SONA COLLEGE OF TECHNOLOGY, SALEM-5

(An Autonomous Institution)

B.E- Electrical and Electronics Engineering

CURRICULUM and SYLLABI

[For students admitted in 2018-2019]

B.E / B.Tech Regulation 2015R

Approved by BOS and Academic Council meetings

SONA COLLEGE OF TECHNOLOGY, SALEM – 636 005
(An Autonomous Institution)

Courses of Study for BE/BTech Semester I under Regulations 2015R (CBCS)

Branch: EEE

S.No.	Course Code	Course Title	L	T	P	C	Group code
Theory							
1	U15ENG101AR	Technical English – I	2	0	2	3	HS
2	U15MAT102AR	Mathematics – I	3	2	0	4	BS
3	U15PHY103AR	Engineering Physics	3	0	0	3	BS
4	U15CHE104AR	Engineering Chemistry	3	0	0	3	BS
5	U15CPR105AR	Programming in C	3	0	0	3	ES
6	U15EGR106AR	Engineering Graphics[1]	2	2	0	3	ES
Practical							
7	U15PCL107AR	Physics and Chemistry Laboratory-I[2]	0	0	2	1	BS
8	U15CPL108AR	C Programming Laboratory	0	0	2	1	ES
9	U15EPL109R	Engineering Practices Laboratory[3]	0	0	2	1	ES
Total Credits						**22**	
Optional Language Elective*							
10	U15OLE1101	French	0	0	2	1	HS
11	U15OLE1102	German					
12	U15OLE1103	Japanese					

***** Students may opt for foreign languages viz., German/French/Japanese with additional one credit (over and above the CGPA calculation).

[1] The examination will be conducted for 3 hours through written and practical modes.

[2] Laboratory classes on alternate weeks for Physics and Chemistry. The lab examination will be conducted separately for 50 marks each with 2 hours duration.

[3] The lab examination will be conducted separately for Group A (Civil & Mechanical) and Group B (Electrical & Electronics) with 50 marks each with 1 ½ hours duration.

Approved by

HOD- **First Year** Dr. M. Renuga	**Chairperson** **BOS/Civil &** **HOD-Civil** Dr. R. Malathy	**Chairperson** **BOS/EEE &** **HOD-EEE** Dr. S. Padma	**Chairperson BOS/** **Mechanical &** **Mechatronics** **HOD-Mechanical** Dr. D. Senthilkumar	**Chairperson BOS/** **FT &** **HOD-FT** Dr. G. Gunasekaran

Member Secretary, Academic Council
Dr. R. Shivakumar

Chairperson, Academic Council & Principal
Dr. S.R.R. Senthilkumar

SONA COLLEGE OF TECHNOLOGY, SALEM – 636 005
(An Autonomous Institution)

Courses of Study for BE / B Tech Semester II under Regulations 2015R (CBCS)

Branch: EEE

S.No.	Course Code	Course Title	L	T	P	C	Group code
Theory							
1	U15ENG201AR	Technical English –II	2	0	2	3	HS
2	U15MAT202AR	Mathematics – II	3	2	0	4	BS
3	U15PHY203CR	Physics For Electrical and Electronics Engineering	3	0	0	3	BS
4	U15CHE205BR	Chemistry For Electrical and Electronics Engineering	3	0	0	3	BS
5	U15PDS206R	Programming and Data Structures[1]	3	0	0	3	ES
6	U15ECT207R	Electric Circuit Theory	2	2	0	3	ES
Practical							
7	U15PCL208AR	Physics and Chemistry Laboratory – II[2]	0	0	2	1	BS
8	U15PDS209R	Programming and Data Structures Laboratory	0	0	2	1	ES
9	U15ECL210R	Electric Circuits Laboratory	0	0	2	1	ES
Total Credits						**22**	
Optional Language Elective*							
10	U15OLE1201	French	0	0	2	1	HS
11	U15OLE1202	German					
12	U15OLE1203	Japanese					

*Students may opt for foreign languages viz., German/French/Japanese with additional one credit (over and above the CGPA calculation).

[1] Common to CSE, IT, EEE branches
[2] Laboratory classes on alternate weeks for Physics and Chemistry. The lab examination will be conducted separately for 50 marks each with 2 hours duration.

Approved by

HOD-First Year Dr. M. Renuga	**Chairperson BOS/ EEE & HOD-EEE** Dr. S. Padma	**Member Secretary, Academic Council** Dr. R. Shivakumar	**Chairperson, Academic Council & Principal** Dr. S.R.R. Senthilkumar

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester III under Regulations 2015R (CBCS)
Branch: Electrical and Electronics Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	U15MAT301AR	Transforms and Partial Differential Equations	3	2	0	4
2	U15EE301R	Electronic Devices and Circuits	3	0	0	3
3	U15EE302R	Electromagnetic Theory	2	2	0	3
4	U15EE303R	Electrical Machines – I	3	0	0	3
5	U15EE304R	Network Analysis and Synthesis	2	2	0	3
6	U15CHE304R	Environmental Science and Engineering	3	0	0	3
Practical						
7	U15EE305R	Electronic Devices and Circuits Laboratory	0	0	4	2
8	U15EE306R	Electrical Machines Laboratory –I	0	0	4	2
9	U15GE301R	Soft Skills and Aptitude – I	0	0	2	1
					Total Credits	**24**

Approved By

Chairperson, Electrical and Electronics Engineering BoS
Dr.S.Padma

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-
HOD/Electrical and Electronics Engineering, Third Semester BE EEE Students and Staff, COE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester IV under Regulations 2015R (CBCS)
Branch: Electrical and Electronics Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	U15EE401R	Signals and Systems	2	2	0	3
2	U15EE402R	Electrical Machines – II	2	2	0	3
3	U15EE403R	Generation, Transmission and Distribution Systems	2	2	0	3
4	U15EE404R	Measurements and Instrumentation	3	0	0	3
5	U15EE405R	Control Systems	2	2	0	3
6	U15EE406R	Digital Logic Circuits	2	2	0	3
Practical						
7	U15EE407R	Control and Instrumentation Laboratory	0	0	4	2
8	U15EE408R	Electrical Machines Laboratory – II	0	0	4	2
9	U15GE401R	Soft Skills and Aptitude – II	0	0	2	1
					Total Credits	**23**

Approved By

Chairperson, Electrical and Electronics Engineering BoS
Dr.S.Padma

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-
HOD/Electrical and Electronics Engineering, Fourth Semester BE EEE Students and Staff, COE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester V under Regulations 2015R (CBCS)
Branch: Electrical and Electronics Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	U15EE501R	Total Quality Management in Electrical Industry	3	0	0	3
2	U15EE502R	Linear Integrated Circuits	3	0	0	3
3	U15EE503R	Microprocessors and Microcontrollers	3	0	0	3
4	U15EE504R	Power Electronics	3	0	0	3
5	U15EE505R	Electrical Machine Design	2	2	0	3
6	U15EE901R	**Elective** – Non-Conventional Energy Sources	3	0	0	3
Practical						
7	U15EE506R	Linear and Digital IC Laboratory	0	0	4	2
8	U15EE507R	Microprocessors and Microcontroller Laboratory	0	0	4	2
9	U15EE508R	Power Electronics Design Laboratory	0	0	4	2
10	U15GE501R	Soft Skills and Aptitude - III	0	0	2	1
					Total Credits	**25**

Approved By

Chairperson, Electrical and Electronics Engineering BoS
Dr.S.Padma

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-

HOD/Electrical and Electronics Engineering, Fifth Semester BE EEE Students and Staff, COE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VI under Regulations 2015R (CBCS)
Branch: Electrical and Electronics Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	U15EE601R	Power System Protection and Switchgear	3	0	0	3
2	U15EE602R	Power System Analysis	2	2	0	3
3	U15EE603R	Solid State Drives	3	0	0	3
4	U15EE604R	Comprehension	2	0	0	2
5	noc21-cs17	Introduction to Internet of Things	3	0	0	3
6	U15CE1004R	Municipal Solid Waste Management	3	0	0	3
	U15CS1004R	Mobile Application Development				
	U15CS1006R	Data Science				
	U15EC1006R	Sensors and Smart Structures Technologies				
	U15IT1003R	Problem Solving Techniques Using Java Programming				
	U15IT1004R	Python Programming				
	U15IT1005R	Introduction to Database Technology				
	U15MC1001R	Automation in Industries				
Practical						
7	U15EE605R	Solid State Drives Laboratory	0	0	4	2
8	U15EE606R	Electrical System Design Laboratory	0	0	4	2
9	U15ENG601R	Communication Skills Laboratory	0	0	2	1
10	U15GE601BR	Soft Skills and Aptitude - IV	0	0	2	1
					Total Credits	**23**

Approved By

Chairperson, Electrical and Electronics Engineering BoS	**Member Secretary, Academic Council**	**Chairperson, Academic Council & Principal**
Dr.S.Padma	**Dr.R.Shivakumar**	**Dr.S.R.R.Senthil Kumar**

Copy to:-

HOD/Electrical and Electronics Engineering, Sixth Semester BE EEE Students and Staff, COE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VII 2015R (CBCS)
Branch: Electrical and Electronics Engineering

S. No.	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U15GE701R	Professional Ethics and Human Values	3	0	0	3	45
2	U15EE701R	Energy Utilization and Management	3	0	0	3	45
3	U15EE702R	Power System Operation and Control	2	2	0	3	60
4	U15EE902R	**Elective -** Power Quality Engineering	3	0	0	3	45
5	U15EE909R	**Elective -** Special Electrical Machines	3	0	0	3	45
6	U15CE1002R	**Open Elective –** Disaster Management	3	0	0	3	45
	U15CE1003R	**Open Elective –** Energy Efficiency and Green Building					
	U15CS1005R	**Open Elective –** Object Oriented Programming and Data Structures					
	U15EC1008R	**Open Elective –** Mobile Technology and its Applications					
	U15IT1003R	**Open Elective –** Problem Solving Techniques Using Java Programming					
	U15ME1004R	**Open Elective –** Industrial Safety					
	U15ME1010R	**Open Elective –** 3D Printing					
Practical							
7	U15EE703R	Power System Simulation Laboratory	0	0	4	2	60
8	U15EE704R	Mini Project	0	0	8	4	120
					Total Credits	**24**	

Approved By

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Dr.S.Padma	Dr.R.Shivakumar	Dr.S.R.R.Senthil Kumar

Copy to:-

HOD/Electrical and Electronics Engineering, Seventh Semester BE EEE Students and Staff, COE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VIII 2015R (CBCS)
Branch: Electrical and Electronics Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Practical							
1	U15EE801R	Project Work	0	0	24	12	360
					Total Credits	**12**	

Approved By

Chairperson, Electrical and Electronics Engineering BoS
Dr.S.Padma

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-

HOD/Electrical and Electronics Engineering, Eighth Semester BE EEE Students and Staff, COE

SONA COLLEGE OF TECHNOLOGY, SALEM – 636 005
(An Autonomous Institution)

Courses of Study for BE/BTech Semester I under Regulations 2015R (CBCS)

Branch: EEE

S.No.	Course Code	Course Title	L	T	P	C	Group code
Theory							
1	U15ENG101AR	Technical English – I	2	0	2	3	HS
2	U15MAT102AR	Mathematics – I	3	2	0	4	BS
3	U15PHY103AR	Engineering Physics	3	0	0	3	BS
4	U15CHE104AR	Engineering Chemistry	3	0	0	3	BS
5	U15CPR105AR	Programming in C	3	0	0	3	ES
6	U15EGR106AR	Engineering Graphics[1]	2	2	0	3	ES
Practical							
7	U15PCL107AR	Physics and Chemistry Laboratory-I[2]	0	0	2	1	BS
8	U15CPL108AR	C Programming Laboratory	0	0	2	1	ES
9	U15EPL109R	Engineering Practices Laboratory[3]	0	0	2	1	ES
Total Credits						**22**	
Optional Language Elective*							
10	U15OLE1101	French	0	0	2	1	HS
11	U15OLE1102	German					
12	U15OLE1103	Japanese					

***** Students may opt for foreign languages viz., German/French/Japanese with additional one credit (over and above the CGPA calculation).

[1] The examination will be conducted for 3 hours through written and practical modes.

[2] Laboratory classes on alternate weeks for Physics and Chemistry. The lab examination will be conducted separately for 50 marks each with 2 hours duration.

[3] The lab examination will be conducted separately for Group A (Civil & Mechanical) and Group B (Electrical & Electronics) with 50 marks each with 1 ½ hours duration.

Approved by

HOD- **First Year** Dr. M. Renuga	**Chairperson** **BOS/Civil &** **HOD-Civil** Dr. R. Malathy	**Chairperson** **BOS/EEE &** **HOD-EEE** Dr. S. Padma	**Chairperson BOS/** **Mechanical &** **Mechatronics** **HOD-Mechanical** Dr. D. Senthilkumar	**Chairperson BOS/** **FT &** **HOD-FT** Dr. G. Gunasekaran

Member Secretary, Academic Council
Dr. R. Shivakumar

Chairperson, Academic Council & Principal
Dr. S.R.R. Senthilkumar

U15ENG101AR - TECHNICAL ENGLISH I

L	T	P	C	M
2	0	2	3	100

Course Outcomes

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

1. frame sentences correctly, both in written and spoken forms of language with accuracy and fluency.
2. develop and demonstrate listening skills for academic and professional purposes.
3. draw conclusions on explicit and implicit oral information.
4. develop effective reading skills and reinforce language skills required for using grammar and building vocabulary.
5. read for gathering and understanding information, following directions and giving responses.

UNIT I – FOCUS ON LANGUAGE

- General Vocabulary
- Prefixes and Suffixes
- Active and Passive Voices
- Adjectives, Comparative Adjectives
- Prepositions and Dependent Prepositions
- Collocations
- Tenses
- Modal Verbs and Probability

UNIT II – LISTENING -I

- Listening to conversations, welcome speeches, lectures and description of equipment.
- Listening to different kinds of interviews (face-to-face, radio, TV and telephone interviews).
- Understanding short conversations or monologues.
- Taking down phone messages, orders, notes etc.
- Listening for gist, identifying topic, context or function.

UNIT III – LISTENING – II

- Listening comprehension, entering information in tabular form.
- Intensive listening exercises and completing the steps of a process.
- Listening exercises to categorise data in tables.
- Listening to extended speech for detail and inference.

UNIT IV – READING -I

- Understanding notices, messages, timetables, advertisements, graphs, etc.
- Reading passages for specific information transfer.
- Reading documents for business and general contexts and interpreting graphical representations.
- Error correction, editing mistakes in grammar, vocabulary, spelling, etc.
- Oral reading – poetry and prose excerpts, general and technical articles, and anecdotes.

UNIT V – READING -II

- Reading passage with multiple choice questions, reading for gist and reading for specific information, skimming for comprehending the general idea, meaning and contents of the whole text.
- Short reading passage: gap-filling exercise related to grammar, testing the understanding of prepositions, articles, auxiliary verbs, modal verbs, pronouns, relative pronouns and adverbs.
- Short reading passage with multiple choice questions, gap-filling exercise testing the knowledge of vocabulary, collocations, dependent prepositions, grammatical structures.
- Short reading passages for sentence matching exercises, picking out specific information in a short text.

Total: 45 Hours

Listening test will be conducted for 20 marks internally and evaluated along with Technical English – I in the End Semester Valuation.
Reading test will be conducted for 20 marks internally and evaluated by internal examiners.

TEXTBOOK

1. Technical English – I & II, Dr. M. Renuga, et al. Sonaversity, Sona College of Technology, Salem, Revised edition, 2016.

EXTENSIVE READING

1. The Story of Amazon.com- Sara Gilbert, published by Jaico
2. The Story of Google – Sara Gilbert, published by Jaico

REFERENCE BOOKS

1. Norman Whitby, Business Benchmark – Pre-Intermediate to Intermediate, Students Book, Cambridge University Press, 2006.
2. A Course in Communication Skills, P. Kiranmai Dutt, Geetha Rajeevan, C. L. N. Prakash, published by Cambridge University Press India Pvt. Ltd.

U15MAT102AR - MATHEMATICS – I

(Common to Civil, Mech, Mechatronics, EEE, IT and FT Branches)

L	T	P	C	M
3	2	0	4	100

Course Outcomes

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

1. find the Eigen values and Eigen vectors of a real matrix and discuss their properties, reduce a real symmetric matrix from quadratic form to canonical form.
2. explain the three dimensional Cartesian coordinates and discuss the problems in straight line, plane and sphere.
3. describe curvature and find the radius of curvature, circle of curvature, evolutes, involutes and envelope of curves.
4. explain functions of several variables and find the Taylor's series expansion, Jacobians, maximum and minimum values of function of several variables.
5. describe the double and triple integrals, discuss the change of order of integration and find the area and volume by multiple integrals.

UNIT I – MATRICES **9+6**

Characteristic equation – Eigen values and Eigen vectors of a real matrix – properties – statement of Cayley – Hamilton theorem and its applications – orthogonal transformation of symmetric matrix to diagonal form – quadratic form – reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II – THREE DIMENSIONAL ANALYTICAL GEOMETRY **9+6**

Direction cosines and ratios, angle between two lines – equation of plane, angle between two planes – equation of the straight line, coplanar lines, skew lines – equation of a sphere, plane section of a sphere, tangent plane, orthogonal spheres.

UNIT III – DIFFERENTIAL CALCULUS AND ITS APPLICATIONS **9+6**

Curvature in Cartesian coordinates, centre and radius of curvature, circle of curvature – evolutes, envelopes, evolute as the envelope of normals.

UNIT IV – FUNCTIONS OF SEVERAL VARIABLES **9+6**

Partial derivatives, total differentiation – differentiation of implicit functions – Taylor's expansion – maxima and minima, constrained maxima and minima by Lagrange's multiplier method – Jacobians – properties.

UNIT V – MULTIPLE INTEGRALS **9+6**

Evaluation of double integrals in Cartesian and polar coordinates – change of order of integration – change of variables from Cartesian to polar coordinates – area as double integral – evaluation of triple integrals in Cartesian coordinates – volume as triple integral in Cartesian coordinates.

Total: 75 Hours

TEXT BOOKS

1. B.S.Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. T.Veerarajan,"Engineering Mathematics" (I Year), Tata McGraw Hill, 4th Edition, 2011.

REFERENCE BOOKS

1. P.Kandasamy, K.Thilagavathy and K.Gunavathy, "Engineering Mathematics", (for first year), S. Chand and Co., Ltd., Revised Edition 2011.
2. E.Kreyszig, "Advanced Engineering Mathematics", International Student Version, Wiley, 10th Edition, 2015.
3. S. Jayabharathi, "Mathematics - I", Sonaversity, Revised Edition, 2017.
4. N. P. Bali and M. Goyal, "Engineering Mathematics", University Science Press, New Delhi, 9th Edition, 2011.

U15PHY103AR - ENGINEERING PHYSICS

(Common to B.E. Mech, Mechatronics, Civil, EEE, CSE & B.Tech. IT, FT Branches)

L	T	P	C	M
3	0	0	3	100

Course Outcomes

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

1. design acoustically good buildings and describe the applications of ultrasonic waves in the field of non-destructive testing
2. classify lasers and explain its applications in the field of medicine, engineering and technology.
3. elucidate the principle of optical fibre communication, applications and the devices involved in the transmission and reception of data.
4. illustrate the dual nature of matter and radiation and its applications.
5. analyze crystal structures and the significance of defects in crystals.

UNIT I – ACOUSTICS AND ULTRASONICS 9

Classification of sound, Pitch, Loudness, Intensity level, Phon, Timbre, Reverberation, Reverberation time – Sabine's formula and its importance (no derivation) – Sound absorbing materials - Absorption Coefficient and its determination – Factors affecting acoustics of buildings and their remedies –- Production of ultrasonic waves by magnetostriction and piezoelectric methods – acoustic grating – Acoustic impedance - Non Destructive Testing – Ultrasonic flaw detector – A scan display - Sonogram (block diagram).

UNIT II – LASERS 9

Principle of spontaneous and stimulated emission – Population inversion - Pumping – Einstein's A and B coefficients derivation – Basic requirements of a laser - Types of lasers – Nd:YAG laser, CO_2 and Semiconductor lasers (homojunction & heterojunction) – Qualitative applications – Lasers in welding, heat treatment and cutting – Medical applications (qualitative) – holography construction and reconstruction.

UNIT III – FIBRE OPTICS AND APPLICATIONS 9

Principle and propagation of light in optical fibers – Numerical aperture and acceptance angle – Types of optical fibres (material, refractive index, mode) – Double Crucible

Technique of fibre drawing – Splicing – Loss in optical fibre – attenuation, dispersion and bending - Fibre optic communication system (Block diagram) – Fibre optic sensors - temperature and displacement sensor - Endoscope.

UNIT IV – QUANTUM PHYSICS **9**

Introduction – Compton Effect theory and experimental verification – Matter waves – Schrodinger's time independent and time dependent wave equation - Physical significance of the wave function – Particle in a one dimensional box – Evolution of microscope - Electron microscope – Comparison of optical and electron microscope - Scanning electron microscope.

UNIT V – CRYSTALLOGRAPHY **9**

Crystalline Solids – Amorphous solids – Space Lattice - Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number and atomic packing factor for SC, BCC, FCC and HCP Structures – Polymorphism and allotropy – Crystal imperfections: point , line and surface defects – burger vector.

Total: 45 Hours

TEXT BOOKS

1. B. K. Pandey and S. Chaturvedi, Engineering Physics , Cengage Learning India Pvt. Ltd., Delhi, 2012.
2. M. Arumugam, 'Engineering Physics' Anuradha Publications, Kumbakonam, 2006.

