control networking – Communication protocols in embedded systems – SPI, I2C, USB – Vehicle communication protocols – Introduction to CAN, LIN, FLEXRAY, MOST, KWP2000.

Course Outcomes:

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

CO1. Explain the mechanical systems of automobiles.
CO2. Describe the electronic system in automobiles.
CO3. Summarize the embedded hardware and software modules.
CO4. Outline the embedded system applications in automobiles.
CO5. Explain the different communication protocols in embedded system for automobile.

Text Books:

1. Robert Bosch Gmbh, Automotive Electrics and Automotive Electronics, Systems and Components, Networking and Hybrid drive, 5th edition, John Wiley& Sons Ltd., 2007
2. William B. Ribbens, "Understanding Automotive Electronics", 6th Edition, SAMS/Elsevier Publishing, 2003

Reference Books:

1. Robert Bosch Gmbh, Automotive Electrics and Automotive Electronics, Systems and Components, Networking and Hybrid drive, 5th edition, John Wiley& Sons Ltd., 2007
2. Knowles.D, Automotive Electronic and Computer Controlled Ignition Systems, Reston Pub Co,1990
3. Rajkamal, "Embedded Systems Architecture, Programming and Design, Tata McGraw-Hill,First reprint 2003
4. Joerg Schaeuffele, Thomas Zurawka – Automotive Software Engineering – Principles, Processes, Methods and Tools, SAE,2016

Web References:

1. www.austincc.edu/autotech
2. https://acconline.austincc.edu/webapps/portal/frameset.jsp

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CourseCode: 141EE9136	Course Title:INDUSTRIAL AUTOMATION (Common to ECE & EEE)	
Core/Elective:Elective	L : T : P : C : M	– 3 : 0 : 0 : 3 : 100
Type: Lecture	Total Contact Hours: 45	

Pre-requisites: The student should have undergone the course(s):

- 141EE0304 Digital Electronics
- 141EE0502 Control Systems

Course Objectives:

The course is intended to:

1. Justify the need for automation in industry
2. Describe the architecture and types of PLC
3. Develop the PLC based control logic program
4. Explain industry networking Protocols and SCADA programming
5. Explain the applications of DCS

UNIT I INTRODUCTION TO FACTORY AUTOMATION 9

History and developments in industrial automation- Vertical integration of industrial automation- Building blocks in Automation: Processing systems, Multi microprocessor systems, LAN, analog and digital I/O modules, remote terminal unit

UNIT II PROGRAMMABLE LOGIC CONTROLLERS 9

PLC an Overview- Parts and Architecture of PLC- Principles of Operation - I /O Specifications - Memory types-Programming devices- PLC vs Computers, PLC size and Applications, Advantages of PLC, selection of PLC

UNIT III PROGRAMMING OF PLC 9

Program scan - PLC Programming Languages-Simple process control programs using Relay Ladder Logic - Programming Timers : On delay timer, OFF delay timer-Programming counters: Up and Down counter – PLC arithmetic functions –Program Control Instructions-Math Instructions-data transfer operations-Data comparison instructions

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UNIT IV INDUSTRY NETWORKING AND SCADA 9

PLC Networking- Networking standards & IEEE Standard - Protocols - Field bus - Process bus and Ethernet .SCADA-Channel scanning-conversion to engineering units-data processing –Distributed SCADA systems- HMI introduction

UNIT V DISTRIBUTED CONTROL SYSTEM AND APPLICATIONS 9

DCS: Evolution – Different architectures – local control unit – Operator interface – Displays – Engineering interface. **Applications:** Thermal power plant-cement plant-water treatment plant- Solar, windmill substation automation.

Course Outcomes:

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

CO1. Justify the need for automation in industry

CO2. Describe the architecture and types of PLC used in industry automation

CO3. Develop the PLC based control logic program according to their application

CO4. Explain industry networking Protocols and SCADA programming

CO5. Explain the applications of DCS in various power plants

Text Books:

1. Frank D Petruzella "Programmable Logic Controllers", McGraw Hill Education India Private Limited, Fourth Edition, 2016.
2. Bolton.W, "Mechatronics", Pearson Education, Fourth Edition, 2014.

References:

1. John W Webb & Ronald A Reis, "Programmable logic controllers: Principles and Applications", Prentice Hall India, fifth edition, 2006.
2. DobrivojiePopovic, Vijay P. Bhatkar,"Distributed Computer Control for Industrial Automation", MarcelDekkar Inc., New York, first edition, 2011.
3. Krishna Kant, 'Computer based Industrial Control', Prentice Hall of India, second edition, 2010 .
4. Rajesh Mehra and Vikrant Vij, "PLCs& SCADA- Theory and Practice",Laxmi Publications, first edition, 2016.

Web References:

1. http://www.fieldbus.org
2. www.nptel.ac.in/downloads/108105063/
3. http://nptel.ac.in/courses/108105062/18

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Course Code:141EE9137	Course Title: VIRTUAL INSTRUMENTATION (Common to ECE,EEE & EIE)	
Elective	L:T:P:C	3:0:0:3
Type: Theory	Total Contact hours:	45 Hours

Prerequisites: The student shculd have undergone the course(s):
- 141EE0105 - C Programming

Course Objectives
The course is intended to:
1. Discuss the importance of virtual instrumentation.
2. Develop virtual instruments.
3. Apply the concept of Arrays, Strings and File I/O tasks.
4. Select suitable Data acq.isition system interfaces.
5. Examine DAQ hardware s and LabVIEW.

UNIT I - GRAPHICAL SYSTEM DESIGN 9

Graphical System Design Model – Virtual Instrumentation – Virtual Instrument and Traditional Instrument – Hardware and software in virtual instrumentation – Virtual instrumentation for test, control and Design – Conventional and Graphical programming.

UNIT II - LABVIEW BASICS I 9

Front Panel and Block Diagram – Tools, Controls and Functions palette. Modular programming – Sub VI. Structures – FOR, WHILE Loops, Case, Sequence, event structures, Formula node.

UNIT III - LABVIEW BASICS II 9

Arrays, Clusters, Strings, File I/O, Time and Dialog controls, Waveform chart, Graph, XY Graph and operations Report generation, Web Publishing tool.

UNIT IV - DATA ACQUISITION SYSTEM 9

Instrument control: GPIB – VISA – Instrument drivers – Serial Port communication. Data Acquisition: Review of Transducers and signal conditioning, DAQ hardware – AI, AO, DIO. DAQ Assistant and configuration.