REFERENCE BOOKS

1. C. Shanthi et al., Engineering Physics, Sonaversity, Sona College of Technology, Salem (Revised edition, 2016).
2. R. K. Gaur and S.C. Gupta, Engineering Physics, Dhanpat Rai Publications, New Delhi, 2003.
3. V. Rajendran and A. Marikani, Engineering Physics, Tata Mc Graw Hill Publications Ltd, III Edition, New Delhi, 2004.
4. M.N. Avadhanulu and PG Kshirsagar, A Text book of Engineering Physics, S.Chand and company, Ltd., New Delhi, 2005.

U15CHE104AR - ENGINEERING CHEMISTRY

(Common to BE - Civil, EEE, Mech, Mechatronics & BTech - FT)

L	T	P	C	M
3	0	0	3	100

Course Outcomes

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

1. analyze the types of impurities present in water, their removal methods and explain the conditioning methods for domestic and industrial uses.
2. outline the principles and applications of electrochemistry to engineering and technology.
3. compare the types of corrosion and describe the methods of corrosion control.
4. outline the principle and applications of surface chemistry and catalysis in engineering and technology.
5. illustrate the basics of nano chemistry, synthesis, properties and applications of nano materials in engineering and technology.

UNIT I – WATER TECHNOLOGY 9

Introduction - Characteristics – hardness – estimation of hardness by EDTA method – alkalinity and its estimation - Boiler feed water – requirements – disadvantages of using hard water in boilers – internal conditioning (colloidal – phosphate – calgon and carbonate conditioning methods) – external conditioning – zeolite process, demineralization process – desalination of brackish water by reverse osmosis - Domestic water treatment – screening, sedimentation – coagulation – aeration – sand filtration and disinfection methods – Chlorination – ozonation and UV treatment.

UNIT II – ELECTROCHEMISTRY 9

Electrode potential - Nernst Equation - derivation and problems based on single electrode potential calculation - reference electrodes - standard hydrogen electrode - calomel electrode – Ion selective electrode - glass electrode - measurement of pH – electrochemical series – significance – electrolytic and electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – potentiometric titrations (redox – Fe^{2+} vs dichromate) – conductometric titrations (acid-base – HCl vs NaOH).

UNIT III – CORROSION AND CORROSION CONTROL 9

Chemical corrosion - Pilling-Bedworth rule – electrochemical corrosion – mechanism - galvanic corrosion – differential aeration corrosion – factors influencing corrosion – corrosion control – sacrificial anode and impressed cathodic current methods – corrosion inhibitors – protective coatings – preliminary treatment - Paints constituents and their functions – surface conversion coatings – Galvanizing and Tinning.

UNIT IV – SURFACE CHEMISTRY AND CATALYSIS 9

Adsorption – types-physical and chemical adsorption – adsorption of gases on solids-adsorption isotherms – Freundlich and Langmuir isotherms-adsorption of solutes from solution – applications of adsorption - role of adsorption in catalytic reactions – ion exchange adsorption-basic principles in adsorption chromatography – adsorption in pollution abatement (granular activated carbon and powdered activated carbon) – catalysis-types - characteristics of catalysts - autocatalysis - definition and examples.

UNIT V – NANOCHEMISTRY 9

Basics - distinction between molecules, nanoparticles and bulk materials – size-dependent properties – nanoparticles: nano cluster, nano rod, nanotube (CNT) and nanowire – Synthesis: precipitation – thermolysis – hydrothermal – solvothermal – electrodeposition - chemical vapour deposition - sol-gel technique – properties and applications of nano materials.

Total: 45 Hours

TEXT BOOKS

1. P.C.Jain and Monica Jain, “Engineering Chemistry” Dhanpat Rai Pub, Co., New Delhi, 2010 (15th Edition).
2. B. Sivasankar “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 2008.

REFERENCE BOOKS

1. T. Maruthavanan et al., “Engineering Chemistry”, Sonaversity, Sona College of Technology, Salem, Revised Edition 2018.
2. Kannan P., Ravikrishnan A., “Engineering Chemistry”, Sri Krishna Hi-tech Publishing Company Pvt. Ltd., Chennai, 2009.
3. H.K. Chopra, A. Parmer, “Chemistry for Engineers”, Narosa Publishing House, New Delhi, 110 002, 2016.
4. Ozin G. A. and Arsenault A. C., “Nanochemistry: A Chemical Approach to Nanomaterials”, RSC Publishing, 2005.

U15CPR105AR - PROGRAMMING IN C

(Common to BE - CIVIL, CSE, EEE, MECH, Mechatronics, B.Tech - FT, IT)

L	T	P	C	M
3	0	0	3	100

Course Outcomes

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

1. formulate problems, apply logics to solve problems by practice and outline the basics of computer technology
2. write, compile and find errors in simple c programs
3. apply the concepts such as arrays, decision making and looping statements to solve real-time applications
4. examine the power of functions and pointers to become expert programmers in c
5. solve simple scientific and statistical problems using structures and unions

UNIT I – INTRODUCTION TO PROBLEM SOLVING AND COMPUTERS 8

Problem formulation, Problem Solving methods, Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart. Need for computer languages, Generation and Classification of Computers- Basic Organization of a Computer

UNIT II – C PROGRAMMING BASICS 10

Structure of a C program – Compiling and Debugging a C program - C Character set, Identifies and Keywords, Data Types, Declarations, Expressions, Statements and Symbolic constants, Operators – Arithmetic Operators – Unary operators – Relational and Logical Operators – Assignment operators – Conditional operators – Managing Input and Output operations, pre-processor directives and storage classes

UNIT III – CONTROL STATEMENTS, ARRAYS AND STRINGS 9

Unconditional statements, conditional statements, branching and looping statements - Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays – String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations and solving simple scientific and statistical problems

UNIT IV – FUNCTIONS AND POINTERS **9**

Function – Library functions and user-defined functions – Function prototypes and function definitions – Call by value –Call by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays - Example Problems. Pointers and Functions

UNIT V – STRUCTURES AND UNIONS **9**

Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure – Passing structures to functions – Array of structures – Pointers to structures – Union - Programs using structures and Unions

Total: 45 Hours

TEXT BOOKS

1. Yashavant P. Kanetkar, “Let Us C”, BPB Publications, 2011.
2. Balagurusamy E, “Programming in ANSI C”, sixth edition, Tata Mcgraw-Hill, 2012.

REFERENCE BOOKS

1. Deitel and Deitel, “C How to Program”, Pearson Education, New Delhi, 2011.
2. Byron S Gottfried, “Programming with C”, Schaums Outlines, Second Edition, Tata McGraw-Hill, 2006.
3. Kernighan, B.W and Ritchie, D.M, “The C Programming language”, Second Edition, Pearson Education, 2006.
4. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.

U15EGR106AR - ENGINEERING GRAPHICS

L	T	P	C	M
2	2	0	3	100

Course Outcomes

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

1. predict the construction of various curves in civil elevation plan and machine components.
2. draw the projection of three dimensional objects representation of machine structure and explain standards of orthographic views by different methods.
3. analyze the principles of projection of various planes by different angle to project points, lines and planes.
4. draw the principles of projection of simple solid by the axis is inclined to one reference plane by change of position method. understand the interior components of machinery (or) buildings by sectioning the solid,
5. study the development of simple solids for fabrication of sheet metals.

CONCEPTS AND CONVENTIONS (Not for Examination) 12

Importance of graphics in engineering applications, Use of drafting instrument, BIS conventions and specifications - Size, layout and folding of drawing sheets, Lettering and dimensioning.

COMPUTER AIDED DRAFTING (Not for Examination) 12

Importance 2d Drafting, sketching, modifying, transforming and dimensioning.

UNIT I – PLANE CURVES (Free hand sketching) 12

Curves used in engineering practices

Conics – Construction of ellipse – Parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

UNIT II – ISOMETRIC TO ORTHOGRAPHIC VIEWS 12

(Free Hand Sketching)

Representation of three dimensional objects – General Principles of Orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout of views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT III – PROJECTION OF POINTS, LINES AND PLANE SURFACES

(Free hand sketching and 2D Software) 12

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

UNIT IV – PROJECTION OF SOLIDS 12

(Free hand sketching and 2D Software)

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

UNIT V – SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES

(Free hand sketching and 2D Software) 12

Sectioning of simple solids like prisms – pyramids, cylinder and cone in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other, (Obtaining true shape of section is not required). Development of lateral surfaces of simple and truncated solids – Prisms – pyramids –cylinders and cones.

TEXT BOOKS

1. P. Suresh et al., "Engineering Graphics and Drawing", Sonaversity, Sona College of Technology, Salem, Revised edition, 2012.
2. K.V. Natarajan Engineering Graphics by, Chennai, 17th edition 2003.

REFERENCE BOOKS

1. Dhananjay A. JoIhe, Engineering Drawing with an introduction to AutoCAD, Tata McGraw Hill Publishing Company Limited, 2008.
2. Basant Agarwal and Agarwal C.M., Engineering Drawing, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. K. R. Gopalakrishnana, Engineering Drawing (Vol. I & II), Subhas Publications, 1998.
4. Bertoline & Wiebe, Fundamentals of Graphics Communication, III edition, McGrawhill 2002.

U15PCL107AR - PHYSICS AND CHEMISTRY LABORATORY I

(Common to Civil, EEE, Mech, Mechatronics & FT Branches)

L	T	P	C	M
0	0	2	1	100

Course Outcomes

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

1. apply the principles of optics, thermal physics and elasticity to determine the engineering properties of materials.
2. analyse the given water sample to determine the amount of hardness and alkalinity.
3. determine the thickness of the given copper turn used for house hold applications and evaluate the amount of alkalinity, pH, conductivity and iron content of house hold water sample.

List of Experiments – (PHYSICS PART)

1. Determination of the thickness of a thin wire by forming interference fringes using air wedge apparatus.
2. Determination of the wavelength and velocity of ultrasonic waves and the compressibility of a given liquid using the ultrasonic interferometer.
3. Determination of thermal conductivity of a bad conductor using Lee's disc apparatus.
4. Determination of the angle and dispersive power of a given prism using a spectrometer.
5. Determination of laser wavelength, particle size (lycopodium powder), acceptance angle and numerical aperture of an optical fibre using a diode laser.
6. Determination of the Young's modulus of a given material by non-uniform bending method.

(Any five experiments may be conducted from the above list)

List of Experiments – (CHEMISTRY PART)

1. Estimation of hardness of water by EDTA method.
2. Estimation of alkalinity of water by indicator method.
3. Estimation of hydrochloric acid by pH metry.
4. Conductometric titration of strong acid vs strong base (HCl vs NaOH).
5. Estimation of ferrous iron by potentiometric titration (Fe^{2+} vs dichromate).
6. Estimation of corrosion in iron sheets by weight loss method.

(Any five experiments may be conducted from the above list)

Total: 30 Hours

U15CPL108AR - C PROGRAMMING LABORATORY

(Common to BE - CIVIL, CSE, EEE, MECH, Mechatronics & BTech FT, IT)

L	T	P	C	M
0	0	2	1	100

Course Outcomes

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

1. design and develop simple programs using branching, looping statements, functions and arrays
2. develop programs using structures, strings, pointers and recursion
3. effectively choose programming components that efficiently solve computing problems in real-world

List of Experiments

1. Programs using Input, Output and assignment statements
2. Programs using Branching statements
3. Programs using Looping statements
4. Programs using Functions
5. Programs using one dimensional and two dimensional arrays
6. Programs using Structures
7. Programs using Strings
8. Programs using Pointers (both data pointers and function pointers)
9. Programs using Recursion

Total: 30 Hours

U15EPL109R - ENGINEERING PRACTICES LABORATORY

(Common to all Branches)

L	T	P	C	M
0	0	2	1	100

Course Outcomes

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

1. plan the pipe connections using PVC, G.I pipes
2. analyze the process of wood separation with proper types of joints using tools and machines
3. demonstrate the method of material removal from metal components and assemble the components using sheet metals
4. demonstrate the working principles of house wiring and Fluorescent lamp wiring
5. analyze the functions of logic gates (AND, OR, NOT, NAND, NOR and Ex-OR)

List of Experiments

GROUP A (CIVIL & MECHANICAL)

1. CIVIL ENGINEERING PRACTICE

PLUMBING WORKS

a. Basic pipe connections (PVC) involving the fittings like Valves, Taps, and Bends.

b. Mixed pipe (PVC and G.I) connections involving the fitting like Valves, Taps, and Bends

CARPENTRY WORKS

a. Planning

b. Lap joint

c. Cross lap joint

II MECHANICAL ENGINEERING PRACTICE

SHEET METAL WORK

a. Square tray

b. Funnel

FITTING WORK

a. L joint

b. V-joint

c. Demonstration of Welding classes

GROUP B (ELECTRICAL & ELECTRONICS)

ELECTRICAL ENGINEERING

1. Study of Resistor, Inductor and capacitor-ratings-colour coding-series and parallel equivalence.
2. House wiring
3. Fluorescent lamp wiring.
4. Stair-case Wiring and Door bell wiring
5. Measurement of circuit parameters for RLC series circuit..
6. Measurement of Energy using Energy meter for Single Phase system.
7. Study of Fan and Iron Box.

ELECTRONICS ENGINEERING

1. Verification of Ohm's Law
2. Measurement of Amplitude and frequency of AC wave forms using CRO.
3. Verification of logic gates (AND, OR, NOT, NAND, NOR and ExOR).
4. Generation of Clock Signal using IC 555 timer.
5. Soldering practice - Components Devices and Circuits - Using general purpose PCB.
6. Study of Multimeter

Total: 45 Hours

SONA COLLEGE OF TECHNOLOGY, SALEM – 636 005
(An Autonomous Institution)

Courses of Study for BE / B Tech Semester II under Regulations 2015R (CBCS)

Branch: EEE

S.No.	Course Code	Course Title	L	T	P	C	Group code
Theory							
1	U15ENG201AR	Technical English –II	2	0	2	3	HS
2	U15MAT202AR	Mathematics – II	3	2	0	4	BS
3	U15PHY203CR	Physics For Electrical and Electronics Engineering	3	0	0	3	BS
4	U15CHE205BR	Chemistry For Electrical and Electronics Engineering	3	0	0	3	BS
5	U15PDS206R	Programming and Data Structures[1]	3	0	0	3	ES
6	U15ECT207R	Electric Circuit Theory	2	2	0	3	ES
Practical							
7	U15PCL208AR	Physics and Chemistry Laboratory – II[2]	0	0	2	1	BS
8	U15PDS209R	Programming and Data Structures Laboratory	0	0	2	1	ES
9	U15ECL210R	Electric Circuits Laboratory	0	0	2	1	ES
Total Credits						**22**	
Optional Language Elective*							
10	U15OLE1201	French	0	0	2	1	HS
11	U15OLE1202	German					
12	U15OLE1203	Japanese					

*Students may opt for foreign languages viz., German/French/Japanese with additional one credit (over and above the CGPA calculation).

[1] Common to CSE, IT, EEE branches
[2] Laboratory classes on alternate weeks for Physics and Chemistry. The lab examination will be conducted separately for 50 marks each with 2 hours duration.

Approved by

HOD-First Year Dr. M. Renuga	**Chairperson BOS/ EEE & HOD-EEE** Dr. S. Padma	**Member Secretary, Academic Council** Dr. R. Shivakumar	**Chairperson, Academic Council & Principal** Dr. S.R.R. Senthilkumar

U15ENG201AR - TECHNICAL ENGLISH II

L	T	P	C	M
2	0	2	3	100

Course Outcomes

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

1. use grammatical components effectively in both written and spoken communication
2. develop speaking skills for self introduction, delivering speeches and technical presentation.
3. speak effectively in real time and business situations
4. write emails, formal letters and descriptions of graphics
5. develop skills for writing reports and proposals

UNIT I – FOCUS ON LANGUAGE

- Cause and effect expressions
- Concord
- If conditionals
- Articles
- Pronouns
- Adverbs
- Grammatical structures

UNIT II – SPEAKING-I

- Self introduction, personal information, name, home background, study details, area of interest, hobbies, strengths and weaknesses, projects and paper presentations, likes and dislikes in food, travel, clothes, special features of home town.
- Welcome address, vote of thanks, special address on specific topics.

UNIT III – SPEAKING – II

- Mini presentation in small groups of two or three regarding, office arrangements, facilities, office functions, sales, purchases, training recruitment, advertising, applying for financial assistance, applying for a job, team work, discussion, presentation
- Situational role play between examiner and candidate, teacher and student, customer and sales manager, hotel manager and organiser, team leader and

team member, bank manager and candidate, interviewer and applicant, car driver and client, industrialist and candidate, receptionist and appointment seeker, new employee and manager, employee and employee, P.A. and manager, schedule for training, asking for directions, seeking help with office equipment, clarifying an error in the bill, job details, buying a product, selling a product, designing a website, cancelling and fixing appointments, hotel accommodation, training facilities, dress code, conference facilities.

UNIT IV –WRITING – I

- Email, fixing an appointment, Cancelling appointments, conference details, hotel accommodation, order for equipment, training programme details, paper submission for seminars and conferences
- Letter Writing, Business communication, quotations, placing orders, complaints, replies to queries from business customers, inviting dignitaries, accepting and declining invitations
- Resume / CV
- Transcoding: Flow Chart, Pie Chart, Graph, Bar Chart, Tabular Column.

UNIT V – WRITING -II

- Technical report writing, feasibility reports, accident reports, survey reports
- General purpose writing specifications of equipment, description of an object, National and International issues, answering general questions with special emphasis on seeking opinions
- Technical Writing: recommendations, checklists, instructions, note making and memo
- Proposal: establishing a lab, introducing a subject in the curriculum, training programme for students

Total: 45 Hours

Speaking test will be conducted for 20 marks externally and evaluated along with Technical English –II in the End Semester Valuation.

TEXTBOOK

Technical English – I & II, Dr. M. Renuga, et al. Sonaversity, Sona College of Technology, Salem, Revised edition, 2016.

EXTENSIVE READING

1. Who Moved my Cheese? – Spencer Johnson-G. P. Putnam's Sons
2. " Discover the Diamond in You" – Arindam Chaudhuri – Vikas Publishing House Pvt. Ltd.

REFERENCE BOOKS

1. Norman Whitby, Business Benchmark – Pre-Intermediate to Intermediate, Students Book, Cambridge University Press, 2006.
2. A Course in Communication Skills, P. Kiranmai Dutt, Geetha Rajeevan, C. L. N. Prakash, published by Cambridge University Press India Pvt. Ltd.

U15MAT202AR - MATHEMATICS – II

(Common to Civil, Mech, Mechatronics, EEE, IT and FT Branches)

L	T	P	C	M
3	2	0	4	100

Course Outcomes

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

1. explain the different types of ordinary differential equations and describe the various methods to solve ordinary differential equations.
2. define and explain the vector functions, operators and discuss the methods of solving line, surface and volume integrals.
3. state the special features of function of a complex variable, properties and discuss the problems involving conformal mapping.
4. describe the power series expansion of a complex function and the procedures of evaluating the complex integral.
5. define Laplace transform, its inverse, properties and solve an ordinary differential equation using Laplace transform.

UNIT I – ORDINARY DIFFERENTIAL EQUATIONS 9+6

Linear higher order ordinary differential equations with constant coefficients – Cauchy's and Legendre's homogeneous linear ordinary differential equations – method of variation of parameters.

UNIT II – VECTOR CALCULUS 9+6

Vector differentiation: Scalar and vector valued functions, gradient, directional derivative, divergence and curl, scalar potential.

Vector integration: Line, surface and volume integrals, statement of Green's, Stoke's and Gauss divergence theorems, simple applications involving squares, rectangles, cubes and rectangular parallelepiped.

UNIT III – ANALYTIC FUNCTIONS 9+6

Function of a complex variable, analytic function, necessary conditions and sufficient conditions (excluding proof), properties of an analytic function, harmonic conjugate, construction of an analytic function by Milne's Thomson method, conformal mapping: $w = z + c$, cz, $1/z$ and bilinear transformation.

UNIT IV – COMPLEX INTEGRATION **9+6**

Statement of Cauchy's integral theorem and Cauchy's integral formula, simple applications, Taylor's and Laurent's expansions, singular points, residues, statement of Cauchy's residue theorem, evaluation of contour integration over unit circle and semi circle (excluding poles on real axis).

UNIT V – LAPLACE TRANSFORM **9+6**

Laplace transform: conditions for existence, transform of elementary functions, basic properties, transform of derivatives and integrals, transform of unit step function and impulse function, transform of periodic functions.

Inverse Laplace transform: standard results – statement of convolution theorem and its applications, initial and final value theorems, solution of linear second order ordinary differential equations with constant coefficients using Laplace transformation.

TOTAL: 75 Hours

TEXT BOOKS

1. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. T. Veerarajan, "Engineering Mathematics"(I Year), Tata McGraw Hill, 4th Edition, 2011.

REFERENCE BOOKS

1. P. Kandasamy, K. Thilagavathy and K. Gunavathy, "Engineering Mathematics", (for first Year), S. Chand and Co., Ltd., Revised Edition 2011.
2. E. Kreyszig., "Advanced Engineering Mathematics", John Wiley and Sons (Wiley Student Edition), 10th Edition, 2011.
3. S.Karthikeyan, R. Rajeswari, P. Senthilvadivu and R.Shivakumar, "Vector Calculus and Complex Analysis", Sonaversity, Revised Edition, 2017.
4. N. P. Bali, M. Goyal, "Engineering Mathematics", University Science Press, New Delhi, 9th Edition, 2011.

U15PHY203CR - PHYSICS FOR ELECTRICAL AND ELECTRONICS ENGINEERING

L	T	P	C	M
3	0	0	3	100

Course Outcomes

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

1. calculate electrical and thermal conductivity of conducting materials.
2. classify semiconductors and analyze the variation of Fermi level with temperature and determine the nature of charge carriers.
3. explain the basics of electron devices and their applications.
4. compare the different types of magnetic materials and their applications in data storage devices.
5. analyze various polarization mechanisms and the causes of breakdown in dielectric materials.

UNIT I – CONDUCTING MATERIALS 9

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory –band theory of solids (qualitative treatment only) - Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals – conducting materials in thermal relay and themostats

UNIT II – SEMICONDUCTOR PHYSICS 9

Atomic structure - Energy band diagram - Types of semiconductor - Electron mobility –Conductivity - Drift current - Diffusion current – Compound semiconductors - Carrier concentration in intrinsic semiconductors - Fermi level – Variation of Fermi level with temperature – Electrical conductivity – Band gap determination – Extrinsic semiconductors – N type semiconductor, P type semiconductor - Carrier concentration in N-type and P-type semiconductors (Qualitative Treatment only) – Variation of Fermi level with temperature and impurity concentration — Hall effect – Determination of Hall coefficient – Hall effect applications.

UNIT III – ELECTRON DEVICES 9

Theory of PN junction, PN junction Diode – V- I Characteristics of PN junction diode

- Application of PN junction Diode - Zener Diode, V-I Characteristics of Zener diode- Application of Zener diode – Voltage Regulators.

Transistor Construction - Detailed study of current in transistor - CB, CC and CE Configurations – Input - Output Characteristics – Switching characteristics of Transistor - Transistor as an amplifier

UNIT IV – MAGNETIC PROPERTIES OF MATERIALS 9

Introduction – Magnetism - Origin of magnetic moment – Bohr magneton – Dia, para and Ferromagnetic materials – Domain theory – origin of domains - Hysteresis – Soft and hard magnetic materials – Ferrites – properties and applications - Simple and Composite Magnetic circuits – concepts of leakage flux – fringing effect – comparison of electric and magnetic circuit.

UNIT V – DIELECTRIC MATERIALS 9

Electrical susceptibility – Dielectric constant – Electronic, ionic, orientation and space charge polarization – Frequency and temperature dependence of polarization – Internal field – Clausius – Mosotti relation (derivation) – Physical significance of Maxwell's equations - Dielectric loss – Dielectric breakdown – Uses of dielectric materials in capacitor and transformer.

Total: 45 Hours

TEXT BOOKS

1. B. K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning India Pvt. Ltd., Delhi, 2012.
2. M. Arumugam, 'Materials Science' Anuradha Publications, Kumbakonam, 2006.

REFERENCE BOOKS

1. C. Shanthi et al., 'Physics for Electrical and Electronics Engineering', Sonaversity, Sona College of Technology, Salem (Revised edition, 2015).
2. V. Rajendran, and A. Marikani, 'Materials science' TMH Publications, New Delhi, 2004.
3 P.K Palanisamy, 'Materials science', Scitech Publications (India) Pvt. Ltd., Chennai, Second Edition, 2007.
4 Charles P. Poole and Frank J. Ownen, 'Introduction to Nanotechnology', Wiley India, 2007 (Unit V).

U15CHE205BR - CHEMISTRY FOR ELECTRICAL AND ELECTRONICS ENGINEERING

L	T	P	C	M
3	0	0	3	100

Course Outcomes

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

- analyze the types of polymers, polymerization reactions, polymerization techniques and fabrication methods of polymers for engineering applications.
- describe the construction, working principle and applications of energy storage devices for electronic appliances.
- discuss the principles, advantages and applications of organic electronic materials in electronic devices.
- explain the electrochemical processes carried out in electronic industries.
- outline the principles and applications of photochemistry and spectroscopy.

UNIT I – POLYMERS AND COMPOSITES 9

Nomenclature of Polymers – Functionality – Types of Polymerization-Addition-Condensation and Copolymerization – Classification of Polymers – Free Radical Mechanism of Addition Polymerization – Properties of Polymers – Glass transition temperature – tacticity - Methods of Polymerization-Bulk-Solution-Emulsion and Suspension – Plastics – Moulding Constituents of Plastic – Moulding of Plastics into Articles-Injection-Compression and Blow Moulding – Thermoplastic and Thermosetting Resins – Engineering Plastics-Nylon 6,6-Polycarbonate and Polyurethane-Preparation-Properties and Applications – Rubbers-Types-Applications-Vulcanization of Rubber – Composites - Constituents of Composites – Types of FRP Composites.

UNIT II – MODERN ENERGY DEVICES FOR ELECTRONIC APPLIANCES 9

Reversible and Irreversible Cells – Batteries-Types of Batteries – Battery Characteristics-Voltage-Current-Capacity-Electricity Storage Density-Power-Discharge Rate-Cycle Life-Energy Efficiency and Shelf Life – Fabrication and Working of Alkaline Battery-Lead-Acid Battery-Ni-Cd-Lithium Ion Batteries and Solar cells – Fuel Cells – Hydrogen-Oxygen Fuel Cells – Nano Batteries- Construction-Working-Advantages and Applications.

UNIT III – CHEMISTRY OF ORGANIC ELECTRONIC MATERIALS 10

Organic Semiconducting Materials – Working Principle and Advantages Over Inorganic Semiconducting Materials - P-Type and N-Type Organic Semiconducting Materials - Pentacene Fullerenes-C-60 – Organic Dielectric Material-Definition-Working Principle and Examples - Polystyrene – PMMA – Organic Light Emitting Polymer – Structure-Properties and Applications of Polythiopene– Organic Light Emitting Diodes(Oleds)-Construction-Working Principle and Applications – Organic Solar Cells-Working Principle and Applications Organic Transistors- Construction-Working Principle and Applications in Electronic Industries.

UNIT IV – ELECTROCHEMICAL PROCESSES IN ELECTRONIC INDUSTRIES 9

Electroplating – Principle and process - plating parameters- current and energy efficiency - Electroplating of Cu, Ni, and Cr. Fundamentals of electroless deposition – Ni and Cu electroless plating, fabrication of PCB's - Electrochemical etching of copper from PCBs - Anodizing - Definition, Principle and applications - Chemical sensors - optical and heat sensors – definitions and applications, Applications of Chemistry in electrical and electronics engineering.

UNIT V – PHOTOCHEMISTRY AND SPECTROSCOPY 9

Photochemistry: Laws of photochemistry - Grotthuss–Draper law, Stark–Einstein law and Lambert- Beer Law. Quantum efficiency – determination- Photo processes - Fluorescence, Phosphorescence, Chemiluminescence and Photo-sensitization. Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and rotational transitions. UV-Visible and IR spectroscopy – principles, instrumentation (Block diagram only) and applications.

TOTAL : 45 Hours

TEXT BOOKS

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi , 2010.
2. Douglas A Skoog, Donald M West, James Holler F Stanley, R Crouch, " Fundamentals of Analytical Chemistry", Thomson learning, 2006.

REFERENCE BOOKS

1. N. Panneer Selvam et al., “Chemistry For Electrical and Electronics Engineering” Sonaversity, Sona College of Technology, Salem, Revised Edition 2018.
2. Gowariker V.R., Viswanathan N.V. and Jayadev Sreedhar, “Polymer Science”, New Age International P (Ltd.,), Chennai, 2006.
3. Electroplating, “Anodizing and Metal treatment”, Hand book, NIIR board, 2004.
4. Hagen Klauk, “Organic Electronics: Materials, Manufacturing and Applications”, Wiley-VCH, 2006.

U15PDS206R - PROGRAMMING AND DATA STRUCTURES

(Circuit branches: CSE, IT, EEE)

L	T	P	C	M
3	0	0	3	100

Course Outcomes

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

1. select suitable language features to solve and implement real-time problems.
2. write c programs to demonstrate file concepts.
3. design and develop real-time scenario using lists.
4. write c programs to manipulate stack data structure.
5. apply queue data structure for solving problems.

UNIT I – POINTERS AND OTHER FEATURES OF C 9

Pointers – Arrays and Pointers – Pointers and Strings – Pointer and Address Arithmetic – Two dimensional Arrays and Pointers – pointers to Functions – Dynamic memory Allocation – Structures and Unions – Enumeration Types – Bitfields.

UNIT II – FILE MANIPULATIONS 9

File Manipulations- File operations – Open, Read, Write and Close, Binary files and text files, Input and out file redirection – Stdin and Stdout and Command line arguments.

UNIT III – LISTS 9

LISTS – Abstract Data Types (ADT) – List ADT - Array implementation of lists – Linked List And their Operations – Doubly Linked List, Circularly Linked List – Polynomial Manipulation using Linked List.

UNIT IV – STACK 9

STACK ADT – Array and Linked List Implementation of Stack – Stack Operations – Stack Applications: Balancing Symbols, Postfix Expression Evaluation, Infix to Postfix Conversion and Function calls.

UNIT VQUEUE 9

QUEUE ADT – Array and Linked List Implementation of Queues – Queue Operations – Circular Queues – Double ended Queues – Applications of Queues.

Total: 45 Hours

TEXT BOOKS

1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language".2nd Edition, Pearson Education, 1988.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 1996.

REFERENCE BOOKS

1. Reema Thareja, "Data Structures Using C", Oxford University Press, 2nd Edition, 2014.
2. Aho, Hopcroft and Ullman,"Data Structures and Algorithms", Pearson Education. 1983.
3. Byron S Gottfried, "Programming with C", Schaum's Outlines, Second Edition. Tata McGraw-Hill, 2006.
4. Yashavant P.Kanetkar. "Let Us C",BPB Publications, 14th Edition, 2016.
5. Deitel and Deitel, "C How to Program", Pearson Education, 8th Edition, 2016.

U15ECT207R - ELECTRIC CIRCUIT THEORY

L	T	P	C	M
2	2	0	3	100

Course Outcomes

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

1. calculate the circuit parameters using kirchoff's law and ohm's law and find the equivalent resistance by series, parallel reduction concept.
2. analyze the complex circuits using mesh and nodal analysis.
3. solve the complex circuits using various network theorems.
4. calculate the circuit parameters of complex ac circuits.
5. solve problems on three phase balanced and unbalanced loads.

UNIT I – DC FUNDAMENTALS 12

Electrical Components – Resistance, Conductance – factors affecting resistance – effect of temperature on resistance, Ohm's Law and its limitations, Kirchhoff's' Laws (statement only), series – parallel resistive circuits, comparison of series and parallel circuits, Star - Delta Transformation – Problems.

UNIT II – ANALYSIS OF ELECTRIC CIRCUITS 12

Network Reduction: Voltage and Current Division, Source Transformation, Mesh current and Nodal Voltage Method of Analysis for D.C Circuits – Problems.

UNIT III – NETWORK THEOREMS FOR D.C. CIRCUITS 12

Superposition Theorem - Thevenin's and Norton's Theorem — Maximum Power Transfer Theorem – Reciprocity Theorem – Problems.

UNIT IV – AC FUNDAMENTALS 12

AC Waveforms - Standard Terminologies – Inductor, Capacitor. Sinusoidal, Triangular and Square wave forms, Effective value or RMS Value – Average value – Form Factor, Peak Factor, Single Phase AC Circuits – RL, RC, RLC series and parallel circuits – Resonance , Power, Power factor, Impedance series and parallel circuits - Problems.

UNIT V – ANALYSIS OF THREE PHASE CIRCUITS **12**

Three Phase 3 – wire and 4 – wire circuits with Star and Delta Connected loads, Balanced & Unbalanced – Phasor diagram of Voltages and Currents – Power and Power factor measurements in Three Phase Circuits –Problems

Total: 60 Hours

TEXT BOOKS

1. William HB. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering circuits Analysis", TMH publishers, 6th edition, New Delhi, (2002).
2. Sudhakar A and Shyam Mohan SP, Circuits and Network Analysis and Synthesis", Tata Mc Graw Hill, Fifth Edition, 2015.

REFERENCE BOOKS

1. Paranjothi SR, "Electric Circuits Analysis", New Age International Ltd., New Delhi, (1996).
2. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's Series, Tata Mc Graw – Hill, New Delhi (2001).
3. Chakrabarti A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, (1999).
4. Charles K. Alexander, Mathew N.O. Sadik, "Fundamentals of Electric Circuits" 2002

U15PCL208AR - PHYSICS AND CHEMISTRY LABORATORY II

L	T	P	C	M
0	0	2	1	100

Course Outcomes

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

1. apply the principles of optics, electricity and elasticity to determine the engineering properties of materials.
2. evaluate the amount of iron content in the given sample using spectrophotometry, analyze the amount of chloride in a domestic water sample and analyse the quality of brass by estimating copper.
3. determine the resistivity of the given fuse wire used for house hold applications and determine the dissolved oxygen in two different water samples collected from the students residential areas.

LIST OF EXPERIMENTS (PHYSICS PART)

1. Determination of rigidity modulus of the material using torsion pendulum.
2. Determination of specific resistance of a given wire using Carey-Foster's bridge.
3. Determination of Young's modulus of the material by non-uniform bending method.
4. Determination of wavelength of the spectral lines in the mercury spectrum using a spectrometer.
5. Determination of band gap of a semiconductor diode.
6. Determination of coefficient of viscosity of the given liquid using Poiseuille's method

(Any five experiments may be conducted from the above list)

LIST OF EXPERIMENTS (CHEMISTRY PART)

1. Determination of molecular weight of Polyvinyl alcohol using Ostwald Viscometer.
2. Estimation of copper in brass solution by EDTA method.
3. Determination of Calcium Oxide (CaO) in Cement.
4. Estimation of chromium in waste water.
5. Determination of dissolved oxygen in water by Winkler's method.
6. Estimation of Iron content in water by Spectrophotometric method.

(Any five experiments may be conducted from the above list)

Total: 30 Hours

U15PDS209R - PROGRAMMING AND DATA STRUCTURES LABORATORY

(Circuit branches: CSE, IT, EEE)

L	T	P	C	M
0	0	2	1	100

Course Outcomes

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

1. write c programs to solve problems using appropriate language features.
2. write programs to handle files.
3. write programs to implement operations and applications of linear data structures.

Write C programs for the following. The faculty concerned will add the suitable scenario based questions for the concepts and that must be shared during the lab classes. (Compiler/IDE: GCC / Code::Blocks)

1. Functions (includes Pass by value, Pass by reference and recursive functions)
2. Pointer manipulations
3. File Handling in C
4. Programs using command line arguments.
5. Singly Linked list and its operations.
6. Circular linked list and its operations.
7. Doubly Linked List and its manipulations.
8. Implement stack and its applications using arrays and linked list.
9. Implement Queues using arrays and linked list

Total: 30 Hours

U15ECL210R - ELECTRIC CIRCUITS LABORATORY

L	T	P	C	M
0	0	2	1	100

Course Outcomes

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

1. apply various circuit laws and theorems to solve complex ac and dc networks.
2. analyse the rlc circuits and to calculate the circuit parameters.
3. solve the complex electrical circuits with help of modern simulation tools.

LIST OF EXPERIMENTS

1. Verification of Ohm's Law and Kirchhoff's Law.
2. Verification of Mesh and Nodal Analysis.
3. Verification of Superposition Theorem.
4. Verification of Thevenin's Theorem.
5. Verification of Norton Theorem.
6. Verification of Maximum Power Transfer Theorem.
7. Verification of Reciprocity Theorem.
8. Measurement of Power and Power Factor for RLC Series circuit.
9. Measurement of Power and Power Factor for RLC Parallel circuit.
10. Frequency response of RLC Series Resonance circuits.
11. Frequency Response of RLC Parallel Resonance circuits.
12. Measurement of Power and Power Factor using Two Wattmeter Method.
13. Study of simulation tools to solve basic electric circuits

Total: 30 Hours

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester III under Regulations 2015R (CBCS)
Branch: Electrical and Electronics Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	U15MAT301AR	Transforms and Partial Differential Equations	3	2	0	4
2	U15EE301R	Electronic Devices and Circuits	3	0	0	3
3	U15EE302R	Electromagnetic Theory	2	2	0	3
4	U15EE303R	Electrical Machines – I	3	0	0	3
5	U15EE304R	Network Analysis and Synthesis	2	2	0	3
6	U15CHE304R	Environmental Science and Engineering	3	0	0	3
Practical						
7	U15EE305R	Electronic Devices and Circuits Laboratory	0	0	4	2
8	U15EE306R	Electrical Machines Laboratory –I	0	0	4	2
9	U15GE301R	Soft Skills and Aptitude – I	0	0	2	1
					Total Credits	**24**

Approved By

Chairperson, Electrical and Electronics Engineering BoS
Dr.S.Padma

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-
HOD/Electrical and Electronics Engineering, Third Semester BE EEE Students and Staff, COE

U15MAT301AR TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS 3 2 04

COURSE OUTCOMES

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

- Describe the general form of Fourier series, expand the periodic function and complex form in terms of Fourier series and find harmonics of Fourier series.
- Describe the complex (or infinite) Fourier transform pairs, sine and cosine transforms pairs and their properties and apply Parseval's identity to evaluate integrals.
- Form the partial differential equations, solve first order linear and nonlinear partial differential equations of certain type, and solve homogenous and non-homogenous linear partial differential equations with constant coefficients of higher order.
- Classify the second order partial differential equations and solve linear hyperbolic and elliptic partial differential equations using method of separation of variables and Fourier series.
- State Z transform pairs, solve Z transform of certain functions, form the difference equation and hence solve it by means of Z transforms

UNIT I FOURIER SERIES 15

General Fourier series –Dirichlet's conditions, odd and even functions, half range sine and cosine series, Parseval's identity, complex form of Fourier series, harmonic analysis.

UNIT II FOURIER TRANSFORMS 15

Fourier integral theorem (without proof) –Fourier transform pair, sine and cosine transforms, properties, transforms of simple functions, convolution theorem (without proof), Parseval's identity.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS 15

Formation of partial differential equations, Lagrange's linear equation, solutions of standard types of first order partial differential equations, linear partial differential equations of second and higher order with constant coefficients.

UNIT IV BOUNDARY VALUE PROBLEMS 15

Classifications of quasi linear PDE, Solutions of one dimensional wave equation in Cartesian co-ordinates; steady state solution of two-dimensional equation of heat conduction in Cartesian co-ordinates (Insulated edges excluded).

UNIT V Z-TRANSFORMS AND DIFFERENCE EQUATIONS 15

Z-Transforms – Elementary properties, inverse Z-transform, convolution theorem (without proof), formation of difference equations, solution of difference equations using Z-transform.

Lecture:45, Tutorial: 30, Total:75 Hours

TEXT BOOKS:

1. "Transforms and Partial Differential Equations", Sonaversity, 2011.
2. Veerarajan.T, "Engineering Mathematics (For semester III)", 3rd Ed., Tata McGraw Hill, 2008.

REFERENCES:

1. Bali N.P, and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition, Laxmi Publications (P) Ltd., 2007.
2. Ramana B.V, "Higher Engineering Mathematics", Tata McGrawHill, 2007.
3. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Ed., Pearson Education 2007.
4. Erwin Kreysizig, "Advanced Engineering Mathematics", 8th edition, Wiley India, 2007.

U15EE301R ELECTRONIC DEVICES AND CIRCUITS 3003

COURSE OUTCOMES:

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

- Describe the properties of semiconductor devices and various types of diodes.
- Design the hybrid models of configurations of BJT and its stability analysis.
- Discuss the operation of FET, MOSFET,UJT and IJBT.
- Analyze the performance of differential amplifiers and the concepts of feedback amplifiers and their characteristics.
- Evaluate the performance characteristics of multistage amplifiers and different types of oscillators.

UNIT I SPECIAL DIODES AND OPTO-ELECTRONIC DEVICES 9

Theory and characteristics of Schottky diode, PIN diode, photo diode, varactor diode and tunnel diode, photo transistor, opto-coupler.

UNIT II BIPOLAR JUNCTION TRANSISTOR ANALYSIS 9

Transistor as an amplifier – h-parameters – A_i, R_i, A_v and R_o – BJT small signal model – analysis of CE, CB, CC amplifiers – bias stability – DC load line, AC load line, stability factor, thermal runaway – methods of transistor biasing – bias compensation.

UNIT III TRANSISTORS AND ITS CHARACTERISTICS 9

Structure, operation, V-I and switching characteristics of UJT, JFET, MOSFET and IGBT.

UNIT IV LARGE SIGNAL AND FEEDBACK AMPLIFIERS 9

Differential amplifiers – common mode and difference mode analysis – analysis of class A,B,C and AB power amplifiers – feedback amplifiers – concept of feedback, general characteristics of negative feedback amplifiers – types of negative feedback amplifiers.

UNIT V MULTISTAGE AMPLIFIERS AND OSCILLATORS 9

Different coupling schemes in amplifiers – operation of RC coupled, transformer coupled and direct coupled amplifiers – conditions for oscillation – RC phase shift oscillator using transistor and FET- Hartley and Colpitts oscillators – Wein-Bridge oscillator – crystal oscillator.

Lecture: 45, Tutorial: 00, Total:45 Hours

TEXTBOOKS:

1. S.Salivahanan, N.Sureshkumar and A.Vallavaraj, "Electronic Devices and Circuits", McGraw Hill, 6th reprint, 2015.
2. David A Bell, "Electronic Devices and Circuits", Oxford University Press, 5th edition, 2010.

REFERENCES:

1. Jacob Millman, CC Halkias and Sathyabratha Jit, "Electronic Devices and Circuits", McGraw Hill, 2nd Edition, 2015.
2. Ramesh Babu, "Electronic Devices and Circuits", Scitech Publications**,** 2009.
3. Robert L.Boylestad, "Electronic devices and circuit theory", 2002.
4. 5. Robert B. Northrop, "Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation", CRC Press, 2004.