UNIT V - LABVIEW APPLICATIONS 9

Lab VIEW RT, Process control applications, Physical applications, Speed control, Data visualization, Imaging and Sound. Level, flow, temperature process, biomedical application - Pulse rate

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Course Outcomes

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

CO1. Discuss the importance of virtual instrumentation using Lab view
CO2. Develop virtual instruments using LabVIEW graphical programming tools
CO3. Apply the concept of Arrays, Strings and File I/O tasks in Data acquisition
CO4. Select suitable Data acquisition system interfaces based on the requirement
CO5. Examine DAQ hardware's and LabVIEW in various real time environments

Text Books

1. Jovitha Jerome, 'Virtual Instrumentation using LabVIEW' PHI Learning Private Limited, New Delhi, Second Printing, 2011
2. Gary W Johnson, Richard Jennings, 'LabVIEW Graphical Programming' Fourth Edition, McGraw Hill, 2006

Reference Books

1. Sanjay Gupta, Joseph John, 'Virtual Instrumentation using LabVIEW' Tata McGraw Hill, Fifth Reprint, 2010
2. Robert H Bishop, 'Learning with LabVIEW 2009' Pearson Education, 2010

Web References

1. http://www.av.it.pt/conftele2009/Papers/125.pdf
2. https://www.researchgate.net/publication/3420671_What_is_virtual_instrumentation
3. http://www.ni.com/pdf/manuals/374629c.pdf

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Course Code:141EE9138	Course Title: JAVA PROGRAMMING (Common to ECE,EEE & EIE)	
Elective	L:T:P:C	3:0:0:3
Type: Theory	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0105 - C Programming

Course Objectives

The course is intended to:

1. Describe the distinct properties and features of Java.
2. Implement name spaces, concurrency and handle exceptions.
3. Employ Java standard library functions.
4. Apply Java utility, input/output functions.
5. Develop Java applications.

UNIT I - INTRODUCTION 9

Overview of Java – Data types, operators, control flows –Class fundamentals, objects and constructors –Method overloading- argument passing, Returning objects, recursion – Method Overriding and Dynamic Method dispatch- Abstract class

UNIT II - PACKAGES, EXCEPTIONS AND THREADS 9

Packages and access protection – Interfaces and extending interfaces – Exception fundamentals and types – Try, catch, throw, throws and finally, Chained Exceptions – Thread model, Creating threads and thread priorities – Synchronization –Inter thread communication

UNIT III - JAVA UTILITIES 9

String Handling –String Buffer class and functions – Library Functions – Math – Process – Clone – System Functions

UNIT IV - COLLECTIONS AND I/O STREAMS 9

Collections – Classes and Interfaces – Iterators and User defined collections – String Tokenizer – Java I/O classes and Interfaces - Streams – Byte Streams - Character Streams – File concepts

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UNIT V - EXPLORING SWING 9

Java Swing – Features –Components and Containers – Event handling – Exploring Swing – Menus – Java Database Connectivity

Course Outcomes

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

CO1. Describe the distinct properties and features of Java
CO2. Implement name spaces, concurrency and handle exceptional conditions in programs
CO3. Employ Java standard library functions for solving complex problems
CO4. Apply Java utility, input/output functions and file manipulators
CO5. Develop Java applications using user interfaces and database connectivity

Text Books

1. Herbert Schildt, "Java the Complete Reference", Mcgraw Hill Education, Ninth Edition, 2014
2. Mahmoud Parsian, "JDBC Metada, MySQL and Oracle Recipes: A Problem-Solution Approach", Apress Publications, 2006

Reference Books

1. Bart Baesens, Aimee Backiel, SeppeVandenBrocke, "Beginning Java Programming: The Object Oriented Approach", John Wiley & Sons, 2015.
2. Daniel Liang, "Introduction to Java Programming, Comprehensive Version", Pearson Education, Ninth Edition, 2014.
3. James M Slack, Programming and Problem solving with JAVA, Thomson Learning, 2002.
4. C Thomas Wu, An Introduction to Object Oriented programming with Java, Tata McGrawHill 2005.
5. Cay S. Horstmann and Gary Cornell, "Core Java: Volume I – Fundamentals", Eighth Edition, Sun Microsystems Press, 2008.

Web References

1. https://docs.oracle.com/javase/tutorial/java/index.html
2. http://javabeginnerstutorial.com/core-java/
3. http://www.w3schools.in/java/

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Software Engineering

Course Code:141EE9139	Course Title: DATA BASE MANAGEMENT SYSTEM (Common to ECE, EEE & EIE)	
Elective	L:T:P:C	3:0:0:3
Type: Theory	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

Nil

Course Objectives

The course is intended to:

1. Construct the Entity Relationship Model.
2. Convert ER diagram to relational database schema.
3. Relate the normalization technique to obtain the relational database design.
4. Choose a query evaluation and optimization technique.
5. Execute the online transactions and control concurrency.

UNIT I - AN OVERVIEW OF DATABASE SYSTEMS 9

Introduction – Database system applications, Database versus file systems, View of data, Data models, Database languages, Database users and administrators, Database system structure, Entity – Relationship Model – Basic concepts, Constraints, Keys, Design issues, ER diagram, Weak entity sets, Design of an ER database schema.

UNIT II - DATA MODELS 9

Relational model - Structure of relational databases – The relational algebra –Tuple relational calculus, Domain relational calculus, SQL – Background, Basic structure, Set operations, Aggregate functions, Null values, Nested sub queries, Views, Joined relations, DDL, Embedded SQL, Dynamic SQL, Integrity and security – Domain constraints, Referential integrity, Assertions, Triggers.

UNIT III - RELATIONAL DATABASES DESIGN 9

Relational database design – First normal form, Second normal form - Pitfalls in relational database design, Functional dependencies, Decomposition, Desirable properties of decomposition, BCNF, Third normal form, Fourth normal form.

UNIT IV - INDEXING AND QUERYING 9

Indexing and hashing – Basic concepts, Ordered indices, B+ tree index files, B tree

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index files – Static hashing, Dynamic hashing, Comparison of ordered indexing and hashing, Multiple key access - Query Processing – Overview, Measures of query cost, Selection operation, Sorting, Join operation - Query Optimization – Overview, Estimating statistics of expression results, Transformation of relational expressions.

UNIT V - TRANSACTION, CONCURRENCY CONTROL AND RECOVERY MANAGEMENT 9

Transactions – Transaction concept, Transaction state, Implementation of atomicity and durability, Concurrent executions, Serializability, Recoverability, Testing for serializability - Concurrency control – Lock based protocols, Timestamp based protocols, Validation based protocols, Multiple granularity, Multiversion schemes, Recovery system – Failure classification, Storage structure, Recovery and atomicity, Log based recovery, Shadow paging, Recovery with concurrent transactions, Buffer management, Failure with loss of nonvolatile storage, Advanced recovery techniques, Remote backup systems.