U15EE302R ELECTROMAGNETIC THEORY 2203

COURSE OUTCOMES:

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

- Describe various electromagnetic quantities in spatial distribution by various co-ordinate systems.
- Explain about electric field intensity and electric flux density due to various charge distributions and also analyse the applications of Gauss's law.
- Analyse the concepts of magneto-statics for charge distributions and boundary conditions.
- Write the Maxwell's Equations in integral and differential form from basic concepts of electro-dynamic fields.
- Illustrate the concepts of electro-magnetic wave equation, wave propagation and poynting theorem.

UNITI FUNDAMENTALS 12

Scalar and vector fields – coordinate systems – cartesian, cylindrical and spherical coordinate systems – relationship between coordinate systems – types of integral related to EMT –gradient – curl – divergence theorem –Stokes theorem.

UNITII ELECTROSTATICS 12

Coulombs' law – electric field intensity – electric field due to various charge distributions – electric field due to infinite line charge, charged circular ring, infinite sheet of charge – electric flux density – electric flux density for various charge distributions –Gauss's law and applications – electric potential – potential due to various charge distributions – electric dipole – boundary conditions –Poisson's and Laplace's equations – series and parallel capacitance – capacitance of parallel conductors, capacitance of an isolated sphere, concentric sphere and coaxial cables.

UNITIII MAGNETOSTATICS 12

Lorentz law of force –Biot-Savart law – Amperes circuit law – magnetic field intensity – magnetic flux density –B and H due to finite length of conductor at any point along the axis of circular coil, at any point along the axis of solenoid, at the centre of toroidal coil – magnetic dipole – magnetization – boundary conditions at the magnetic surface – magnetic torque – inductance – types, inductance of solenoid and toroid, coaxial cable, two transmission lines.

UNITIV ELECTRODYNAMIC FIELDS 12

Faradays law of electromagnetic induction – coefficient of coupling - Maxwell's equation (differential and integral form) – conduction current – displacement current – equation of continuity – energy density – relation between field theory and circuit theory.

UNITV ELECTROMAGNETIC WAVES 12

Derivation of electromagnetic wave equations – wave propagation in a conducting medium, lossless medium, good dielectrics and good conductors – skin effect – Brewster angle – Snell's law – Poynting theorem.

Lecture: 30; Tutorial: 30; Total: 60 Hours

TEXTBOOKS:

1. K.A.Gangadhar, "Field Theory", Khanna Publishers, New Delhi, 2009.
2. W.H.HaytJ.A.Buck and M.Jallel Akhtar, "Engineering Electromagnetics", 8th Edition, McGraw Hill Education (India) Private Limited, Special Indian Edition, 2014.

REFERENCES:

1. Kraus Fleisch, "Electromagnetics with Applications", 5th Edition, McGraw Hill Education (India) Edition, 2010.
2. Matthew N.O. Sadiku, "Principles of Electromagnetics", 4th Edition, International Version, Oxford University Press, 2009.
3. S C Mahapatra, Sudipta Mahapatra, "Principles of Electromagnetics", McGraw Hill Education (India) Private Limited,2nd Edition, 2015.
4. Joseph. A.Edminister, 'Schaum's Outline of Electromagnetics, Third Edition (Schaum'sOutlineSeries), Tata McGraw Hill, 2010

U15EE303R ELECTRICAL MACHINES – I 3 0 0 3

COURSE OUTCOMES

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

- Explain the fundamentals of energy conversion and single-phase transformer.
- Classify different types of polyphase connections and construction of polyphase transformer.
- Explain the constructional details and principle of operation of DC generator and analyse the performance under various operating conditions.
- Explain the constructional details and principle of operation of DC generator and analyse the performance under various operating conditions.
- Discuss various testing methods of DC machines and transformers.

UNIT I MAGNETIC CIRCUITS AND TRANSFORMER 9

Principle of energy conversion – basic magnetic circuit analysis, Faraday's law of electromagnetic induction – principle of operation – construction – classification of transformers –EMF equation – transformation ratio – transformer on no-load and load – phasor diagrams – equivalent circuit – voltage regulation – parallel operation – auto transformer – applications – simple problems.

UNIT II POLYPHASE TRANSFORMER 9

Three-phase transformers – principle – construction – polyphase connections – star, zig-zag, open-delta, Scott connection, Leblanc connection – three-phase to single-phase conversion – on-load tap changing – special transformers – variable frequency transformer, pulse transformer, high frequency transformer.

UNIT III DC GENERATORS 9

Principle of operation, constructional details, armature windings, EMF equation, methods of excitation – separate, shunt, series and compound excitations – no-load and load characteristics – armature reaction – commutation –inter poles, compensating windings – applications – simple problems.

UNIT IV DC MOTORS 9

Principle of operation – torque equation – electrical and mechanical characteristics of DC shunt, series and compound motors – power flow – starters – speed control – braking –applications – simple problems.

UNIT V TESTING OF DC MACHINES AND TRANSFORMERS 9

Losses and efficiency in DC machines and transformers – condition for maximum efficiency – testing of DC machines – brake test, Swinburne's test and Hopkinson's test – testing of transformers – polarity test, load test – phasing out test – Sumpner's test – separation of losses – all day efficiency – simple problems.

Lecture: 45, Tutorial: 0, Total: 45 Hours

TEXTBOOKS:

1. B.L. Theraja and A. K. Theraja, "A Text Book of Electrical Technology",S.Chand Publisher, Vol 2, 2014.
2. D.P. Kothari and I.J. Nagrath, "Electric Machines", McGraw Hill Publishing Company Ltd, Fourth Edition, 2011.

REFERENCES:

1. A.E. Fitzgerald, Charles Kingsley, Stephen.D.Umans, "Electric Machinery", Tata McGraw Hill Publishing Company Ltd, 2003.
2. Samarajit Ghosh, "Electrical Machines", Pearson Education, second edition, 2008.
3. Stephen J Chapman, "Electric Machinery Fundamentals", Tata McGraw-Hill Education Private Ltd, Fifth Edition, 2012.
4. R.K.Rajput, "Direct current Machines", Laxmi Publications, 2007.

U15EE304R NETWORK ANALYSIS AND SYNTHESIS 2203

COURSE OUTCOMES:

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

- Analyse the transient response of circuits.
- Define various network topologies and analyse circuits.
- Solve and analyse one port and two port networks.
- Design of different types of filters.
- Synthesize of RL, RC and LC networks.

UNIT I CIRCUIT TRANSIENT ANALYSIS 12

Introduction –transient response of RL & RC for step input and sinusoidal input –transient response of RLC series circuit for step input using Laplace transform method – network functions – poles and zeros – graphical method for determination of residue.

UNIT II NETWORK TOPOLOGY 12

Introduction – graph of a network – definitions associated with graph – incidence matrix – loop matrix – cut set matrix – KVL – KCL – network equilibrium equations – applications to network solutions.

UNIT III ONE PORT AND TWO PORT NETWORKS 12

Driving point impedance and admittance of one port networks – Z parameters – Y parameters – ABCD parameters – h parameters – inter relationship between parameters – interconnection of two port networks– equivalent networks(T & π networks).

UNIT IV FILTERS 12

Characteristics of ideal filters – low pass and high pass filters – attenuation and phase shift constant – constant k and m – derived filters – band pass filters.

UNIT V ELEMENTS OF NETWORK SYNTHESIS 12

Introduction – Hurwitz polynomials – properties of Hurwitz polynomials – PR functions –necessary and sufficient conditions of PR function –synthesis of RL, RC and LC functions.

Lecture: 30; Tutorial: 30; Total: 60 Hours

TEXTBOOKS:

1. Ravish R Singh, "Electrical Networks", McGraw Hill, 2011.
2. ShyamMohan S.P., Sudhakar A, "Circuits and Network Analysis &Synthesis", Tata McGraw Hill, 5th edition, 2015.

REFERENCES:

1. Arumugam .M and Premkumar, "N, Electric Circuit Theory", Khanna & Publishers, 1989.
2. Soni M.L and Gupta J.C, "Electrical circuit Analysis", Dhanpat Rai and Sons, Delhi, 1990.
3. KuoF.F.,"Network Analysis and Synthesis", Wiley International Edition, Second Edition, 1996.
4. Behrouz Peikari, "Fundamentals of Network Analysis & synthesis", Jaico Publishing House, 2006

U15CHE304R ENVIRONMENTAL SCIENCE AND ENGINEERING 3 0 0 3

COURSE OUTCOMES:

At the end of a study of the unit concerned, the student should be able to

- State the importance of the acute need for environmental awareness and discuss significant aspects of natural resources like forests, water, mineral, food, energy and land resources.
- Explain the concepts of an ecosystem and provide an overview of biodiversity and its conservation.
- Define the various known kinds of environmental pollution and discuss their causes, effects and control measures and to describe the safe disposal of hazardous wastes and waste water treatment.
- Give an account of the social issues with regard to the environment.
- Discuss the impact of human population on the environment.

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 12

Definition, Scope and Importance – Need for public awareness – Forest Resources:- Use and over - exploitation, deforestation, Case Studies, Timber Extraction, Dams, Benefits and their effects on forests and tribal people - Water Resources:- Use and Over-Utilization of Surface and ground water , Floods, Drought, Conflicts Over Water – Mineral Resources:- Use–Environmental Effects of Extracting and Using Mineral Resources – Food Resources: World Food Problems, Changes caused by Agriculture and Overgrazing, Effects of Modern Agriculture, Fertilizer- Pesticide Problems, Water Logging, salinity – Energy Resources:- Growing Energy Needs, Renewable and Non Renewable Energy Sources, Use of Alternate Energy Sources – Land Resources:- Land as a Resource, Land Degradation, Man Induced Landslides, Soil Erosion and Desertification – Role of an Individual in Conservation of Natural Resources.

UNIT II ECOSYSTEMS AND BIODIVERSITY 9

Concepts of an Ecosystem – Structure and Function of an Ecosystem – Producers, Consumers and Decomposers – Energy Flow in the Ecosystem – Biogeochemical Processes - Ecological Succession – Food Chains, Food Webs and Ecological Pyramids.

Introduction to Biodiversity – Definition: Genetic, Species and Ecosystem Diversity – Value of Biodiversity: Consumptive Use, Productive Use, Social, Ethical, Aesthetic and Option Values – Biodiversity at Global, National and Local Levels – India as a Mega-Diversity Nation – Hot-Spots of Biodiversity – Threats to Biodiversity: Habitat Loss, Poaching of Wildlife, Man-Wildlife Conflicts – endangered and Endemic Species of India – Conservation of Biodiversity: In-Situ and Ex-Situ conservation of Biodiversity.

UNIT III ENVIRONMENTAL POLLUTION 10

Definition – Causes, Effects and Control Measures of:- (A) Air Pollution(B) Water Pollution (C) Soil Pollution (D) Marine Pollution (E) Noise Pollution (F) Thermal Pollution (G) Nuclear Hazards – Solid Waste Management:- Causes, Effects and Control Measures of Urban and Industrial Wastes, hazardous wastes and biomedical wastes – Role of an Individual in Prevention of Pollution – Pollution Case Studies – disaster Management:- Floods, Earthquake, Cyclone and Landslides, Waste water treatment methods, Green chemistry – principles and applications

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 8

Sustainable Development – Urban Problems Related To energy – Water conservation, Rain Water Harvesting, Watershed Management – Resettlement and Rehabilitation of People, its Problems and Concerns – Environmental Ethics:- Issues and Possible Solutions –- Climate Change, Global Warming, Acid Rain, Ozone Layer Depletion, Nuclear Accidents and Holocaust, Case Studies – Wasteland Reclamation – Environment Production Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and Control of Pollution)

Act – Wildlife Protection Act – Forest Conservation Act – Issues Involved in enforcement of Environmental Legislation – Public Awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

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.

Lecture: 45; Tutorial: 00; Total: 45 Hours

TEXTBOOKS:

1. S. Radjarejesri et al., "Environmental Science" Sonaversity, Sona College of Technology, Salem, 2018.
2. Anubha Kaushik and Kaushik, "Environmental Science and Engineering" New Age International Publication, 4th Multicolour Edition, New Delhi, 2014.

REFERENCES:

5. Masters, G.M., "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., 2nd Edition, 2004.
6. Miller, T.G. Jr., "Environmental Science", Wadsworth Pub. Co.
7. Erach, B., "The Biodiversity of India", Mapin Publishing P.Ltd.,Ahmedabad, India.
8. ErachBharucha, "Textbook of Environmental Studies for Undergraduate Courses", 2005, University Grands Commission, Universities Press India Private Limited, Hyderguda, Hyderabad – 500029.

U15EE305R ELECTRONIC DEVICES AND CIRCUITS LABORATORY 0 0 4 2

COURSE OUTCOMES:

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

- Design h-model for the different configurations of BJT.
- Examine the characteristics of JFET, MOSFET, IGBT and UJT.
- Design for different modes of amplifiers and oscillators.

LIST OF EXPRIMENTS

1. Design of h-model of transistor with CE configuration.
2. Design of h-model of transistor with CB configuration.
3. Design of h-model of transistor with CC configuration.
4. Verify the characteristics of JFET and MOSFET.
5. Verify the characteristics of UJT
6. Verify the characteristics of IGBT.
7. Design of RC coupled amplifier.
8. Design of negative feedback amplifier.
9. Design of Hartley and Colpitts oscillator.
10. Design of phase shift and Wein bridge oscillator.

Total: 60 Hours

U15EE306R ELECTRICAL MACHINES LABORATORY – I 0 0 4 2

COURSE OUTCOMES

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

- Analyse the magnetization, internal and external characteristics of DC shunt and compound generator.
- Determine and draw the mechanical, electrical and performance characteristics of DC shunt, series and compound motor.
- Pre-determine the losses on no-load and determine the efficiency and regulation of transformer.

LIST OF EXPRIMENTS:

1. Analyse the open circuit and load characteristics on separately excited DC shunt generator.
2. Analyse the load characteristics on DC compound generator.
3. Analyse the load characteristics of DC shunt motor.
4. Analyse the load characteristics of DC series motor.
5. Analyse the load characteristics of DC compound motor.
6. Analyse the speed control on a DC shunt motor by field and armature control method.
7. Predetermine the efficiency of Swinburne's test and Hopkinson's test on DC motor-generator set.
8. Determine the efficiency on single-phase transformer.
9. Predetermine the efficiency of transformer by Sumpner's test and open circuit and short circuit tests on transformers.
10. Analyse the no-load losses in single-phase transformer by separation method.
11. Determine the efficiency of Scott connected transformer using load test.

Total: 60 Hours

Semester-III	U15GE301R:SOFT SKILLS AND APTITUDE – I	L	T	P	C	Marks
		0	0	2	1	100

Course Outcomes

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

1. Demonstrate capabilities in specific soft-skill areas using hands-on and/or case-study approaches
2. Solve problems of greater intricacy than those in BA-I and II in stated areas of quantitative aptitude and logical reasoning
3. Demonstrate higher than BA-I and II levels of verbal aptitude skills in English with regard to specific topics

1.Soft Skills	**Demonstrating soft-skill capabilities with reference to the following topics**: a. Attitude building b. Dealing with criticism c. Innovation and creativity d. Problem solving and decision making **e.** Public speaking **f.** Group discussions
2. Quantitative Aptitude and Logical Reasoning	**Solving problems with reference to the following topics:** a. Numbers: Finding units digit, Power rule b. Base system – Progressions: Arithmetic, geometric and harmonic c. HCF and LCM d. Averages e. Percentages f. Ratio and proportion g. Ages h. Partnership i. Profit and loss j. Mensuration: Area, perimeter, volume and Surface area k. Coding and Decoding: Numbers, alphabet, alphanumeric coding and Artificial language l. Direction Sense m. Symbols and series: Numbers, alphabet, symbols, pictures and alphanumeric n. Seating arrangement
3. Verbal Aptitude	**Demonstrating English language skills with reference to the following topics:** a. Verbal analogy b. Tenses c. Prepositions d. Reading comprehension e. Choosing correct / incorrect sentences f. Describing pictures

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester IV under Regulations 2015R (CBCS)
Branch: Electrical and Electronics Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	U15EE401R	Signals and Systems	2	2	0	3
2	U15EE402R	Electrical Machines – II	2	2	0	3
3	U15EE403R	Generation, Transmission and Distribution Systems	2	2	0	3
4	U15EE404R	Measurements and Instrumentation	3	0	0	3
5	U15EE405R	Control Systems	2	2	0	3
6	U15EE406R	Digital Logic Circuits	2	2	0	3
Practical						
7	U15EE407R	Control and Instrumentation Laboratory	0	0	4	2
8	U15EE408R	Electrical Machines Laboratory – II	0	0	4	2
9	U15GE401R	Soft Skills and Aptitude – II	0	0	2	1
					Total Credits	**23**

Approved By

Chairperson, Electrical and Electronics Engineering BoS
Dr.S.Padma

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-
HOD/Electrical and Electronics Engineering, Fourth Semester BE EEE Students and Staff, COE

U15EE401R **SIGNALS AND SYSTEMS** **2 2 0 3**

COURSE OUTCOMES:

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

- Explain the basic properties of signal & systems and the various methods of classification.
- Apply Laplace transform & Fourier transform for continuous signals and systems analysis.
- Analyse discrete time signals and linear time invariant systems.
- Analyse LTI systems in the time domain and various transform domains.
- Analysediscrete transforms properties

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 12

Continuous Time signals (CT signals) – Discrete Time signals (DT signals) –step, ramp, pulse, impulse, sinusoidal, exponential, classification of CT and DT signals –periodic & aperiodic signals, deterministic & random signals, energy & power signals – CT systems and DT systems-classification of systems – static & dynamic, linear & nonlinear, time-variant & time-invariant, causal & non-causal, stable & unstable.

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS AND LTIV SYSTEMS 12

Fourier and Laplace transforms in CT Signal analysis – Fourier and Laplace transforms in analysis of CT systems.

UNIT III ANALYSIS OF DISCRETE TIME SIGNALS 12

Baseband sampling – DTFT – properties of DTFT – Z transform – properties of Z transform.

UNIT IV LINEAR TIME INVARIANT DISCRETE TIME SYSTEMS 12

Difference equations – block diagram representation – impulse response – convolution sum – discrete Fourier and Z transform analysis of recursive & non-recursive systems.

UNIT V DISCRETE TRANSFORMS 12

DFT – definition – properties, computation of DFT using FFT algorithm – DIT & DIF – FFT using radix-2 – butterfly structure – computation of IDFT using DFT.

Lecture: 30; Tutorial: 30; Total: 60 Hours

TEXT BOOKS:

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, "Signals and Systems", Pearson Education, 2007.
2. Edward W Kamen & Bonnie's Heck, "Fundamentals of Signals and Systems",Pearson Education, 2007.

REFERENCES:

1. H.P.Hsu, Rakesh Ranjan, "Signals and Systems", Schaum's Outlines, Tata McGraw Hill, Indian Reprint, 2007
2. S.Salivahanan, A.Vallavaraj, C.Gnanapriya, "Digital Signal Processing", McGraw Hill International, 2007.
3. Simon Haykins and Barry Van Veen, "Signals and Systems", John Wiley & sons Inc.,2004.
4. Rodger E.Ziemer, William H.Tranter, D.Ronald Fannin,"Signals &Systems", Pearson Education, Fourth Edition, 2002.

U15EE402R ELECTRICAL MACHINES - II 2 2 0 3

COURSE OUTCOMES

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

- Illustrate the construction and working of alternators and apply various methods to calculate voltage regulation.
- Explain the operation and derive the power equations of synchronous motor.
- Explain the construction and operation of three phase induction motor.
- Calculate the performance characteristics of induction motor using circle diagram and explain various starting methods and speed control methods of three phase induction motor.
- Construct the equivalent circuit of single phase induction motor and explain the working of special machines.

UNIT I ALTERNATOR 12

Constructional details – types of rotors – armature windings – terminologies – EMF equation – alternator on load, synchronous reactance – voltage regulation – EMF, MMF and ZPF methods – synchronizing of alternators – synchronizing current and power – change of excitation and mechanical input – Blondel's theory – determination of X_d and X_q using slip test.

UNIT II SYNCHRONOUS MOTOR 12

Principle of operation – starting methods –power flow – effect of change of excitation and load – expression for back EMF – power equations – power/power angle relations –construction of V-curves –hunting – synchronous condenser – Applications.

UNIT III THREE PHASE INDUCTION MOTOR 12

Constructional details– principle of operation – slip and its importance – torque equations – slip-torque characteristics – power and efficiency – equivalent circuit – crawling and cogging – induction generator.

UNIT IV CIRCLE DIAGRAM, STARTERS AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR 12

Load test – no load and blocked rotor test – circle diagram – need for starters – types of starters: stator resistance and reactance, rotor resistance, auto-transformer and star-delta starters – speed control – voltage, voltage/frequency, poles and rotor resistance – cascaded connection.

UNIT V SINGLE-PHASE INDUCTION MOTOR AND SPECIALMACHINES 12

Principle of operation – double revolving field theory – types of single phase induction motor – equivalent circuit – performance calculation – no load and blocked rotor test – construction and working principles of reluctance motor, repulsion motor, hysteresis motor, and universal motor – applications.

Lecture: 30, Tutorial: 30, Total: 60Hours

TEXT BOOKS:

1. B.L.Theraja and A.K.Theraja, "A Text Book of Electrical Technology", S.Chand Publisher, Fifth Edition, 2008.
2. D.P.Kothari and I.J.Nagrath, "Electric Machines", Tata McGraw Hill Publishing Company Ltd, Fourth Edition, 2011.