Course Outcomes

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

CO1. Construct the Entity Relationship Model for obtaining the structure of a database.
CO2. Convert ER diagram to relational database schema.
CO3. Apply the normalization technique to obtain the relational database design.
CO4. Select a query evaluation and optimization technique for a given query.
CO5. Implement online transactions and control concurrency

Text Books

1. Silberschatz, Korth, Sudarshan, "Database System Concepts", Sixth Edition, McGrawHill International Edition, New Delhi 2010.
2. Date C.J., Kannan A, Swaminathan S, "An introduction to database systems", Eighth Edition, Pearson Education, New Delhi, 2009.

Reference Books

1. Elmasri, R., Navathe, S.B., "Fundamentals of database systems", Sixth Edition, Pearson Education, New Delhi, 2010.
2. Raghu Ramakrishnan, Johannes Gehrke. "Database Management Systems", Third Edition, McGrawHill International Edition, New Delhi 2007
3. Bipin C Desai, "An Introduction to Database Systems", Eleventh Edition, Galgotia

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Publications Pvt. Ltd., New Delhi, 2001.

4. JefreyD.Ulman and Jenifer Widom, "A First Course in Database Systems", Third Edition, Prentice-Hall, New Delhi, 2007.
5. 5.C.J.Date, A.Kannan and S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006

Web References

1. http://www.sanfoundry.com/database/
2. http://codex.cs.yale.edu/avi/db-book/db6/slide-dir/
3. www.nptelvideos.in/2012/11/database-management-system.html

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Course Code:141EE9140	Course Title: DATA MINING AND ANALYTICS (Common to ECE, EEE & EIE)	
Elective	L:T:P:C	3:0:0:3
Type: Theory	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

Nil

Course Objectives

The course is intended to:

1. Select the appropriate pre-processing technique.
2. Relate the techniques of association rule.
3. Evaluate the classification algorithms.
4. Apply the clustering algorithms.
5. Analyze the requirements for a big data analytics.

UNIT I - DATA PREPROCESSING 9

Data Mining Overview – Data Objects and Attribute Types – Data Visualization. Data Pre-processing: Data Cleaning – Data Integration – Data Reduction – Data Transformation and Data Discretization.

UNIT II - ASSOCIATION 9

Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and Methods –Basic Concepts – Frequent Item set Mining Methods – Pattern Evaluation Methods. Advanced Pattern Mining: Pattern Mining: A Road Map – Pattern Mining in Multilevel, Multidimensional Space.

UNIT III - CLASSIFICATION 9

Basic Concepts: Decision Tree Induction – Bayes Classification Methods – Rule Based Classification – Model Evaluation and Selection – Techniques to Improve Classification Accuracy.

UNIT IV - CLUSTERING 9

Cluster Analysis: Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of Clustering.

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UNIT V - INTRODUCTION TO BIG DATA

Introduction to Big Data: Classification of Digital Data – Characteristics, Evolution and Definition of Big data - Challenges with Big Data – Traditional Business Intelligence (BI) vs Big Data – The Big Data Technology Landscape: Hadoop. Introduction to Hadoop: Hadoop Overview – Hadoop Distributors - Hadoop Distributed File System.

Course Outcomes

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

CO1. Choose the appropriate pre-processing technique to solve the given problem.

CO2. Apply the techniques of association rule to real world data.

CO3. Evaluate the classification algorithms with respect to their accuracy.

CO4. Apply the clustering algorithms to group the real world data.

CO5. Analyze the requirements for a big data analytics system for the organization.

Text Books

1. Jiawei Han, MichelineKamber, Jian Pei, "Data Mining: Concepts and Techniques", 3rd Edition, Elsevier, 2012.
2. SeemaAcharya, SubhashiniChellappan, "Big Data and Analytics", 1st Edition, Wiley India, 2015.

Reference Books

1. Jure Leskovec, AnandRajaraman, Jeffery David Ullman, "Mining of Massive Datasets", 2nd Edition, Cambridge University Press, 2014.
2. Ian H.Witten, Eibe Frank, Mark A.Hall, "Data Mining: Practical Machine Learning Tools and Techniques", 3rd Edition, Elsevier, 2011.
3. EMC Education Services, "Data Science and Big Data Analytics", Wiley, 2015.
4. DT Editorial Services, "Black Book- Big Data (Covers Hadoop 2, MapReduce, Hive, Yarn, PIG, R, Data visualization)", Dream tech Press edition 2016.
5. G. K. Gupta, "Introduction to Data Mining with Case Studies", Eastern Economy Edition, Prentice Hall of India, 2006.

Web References

1. http://hanj.cs.illinois.edu/bk3/bk3_slidesindex.html
2. http://www.mmds.org/
3. http://www.kdnuggets.com/tutorials/index.html

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Course Code:141EE9141	Course Title: SOFTWARE TESTING (Common to ECE, EEE & EIE)	
Elective	L:T:P:C	3:0:0:3
Type: Theory	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

NIL

Course Objectives

The course is intended to:

1. Describe the software testing principles and its characteristics.
2. Choose the appropriate testing for software development.
3. Design Test cases suitable for a software development in various domains.
4. Justify the importance of planning, documenting and validating the test plan.
5. Illustrate the need for automatic testing tools.

UNIT I - TESTING FUNDAMENTALS 9

Introduction to testing as Engineering Activity –Testing Fundamentals: Basic Definitions-Testing principles-Tester's role –Defects, Hypotheses and Tests

UNIT II - LEVELS OF TESTING 9

The need for levels of Testing- Unit Test: Functions, Procedures, Classes, and Methods as Units- Unit Test: The Need for Preparation- Unit Test Planning- Designing the Unit Tests- Running the Unit Tests and Recording Results- Integration Test: Goals- Integration Strategies for Procedures and Functions- Integration Strategies for Classes- Designing Integration Tests- Integration Test Planning- System Test: The Different Types- Regression Testing- Alpha, Beta, and Acceptance Tests

UNIT III - DESIGNING TEST CASES 9

Test case design strategies-Using Black Box approach to Test Case design-Random Testing – Equivalence class partitioning –Boundary value Analysis-Cause effect testing and state transition testing-Error Guessing - Using White Box Approach to Test case design – Test Adequacy Criteria –Coverage and Control Flow Graphs – Covering Code Logic – Paths –Additional test design approaches- code complexity testing – Evaluating Test Adequacy Criteria.

UNIT IV - TEST MANAGEMENT 9

Test Planning: Preparing a plan – scope management – deciding test strategy – responsibilities –resource requirements – test deliverables –testing tasks – Test management: standards – infrastructure management- People management – product release - Test Process – Test Reporting .