REFERENCES:

1. A.E.Fitzgerald, Charles Kingsley, Stephen.D.Umans, "Electric Machinery", Tata McGraw Hill Publishing Company Ltd, 2013.
2. K.Murugesh Kumar, "Induction & Synchronous Machines", Vikas Publishing House Pvt. Ltd, 2000.
3. M.V Deshpande, "Electrical Machines", Wheeler Publishing, 2011
4. M. G. Say, "Performance and Design of AC Machines", CBS Publishers, 3rd Edition, 2002.

U15EE403R GENERATION, TRANSMISSION AND DISTRIBUTION SYSTEMS 2 2 0 3

COURSE OUTCOMES

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

- Explain the structure of power system and operation of power plants using different sources of electrical energy.
- Develop expressions for the computation of various transmission line parameters and its application in various networks.
- Analyse the types of transmission lines by calculating the transmission line efficiency, regulation and sag.
- Analyse the voltage distribution in insulator strings, its improvement and also the various parameter in underground cables.
- Explain the operation of various distribution systems and the principle of operation of various FACTS devices.

UNIT I POWER GENERATION SYSTEMS 10

Sources of electric energy – structure of electric power system –load characteristics – load curve, load duration curve, important terms and factors – types of loads – selection of generating units – base load and peak load on station (related problems in load characteristics) introduction to interconnected grid system and smart grid – economic aspects – calculation of cost of electrical energy.

Power plants: construction and working principle of steam, hydroelectric, nuclear, solar and wind power plants.

UNIT II TRANSMISSION LINE PARAMETERS 14

Transmission line conductors – solid, stranded and bundled conductors – parameters of single and three-phase transmission lines – resistance of a transmission line – flux linkage – inductance calculation, single phase two-wire, three-phase symmetrical and unsymmetrical space (single and double circuits) – transposition of transmission line conductors – concept of self-GMD and mutual–GMD (single and group of conductors), applications – electric potential – capacitance calculation, single phase two-wire, three-phase symmetrical and unsymmetrical spacing – skin and proximity effects –interference with neighbouring communication circuits.

UNIT III ANALYSIS OF TRANSMISSION LINES 13

Classification of overhead lines: important terms, calculation of transmission efficiency and voltage regulation of short line, medium line (end condenser, nominal T, nominal π method) and long line (rigorous method) – equivalent circuits **–** calculation of ABCD constants – Ferranti effect and corona loss – calculation of sag and tension (equal, unequal supportsand effect of wind and ice).

UNIT IV INSULATORS AND CABLES 12

Main components of overhead lines – conductor materials – line supports.

Insulators: properties and types of insulators – Voltage distribution in insulator string – calculation of string efficiency – improvement of string efficiency.

Underground cables: classification of cable – constructional features of LT and HT cables – calculation of capacitance and dielectric stress of a single core cable – grading of cables – thermal resistance of cable.

UNIT V DISTRIBUTION SYSTEM & FACTS TECHNOLOGY 11

Distribution system: feeders, distributor and service mains – radial, ring-main and interconnected system – AC distribution, primary and secondary distribution – DC distribution 2 wire and 3 wire DC distribution – AC distribution andDC distribution comparison.

FACTS: principle of operation of SVC,TCSC, STATCOM, UPFC– merits &demerits of FACTS technology.

Lecture: 30; Tutorial: 30; TOTAL: 60 Hours

TEXT BOOKS:

1. V.K.Mehta and Rohit Mehta, "Principles of Power System", S.Chand Publishers, Reprint Edition, 2006.
2. S.N. Singh, "Electric Power Generation, Transmission and Distribution", Prentice Hall of India Pvt. Ltd, New Delhi, 2007.

REFERENCES:

1. M.L. Soni, Gupta, Bhatnagar, Chakrabarthy, "A Text book on Power Systems Engineering",Dhanpat Rai & Sons, 2007.
2. B.R. Gupta, "Generation of Electrical Energy", S.Chand company Ltd., 2009.
3. Wadhwa, C.L., 'Electrical Power Systems', John Wiley and sons Ltd., 2009.
4. G.Ramamurthy, "Handbook of Electrical power Distribution," Universities Press, 2013.

U15EE404R MEASUREMENTS AND INSTRUMENTATION 3 0 0 3

COURSE OUTCOMES:

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

- Discuss the static and dynamic characteristics and define various errors.
- Derive torque equation for different types of meters.
- Calculate R, L, and C using bridges.
- Explain storage and display devices.
- Discuss the types of transducers.

UNIT I INTRODUCTION 9

Functional elements of an instrument – static characteristics: true value, static error, static correction, reproducibility, drift, repeatability, noise, signal to noise ratio, accuracy and precision, sensitivity, linearity, threshold, dead zone, resolution. Dynamic characteristics: speed of response, fidelity, lag, dynamic error – errors: gross error, systematic error and random error – statistical evaluation of measurement data – standards and calibration.

UNIT II ELECTRICAL AND ELECTRONICS INSTRUMENTS 9

Principle and operation of analog voltmeters and ammeters: moving iron: attraction and repulsion type instruments. Moving coil instruments; PMMC, dynamometer type, torque equation – single phase dynamometer type watt meter: toque expression, errors – single phase induction type energy meters – measurement of power using instrument transformers – single phase electro-dynamometer power factor meters and Weston frequency meter.

UNIT III BRIDGES & INTERFERENCE TECHNIQUES 9

DC bridges: Wheatstone bridge, Kelvin double bridge, Megger – AC bridges: Maxwell's, Anderson, Schering, Wien - interference & screening – multiple earths and earth loops - electrostatic and electromagnetic interference – grounding techniques.

UNIT IV DIGITAL INSTRUMENTS AND DISPLAY DEVICES 9

Digital voltmeter: ramp, integrating and successive approximation – digital multi-meter – CRT display, dot matrix display, LED and LCD display, digital energy meter, Digital Storage Oscilloscope (DSO) – digital printers and plotters – recorders: X-Y graphic recorders.

Special instruments: measurement of wind velocity and solar radiation, power quality analyser.

UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS 9

Classification of transducers – selection of transducers – resistive, capacitive and inductive transducers – measurement of temperature – RTD, thermistors and thermocouples – piezoelectric transducers – digital transducers – optical encoders – elements of data acquisition system – A/D, D/A converters.

Lecture: 45; Tutorial: 0; Total: 45Hours

TEXT BOOKS:

1. A.K.Sawhney, "A Course in Electrical & Electronic Measurements &Instrumentation", DhanpatRai and Co, 2012.
2. R.K.Rajput, "Electrical Measurements and Measuring Instruments", S.Chand and Company Pvt. Ltd., Second Edition, 2013.

REFERENCES:

1. E.O.Doebelin, "Measurement Systems – Application and Design", Tata McGraw Hill Publishing company, 2003.
2. D.V.S. Moorthy, "Transducers and Instrumentation", Prentice Hall of India Pvt Ltd, 2007.
3. H.S. Kalsi, "Electronic Instrumentation", Tata McGraw Hill, II Edition, 2004.
4. J. B. Gupta, "A Course in Electronic and Electrical Measurements", S. K. Kataria & Sons, Delhi, 2003.

U15EE405R **CONTROL SYSTEMS** **2 2 0 3**

COURSE OUTCOMES:

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

- Derive the transfer function of a given system using mathematical models.
- Determine the time response of systems and analyse the steady state error.
- Calculate the frequency domain specifications using frequency response plots.
- Determine and analyse the stability of given system.
- Solve the state equations using state space model and obtain the controllability and observability of the given system.

UNIT I BASIC CONCEPTS AND SYSTEM REPRESENTATION 12

Introduction – types of control systems-linear –non-linear – continuous discrete – open loop and closed loop systems – mathematical model of control systems – transfer functions – mechanical translational system – mechanical rotational systems – electrical analogous of mechanical systems – transfer function of field controlled DC motor – block diagram algebra – signal flow graph –Mason's gain formula – transfer function of armature controlled DC motor.

UNIT II TIME RESPONSE ANALYSIS 12

Time response – standard test signals – type and order of control system – time response of first order system for unit step, unit ramp and impulse input – time response of second order system for unit step input – time domain specifications – steady state error and static error constants – generalized error coefficients – correlation between static and dynamic error coefficients – controllers: P, PI and PID – Tuning methods.

UNIT III FREQUENCY RESPONSE ANALYSIS 12

Frequency response – frequency domain specifications – correlation between time and frequency response – frequency response plots – polar plot – bode plot – M and N Circles – Nichol's Chart.

UNIT IV STABILITY ANALYSIS 12

The concepts of stability – necessary conditions for stability –relative stability - Routh Hurwitz stability criterion – root locus – effect of addition of poles – effect of addition of zeros –Nyquist stability criterion.

UNIT V COMPENSATORS AND STATE SPACE ANALYSIS 12

Compensators: introduction – types – lag, lead and lag-lead (qualitative treatment only).

State space analysis: concepts of state, state variables and state model for linear continuous time systems – state space representation using physical variable and phase variable method – solution of state equation using Laplace transform method – controllability and observability.

Lecture: 30; Tutorial: 30; Total: 60 Hours

TEXT BOOKS:

1. I.J.Nagrath and M.Gopal, "Control Systems Engineering", 5th Edition, New Age International (P) Ltd,Publishers, 2006.
2. Samarajit Gosh, "Control Systems Theory and Applications", Second edition, Pearson publications, 2012.

REFERENCES:

1. M.Gopal, "Control Systems, Principles and Design", Fourth Edition, Tata McGraw Hill, New Delhi, 2012.
2. A.Nagoorkani, "Control Systems Engineering", First edition, RBA Publications, 2010.
3. S.Palani, "Control Systems Engineering", Second Edition, Tata McGraw Hill,2010.
4. B. C. Kuo, "Automatic Control Systems", John wiley and sons, 8th edition, 2003.

U15EE406R DIGITAL LOGIC CIRCUITS 2 2 0 3

COURSE OUTCOMES:

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

- Discuss the different number systems, error correcting codes and implement Boolean functions using logic gates.
- Design and analyse the combinational logic circuits.
- Design and analyse synchronous sequential circuits using flip flops
- Analyse asynchronous sequential circuits using logic gates and discuss the concept of VHDL.
- Design and implement various logic functions using ROM, PLA and PAL.

UNIT I BINARY SYSTEMS AND BOOLEAN ALGEBRA 12

Number systems, Base conversion – Binary arithmetic, 1's and 2's complement – Binary codes – BCD, Gray, Excess-3, Alphanumeric codes – Code conversion – Error detecting and correcting codes – Logic gates – Boolean laws and theorems – Switching functions, SOP and POS form – Simplification using K-map and Quine McCluskey method – Realization of circuits using logic gates.

UNIT II COMBINATIONAL CIRCUITS 12

Design of adder, subtractor, comparators, code converters, encoders, decoders, multiplexers and de-multiplexers. Implementation of combinational logic circuits using decoder, multiplexer and de-multiplexers.

UNIT III DESIGN OF SYNCHRONOUS SEQUENTIAL CIRCUITS 12

Flip flops – SR, JK, D and T. Analysis of synchronous sequential circuits – Design of synchronous sequential circuits – Moore and Mealy circuits – Counters – Shift registers.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS AND VHDL 12

Asynchronous sequential circuits: Analysis of asynchronous sequential machines – State, state diagram, state table, state assignment, and state reduction – Asynchronous design – Hazards.

VHDL: Digital design process flow – Entities and architecture – Concurrent statements – Sequential statements – Behavioural, data flow and structure modelling – Simple VHDL coding.

UNIT V MEMORIES AND PLD 12

Classification of memories – Random Access Memory (RAM) – Read Only Memory (ROM) – Memory decoding – Programmable Logic Array (PLA) – Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) – Implementation of logic functions with ROM, PLA and PAL.

Lecture: 30; Tutorial: 30; Total: 60 Hours

TEXT BOOKS:

1. M. Morris Mano, Michael D Cileti, "Digital Design: With an Introduction to Verilog HDL", Pearson Education, 5th edition, 2013.
2. D. P. Kothari, J. S. Dhillon, "Digital Circuits and Design", Pearson, 2016.

REFERENCES:

1. Charles H. Roth, Jr., Lizy Kurian John, "Digital System Design using VHDL", Cengage, 3rd Edition, 2013.
2. A. Anand Kumar, "Fundamentals of Digital Circuits", PHI India, 4th edition, 2016.
3. Donald D. Givone, "Digital Principles and Design", McGraw Hill Education, 2016.
4. Charles H.Roth Jr, Lizy Lizy Kurian John, 'Digital System Design using VHDL, Cengage, 2013.

U15EE407R CONTROL AND INSTRUMENTATION LABORATORY 0 0 4 2

COURSE OUTCOMES

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

- Derive and determine the transfer functions of electromechanical system.
- Calculate the unknown values of Resistance, Inductance and Capacitance in given circuit.
- Determine the response and stability of linear system.

LIST OF EXPERIMENTS

1. Determination of transfer functions of DC Motor.
2. Determination of transfer functions of AC Servomotor.
3. Analog simulation of type-0 and type-1 system.
4. Determination of transfer functions of DC Generator.
5. Digital simulation of first order systems and second order systems using MATLAB.
6. Stability analysis of linear systems using MATLAB.
7. Design of controllers using MATLAB.
8. Determine the characteristics of displacement and pressure transducers.
9. Measurement of inductance and capacitance.
10. Measurement of low and medium value of resistance.
11. Analog to digital converter and digital to analog converter.
12. Calibration of current transformer and single-phase energy meter.

Total: 60 Hours

U15EE408R ELECTRICAL MACHINES LABORATORY – II 0 0 4 2

COURSE OUTCOMES:

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

- Determine the regulation of three-phase alternator using EMF, MMF, ZPF, slip test, inductive and capacitive load methods.
- Analyse the V and inverted V curves of three-phase synchronous motor.
- Draw the performance characteristics and equivalent circuit of single-phase and three-phase induction motor.

LIST OF EXPERIMENTS:

1. Regulation of three-phase alternator by EMF and MMF methods.
2. Regulation of three-phase alternator by ZPF method.
3. Regulation of three-phase salient pole alternator by slip test.
4. Synchronization and load sharing by two alternators.
5. V and inverted V curves of three-phase synchronous motor.
6. Comparison of performance quantities of three-phase squirrel cage and slip ring induction motors.
7. Equivalent circuit of a three-phase induction motor.
8. Pre-determination of performance from circle diagram of a three-phase induction motor.
9. Determination of starting current of a three-phase induction motor with different types of starters.
10. Determination of equivalent circuit of single-phase induction motor.
11. Performance calculation of three-phase alternator.
12. Regulation of three-phase alternator using inductive load.
13. Regulation of three-phase alternator using capacitive load.

Total: 60 Hours

Semester – IV	U15 GE 401R: SOFT SKILLS AND APTITUDE – II	L	T	P	C	Marks
		0	0	2	1	100

Course Outcomes

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

1. Demonstrate capabilities in additional soft-skill areas using hands-on and/or case-study approaches
2. Solve problems of increasing difficulty than those in SSA-I* in given areas of quantitative aptitude and logical reasoning and score 65-70% marks in company-specific internal tests
3. Demonstrate greater than SSA-I level of verbal aptitude skills in English with regard to given topics and score 65-70% marks in company-specific internal tests

1. Soft Skills	**Demonstrating soft-skill capabilities with reference to the following topics:** a. SWOT b. Goal setting c. Time management d. Stress management e. Interpersonal skills and Intrapersonal skills f. Presentation skills g. Group discussions
2. Quantitative Aptitude and Logical Reasoning	**Solving problems with reference to the following topics:** a. Allegation and mixture b. Time, speed and distance: Unit conversion, Average speed, Relative speed, two objects crossing each other in the same direction and opposite direction, Boats and streams, Races and games c. Clocks d. Calendars e. Blood relations f. Cubes and Dices g. Syllogism (≤3 statements) h. Ranking and order i. Company specific aptitude questions
3. Verbal Aptitude	**Demonstrating English language skills with reference to the following topics:** a. Critical reasoning b. Theme detection c. Verbal analogy d. Prepositions e. Articles f. Cloze test g. Company specific aptitude questions

S. Anita

Dr.S.Anita

Department of Placement Training
Sona College of Technology,
Salem-636 005.

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester V under Regulations 2015R (CBCS)
Branch: Electrical and Electronics Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	U15EE501R	Total Quality Management in Electrical Industry	3	0	0	3
2	U15EE502R	Linear Integrated Circuits	3	0	0	3
3	U15EE503R	Microprocessors and Microcontrollers	3	0	0	3
4	U15EE504R	Power Electronics	3	0	0	3
5	U15EE505R	Electrical Machine Design	2	2	0	3
6	U15EE901R	**Elective** – Non-Conventional Energy Sources	3	0	0	3
Practical						
7	U15EE506R	Linear and Digital IC Laboratory	0	0	4	2
8	U15EE507R	Microprocessors and Microcontroller Laboratory	0	0	4	2
9	U15EE508R	Power Electronics Design Laboratory	0	0	4	2
10	U15GE501R	Soft Skills and Aptitude - III	0	0	2	1
					Total Credits	**25**

Approved By

Chairperson, Electrical and Electronics Engineering BoS
Dr.S.Padma

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-

HOD/Electrical and Electronics Engineering, Fifth Semester BE EEE Students and Staff, COE

U15EE501R TOTAL QUALITY MANAGEMENT IN ELECTRICAL INDUSTRY 3 0 0 3

COURSE OUTCOMES

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

- Explain the fundamental concepts and principles of total quality management (TQM) along with the contributions of quality gurus.
- Discuss the various statistical tools used for quality control.
- Illustrate the techniques of quality which are widely practiced in organizations.
- Discuss the fundamental concepts of ISO 9001:2015 and ISO 50001:2011 standards and quality awards.
- Explain the concepts of world class manufacturing.

UNIT I EVOLUTION OF QUALITY 7

Quality control – quality assurance – total quality management – core concepts – quality gurus and their contribution – quality costs – quality measurement.

UNIT II STATISTICAL PROCESS CONTROL IN INDUSTRY 15

Statistical quality control – quality control vs process control – control charts – applications – problems – seven tools of quality – seven tools of management – implementation in electrical industry.

UNIT III TECHNIQUES OF QUALITY IN INDUSTRY 8

TQM tools: Quality Function Deployment (QFD) – Failure Modes and Effect Analysis (FMEA) – applications in industry. Process approach and improvement: just in time – KANBAN – 5S principle in industry – zero defects – poka yoke –SMED-Quality circles.

UNIT IV QUALITY SYSTEMS AND AWARDS 8

ISO 9001:2015 and ISO 50001:2011: philosophy – elements – requirements – benefits – procedure – documentation – certification – auditing – implementation in organization – awards: MBNQA, EQA, RGNQA.

UNIT V WORLD CLASS MANUFACTURING 7

Six sigma – lean manufacturing – lean six sigma – theory of constraints – agile manufacturing.

Lecture: 45, Tutorial: 0, TOTAL: 45 Hours

TEXT BOOKS:

1. Ramasamy,Subburaj,"Total Quality Management", 7th reprint McGrawHill,2016.
2. Dale H. Besterfield, Carol Besterfield-Michna, Glen Besterfield and Mary Besterfield-Sacre,"Total Quality Management", Third edition, Pearson Education, 2013.

REFERENCES:

1. Dahlgaard Jens J; Kristensen Kai; Kanji Gopal K, "Fundamentals of Total Quality Management: process analysis and improvement" , Nelson Thornes Ltd, 2010
2. Lal.H," Total Quality Management: a Practical Approach", New Age International, 2014
3. James R.Evans& William M.Lidsay, "The Management and Control of Quality", Eighth Edition, South – Western (Thomson Learning), 2011.
4. https://www.iso.org/popular-standards.html

U15EE502R LINEAR INTEGRATED CIRCUITS 3 0 0 3

COURSE OUTCOMES:

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

- Describe the IC fabrication process of active and passive components.
- Infer the DC and AC characteristics of op-amp and its effect on output and their compensation techniques.
- Elucidate and design filters and generate waveforms using op-amp circuits.
- Explain and compare the working of multi-vibrators using special application IC 555 and PLL and its application in communication.
- Design the application specific ICs such as voltage regulators and isolation amplifier.

UNIT I IC FABRICATION 9

IC classification, fundamentals of monolithic IC technology – basic planner process – epitaxial growth, masking and etching, realization of monolithic ICs and packaging. fabrication of active and passive components (R, C, diodes, transistors, FETs) in ICs.

UNIT II CHARACTERISTICS OF OP-AMP 9

Block diagram of differential amplifier, packing characteristics, ideal op-amp – ideal differential amplifier – differential mode, common mode, CMRR –ideal op-amp characteristics – practical op-amp characteristics – open loop and closed loop configuration of ideal and practical op-amp as an inverting amplifier, non-inverting amplifier, voltage follower, DC characteristics, AC characteristics – frequency response, slew rate, frequency compensation.

UNIT III APPLICATIONS OF OP-AMP 9

summing amplifier – adder, subtractor, low pass and high pass filters, three op-amp instrumentation amplifier, log and antilog amplifiers, waveform generator (triangular, saw tooth and stair case waveforms), clippers and clampers, sample and hold circuit, differentiator, integrator, comparators & its characteristics, Schmitt trigger, peak detector, precision rectifiers.

UNIT IV SPECIAL ICS AND APPLICATIONS 9

555 timer circuit – functional block, applications - monostable multi-vibrator, astable multi-vibrator, 565 phase locked loop – functional blocks, capture range, lock range, applications – frequency multiplier, FSK, AM detection, FM demodulator, 566 voltage controlled oscillator circuit – functional block, voltage to frequency conversion factor, analog multiplier ICs.

UNIT V VOLTAGE REGULATORS AND APPLICATION ICS 9

Fixed voltage regulators (IC78xx, 79xx), adjustable voltage regulators (LM317, 337), LM 380 power amplifier, ICL 8038 Function generator IC, general purpose voltage regulator (IC723), switching voltage regulator (ICµA 78S40) – SMPS, isolation amplifier, Opto-coupler, Opto-electronic ICs.

Lecture: 45, Tutorial: 0, TOTAL: 45 Hours

TEXTBOOKS:

1. D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 4th Edition ,2012.
2. RamakantA.Gayakwad, "Op-amp and Linear ICs", Prentice Hall, 4th Edition, 2010.

REFERENCES:

1. Jacob Millman, Christos C. Halkias, "Integrated Electronics – Analog and Digital Circuit System", Tata McGraw Hill, 2009.
2. Robert F. Coughlin, Frederick F. Driscoll, "Operational Amplifiers and Linear Integrated Circuits", PHI, 2015.
3. S.Salivahanan& V.S. KanchanaBhaskaran, "Linear Integrated Circuits", TMH, 2014.
4. K.R. Botkar, "Integrated Circuits", Khanna Publisher, 5th Edition, 2010.

U15EE503R MICROPROCESSORS AND MICROCONTROLLERS 3 0 0 3

COURSE OUTCOMES:

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

- Analyse the architecture, discuss the addressing modes, instruction set interrupt structure and develop skill in simple programming of Intel 8085 microprocessor.
- Discuss various Peripheral Interfacing functions and interface with 8085 processor.
- Outline the architecture, discuss the addressing modes, instruction set interrupt structure and develop skill in simple programming of Intel 8086 microprocessor.
- Analyse the architecture, discuss the addressing modes, instruction set interrupt structure and develop skill in programming of Intel 8051 microcontroller.
- Apply the interfacing techniques in motors and traffic light controller for microcontroller based simple applications.

UNIT I 8085 MICROPROCESSOR 9

8085 architecture – instruction set – addressing modes – need for assembly language – development of assembly language programs – machine cycles and timing diagrams – interrupts - memory interfacing, typical EPROM and RAM Interfacing.

UNIT II PERIPHERALS INTERFACING OF 8085 9

Architecture and programming of ICs: 8255 PPI, 8259 PIC, 8251 USART, 8279 keyboard display controller ,8254 timer/ counter, interfacing ADC0801 A/D converter – DAC0800 D/A converter – waveform generation, sensors – interfacing IO devices with 8085.

UNIT III 8086 MICROPROCESSOR 9

8086 architecture – 8086 addressing modes – memory organization instruction set – 8086 assembly language programming – interrupts.

UNIT IV 8051 & PIC18F MICROCONTROLLER 9

8051: Architecture, I/O pins – ports and circuits – memory organization (internal and external) – counters and timers – serial data I/O – interrupts. PIC18F: Architecture, I/O pins – ports and circuits.

UNIT V 8051 PROGRAMMING AND APPLICATIONS 9

8051 addressing modes – instruction set – 8051 simple programming: speed control of stepper motor, induction motor, DC motor and traffic light control.

Lecture: 45, Tutorial:00, TOTAL: 45 Hours

TEXT BOOKS

1. Gaonkar, R. S., "Microprocessor Architecture, Programming and Application with the 8085", Penram International Publishing, 6th edition, 2013.
2. Soumitra Kumar Mandal, "Microprocessors and Microcontrollers", McGraw Hill Education (India) Private Limited, 2013.

REFERENCE BOOKS

1. Krishna Kant, "Microprocessors and Micrcontrollers", Eastern Econmy Edition, PHI Learning Private Limited, 2014.
2. Mohammed Ali Mazidi and Janice GillispieMazidi, "The 8051 Microcontroller and Embedded Systems", Pearson Education, 2005.
3. Senthilkumar, N., Saravanan, M., Jeevananthan, S., "Microprocessor and Microcontrollers", Oxford University Press, 2014.
4. Danny Causey, Muhammad Ali Mazidi and Ralin D McKinlay, "PIC Microcontroller & Embedded System: Using Assembly and C for PIC18", Pearson Education India, 2008.

U15EE504R POWER ELECTRONICS 3 0 0 3

COURSE OUTCOME

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

- Explain different types of power semiconductor devices and their v-i and switching characteristics with protection circuits.
- Illustrate the operation, characteristics and performance parameters of single phase and three phase controlled converters.
- Classify different types of chopper and to analyse the operation of choppers with relevant mode waveforms.
- List various types of inverter and Explain the operation of single phase and three phase inverters with and outline voltage control and harmonic reduction methods.
- Explain operation of single phase and three phase AC voltage regulators with its sequence control techniques and summarise the operation of cycloconverters.

UNIT I POWER SEMI-CONDUCTOR DEVICES 9

Symbol, VI and Switching characteristics of Power diodes, SCR, BJT, MOSFET, IGBT and IGCT – Firing and Gating circuits for MOSFET, IGBT – Protection for thyristor – Series and parallel operation of SCRand MOSFET.

UNIT II PHASE-CONTROLLED CONVERTERS 9

Single phase half wave and full wave converter - half controlled bridge converter and full controlled bridge converter with R,RL Load – Estimation of average & RMS values of load voltage, load current and input power factor.

Three phase full bridge converter – Half controlled and fully controlled converter with R, RL Load – Estimation of average & RMS values of load voltage, load current for R load.

UNIT III DC TO DC CONVERTER 9

DC Choppers : Principle of step up , step down chopper and Step Up/Down Chopper operation – Control strategies – Classification & operation of choppers class(A,B,C,D,E) – Operation of voltage, current and load commutated choppers.

UNIT IV INVERTERS 9

Types of inverters – operation of Single phase and three phase (120^{o}, 180^{o}) voltage source inverter modes analysis with star connected R load – operation of single phase current source inverter – series inverters – parallel inverter – Voltage control of Single phase inverters – harmonic reduction techniques and filters.

UNIT V AC TO AC CONVERTERS 9

AC Voltage Controllers : Single phase voltage regulators – half wave and full wave with R, RL loads – sequence control of AC regulators – two stage sequence regulator with R, RL load – Multistage sequential control of AC regulators – Introduction to Three phase regulators (no analysis).

Cycloconverters : Single phase to single phase cycloconverter – three phase to single phase and three phase to three phase cycloconverters.

Lecture : 45, Tutorial :0, TOTAL :45Hours

TEXT BOOKS

1. Singh.M.D.&Khanchandani.K.B. Power Electronics Mcgraw Education (India) Private limited, New Delhi 2016.
2. P.S.Bimbra “Power Electronics” Khanna Publishers, third Edition 2003.

REFERENCES

1. M.H. Rashid, ‘Power Electronics: Circuits, Devices and Applications’, Pearson Education, PHI Third edition, New Delhi 2004.
2. Ned Mohan, Tore. M.Undeland, William.P.Robbins, ‘Power Electronics: Converters, applications and Design’, John Wiley and sons, third edition, 2003.
3. Philip T. Krien, “ Power Electronics’ Oxford University Press, 2012.
4. Daniel.W.Hart, “Power Electronics”, Indian Edition, Mc Graw Hill, 3 rd Print, 2013.

U15EE505R ELECTRICAL MACHINE DESIGN 2 2 0 3

COURSE OUTCOMES:

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

- Approximate the design values for machine dimensions for the required power.
- Relate the output power of a DC machine with its main dimensions and design the armature of a DC machine.
- Relate the output power of a transformer with its core dimensions and design the transformer.
- Relate the power of an induction motor with its main dimensions and design squirrel cage and slipring induction motors.
- Relate the power of a synchronous machine with its main dimensions and design salient pole and cylindrical pole type synchronous machines.

UNIT I INTRODUCTION 12

Definition for design – considerations and limitations in design – concept of magnetic circuit – comparison of magnetic and electric circuits – MMF calculation for air gap and teeth – real and apparent flux density in rotating machines – total loadings – specific loadings – magnetic leakage calculations– leakage reactance – specific permeance of semi-closed parallel sided slots used in induction machine and transformers.

UNIT II D.C. MACHINES 12

Output equation – main dimensions – separation of D and L – choice of specific loadings – choice of number of poles – core length – armature diameter – pole proportions – design of air gap – armature design –design of commutator and brushes.

UNIT III TRANSFORMERS 12

Classification of transformers – output of single phase and three phase transformers – volt per turn and transformer constants – optimum design – design of core, windings and yoke for core and shell type transformers – temperature rise of transformers – design of tanks and cooling tubes.

UNIT IV THREE PHASE INDUCTION MOTOR 12

Output equation – main dimensions – separation of D and L – choice of specific loadings – design of stator – length of air gap – design of rotor bars and end rings of squirrel cage rotor – design of wound rotor.

UNIT V SYNCHRONOUS MACHINES 12

Output equation – runaway speed – main dimensions – separation of D and L – choice of specific loadings – short circuit ratio – estimation of air gap length – shape of pole face – design of stator and rotor of cylindrical pole and salient pole machines –design of damper winding – design of field winding.

Lecture: 30, Tutorial: 30, TOTAL: 60 Hours

TEXT BOOKS:

1. A.K.Sawhney, "A Course in Electrical Machine Design", DhanpatRai and Sons, 2003.
2. C.Easwarlal, "Electrical Machine Design", Sonaversity, First Edition, 2009.

REFERENCES:

1. V.N. Mittle and A. Mittle, "Design of Electrical Machines", Standard Publications, 2002.
2. Sen S.K., "Principles of Electrical Machine Designs with Computer Programmes",Oxford and IBH Publishing Co. Pvt. Ltd., Second Edition, 2009.
3. R.K.Agarwal, "Principles of Electrical Machine Design", S.K.Kataria and Sons, Delhi, 2002.
4. A.Nagoorkani, "Electrical Machine Design", RBA publications, 2005.

U15EE901R NON-CONVENTIONAL ENERGY SOURCES 3 0 0 3

COURSE OUTCOMES

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

- Describe the power demand scenario in world level and impact of various renewable energy sources in satisfying power demand.
- Explain the principle of operation and the application of solar system.
- Outline in the components and to find the suitability based on the performance of wind energy and Conversion system, biomass energy system
- Describe the principle of operation and the application of geo thermal power tidal power generation scheme, wave energy and OTEC scheme.
- Illustrate the emerging energy generation systems of MHD, Thermal and fuel cells applications.

UNIT – I INTRODUCTION 9

World energy futures – Energy sources and their availability – Energy cycle of the earth – environmental aspects of energy utilization – Energy plantation- Renewable energy resources and their importance- Prospects of Renewable energy sources.

UNIT – II SOLAR ENERGY SYSTEMS 9

Introduction – Solar radiation and measurements - Solar energy collectors-solar energy storage systems - Solar pond and applications- Applications of solar energy: solar pumping, solar cooking, solar distillation and solar greenhouse.

UNIT – III WIND AND BIOMASS ENERGY SYSTEMS 9

Introduction – Wind Energy conversion- Wind speed and power relation – Power extracted from wind – wind distribution and wind speed predictions – types of Wind power systems.

Bio mass conversion technologies-Biogas generation-Types of biogas plants-Bio gas from plant wastes-Utilization of Bio gas and applications.

UNIT – IV GEO THERMAL, TIDAL AND OCEAN ENERGY SYSTEMS 9

Geothermal energy – Estimates of Geothermal power- site selection for geothermal power plant-Applications of Geothermal energy. Origin of tides – Basic principle of Tidal power- Operation of a Tidal power plant. Ocean Thermal Energy conversion system- Open and closed OTEC cycles- Prospects of ocean thermal energy conversion in India.

UNIT – V EMERGING ENERGY SYSTEMS 9

Magneto Hydro Dynamic (MHD) Power Generation - MHD systems and its operation. Thermo Electric power generation - Basic principle - Thermo electric power generator.

Thermonuclear fusion energy - Nuclear fusion and reactions - Advantages. Fuel cell - classification of fuel cells - Fuel cell based electrical power generation scheme - Applications.

Lecture: 45; Tutorial: 0; Total: 45

TEXT BOOKS:

1. Rai, G.D., “Non-Conventional Energy Sources”, Khanna Publishers, Sixth Edition 2017.
2. Khan, B.H, Non- Conventional Energy Resources”, Mc. Graw Hill Education Ltd, third reprint 2017.

REFERENCES:

1. Rao S. Paruklekar,B.B, “Energy Technology – Non Conventional, Renewable and Conventional”, KhannaPublishers,1994.
2. F.Kreith and J.F.Kreider, “Principles of Solar Engineering”, McGraw Hill.
3. T.N.Veziroglu, “Alternative Energy Sources”, Vol 5 and 6, McGraw Hill.
4. MukundR.Patel, “Wind and Solar Power Systems”, CRC Press LLC.

U15EE506R LINEAR AND DIGITAL IC LABORATORY 0 0 4 2

COURSE OUTCOMES:

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

- Develop an inverting, non-inverting and Schmitt trigger circuits for the given parameter using Op-amp and also to design circuit diagrams for instrumentation amplifier and precision rectifier using operational amplifier.
- Design an astable and mono stable multivibrator circuits for the given frequency using IC555.
- Implement Boolean function and code conversion circuit using logic gates and also to verify the truth table for Adder, Subtractor, Multiplexer, Counter and De-multiplexer.

LIST OF EXPERIMENTS:

1. Design of inverting and non-inverting amplifiers.
2. Design of instrumentation amplifier using op-amp.
3. Design of integrator and differentiator (IC741).
4. Design of schmitt trigger using op-amp.
5. Design of precision rectifiers using op-amp.
6. Design of astable and monostable multi vibrators using IC555 timer.
7. Minimization of Boolean function and implement using logic gates.
8. Design of adder and subtractor
9. Design of code converters.
10. Design of encoders and decoders using suitable ICs.
11. Design of multiplexer and de-multiplexer
12. Design and implementation of 4-bit synchronous counter using JK flip flop

Total: 60 Hours

U15EE507R MICROPROCESSORS AND MICROCONTROLLER LABORATORY 0 0 4 2

COURSE OUTCOMES:

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

- Write an assembly language program to perform basic arithmetic operations using 8085 Microprocessor instructions and also to interface various devices using 8085 instructions.
- Write an assembly language program to perform basic arithmetic operations using 8086 Microprocessor instructions.
- Write an assembly language program to perform basic arithmetic operations using 8051Microcontroller instructions

LIST OF EXPERIMENTS:

1. Assembly Language Programming of 8-bit binary addition and subtraction using 8085 processor.
2. Assembly Language Programming of 8-bit binary multiplication and division using 8085 processor.
3. Assembly Language Programming of 16-bit addition and multiplication using 8085 processor.
4. Assembly Language Programming of 8-bit Minimum/Maximum number, Ascending/Descending order using 8085 processor.
5. Assembly Language Programming of Code converter (BCD to Binary and Binary to BCD) using 8085 processor.
6. Assembly Language Programming of Interface Experiments (A/D and D/A interface) using 8085 processor.
7. Interfacing and Programming of Stepper Motor control using 8085 processor.
8. Assembly Language Programming of 16-bit binary addition and subtraction using 8086 processor.
9. Assembly Language Programming of 16-bit binary multiplication and division using 8086 processor.
10. Assembly Language Programming of 8-bit binary addition and subtraction using 8051microcontroller.
11. Assembly Language Programming of 8-bit binary multiplication and division using 8051 microcontroller.
12. Assembly Language Programming of Array of addition using 8051 microcontroller.

Total: 60 Hours

U15EE508R POWER ELECTRONICS DESIGN LABORATORY 0 0 4 2

COURSE OUTCOME

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

- Design different types of firing circuits for SCR and driver circuits for MOSFET and IGBT.
- Design various configurations of converters to feed R and RL loads.
- Verify the operation of step down and step up choppers, commutated choppers, single phase and three phase PWM inverters, cycloconverter and AC voltage regulators.

LIST OF EXPERIMENTS

1. Static characteristics of SCR, MOSFET and IGBT.
2. Construct R, RC and UJT firing circuits for SCR.
3. Driver circuit design for MOSFET and IGBT device.
4. Develop digital firing circuits of SCR.
5. Design of single phase half controlled & fully controlled converter using R, RL Loads.
6. Design of three phase half controlled & fully controlled converter using R, RL Loads
7. Design of step down and step up MOSFET based choppers.
8. Construct current and voltage commutated chopper.
9. Construct and verify the four quadrant operation of chopper.
10. Design IGBT based single-phase PWM inverter.
11. Design IGBT based three-phase PWM inverter(120 and 180 degree)
12. Design of single phase cycloconverter.
13. Construct single phase and three phase AC voltage regulators and verify its operation.

Total: 60 Hours.

Semester –V	U15 GE 501R:SOFT SKILLS AND APTITUDE - III	L	T	P	C	Marks
		0	0	2	1	100

Course Outcomes

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

1. Demonstrate capabilities in supplementary areas of soft-skills and job-related selection processes using hands-on and/or case-study approaches
2. Solve problems of advanced levels than those in SSA-II in specified areas of quantitative aptitude and logical reasoning and score 70-75% marks in company-specific internal tests
3. Demonstrate greater than SSA-II level of verbal aptitude skills in English with regard to given topics and score 70-75% marks in company-specific internal tests

1.Soft Skills	**Demonstrating soft-skill capabilities with reference to the following topics:** a. Career planning b. Resume writing c. Group discussion d. Teamwork e. Leadership skills f. Interview skills g. Mock interview **h.** Mock GDs
2.Quantitative Aptitude and Logical Reasoning Topics	**Solving problems with reference to the following topics :** a. Numbers: Remainder concept b. Time and work: Fraction technique, Efficiency technique, Pipes and cisterns and Chain rule c. Simple interest d. Compound interest e. Set theory: Venn diagram f. Puzzles g. Mathematical operators h. Syllogism (≥4 Statements) i. Data sufficiency j. Statement and assumptions k. Statement and conclusions **l.** Company specific aptitude questions
3. Verbal Aptitude	**Demonstrating English language skills with reference to the following topics:** a. Subject verb agreement b. Selecting the best alternative for the stated parts of given sentences c. Reading comprehension d. Contextual synonyms e. Sentence fillers f. Writing a story for a given picture **g.** Company specific aptitude questions

Department of Placement Training

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VI under Regulations 2015R (CBCS)
Branch: Electrical and Electronics Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	U15EE601R	Power System Protection and Switchgear	3	0	0	3
2	U15EE602R	Power System Analysis	2	2	0	3
3	U15EE603R	Solid State Drives	3	0	0	3
4	U15EE604R	Comprehension	2	0	0	2
5	noc21-cs17	Introduction to Internet of Things	3	0	0	3
6	U15CE1004R	Municipal Solid Waste Management	3	0	0	3
	U15CS1004R	Mobile Application Development				
	U15CS1006R	Data Science				
	U15EC1006R	Sensors and Smart Structures Technologies				
	U15IT1003R	Problem Solving Techniques Using Java Programming				
	U15IT1004R	Python Programming				
	U15IT1005R	Introduction to Database Technology				
	U15MC1001R	Automation in Industries				
Practical						
7	U15EE605R	Solid State Drives Laboratory	0	0	4	2
8	U15EE606R	Electrical System Design Laboratory	0	0	4	2
9	U15ENG601R	Communication Skills Laboratory	0	0	2	1
10	U15GE601BR	Soft Skills and Aptitude - IV	0	0	2	1
					Total Credits	**23**

Approved By

Chairperson, Electrical and Electronics Engineering BoS	**Member Secretary, Academic Council**	**Chairperson, Academic Council & Principal**
Dr.S.Padma	**Dr.R.Shivakumar**	**Dr.S.R.R.Senthil Kumar**

Copy to:-

HOD/Electrical and Electronics Engineering, Sixth Semester BE EEE Students and Staff, COE

U15EE601R POWER SYSTEM PROTECTION AND SWITCHGEAR 3 0 0 3

COURSE OUTCOMES:

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

- Discuss the need for the protection and various digital protection schemes and analyse relay characteristics.
- Discuss protection schemes of generator, transformer, bus bars and transmission lines.
- Describe the method of circuit breaking, arcing phenomena – various arc theories – capacitive and inductive breaking.
- Discuss the modern trends in protectionand working of different types of circuit breakers.
- Describe the methods of protection against over voltages and insulation co-ordination in power system.

UNIT IRELAYS 9

Need for protection – essential qualities of protective relays – over current relays directional, distance and differential, under frequency, negative sequence relays – static relays – microprocessor – based relays. – Digital filtering in protective relays – relays algorithms –Impedance relay, MHO relay – quadrilateral relay.

UNIT II APPARATUS PROTECTION 9

Apparatus protection – generator and transformer protection – protection of bus bars, transmission lines, CTs & PTs and their application in protective schemes.

UNIT III THEORY OF ARC QUENCHING 9

Physics of arc phenomena and arc interruption – re-striking voltage &recovery voltage, rate of rise of recovery voltage, current chopping, interruption of capacitive current, resistance switching – DC circuit breaking.

UNIT IV MODERN TRENDS IN PROTECTION AND CIRCUIT BREAKER 9

Carrier current pilot relaying – phase comparison, carrier aided distance protection – travelling wave relays – amplitude comparison relay, phase comparison relay – fibre optic based relaying. switchgear – fault clearing and interruption of current –types of circuit breakers: vacuum circuit breakers, SF_6 circuit breakers, oil circuit breakers and air circuit breakers – selection of circuit breakers – intelligent circuit breakers.

UNIT V PROTECTION AGAINST OVER VOLTAGES 9

Causes of over voltages – methods of protection against over voltages – ground wires, Peterson coil, surge absorbers, surge diverters – relay co-ordination – selection of Protective system – Insulation co-ordination.