UNIT V - TEST AUTOMATION 9

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Test Automation – Terms – Skills required – Scope of automation- Design and Architecture for Automation – Process Model – Selecting Test tools – automation for extreme Programming- Test Metrics and Measurements

Course Outcomes

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

CO 1: Describe the software testing principles and its characteristics

CO 2: Choose the appropriate testing during the phases of software development

CO 3: Design Test cases suitable for a software development in various domains

CO 4: Justify the importance of planning, documenting and validating the test plan.

CO 5: Illustrate the need for automatic testing tools

Text Books

1. Ilene Burnstein,"Practical Software Testing: A Process-Oriented Approach", Springer International Edition, 2013

2. SrinivasanDesikan and Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson Education, 2006

Reference Books

1. Ron Patton, "Software Testing", Sams Publishing, Pearson Education,Second Edition,2009.
2. Boris Bezier, "Software Testing Techniques",Dreamtech, Second Edition, Reprint 2009
3. Aditya P. Mathur, "Foundations of Software Testing: Fundamental Algorithms and Techniques",Pearson Education, 2008.
4.Edward Kit," Software Testing in the Real World – Improving the Process", Pearson Education, 1995.
5.RenuRajani, Pradeep Oak, "Software Testing – Effective Methods, Tools and Techniques", Tata McGraw Hill, 2004.

Web References

1.http://nptel.ac.in/courses/106105150/
2.Lecturehttps://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-00-introduction-to-computer-science-and-programming-fall-2008/video-lectures/lecture-11/
3.http://www.testingtools.com/

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Course Code:141EE9142	Course Title: PYTHON PROGRAMMING (Common to EEE, EIE & CSE)	
Elective	L:T:P:C	3:0:0:3
Type: Theory	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0306 Data Structures and OOPs with C++

Course Objectives

The course is intended to:

1. Identify various syntax and operators in python programming.
2. Illustrate control flow, library functions and file operations.
3. Implement object oriented features in python.
4. Apply database connectivity technique.
5. Design user interfaces.

Unit I - PROGRAMMING CONSTRUCTS 9

Basics: Data Types – Declaring variables - Usage of Operators- Special functions - Python standards in Coding. Sequential Statements - Control statements - Performing Iterations – Strings - Tuples-Sets - Dictionary.

Unit II - FUNCTIONS 9

Functions: Defining & Calling function- Passing arguments to functions: Mutable & Immutable Data Types - Different types of arguments-Recursion-Scope of variables. Standard Library: Math, String, List, Date & Time Modules. Files: Open- Close- Write-Read.

Unit III - OOP IN PYTHON 9

Classes - Objects – Modifiers - Method Invocation – Inheritance – Polymorphism - Packages - Scopes and Namespaces - Interface - Exception Handling.

Unit IV - DATABASE PROGRAMMING 9

DBM files - Pickled objects - Shelve files - Object Oriented Database - SQL Database interfaces - Building record dictionaries - loading database tables from files.

Unit V - GUI PROGRAMMING AND DATA VISUALIZATION 9

GUI basics-Working with TKinter library- Adding widgets-Binding Events- Message and Entry- Check and Radio button- Menus and list-Canvas-Introduction to Matplotlib - Line and Bar plot - Scatter plot - pie chart-working with multiple figures - 3D plots - Plotting using files.

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Course Outcomes

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

CO1. Identify various syntax and operators in python programming for writing simple programs.

CO2. Illustrate control flow, library functions and file operations using user-defined and pre-defined functions.

CO3. Implement object oriented features in python for writing reusable codes.

CO4. Apply database connectivity technique for real time applications.

CO5. Design user interfaces using python based GUI components.

Text Books:

1. Peter Wentworth, Jeffrey Elkner, Allen B. Downey, and Chris Meyers, "How to Think Like a Computer Scientist: Learning with Python", Third Edition, O'Reilly, 2014.
2. MarkLutz,"Powerful Object Oriented Programming Python", Fourth Edition, O'Reilly, 2012.

Reference Books:

1. Mark Lutz, "Learning Python, Powerful OOPs", O'Reilly, 2011.
2. Zelle, John M, "Python Programming: An Introduction to Computer Science", Franklin Beedle & Associates, 2003.
3. Budd, Timothy, "Exploring Python", McGraw-Hill Science, 2009.
4. Matplotlib for Python Developers: Effective techniques for data visualization with Python, 2nd Edition, Kindle Edition.

Web References:

1. Python tutorial URL:https://docs.python.org/3/tutorial/
2. Advanced Python URL:https://www.learnpython.org/
3. Python basic tutorial URL:www.pyschools.com/
4. Data Visualization https://www.datacamp.com/courses/introduction-to-data-visualization-with-python/

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Management Engineering

Course Code:141EE9143	Course Title: PRINCIPLES OF MANAGEMENT (Common to ECE,EEE, VII Sem-EIE,MECH & AUTO)	
Elective	L:T:P:C	3:0:0:3
Type: Theory	Total Contact hours:	45 Hours

Prerequisites: The student should have undergone the course(s):

- 141EE0101 - Communication Skills - I
- 141EE0201 - Communication Skills - II

Course Objectives

The course is intended to:

1. Describe the overview of management
2. Explain the planning process, policy and decision making
3. Explain the human resource structure and policy
4. Explain the motivational theories for management
5. Explain the control techniques for operations

UNIT I - OVERVIEW OF MANAGEMENT 9

Organization – Management – Role of managers – Evolution of Management thought – Organization and the environmental factors – Managing globally – Strategies for International Business.

UNIT II - PLANNING 9

Nature and Purpose planning – Planning process – Types of plans – Objectives – Managing by objective (MBO) Strategies – Types of strategies – Policies – Decision Making – Types of decision –Decision Making Process - Rational Decision Making Process – Decision Making under different conditions.

UNIT III - ORGANISING 9

Nature and purpose of organizing – Organization structure – Formal and informal groups / organization – Line and Staff authority – Departmentation – Span of Control – Centralization and Decentralization – Delegation of authority – Staffing – Selection and Recruitment – Orientation Career Development – Career stages – Training – Performance Appraisal.

UNIT IV - DIRECTING 9

Creativity and Innovation – Motivation and Satisfaction – Motivation Theories Leadership – Leadership theories – Communication – Hurdles to effective

communication – Organization Culture – Elements and types of culture – Managing cultural diversity.

UNIT V - CONTROLLING 9

Process of controlling – Types of control – Budgetary and non-budgetary control techniques – Managing Productivity – Cost Control – Purchase Control – Maintenance Control – Quality Control – Planning operations.

Course Outcomes

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

CO6. Describe the overview of management
CO7. Explain the planning process, policy and decision making
CO8. Explain the human resource structure and policy
CO9. Explain the motivational theories for management
CO10. Explain the control techniques for operations

Text Books

1. Stephen P. Robbins and Mary Coulter, "Management", Prentice Hall of India, Eighth edition, 2009.
2. Charles W.L Hill, Steven L McShane, "Principles of Management", Mcgraw Hill Education, 2007.