Lecture: 45; Tutorial: 0; TOTAL: 45 Hours

TEXT BOOKS:

1. Ravindranath.B and Chander.N,"Power System Protection and Switchgear", New Age international Publishers, 2011.
2. BadriRam andB.H.Vishwakarma,"Power System Protection and Switchgear", Tata McGraw Hill Education Pvt. Ltd, 2013.

REFERENCES:

1. Chakrabarti.A, Soni.M.L, Bhatnagar.U.S.,Gupta.P.V, "A text book on PowerSystem Engineering", Dhanpatrai&Co. pvt.ltd., 2013.
2. C.L. Wadhwa, "Electrical Power Systems", New Age International (P) Ltd., 2016.
3. RavindraP.Singh , " Digital Power System Protection" , PHI , New Delhi, 2007.
4. Sunil S. Rao, "Switchgear and Protection", Khanna Publishers, 13th Edition, 2015.

U15EE602R POWER SYSTEM ANALYSIS 2 2 0 3

COURSE OUTCOMES:

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

- Model the various power system components and to draw the reactance diagram for practical power system networks.
- Solve the power flow equation for power system networks using iterative solution techniques.
- Carry out symmetrical fault analysis for power system networks using bus impedance matrix formulation.
- Carry out unsymmetrical fault analysis for various power system networks using symmetrical components.
- Model the power system for stability analysis and to solve the swing equation using modified Euler's and Runge-Kutta methods.

UNIT IPOWER SYSTEM – AN OVERVIEW AND MODELLING 9

Need for system analysis in planning and operation of power system – modelling of synchronous generator and motor, transformer and transmission line – per unit system– change of base – impedance and reactance diagrams.

UNIT II POWER FLOW ANALYSIS 15

Primitive network and network matrices – Y-bus formulation by direct inspection and singular transformation methods – problem definition –bus classification – derivation of power flow equation – power flow solution by Gauss Seidel – computation of slack bus power, transmission loss and line flow – Newton Raphson and fast decoupled methods (qualitative treatment only)comparison of solution techniques.

UNIT III SYMMETRICAL FAULT ANALYSIS 12

Need for short circuit study – approximations in modelling – fault MVA – symmetrical short circuit analysis – Thevenin's equivalent representation –bus impedance matrix formulation – bus building algorithm – symmetrical fault calculations using bus impedance matrix.

UNIT IV UNSYMMETRICAL FAULT ANALYSIS 12

Unsymmetrical fault analysis – symmetrical component transformation – sequence impedances – sequence networks – types of unsymmetrical fault – unsymmetrical fault analysis on an unloaded generator – unsymmetrical fault analysis on power system.

UNIT V STABILITY ANALYSIS 12

Concept of stability in power system – steady and transient state stability – rotor angle stability– voltage stability – swing equation – power angle equation and curve – equal area criterion – critical clearing angle and time – solution of swing equation by modified Euler's method and Runge-Kutta method (qualitative treatment only).

Lecture: 30, Tutorial: 30, TOTAL: 60 Hours

TEXT BOOKS:

1. Nagrath.I.J, Kothari.D.P, "Modern Power System Analysis", Tata McGraw Hill,3rd Ed., 2003.
2. HadiSaadat, "Power System Analysis", Tata McGraw Hill Pub Co. Ltd., New Delhi, 2002.

REFERENCES:

1. Gupta, J.B., "A Course in Electrical Power", S.K.Kataria and Sons, 2009.
2. Abhijit Chakrabarti, Sunita Halder, "Power System Analysis: Operation and Control", 2nd Edition, Prentice Hall of India Learning Private Limited, 2008.
3. Stagg.G.W, and El-Abaid.A.H.,"Computer Methods in Power System Analysis", Tata McGraw Hill Pub Co. Ltd, New Delhi, 1993.
4. John J. Grainger & William Stevenson JR., "Power system Analysis by Tata McGraw-Hill New Delhi, 1st Ed., 2003

U15EE603R SOLID STATE DRIVES 3 0 0 3

COURSE OUTCOMES:

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

- Describe the steady state operation and transient dynamics of a motor load system.
- Analyse the operation of the converter and chopper fed DC drives.
- Discuss the operation of solid state speed control of induction motor.
- Discuss the performance of solid state speed control of synchronous motor.
- Describe the stepper motor, solar pump drive and battery powered electric vehicle.

UNIT IREVIEW OF ELECTRIC DRIVES 9

Electric drives – advantage of electric drives – selection of motor power rating – thermal model of motor for heating and cooling – classes of duty cycle – determination of motor rating four quadrant operations – starting, braking and reversing operations.

UNIT II SOLID STATE CONTROL OF DC DRIVES 9

Single-phase and three-phase converter fed drives – continuous and discontinuous conduction modes – chopper fed drives – four-quadrant operation – closed loop drive system.

UNIT III SOLID STATE CONTROL OF INDUCTION MOTOR 9

Induction motor drives – stator control – stator voltage and frequency control – AC chopper, inverter and cyclo-converter fed induction motor drives – rotor control – rotor resistance control and slip power recovery scheme.

UNIT IV SOLID STATE CONTROL OF SYNCHRONOUS MOTOR 9

Variable speed drives – variable frequency control – self-controlled synchronous motor – inverter fed synchronous motors – cyclo-converter fed synchronous motor – brushless DC motor drives.

UNIT V STEPPER MOTOR, SOLAR AND ELECTRIC VECHICLE DRIVES 9

Stepper motor – variable reluctance – permanent magnet – features of stepper motors – torque vs stepping rate characteristics – driver circuits – solar panels – motor suitable for pump drives – solar powered pump drives –drive for hybrid electric vehicles.

Lecture: 45, Tutorial: 0, TOTAL: 45 Hours

TEXT BOOKS:

1. GopalKDubey, "FundamentalsofElectric Drive",Narosa Publications, II Edition, 2002.
2. BimalK.Bose, "Modern Power Electronics and AC Drives", Prentice Hall of India, 2005.

REFERENCES:

1. Pillai.S.K., "A first course on Electrical Drives", New Age International (P) Ltd., 1984.
2. VedamSubramanyan, "Thyristor control of Electrical Drives", Tata McGraw Hill, 1996.
3. Sen P.C., "Thyristor Drives", John Wiley & sons, New York, 1993.
4. R. Krishnan, 'Electric Motor & Drives Modeling, Analysis and Control', Prentice Hall of India, 2001.

Review of Electric Circuits, Electromagnetic Fields, Signals and Systems, Electrical Machines, Control Systems, Electrical and Electronic Measurements, Analog and Digital Electronics and Power Electronics.

TOTAL: 30 Hours

U15EE605R SOLID STATE DRIVES LABORATORY 0 0 4 2

COURSE OUTCOMES:

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

- Simulate AC and DC drives using power electronics modules and the performance characteristics of AC, DC and special drives.
- Analyse the speed control using microcontroller, DSP and PLC based control of VFD
- Analyse the performance parameters of electrical drives.

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 3 phase induction motor.
4. Simulation of 3-phase synchronous motor drive.
5. Speed control of stepper motor using microcontroller.
6. Design of DSP based closed drive for induction motor.
7. Analysis of converter fed DC drive.
8. Speed control of induction motor using PLC
9. Analysis of DSP based chopper fed DC drives.
10. Speed control of Brushless DC motor.
11. Speed control of 3 phase induction motor using PWM inverter.
12. Speed control of PMSM motor drive using FPGA
13. Speed control of switched reluctance motor drive using DSP.

Total: 60 Hours

U15EE606R ELECTRICAL SYSTEM DESIGN LABORATORY 0 0 4 2

COURSE OUTCOMES:

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

- Create revit model and single line diagram for an electrical layout
- Design and implement electrical components for a building
- Panel scheduling for electrical system of a building

LIST OF EXPERIMENTS:

1. Create Revit models by linking and setting up the architecture and structural file.
2. Create copy/monitor levels for an electrical layout.
3. Create visibility graphics settings for designing an electrical design layout.
4. Create spaces for an electrical system model in Revit architecture.
5. Design single line diagram for a living room.
6. Design lighting circuits for a building.
7. Design power circuits for a building.
8. Design fire protection and alarm system for a building.
9. Design distribution system for an electrical load.
10. Calculate panel schedules for an electrical system layout.
11. Implement addition and modification of tags for a given layout.
12. Verify coordination of electrical system design with HVAC/Plumbing.

Total: 60 Hours

PRE-REQUISITES: Basic programming knowledge.

INTENDED AUDIENCE: CSE, IT, ECE, EE, Instrumentation Engg, Industrial Engineering

COURSE OUTLINE:
Internet of Things (IoT) is presently a hot technology worldwide. Government, academia, and industry are involved in different aspects of research, implementation, and business with IoT. IoT cuts across different application domain verticals ranging from civilian to defence sectors. These domains include agriculture, space, healthcare, manufacturing, construction, water, and mining, which are presently transitioning their legacy infrastructure to support IoT. Today it is possible to envision pervasive connectivity, storage, and computation, which, in turn, gives rise to building different IoT solutions. IoT-based applications such as innovative shopping system, infrastructure management in both urban and rural areas, remote health monitoring and emergency notification systems, and transportation systems, are gradually relying on IoT based systems. Therefore, it is very important to learn the fundamentals of this emerging technology.

COURSE PLAN:

Week 1: Introduction to IoT: Part I, Part II, Sensing, Actuation, Basics of Networking: Part-I
Week 2: Basics of Networking: Part-II, Part III, Part IV, Communication Protocols: Part I, Part II
Week 3: Communication Protocols: Part III, Part IV, Part V, Sensor Networks: Part I, Part II
Week 4: Sensor Networks: Part III, Part IV, Part V, Part VI, Machine-to-Machine Communications
Week 5: Interoperability in IoT, Introduction to Arduino Programming: Part I, Part II, Integration of
Sensors and Actuators with Arduino: Part I, Part II
Week 6: Introduction to Python programming, Introduction to Raspberry Pi, Implementation of IoT with
Raspberry Pi
Week 7: Implementation of IoT with Raspberry Pi (contd), Introduction to SDN, SDN for IoT
Week 8: SDN for IoT (contd), Data Handling and Analytics, Cloud Computing
Week 9: Cloud Computing(contd), Sensor-Cloud
Week 10: Fog Computing, Smart Cities and Smart Homes
Week 11: Connected Vehicles, Smart Grid, Industrial IoT
Week 12: Industrial IoT (contd), Case Study: Agriculture, Healthcare, Activity Monitoring

Lecture: 45, Tutorial: 0, TOTAL: 45 Hours

BOOKS AND REFERENCES

1. S. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University Press.
2. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.
3. Research Papers

Semester –VI	U15 GE 601B R: SOFT SKILLS AND APTITUDE – IV (For all Department except Civil)	L	T	P	C	Marks
		0	0	2	1	100

Course Outcomes

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

1. Demonstrate capabilities in job-oriented company selection processes using the hands-on approach
2. Solve problems of any given level of complexity in all areas of quantitative aptitude and logical reasoning and score 70-75% marks in company-specific internal tests
3. Demonstrate advanced-level verbal aptitude skills in English and score 70-75% marks in company-specific internal tests

1. Soft Skills	**Demonstrating Soft -Skills capabilities with reference to the following topics:** a. Mock group discussions b. Mock interviews c. Mock stress interviews
2. Quantitative Aptitude and Logical Reasoning	**Solving problems with reference to the following topics:** a. Crypto arithmetic problems b. Permutation & Combination c. Probability d. Clocks & Calendars e. Functions & polynomials f. Logarithm g. Geometry h. Puzzles i. Data interpretation j. Data Sufficiency k. Company specific aptitude questions (AMCAT & Co cubes)
a. 3. Verbal Aptitude	**Demonstrating English language skills with reference to the following topics:** a. Writing captions for given pictures b. Reading comprehension c. Critical reasoning d. Theme detection e. Jumbled sentences f. Writing a story on given pictures g. Company specific aptitude questions

Department of Placement Training
Sona College of Technology,
Salem-636 005.

EEE

PREAMBLE

ELECTRIC MOBILITY

Electrical propulsion systems date back virtually to the time of Faraday and a substantial body of literature exists in the library of the Institution of Electrical Engineers from which it is safe only to consider a small amount in relation to current road vehicle developments. Similarly a considerable quantity of works are available on aerospace structural design which can be found in the library of the Royal Aeronautical Society, and on automotive systems developments within the library of the Institution of Mechanical Engineers. With the massive recent step-changes in capital investment, first in the build-up to battery-electric vehicle development, then in the switch to hybrid drive engineering, and finally the move to fuel-cell development – it would be dangerous to predict an established EV technology at this stage.

The development of internal combustion engine vehicles, especially automobiles, is one of the greatest achievements of modern technology. Automobiles have made great contributions to the growth of modern society by satisfying many of its needs for mobility in everyday life. The rapid development of the automotive industry, unlike that of any other industry, has prompted the progress of human society from a primitive one to a highly developed industrial society. The automotive industry and the other industries that serve it constitute the backbone of the word's economy and employ the greatest share of the working population. However, the large number of automobiles in use around the world has caused and continues to cause serious problems for the environment and human life. Air pollution, global warming, and the rapid depletion of the Earth's petroleum resources are now problems of paramount concern.In recent decades, the research and development activities related to transportation have emphasized the development of high efficiency, clean, and safe transportation. Electric vehicles, hybrid electric vehicles, and fuel cell vehicles have been typically proposed to replace conventional vehicles in the near future.

U15EE1001R ELECTRIC MOBILITY 3 0 0 3

COURSE OUTCOMES

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

- Explain the need for electric and hybrid vehicles fundamentals.
- Describe the energy sources of types of batteries and fuel cells.
- Discuss the various types of motor control design features of Electric vehicle.
- Illustrate the design of various considerations of electric vehicle.
- Explain the hybrid design vehicle technology.

UNIT I INTRODUCTION 9

Need for electric and hybrid vehicles-Comparative study of electric and hybrid vehicles-Limitations of electric vehicles- Petroleum resources- Global warming-Fuel cell vehicles-Optimum solutions for motor, drives and batteries.

UNIT II ENERGY SOURCES 9

Battery Parameters-Power requirement of electric vehicles- Different types of batteries - Lead acid- Nickel based-Sodium based-Lithium based- Metal Air based. Battery charging- Charger design- Quick charging devices- Battery Modeling. Different type of energy storage – Solar, wind, compressed fluid. Fuel Cell- Fuel cell characteristics- Fuel cell types-Hydrogen fuel cell- Connecting cell in series.

UNIT III PROPULSION MOTORS AND CONTROLLERS 9

Characteristic of permanent magnet and separately exited DC motors.– Basic Principles of BLDC Motor Drives- Performance Analysis and Control of BLDC Machines- Inverters – DC and AC motor speed controllers.

UNIT IV DESIGN OF ELECTRIC VEHICLES FUNDAMENTALS 9

Aerodynamic-Rolling resistance- Transmission efficiency- Grading Resistance -Vehicle mass- Electric vehicle chassis and Body design considerations- Heating and cooling systems- Controllers- Power steering-Vehicle Performance.

UNIT V HYBRID VEHICLES 9

Types of Hybrid- Series, parallel, parallel - Advantages and Disadvantages- Hybrid drive prospects - Hybrid technology case studies - Production hybrid-drive cars -Hybrid passenger and goods vehicles.

Lecture: 45; Tutorial: 0; Total: 45 Hrs

TEXT BOOKS:

1. 1.Mehrdad Ehsani, " Modern Electric, Hybrid Electric and Fuel Cell Vehicles", CRC Press, 2009.
2. Ron HodKinson, " Light Weight Electric/Hybrid Vehicle Design", Butterworth Heinemann Publication, 2005.

REFERENCE BOOKS

1. Iqbal Husain, " Electric and Hybrid Vehicles-Design Fundamentals", CRC Press, 2003.
2. Jack Erjavec, "Hybrid, Electric & Fuel-Cell Vehicles", Delmar, Cengage Learning, 2013.
3. James Larminie and John Lowry, "Electric Vehicle Technology Explained " John Wiley & Sons, 2003.

PREAMBLE
TO
ELECTRIFICATION IN BUILDING CONSTRUCTION

Engineers are responsible for the design, installation, and operation and monitoring of the mechanical, electrical and public health systems required for the safe, comfortable and environmentally friendly operation of modern buildings.

Engineers work closely with other construction professionals such as architects, structural engineers and quantity surveyors. They influence the architecture of a building and play a significant role on the sustainability and energy demand of a building. Within building services engineering, new roles are emerging, for example in the areas of renewable energy, sustainability, low carbon technologies and energy management.

U15EE1002R ELECTRIFICATION IN BUILDING CONSTRUCTION 3 0 0 3

COURSE OUTCOME

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

- Draw the layout of electrical wiring and explain various earthing methods.
- Explain the construction and operation of transformer, motor, and sensors and its applications.
- Explain the need for protection and analyze the selection of circuit breakers.
- Outline the fundamentals of illumination.
- Design the lighting schemes required for various types of buildings.

UNIT IELECTRICAL SYSTEMS IN BUILDINGS 9

Basics of electricity–Single / Three phase supply–Earthing for safety–Types of earthing–ISI specifications–Types of wires, wiring systems and their choice–Planning electrical wiring for building–Main and distribution boards–Layout of substations

UNIT II ELECTRICAL EQUIPMENT AND SENSORS IN BUILDINGS 9

Transformer:Principle of operation – Construction – Classification of transformers - applications

Motor: Principle of operation – types of DC motor – types of AC motor – applications

Sensors:Principle of operation – types of sensors - Temperature Sensors, Proximity Sensor, Pressure Sensor, Water Quality Sensor, Chemical Sensor, Gas Sensor, Smoke Sensor, IR Sensors, Level Sensors, Humidity Sensors - applications

UNIT III RELAYS AND CIRCUIT BREAKERS 9

Need for protection – Essential qualities of protective relays – distance and differential relay. Switchgear – Fault clearing and interruption of current – selection of circuit breakers.

UNIT IV PRINCIPLES OF ILLUMINATION 9

Visual tasks–Factors affecting visual tasks–Modern theory of light and color–Synthesis of light–Additive and subtractive synthesis of color–Luminous flux–Candela–Solid angle illumination–Utilization factor–Depreciation factor–MSCP–MHCP–Laws of illumination.

UNIT V LIGHTING DESIGN: INSTALLATION AND APPLICATION 9

Classification of lighting– Artificial light sources–Spectral energy distribution–Luminous efficiency–Colour temperature–Colour rendering. Design of modern lighting–Lighting for stores, offices, schools, hospitals and house lighting. Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types.

Lecture : 45, Tutorial :00; Total :45Hrs

Text books:

1. Udayakumar R., "Building Services", Easwar Press, 2007.
2. Badriram, B.H.Viswakarma,"Power system protection and Switchgear",Tata McGraw Hill,2001.

References:

1. Philips."Lighting in Architectural Design", McGraw-Hill, New York, 1997.
2. Hopkinson R.G. and Kay J.D., "The Lighting of buildings", Faber and Faber, London, 1969.
3. B.L.Theraja and A.K.Theraja , "A Text Book of Electrical Technology" , S.Chand Publisher Vol2,2014.
4. A K.Sawhney, "A course in Electrical and Electronic Measurements and Instrumentation" Thanpat Roy and Co.

PREAMBLE

EMBEDDED SYSTEMS AND IoT

Internet of things is a new revolution of the Internet that is rapidly gathering thrust driven by the advancements in networks, devices, wireless communications and networking technologies. The explosive growth of the "Internet of Things" is changing our world and the rapid drop in price for typical IoT components is allowing people to innovate new designs and products at home. An embedded system is a dedicated, computer-based system for an application or product. An embedded system may either be an independent system or a part of a larger system. In this course, the students will learn the fundamentals of embedded systems and the devices and communication buses for devices network. The fundamentals of IoT with typical IoT devices, interfacing between physical world and the device will also be covered.

After completing the course the students will

- ✓ Apply their knowledge to build real time IoT applications for industries with the basics in programming
- ✓ Differentiate the buses for serial and parallel communication in Embedded system applications

U15EE1003R EMBEDDED SYSTEMS AND IoT 3 0 0 3

COURSE OUTCOMES

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

- Explain the architectural features of embedded system.
- Describe the input-output devices for embedded network
- Describe the interactions of embedded systems with the physical world
- Describe the role of an operating system to support software in an IoT device
- Explain the use of networking and basic networking hardware

UNIT IINTRODUCTION TO EMBEDDED SYSTEM 9

Introduction to Embedded systems – Processor embedded into a system – Embedded hardware units – Register, memory devices, ports, timer, interrupt controllers – classification of embedded system – design process in embedded system: design Metrics.

UNIT II DEVICES & BUSES FOR DEVICES NETWORK 9

I/O devices: timer and counting devices - serial communication using I^2C, CAN, USB buses - parallel communication using ISA, PCI, PCI/X buses, arm bus – internet enabled systems-network protocols.

UNIT III FUNDAMENTALS OF IoT 9

Introduction - Definition and Characteristics of IoT - Physical design - IoT Protocols - Logical design - IoT communication models, IoT Communication APIs - Enabling technologies - Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates - Domain specific IoTs - IoT Architectural view

UNIT II PYTHON & ELEMENTS OF IoT 9

Python –Introduction – Python Data types & Data Structures – Control flow – Functions – Modules – Packages – File Handling – Date/Time operations – Classes –Simple examples -

Sensors and actuators – Analog sensors, Digital sensors-examples – Participatory Sensing, Industrial IoT and Automotive IoT – Actuator- Communication modules – Zigbee - LoRa - RFID

UNIT IV BUILDING IoT & CASE STUDY 9

IoT platforms – Arduino – Raspberry Pi –Raspberry Pi Interfaces - Real time applications of IoT – Home automation – Automatic lighting – Home intrusion detection – Cities – Smart parking – Environment – Weather monitoring system – Agriculture – Smart irrigation

Lecture: 45, Tutorial:00, TOTAL: 45 Hrs

TEXT BOOKS

1. P. Rajkamal, 'Embedded System – Architecture, Programming and Design', Tata McGraw Hill, 2010.
2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things-A hands-on approach", Universities Press, 2015.