Reference Books

1. Hellriegel, Slocum & Jackson, "Management – A Competency Based Approach", Thomson South Western, Tenth edition, 2007.
2. Harold Koontz, Heinz Weihrich and mark V Cannice, "Management – A global & Entrepreneurial Perspective", Tata Mcgraw Hill, Twelfth edition, 2007.
3. Andrew J. Dubrin, "Essentials of Management", Thomson Southwestern, Seventh edition, 2007

Web References

1. http://www.managementstudyguide.com/all-subjects.htm

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Management Engineering

Course Code: 141EE9145	**Course Title: DISASTER MANAGEMENT (Common to ECE,EEE & EIE)**	
Core/Elective: Elective	**L : T : P : C : M**	**– 3 : 0 : 0 : 3 : 100**
Type: Lecture	**Total Contact Hours:45**	

Prerequisites: The student should have undergone the course(s):

- 141EE0101 Communication Skills–I
- 141EE0201 Communication Skills–II

Course Objectives
The course is intended to:

1. Distinguish the natural and manmade disasters
2. Explain the environment hazards and level of toxicology
3. Analyze the causes and effects of Earthquake and Tsunami formation
4. Analyze the causes and effects of Cyclone formation
5. Describe about modern technological tools in disaster management

UNIT I INTRODUCTION 9

Disaster- Disaster management- Disaster prevention and preparedness measures- Types of Disaster – Causal factor of Disaster – Natural, Manmade, creeping disaster- Disaster in the Indian context various measures – Disaster related policy goals – United Nations Development Program (UNDP) – United Nations Disaster Relief Organization (UNDRO) – Govt. of India.

UNIT II ENVIRONMENTAL DISASTER 9

Environmental hazards – Typology – Assessment and response – the strategies– the scale of disaster – Vulnerability – Disaster trends – Paradigms towards a balanced view – Chemical hazards and Toxicology – Biological hazards –Hazard caused by world climate change – Risk analysis – other technological disasters.

UNIT III EARTHQUAKE AND TSUNAMI 9

Earthquake – Causes of earthquake – Earthquake scales – Measures of earth –quake – Magnitude and Intensity – Earthquake Recurrence hazard assessment –Seismic zoning – Earthquake disaster mitigation – Component research focus –Forecasting techniques and Risk analysis – Tsunami – Causes of Tsunami –Effects of Tsunami – Tsunami warning system – Tsunami warning system in India – International status of Tsunami

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warning and communication system –Tsunami warning centers – Pacific Tsunami Warning Center (PTWC) – Pacific Tsunami Warning System (PTWS) components – Institutional arrangements and design criteria for Tsunami mitigation.

UNIT IV CYCLONE 9

Tropical cyclone - Warning system – Protection of buildings from cyclones - Precaution before and during cyclones – Tropical cyclone warning strategy in India – Cyclone related problems – aerial survey – Management strategy – risk reduction by public awareness and education.

UNIT V APPLICATION OF TECHNOLOGY IN DIASTER MANAGEMENT9

Hazard map – Multi hazard mapping – Application of satellites in Disaster Management – Application of remote sensing in forecasting and disaster relief –Use of digital image processing in disaster management – GIS in disaster management – Spatial data – GIS data base design – Convention mapping concepts and Coordinate system – Methods of spatial Interpolation in GIS.

Course Outcomes

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

CO1. Distinguish the natural and manmade disasters
CO2. Explain the environment hazards and level of toxicology
CO3. Analyze the causes and effects of Earthquake and Tsunami formation
CO4. Analyze the causes and effects of Cyclone formation
CO5. Describe about modern technological tools in disaster management

Text Books:

1. PardeepSahni, Madhavimalalgoda and Ariyabandu, "Disaster risk reduction in south Asia", PHI
2. AmitaSinhal, "Understanding earthquake disasters" TMH, 2010.

References:

1. PardeepSahni, AlkaDhameja and Uma medury, "Disaster mitigation: Experiences and reflections", PHI
2. Jeff Groman, "The atlas of Natural Disasters", Friedman/Fairfax publishing, 2002
3. Jaikrishna and Chandrasekar, Elements of Earthquake Engineering.

Web References:

1. www.nptel.ac.in

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CourseCode: 141EE9146	Course Title:ENGINEERING ECONOMICS AND COST ANALYSIS (V sem MECH,Elective-AUTO,ECE,EEE,EIE)	
Core/Elective: Elective	L : T : P : C : M	– 3 : 0 : 0 : 3 : 100
Type: Lecture	Total Contact Hours: 45	

Prerequisites: The student should have undergone the course(s):

- 141EE0102 Engineering Mathematics– I
- 141EE0202 Engineering Mathematics – II

Course Objectives

The course is intended to:

1. Calculate the breakeven point
2. Apply different interest formulae.
3. Compare the economic alternatives.
4. Develop an equipment replacement policy
5. Calculate the depreciation of equipment .

UNIT I INTRODUCTION TO ECONOMICS 8

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics - Elements of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis- V ratio, Elementary economic Analysis

UNIT II VALUE ENGINEERING 10

Make or buy decision, Value engineering – Function, aims, and Value engineering procedure. Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor-Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods with problems.

UNIT III CASH FLOW 9

Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.

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UNIT IV REPLACEMENT AND MAINTENANCE ANALYSIS 9

Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

UNIT V DEPRECIATION 9

Depreciation- Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset. Case study.

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

CO1. Categorize different cost and calculate the breakeven point for a given business situation

CO2. Apply different interest formulae and their application in decision making process.

CO3. Evaluate present value, future value and annual worth analysis on one or more economic alternatives.

CO4. Determine the economic value of an asset and develop a better replacement policy for given equipment.

CO5. Evaluate the depreciation of equipment per period.

Text Books:

1. PanneerselvamR, "Engineering Economics", Prentice Hall of India Ltd, NewDelhi, 2014
2. Chan S.Park, "Contemporary Engineering Economics", Prentice Hall of India, 2010.

References:

1. Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis" Engg. Press, Texas, 2010.
2. Degarmo, E.P., Sullivan, W.G and Canada, J.R, "Engineering Economy", Macmillan, New York, 2010.
3. Grant.E.L., Ireson.W.G., and Leavenworth, R.S, "Principles of Engineering Economy", Ronald Press, New York,1990.

Web References:

1.https://en.wikipedia.org/wiki/Engineering_economics
2. https://en.wikipedia.org/wiki/Cost%E2%80%93benefit_analysis

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Basic Sciences

Course Code: 141EE9147	Course Title: OPERATIONS RESEARCH (Common to ECE , EEE & EIE)
Core/Elective: Elective	L : T : P : C : M – 3 : 0 : 0 : 3 : 100
Type: Lecture	Total Contact Hours: 45

Prerequisites: The student should have undergone the course(s):

- Nil

Course Objectives:
The course is intend to:

1. Find the value of the given objective functions.
2. Solve transportation problems
3. Solve assignment problems
4. Find shortest path and total project cost .
5. Calculate the sequence for the given sequencing models.

UNIT I LINEAR PROGRAMMING PROBLEM 9

Introduction to Operations Research: Basics definition, scope, objectives, phases, models and limitations of Operations Research. Linear Programming Problem – Formulation of LPP, Graphical solution of LPP. Simplex Method, Artificial variables, big-M method.

UNIT II TRANSPORTATION MODEL 9

Transportation Problem.Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: the stepping stone method and MODI method.

UNIT III ASSIGNMENT MODEL 9

Assignment model.Formulation.Hungarian method for optimal solution.Solving unbalanced problem.Traveling salesman problem and assignment problem.

UNIT IV NETWORK ANALYSIS 9

Network Techniques: Shortest path model, minimum spanning Tree Problem, Max-Flow problem and Min-cost problem.Project Management: Phases of project management, guidelines for network construction, CPM and PERT.

UNITV SEQUENCING PROBLEM 9

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Sequencing models. Solution of Sequencing Problem – Processing n Jobs through 2 Machines – Processing n Jobs through 3 Machines – Processing 2 Jobs through m machines – Processing n Jobs through m Machines.

Course outcomes:

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

CO1. Find the value of the given objective functions using linear programming techniques.
CO2. Solve transportation problems using optimality tests to minimize transportation cost.
CO3. Solve assignment problems using Hungarian method to obtain optimal solution
CO4. .Find shortest path and total project cost using various network techniques
CO5. Calculate the sequence to optimize time and cost for the given sequencing models

Text Books:

1. P. Sankaralyer, "Operations Research", Tata McGraw-Hill, 2008.
2. A.M. Natarajan, P. Balasubramani, A. Tamilarasi, "Operations Research", Pearson Education, 2005

References:

1. Wayne L. Winston, "Operations Research" Thomson Learning, 2003
2. Hamdy H. Taha, "Operations Research-An Introduction" Pearson Education, 2003
3. R. PanneerSelvam, "Operations Research" PHI Learning, 2008.
4. V. K. Khanna, "Total Quality Management" New Age International, 2008.

Web Reference:

1. http://nptel.ac.in/courses/112106131/1

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Course Code: 141EE9148	**Course Title: PROBABILITY THEORY AND STATISTICS (Common to IV Sem: ECE,EEE(Elective))**
General/Core/Elective: General	**L : T : P : C : M – 3 : 2 : 0 : 4 : 100**
Type: Lecture	**Total Contact Hours:75**

Prerequisites: The student should have undergone the course(s):

- 141EE0102 Engineering Mathematics– I
- 141EE0202 Engineering Mathematics – II

Course Objectives
The course is intended to:

1. Explain the concepts of discrete and continuous random variables.
2. Describe the basic properties of standard discrete and continuous probability distributions.
3. Calculate correlation between two dimensional random variables
4. Test the small and large samples based on their sample mean and variance.
5. Test the samples based on the analysis of variance .

UNIT I PROBABILITY THEORY AND RANDOM VARIABLES **9+6**

Probability theory –Axioms of probability- conditional probability- Baye's Theorem.

Random Variables – Discrete random variables – Probability mass function, cumulative distribution function, expectations, variances-Moment generating functions.

Continuous random variables - Probability density functions- expectations and variances of continuous random variables-Moment generating functions.

UNIT II STANDARD DISTRIBUTIONS **9+6**

Discrete Distributions- Binomial, Poisson and Geometric distributions – Properties - moment generating functions.

Continuous Distributions - Normal, Uniform and Exponential and Rayleigh distributions, distribution – Properties - Moment generating functions.

Unit III TWO DIMENSIONAL RANDOM VARIABLES **9+6**

Two dimensional Random Variables – Marginal and conditional distributions – Covariance – Correlation- Regression.

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UNIT IV TEST OF HYPOTHESES 9+6

Statistical hypothesis –Large sample test based on Normal distribution for single mean, proportion and difference of means, proportions.

Small sample test based on t distribution- Mean and difference of means- F test for variances-Chi-square for Goodness of fit and independence of attributes.

UNIT V DESIGN OF EXPERIMENTS 9+6

Aim of Design of experiments- Basic Principles of Experimental Design –Completely Randomized Design (C.R.D) - Analysis of variance (ANOVA) - Analysis of variance for one factor of Classification – Randomized Block Design (R.B.D) – Latin square Design (L.S.D) – Comparison of RBD and LSD

Course outcomes:

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

CO1. Explain the concepts of discrete and continuous random variables.
CO2. Describe the basic properties of standard discrete and continuous probability distributions.
CO3. Use two dimensional random variables and calculate correlation between them
CO4. Test the small and large samples based on their sample mean and variance.
CO5.Test the samples based on the analysis of variance

Text Books:

1. J. Ravichandran, "Probability and Statistics for Engineers", Wiley India, New Delhi, 2012.
2. T.Veerarajan, "Probability, statistics and Random process", Tata McGraw Hill, New Delhi, 2007.

References:

1. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics for Engineers And Scientists", Pearson Education, Asia, Eigth Edition, 2007.
2. M.R. Spiegel, J. Schiller and R.A. Srinivasan, "Schaum's Outlines Probability and Statistics",Tata McGraw Hill edition, 2004.
3. Johnson.A and Gupta. C.B., "Miller and Freund's Probability and Statistics for Engineers",Pearson Education Asia, Seventh Edition, 2007.
4. Peyton Peebles, "Probability, Random variables and Random signal principles", Fourth Edition, Tata McGraw Hill, New Delhi, 2002.

Web References:

1. http://nptel.ac.in/courses/111105041/1
2. http://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-and-statistics-spring-2014/

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Course Code: 141EE9149	Course Title: DISCRETE MATHEMATICS (Common to ECE, EEE & EIE)
Core/Elective: Elective	L : T : P : C : M - 3: 2: 0: 4 : 100
Type: Lecture	Total Contact Hours: 75

Prerequisites: The student should have undergone the course(s):

- 141EE0102 Engineering Mathematics– I
- 141EE0202 Engineering Mathematics – II

Course Objectives

The course is intended to:

1. Organize the concepts of propositional logic in programming languages.
2. Apply the theory of predicate calculus to test the validity of arguments.
3. Interpret the concept of various algebraic structures.
4. Classify several types of Graphs its algorithms in computer programs.
5. Categorize the different types of trees.

UNIT I PROPOSITIONAL LOGIC **9+6**

Propositions – Logical Connectives – Tautologies and Contradictions – Contra Positive – Logical Equivalences and Implications – Normal Forms – Principal Conjunctive and Disjunctive Normal Forms – Rules of Inferences

UNIT II PREDICATE CALCULUS **9+6**

Predicates – Quantifiers – Free and Bounded variables – Universe of Discourse – Rules of Universal Specification and Generalization – Validity of Arguments.

UNIT III GROUPS **9+6**

Algebraic Systems – Properties – Semigroups – Monoids – Homomorphism Sub semigroups and Submonoids– Cosets and Lagrange's Theorem – Normal Subgroups .

UNIT IV GRAPHS **9+6**

Basic Definitions – Degree of Vertex –Matrix Representation of a Graphs - Paths Cycles and Connectivity – Eulerian and Hamiltonian Graphs.

UNIT V TREES **9+6**

Introduction to Trees – Spanning Tree – Minimum Spanning Tree – Binary Trees – Rooted and Binary Trees– Tree Traversal – Expression Trees.

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Course Outcomes:

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

CO1: Organize the concepts of propositional logic in programming languages. using logical connectivity

CO2: Apply the theory of predicate calculus to test the validity of arguments using quantifiers

CO3: Interpret the concept of various algebraic structures using group and sub groups

CO4: Classify several types of Graphs its algorithms in computer program using fundamentals

CO5: Categorize the different types of trees using concepts of graph

Text Book:

1. T.Veerarajan, "Discrete Mathematical Structures with Graph Theory and Combinatorics", Tata McGraw–Hill Education Private Limited, New Delhi, 2011.

References:

1. Kenneth H.Rosen, "Discrete Mathematics and its Applications", Special Indian edition, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 2007.
2. Trembly J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw–Hill Pub. Co. Ltd, New Delhi, 2007
3. Seymour Lipschutz and Mark Lipson, "Discrete Mathematics",2nd Edition, Schaum's Outlines, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 2007.

Web References:

1. http://nptel.ac.in/courses/111104026/
2. http://nptel.ac.in/courses/106106094/
3. http://nptel.ac.in/video.php?subjectId=106106094

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OPEN ELECTIVE

Course Code: 141OE0912	Course Title: ELECTRIC AND HYBRID VEHICLES	
Core/Elective: Open Elective	**Credits (L:T:P:C:M**	– 3 : 0 : 0 : 3 : 100
Type: Lecture	**Total Contact Hours:** 45	

Pre-requisites:

- Basics of Electrical Machines

Course Objectives

The course is intended to:

1. Enumerate the need and performances of Electric vehicles.
2. Identify the types of Architectures in Electric & Hybrid Vehicles.
3. Discuss theelectric propulsion system and motor controlling techniques.
4. Describe the energy storage system and generators in electric hybrid vehicle.
5. Explain the construction and working of fuel cells & solar cars.

UNIT I ELECTRIC VEHICLES 9

Layout of an Electric Vehicle, performance of electric vehicles – traction motor characteristics, tractive effort,transmission requirements, vehicle performance, energy consumption, advantage and limitations,specifications,system components, electronic control system.

UNIT II HYBRID VEHICLES 9

Concepts of hybrid electric drive train, architecture of series and parallel hybrid electric drive train, merits anddemerits, series and parallel hybrid electric drive train design.

UNIT III - ELECTRIC PROPULSION SYSTEM AND MOTOR CONTROL SYSTEM 9

DC Motors, AC Motors, Permanent Magnet Motors, Brushless DC and Reluctance Motors, Characteristics,Regenerative Braking, Control System Principles, speed and torque control – DC motors and AC Motors

UNIT IV - ENERGY STORAGES & GENERATORS 9

Electromechanical batteries – types of batteries – lead acid batteries, nickel based batteries, lithium based batteries, electrochemical reactions, thermodynamic voltage, specific energy, specific power, energy efficiency, ultra capacitors – DC Generators, AC

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Generators, Voltage and Frequency regulations.

Unit V – FUEL CELLS & SOLAR CARS 9

Fuel Cell, Construction, Working, Equations, possible fuel sources, fuel reformer, design, solar cars, photovoltaic cells, tracking, efficiency and cost comparison, Plug In Vehicles(PIV).

Course Outcomes

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

CO1: Enumerate the layout of electric vehicle, system components andelectronic control system.

CO2: Classify the various architecture of electric hybrid vehicles.

CO3: Exemplify the electric propulsion system and motor controlling techniques.

CO4: Describe the energy storage system and generators in electric hybridvehicle.

CO5: Explain the construction and working of fuel cells & solar cars.

Text Books:

1. MehrdadEhsani, YiminGao, Sebatien Gay and Ali Emadi, " Modern Electric, Hybrid Electric and Fuelcell vehicles: Fundamentals, Theory and Design", CRC press, 2004.
2. James Larminie and John Loury, " Electric Vehicle Technology – Explained", John Wiley & Sons Ltd, 2003.

Reference Books:

1. SandeepDhameja, "Electric Vehicle Battery Systems", Butterworth – Heinemann, 2002.
2. Ronald K Jurgen, "Electric and Hybrid – Electric Vehicles", SAE, 2002.
3. Ron Hodkinson and John Fenton, "Light Weight Electric/Hybrid Vehicle Design",Butterworth –Heinemann, 2001.

Web References:

1. http://nptel.ac.in/courses/108103009/1
2. http://nptel.ac.in/courses/108103009/4
3. http://nptel.ac.in/courses/108103009/9
4. http://nptel.ac.in/courses/108103009/32
5. http://www.engnetbase.com/books/4675/3154fm.pdf

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Course Code: 141OE0913	Course Title: SOLAR ENERGY SYSTEM	
Core/Elective: Open Elective	**Credits (L:T:P:C:M)**	3 : 0 : 0 : 3 : 100
Type: Lecture	**Total Contact Hours:** 45	

Pre-requisites:

- Nil

Course Objectives
The course is intend to

1. Understand the importance of solar radiation and its measurement techniques.
2. Understand the principles of solar Cooking, Distillation and Heating Systems.
3. Study the basic principles of solar photovoltaic (PV) cell and the factors affecting its electricity generation.
4. Understand the Balance of systems associated with PV power plants.
5. Design and study stand alone and grid connected Solar PV systems.

UNIT I SOLAR RADIATION AND MEASUREMENTS 9

World Solar Energy - Indian Solar energy scenario-The sun and The Earth-Sun Earth Movement-Angle of Sunrays on solar collector-Sun tracking-Estimation of solar radiation empirically-Measurement of Solar Radiation.

UNIT-II SOLAR THERMAL TECHNOLOGIES 9

Solar Thermal Energy Systems-Absorption and Radiation-Solar Cooking Systems-Principle -Types of Solar Cooker-Solar Distillation System-Operation and design-Solar Heating Systems.

UNIT-III SOLAR PHOTOVOLTAIC TECHNOLOGIES 9

Solar photovoltaic(PV) energy conversion - Principles - Physics and operation of solar cells- Solar cell types and Technologies-Factors affecting electricity generated by solar cell-Solar PV modules-Ratings of PV module-Standard PV module parameters- Factors affecting electricity generated by PV module-Measuring Module Parameters-Solar Arrays-Connection of Modules in series, parallel and Series-parallel.

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UNIT –IV BALANCE OF SYSTEMS 9

Batteries-Types-Parameters-Comparison of Various rechargeable batteries-Selection of Batteries-Batteries for PV Systems-Estimation of number of batteries required in series, parallel and series parallel for an application-Power Converters-Types-Charge Controllers-Function-Working-types-features-Typical Specifications-Maximum Power Point Tracking.

UNIT V SOLAR PV SYSTEM DESIGN AND INTEGRATION 9

Types of Solar PV systems-Design methodology for standalone Solar PV system-Configuration of Grid Connected Solar PV system-Components of Grid Connected Solar PV system-Design of Grid Connected Solar PV systems.

Course Outcomes:

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

CO1: Explain the importance of solar radiation and its measurement techniques.
CO2: Describe the principles of solar Cooking, Distillation and Heating Systems.
CO3: Explain the basic principles of solar photovoltaic (PV) cell and thefactors affecting its electricity generation.
CO4: Describe the Balance of systems associated with PV power plants.
CO5: Design Stand alone and grid connected Solar PV systems.

Textbooks:

1. Solar Photovoltaic Technology and Systems A manual for Technicians, Trainers and Engineers -Chetan Singh Solanki-PHI Learning Private Limited, 2013.
2. Solar Energy Utilisation, G.D.Rai, Khanna Publishers, 1993.

Reference Books:

1. Solar Photovoltaics: Fundamentals, Technologies And Applications By Chetan Singh Solanki- PHI Learning Private Limited, 2015.
2. Solar Energy by S P Sukhatme, J K Nayak, Tata McGraw Hill Publishing, 2008
3. **Renewable Energy Technologies: A Practical Guide for Beginners ByChetan Singh Solanki- PHI Learning Private Limited, 2009.**

Websites:

1. http://www.pveducation.org/
2. http://www.ese.iitb.ac.in/~chetan/PVmaterial.html
3. https://pveducation.com/
4. http://www.ncpre.iitb.ac.in/
5. https://mnre.gov.in/file-manager/UserFiles/support_hrd_coursematerial_iti.htm

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Course Code: 141OE0914	Course Title: ENERGY AUDITING AND CONSERVATION	
Core/Elective: Open Elective	Credits (L:T:P:C:M)	3 : 0 : 0 : 3 : 100
Type: Lecture	Total Contact Hours: 45	

Pre-requisites:

- Nil

Course Objectives
The course is intend to

1. Understand the basic principles of energy management material, energy balance
2. Study the financial and project management techniques for energy management
3. Gain knowledge in energy conservation of thermal utilities
4. Gain knowledge in energy conservation of electrical utilities
5. Analyze the performance of thermal and electrical utilities

UNIT I ENERGY MANAGEMENT & AUDIT 9

Energy Scenario-Basics of Energy and its various forms-**Energy Management & Audit:** Definition, Energy audit- need, Types of energy audit,Energy management (audit) approach-understanding energy costs, Bench marking,Energy performance, Matching energy use to requirement, Maximizing systemefficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments- **Material and Energy balance:** Facility as an energy system, Methods for preparing process flow, Material and energy balance diagrams.

UNIT II FINANCIAL& PROJECT MANAGEMENT 9

Financial Management: Investment-need, Appraisal and criteria, Financial analysis techniques-Simple pay back period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis; Financing options, Energy performance contracts and role of ESCOs.

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Project Managemnet: Definition and scope of project, Technical design, Financing, Contracting,Implementation and performance monitoring. Implementation plan for top management,Planning Budget, Procurement Procedures, Construction, Measurement & Verification.

UNITIII ENERGY EFFICIENCY IN THERMALUTILITIES 10

Boilers: Performances evaluation, Analysis of losses, Feed water treatment, Blow down, Energy conservation opportunities. **Steam System:** Properties of steam, Assessment of steam distribution losses, Steam leakages, Steam trapping, Condensate and flash steam recovery system, Identifying opportunities for energy savings. **Waste Heat Recovery:** Classification, Advantages and applications, Commercially viable waste heat recovery devices, Saving potential-Introduction to cogeneration & furnaces

UNIT IV ENERGY EFFICIENCY ELECTRICAL UTILITIES 12

Electric motors: Types, Losses in induction motors, Motor efficiency, Factors affecting motor performance, Energy saving opportunities with energy efficient motors. **Compressed air system:** Types of air compressors, Compressor efficiency, Capacity assessment, Leakage test, Factors affecting the performance and efficiency, **Fans and blowers**: Types, Performance evaluation, **Pumps and Pumping System**: Types, Performance evaluation,**Cooling Tower:** Types and performance evaluation, **Lighting System:** Light source, Choice of lighting, Luminance requirements, and Energy conservation avenues.

UNIT V ENERGY PERFORMANCE ASSESSMENT CASE STUDIES 5

Boilers-Heat Exchangers-Electric Motors –Fans and Motors-Compressors.

Course Outcomes:

At the end of the course the student can able to

CO 1: Explain the basic principles energy management and material, energy balance

CO2: Explain the financial and project management techniques for energy management

CO3: Identify the opportunities for energy conservation in thermal utilities

CO4: Identify the opportunities for energy conservation in electrical utilities

CO 5: Identify the improvement measures in the performance of thermal and electrical utilities

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Text Books:

1.Energy Manager Training Manual (4Volumes) available at www.energymanagertraining.com, a website administered by Bureau of Energy Efficiency (BEE), a statutory body underMinistry of Power, Government of India.2004.

2. Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, Guide to Energy Management, Fifth Edition, The Fairmont Press, Inc., 2006

Reference Books:

1. L.C. Witte, P.S. Schmidt, D.R. Brown, "Industrial Energy Management and Utilisation"HemispherePubl, Washington, 1988.
2. Callaghn, P.W. "Design and Management for Energy Conservation", Pergamon Press, Oxford,1981.
3. I.G.C. Dryden, "The Efficient Use of Energy" Butterworths, London, 1982
4. W.C. turner, "Energy Management Hand book" Wiley, New York, 1982.

Web references:

1. http://www.em-ea.org/gbook1.asp

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