REFERENCES

1. Raj Kamal, "Internet of Things – Architecture and Design Principles", Mc Graw Hill Education Pvt. Ltd., 2017.
2. Internet of Things and Data Analytics, Hwaiyu Geng, P.E, Wiley Publications, 2017.
3. Manoel Carlos Ramon, ―Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers‖, Apress, 2014.
4. Marco Schwartz, ―Internet of Things with the Arduino Yun‖, Packt Publishing, 2014.
5. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley Publications, 2012.
6. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key applications and Protocols", Wiley Publications 2nd edition , 2013.

PREAMBLE
TO
ENERGY CONSERVATION AND MANAGEMENT

Energy is one of the most important resources to sustain our lives. At present we still depend a lot on fossil fuels and other kinds of non-renewable energy. The extensive use of renewable energy including solar energy needs more time for technology development. In this situation Energy Conservation (EC) is the critical needs in any countries in the world.

Energy saving is important and effective at all levels of human organizations – in the whole world, as a nation, as companies or individuals. Energy Conservation reduces the energy costs and improves the profitability.

Energy costs are often treated as a fixed overhead by organisations. But, by taking the right approach to energy management it is possible to make considerable savings. Successful energy management must combine an effective strategy with the right practical interventions. Many organisations would like to save energy, but they need to make energy management an integral part of running the organisation to ensure success. Energy Management is very important for the management of factories/companies, and Energy Conservation is one of its major topics.

U15EE1004R ENERGY CONSERVATION AND MANAGEMENT 3 0 0 3

COURSE OUTCOMES

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

- Assess role of energy in global economic development.
- Explain methodology of energy audit and concept of instruments used.
- Discuss various lamps and design energy efficient illumination schemes.
- Apply energy conservation concepts in buildings.
- Identify the energy conserving opportunities in utilities.

UNIT- I ENERGY SCENARIO AND BASICS 9

Classification of Energy – Purchasing Power Parity – Energy Security – Strategy to meet future energy requirements – Objectives and features for electricity act 2003 – Energy efficiency standards and labeling – Study of Global and Indian primary energy reserves – Study of energy scenario for India – Energy and environment – Global environmental issues – Types of Energy – Electrical and Thermal energy basics – Energy units and conversions.

UNIT- II ENERGY MANAGEMENT AND AUDIT 9

Definition and objectives of energy management and audit – Need for energy audit – Types of energy audit – Methodology for conducting detailed energy audit – ENCON opportunities and measures – Energy audit report. Energy costs – Benchmarking – Energy performance – Fuel and Energy substitution – Instruments and metering for energy audit – Basic principles, components of material and energy balance – Sankey diagram – Financial analysis terms – Payback period, ROI, NPV, IRR.

UNIT- III LIGHTING SYSTEMS 9

Introduction – Terms in Lighting and Illumination – Light sources - Lamp types – Arc Lamps, Vapour lamps – Incandescent lamp, Fluorescent lamp – Energy saving lamps – CFL, LED – Lighting design for interiors – Indoor and outdoor lighting schemes – Energy saving opportunities – Energy efficient lighting controls.

UNIT- IV ENERGY CONSERVATION IN BUILDINGS 9

Energy conservation building code (ECBC) – Compliance approaches – ECBC guidelines on Building envelope, HVAC system, Service hot water, Water pumps – Energy consumption in Escalators and Elevators – Building Energy Management Systems – Star ratings – Energy Efficiency Measures in AC and Lighting system.

UNIT- V ENERGY EFFICIENT OPPORTUNITIES IN UTILITIES 9

Introduction to Compressed air system components – Heat transfer loops in refrigeration systems – Standards and labelling of room air conditioners – Introduction to Fans, Blowers and Compressors – Types of pumps, Pump curves – Efficient operation of pumps – Components of cooling towers and its efficient operation - Introduction to DG set system.

Energy Efficiency and energy savings in Compressed Air System, HVAC system, Fans and Blowers, Pumping system, Cooling towers, and DG sets.

Lecture: 45; Tutorial: 00; Total: 45

TEXT BOOKS:

1. "General Aspects of Energy Management and Energy Audit", Bureau of Energy Efficiency, Fourth Edition, 2015.
2. "Energy Efficiency in Electrical Utilities", Bureau of Energy Efficiency, Fourth Edition, 2015.

REFERENCE BOOKS:

1. Chakrabarti A, "Energy Engineering and Management", PHI, 2011.
2. Murphy W R, McKay G, "Energy management", Elsevier, 2009.
3. Rajput R K, "Utilization of Electrical Power", Lakshmi Publications, 2006.

PREAMBLE
TO
INSTRUMENTATION SYSTEMS

Instrumentation System for the engineering to focused on the principle and operation of measuring instruments that are used in design and configuration of automated systems in electrical, pneumatic domains etc. They typically work for industries with automated processes. The term “system” refers to a set of components that are connected to form and act as an entire unit. An instrumentation system is collection of instruments used to measure, monitor, and control a process. There are many applications of instrumentation systems, within technological areas as large as those associated with communications, defence, transportation, education, industrial manufacturing and research and development, and chemical and other process industries.

U15EE1005R INSTRUMENTATION SYSTEMS 3 0 0 3

COURSE OUTCOMES:

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

1. Discuss the static and dynamic characteristics and define various errors.
2. Derive torque equation for various types of meters
3. Calculate R, L and C using bridges.
4. Explain storage and display device
5. Discuss the various types of transducers

UNIT IINTRODUCTION 9

Functional elements of an instrument – Static characteristics: True value, Static error, static correction, Reproducibility, Drift, Repeatability, Noise, Signal to Noise ratio, Accuracy and precision, Sensitivity, Linearity, Threshold, Dead Zone, Resolution. Dynamic Characteristics: Speed of response, Fidelity, Lag, Dynamic error – Errors: Gross error, Systematic error and Random error – Statistical evaluation of measurement data – Standards and calibration.

UNIT II ELECTRICAL AND ELECTRONICS INSTRUMENTS 9

Principle and operation of analog voltmeters and ammeters: Moving Iron; attraction and repulsion type instruments. Moving coil Instruments; PMMC, Dynamometer type, Torque equation – Single phase Dynamometer type watt meter: Toque expression, Errors – Single phase Induction type energy meters – Measurement of Power using Instrument transformers – Single Phase Electrodynamometer Power factor meters and Weston Frequency meter.

UNIT III BRIDGES & INTERFERENCE TECHNIQUES 9

D.C bridges: Wheatstone bridge, Kelvin double bridge, Megger – A.C bridges: Maxwell's, Anderson, Schering - Interference & screening – Multiple earths and earth loops - Electrostatic and electromagnetic interference – Grounding techniques.

UNIT IV STORAGE AND DISPLAY DEVICES 9

Magnetic disk and tape – Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD, Memory cards & dot matrix display.

UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS 9

Classification of transducers – Selection of transducers – Resistive, capacitive & Inductive transducers – Measurement of temperature – RTD, thermistors and thermocouples - Piezoelectric transducers - Digital transducers – optical encoders - Elements of data Acquisition system – A/D, D/A converters.

Lecture: 45, Tutorial:0, Total: 45 Hrs

TEXT BOOKS

1. A.K. Sawhney, "A Course in Electrical & Electronic Measurements &Instrumentation", DhanpatRai and Co, 2012.
2. RK Rajput, "Electrical Measurements and Measuring Instruments" S.Chand and Company Pvt. Ltd., Second Edition, 2013

REFERENCE BOOKS

1. E.O. Doebelin, "Measurement Systems – Application and Design", Tata McGraw Hill Publishing company, 2003.
2. A.J. Bouwens, "Digital Instrumentation", Tata McGraw Hill, 1997.
3. D.V.S. Moorthy, 'Transducers and Instrumentation', Prentice Hall of India Pvt Ltd, 2007.
4. H.S. Kalsi, "Electronic Instrumentation", Tata McGraw Hill, II Edition 2004.
5. J. B. Gupta, "A Course in Electronic and Electrical Measurements", S. K. Kataria&Sons,Delhi, 2003.

PREAMBLE
TO
RENEWABLE ENERGY SYSTEMS

Energy is an important source of all technological developments as well as for all basic needs. The usage of renewable energy sources are the only way for sustainable development and future energy requirements. Renewable energy encourages the generation of electricity without any environmental impact and improves the economic growth of the country.

By choosing this elective the students will be able to know the importance of renewable energy sources for power generation. And also they could understand how the fossil fuels are made an impact on environmental issues. They will be familiar with the following

1. Concept of solar energy power production and solar photovoltaic cells and the application of solar PV system and Bio Mass power generation system.
2. Principle of conversion of wind energy in to electric energy
3. Working of geothermal and hydro power stations.
4. Principle of the conversion of tidal and wave energy in to electric energy.
5. The emerging technology of power generation.

After completion of this subject students will know how the energy can be produced locally. This knowledge would provide an opportunity to install small capacity power generation units independently for their needs.

U15EE1006R RENEWABLE ENERGY SYSTEMS 3 0 0 3

COURSE OUTCOMES

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

- Describe the power demand scenario in world level and impact of various renewable energy sources in satisfying power demand.
- Explain the principle of operation and the application of solar system.
- Outline in the components and to find the suitability based on the performance of wind energy and Conversion system, biomass energy system
- Describe the principle of operation and the application of geo thermal power tidal power generation scheme, wave energy and OTEC scheme.
- Illustrate the emerging energy generation systems of MHD, Thermal and fuel cells applications.

UNIT I INTRODUCTION 9

World energy futures–Energy sources and their availability – Energy cycle of the earth – environmental aspects of energy utilization – Energy plantation- Renewable energy resources and their importance- Prospects of Renewable energy sources.

UNIT II SOLAR ENERGY SYSTEMS 9

Introduction –Solar radiation and measurements-Solar energy collectors-solar energy storage systems- Solar pond and applications- Applications of solar energy: solar pumping, solar cooking, solar distillation and solar greenhouse.

UNIT III WIND AND BIOMASS ENERGY SYSTEMS 9

Introduction – Wind Energy conversion- Wind speed and power relation – Power extracted from wind – wind distribution and wind speed predictions – types of Wind power systems.

Bio mass conversion technologies-Biogas generation-Types of biogas plants-Bio gas from plant wastes-Utilization of Bio gas and applications.

UNIT IV GEO THERMAL, TIDAL AND OCEAN ENERGY SYSTEMS 9

Geothermal energy – Estimates of Geothermal power- site selection for geothermal power plant-Applications of Geothermal energy.

Origin of tides – Basic principle of Tidal power- Operation of a Tidal power plant. Ocean Thermal Energy conversion system- Open and closed OTEC cycles- Prospects of ocean thermal energy conversion in India.

UNIT V EMERGING ENERGY SYSTEMS 9

Magneto Hydro Dynamic (MHD) Power Generation- MHD systems and its operation. Thermo Electric power generation- Basic principle- Thermo electric power generator.

Thermonuclear fusion energy-Nuclear fusion and reactions- Advantages. Fuel cell- classification of fuel cells- Fuel cell based electrical power generation scheme- Applications.

Lecture: 45; Tutorial: 0; Total: 45

TEXT BOOKS:

1. Rai, G.D., “Non-Conventional Energy Sources”, Khanna Publishers, Sixth Edition 2017.
2. Khan, B.H, Non- Conventional Energy Resources”, Mc. Graw Hill Education Ltd, third reprint 2017.

REFERENCE BOOK

1. Rao S. Paruklekar,B.B, “Energy Technology – Non Conventional, Renewable and Conventional”, KhannaPublishers,1994.
2. F.Kreith and J.F.Kreider, “Principles of Solar Engineering”, McGraw Hill.
3. T.N.Veziroglu, “Alternative Energy Sources”, Vol 5 and 6, McGraw Hill.
4. Mukund R.Patel, “Wind and Solar Power Systems”, CRC Press LLC.

PREAMBLE
TO
Innovation, IPR and Entrepreneurship Development

The open elective course syllabus has been framed by Entrepreneurship Development Cell of Sona College of Technology on above mentioned title for even semester. The course covers a wide range of topics from Innovation, Intellectual Property Right and entrepreneurial Competitiveness and competency, basic requirements of setting of an enterprise/startups, factors influencing entrepreneurship, Barriers to Entrepreneurship & Concepts, Issues of Entrepreneurship Failure, Idea selection, Innovation & creativity, design thinking.

The course also covers identifying and selecting a good business opportunity, market survey & research, techno-economic feasibility assessment and preparation of preliminary project reports, management of working capital, costing, break even analysis, taxation, income tax, GST, provision of incentives, subsidies & concessions, entrepreneurship finance and angels & ventures capital fund etc. Benefit out of Government policies to small scale industries and business incubators.

U15EE1007R INNOVATION, IPR AND ENTREPRENEURSHIP DEVELOPMENT

3 0 0 3

COURSE OUTCOMES

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

- Acquire the knowledge for establishment of an enterprise and management,
- Derive the innovative ideas, right approach to the problem and arrive solution for problem with IPR and its legal aspects.
- Prepare the project report preparation and assessment of Business.
- Acquire the knowledge on costing, Techno-economic aspects, find out the sources of finance and opportunities in business.
- Identify the support system for Entrepreneurs by Government and venture capitals.

UNIT IENTREPRENEURSHIP & MOTIVATION 9

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth. Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self-Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

UNIT II INNOVATION, CREATIVITY, DEVELOPMENT PROCESS AND LEGAL ASPECTS 9

Innovation and Creativity- An Introduction, Innovation in Current Environment, Types of Innovation Sources of new Ideas, Methods of generating innovative ideas, creating problem solving, product planning and development process. Legal aspects of business (IPR, Labor law).

UNIT III BUSINESS 9

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

UNIT IV FINANCING AND ACCOUNTING 9

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, GST.

UNIT V SUPPORT TO ENTREPRENEURS 9

Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures - Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

Lecture: 45; Tutorial: 0; Total: 45 Hrs

TEXT BOOKS:

1. Khanka. S.S., "Entrepreneurial Development" S.Chand & Co. Ltd., Ram Nagar, New Delhi, 2013. 99
2. Donald F Kuratko, "Entreprenuership – Theory, Process and Practice", 9 th Edition, Cengage Learning, 2014.

REFERENCES:

1. Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill, 2013.
2. Mathew J Manimala, "Enterprenuership theory at cross roads: paradigms and praxis" 2 nd Edition Dream tech, 2005.
3. Rajeev Roy, "Entrepreneurship" 2 nd Edition, Oxford University Press, 2011.
4. EDII "Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development", Institute of India, Ahmadabad, 1986.
5. Innovation and Entrepreneurship Book by Peter Drucker,
6. James Larminie and John Lowry, "Electric Vehicle Technology Explained " John Wiley & Sons, 2003.

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VII 2015R (CBCS)
Branch: Electrical and Electronics Engineering

S. No.	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U15GE701R	Professional Ethics and Human Values	3	0	0	3	45
2	U15EE701R	Energy Utilization and Management	3	0	0	3	45
3	U15EE702R	Power System Operation and Control	2	2	0	3	60
4	U15EE902R	**Elective -** Power Quality Engineering	3	0	0	3	45
5	U15EE909R	**Elective -** Special Electrical Machines	3	0	0	3	45
6	U15CE1002R	**Open Elective –** Disaster Management	3	0	0	3	45
	U15CE1003R	**Open Elective –** Energy Efficiency and Green Building					
	U15CS1005R	**Open Elective –** Object Oriented Programming and Data Structures					
	U15EC1008R	**Open Elective –** Mobile Technology and its Applications					
	U15IT1003R	**Open Elective –** Problem Solving Techniques Using Java Programming					
	U15ME1004R	**Open Elective –** Industrial Safety					
	U15ME1010R	**Open Elective –** 3D Printing					
Practical							
7	U15EE703R	Power System Simulation Laboratory	0	0	4	2	60
8	U15EE704R	Mini Project	0	0	8	4	120
					Total Credits	**24**	

Approved By

Chairperson, Electrical and Electronics Engineering BoS	**Member Secretary, Academic Council**	**Chairperson, Academic Council & Principal**
Dr.S.Padma	Dr.R.Shivakumar	Dr.S.R.R.Senthil Kumar

Copy to:-

HOD/Electrical and Electronics Engineering, Seventh Semester BE EEE Students and Staff, COE

U15GE701R PROFESSIONAL ETHICS AND HUMAN VALUES 3 0 0 3

COURSE OUTCOMES:

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

1. Identify the core values that shape the ethical behavior of an engineer.
2. Utilize opportunities to explore one's own values in ethical issues.
3. Apply codes of ethics and standards in the engineering field.
4. Explore various safety issues and ethical responsibilities of an engineer.
5. Recognize and resolve global issues.

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1						3	2	2	3	3	3	3		
CO2			2	1		3	3	3	3	2	3	3		
CO3	2		2	2	2	3	3	3	3	3	3	3		1
CO4	2	2	2	2	1	3	3	3	3	3	3	3	1	1
CO5			2	1	2	3	3	3	3	3	3	3	1	1

UNIT-I HUMAN VALUES 9

Morals, Values and Ethics – Integrity – Work Ethics – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – Caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality.

UNIT -II ENGINEERING ETHICS 9

Senses of Engineering Ethics – Variety of moral issues – Types of inquiry – Moral Dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Profession and Professionalism – Professional Ideals and Virtues – Theories of Right action- Uses of Ethical Theories.

UNIT-III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Contrasts with standard experiments- Engineers as Responsible Experimenters – Importance and limitations of Codes of Ethics - Industrial Standards - A Balanced Outlook on Law – Case Study: Space shuttle challenger disaster.

UNIT-IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and Risk – Types of risk - Assessment of Safety and Risk – Risk Benefit analysis-Reducing Risk – Case Studies - Chernobyl and Bhopal plant disaster.

Collegiality and Loyalty –Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Importance and consequences of whistle blowing - Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT-V GLOBAL ISSUES 9

Multinational Corporations – Environmental Ethics – Computer Ethics and Internet- Engineers and Technological progress – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Participation in professional societies- Sample Code of Conduct (pertaining to specific professional societies).

Lecture: 45, Tutorial: 0, TOTAL: 45 Hours

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw Hill, Indian Edition, Tenth reprint, 2017.
2. Professional Ethics and Human values- Sonaversity, Edition 2018.

REFERENCES

1. Charles D Fleddermann, “Engineering Ethics”, Prentice Hall, New Mexico, 2012.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2016.
3. Charles E Harris, Michael S Pritchard and Michael J Rabins, “Engineering Ethics – Concepts and Cases”, CengageLearning, 2000.
4. R.Subramanian , “Professional Ethics “,Oxford University Press ,Reprint ,2015.

U15EE701R ENERGY UTILIZATION AND MANAGEMENT 3 0 0 3

COURSE OUTCOMES:

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

1. Discuss the types of electric drives and systems employed in electric traction.
2. Describe various lamps and design of illumination schemes.
3. Explain the methods used for electric heating and welding, concepts of refrigeration and air conditioning.
4. Discuss procedure for energy management and audit.
5. Analyze the various energy pricing and cost analysis.

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	1		1		2		3						2	2
CO2	2	3	3	2	3	3	3	2	1			2	2	
CO3					2	1	2						2	1
CO4			1			2	1						1	2
CO5	3	2	3	3		3	3	2	2		1	2	2	3

UNIT I ELECTRIC DRIVES AND TRACTION 8

Electric Drive: Fundamentals of electric drives – Choice of an electric Motor – Temperature rise in machines – Choice of rating of motors – Electric braking.

Traction systems: Traction Motors – Features of traction motors – Systems of railway electrification – Train movement and energy consumption – Speed time curves – Mechanics of train motion – Track equipment and collection gear.

UNIT II ILLUMINATION AND LIGHTING DESIGN 6

Laws of Illumination:laws and Terms used in illumination – Classification of light sources.

Types of lamp: Arc lamps, Incandescent lamps, Sodium and Mercury vapor lamps, Neon lamps, Fluorescent lamps, CFL and LED.

Lighting Design: Types of lighting systems – Lighting scheme calculations – Design of Indoor and Outdoor lighting schemes.

UNIT III ELECTRIC HEATING AND COLLING 12

Electric Heating: Classification and Advantages of electric heating – Modes of transfer of heat – Resistance heating – Induction heating – Eddy current heating – Dielectric heating – selection of frequency for electric heating.

Electric Welding: Classification and Advantages of electric welding – Resistance welding – Arc welding – Ultrasonic and Electron Beam welding – Requirements of good weld – Preparation of work – Electrodes – Electric welding equipment.

Refrigeration: Refrigeration cycle – Refrigeration systems – Types of refrigerants – Domestic refrigerator – Water coolers

Air Conditioning: Air conditioning cycle – Classification of air conditioning systems – Central system – Room air conditioner – Heating of buildings

UNIT IV ENERGY MANAGEMENT & AUDIT 11

Energy Management: Scope of energy management, necessary steps in energy management programme, general principles of energy management, qualities of energy manager, functions of energy manager, language of energy manager.

Energy Audit: Energy surveying and auditing, objectives, uses of energy, energy conservation schemes, energy index, cost index, pie charts, Sankey diagrams, load profiles (histograms), types of energy audits- preliminary energy audit – detailed energy audit, questionnaire, energy audit instruments, Energy audit report writing

UNIT V ECONOMICS OF ELECTRICAL ENERGY UTILIZATION 8

Tariffs: General rule for charging the energy – Cost of electrical energy – various types of Tariffs.

Cost Analysis: Fixed and variable costs, interest charges, simple payback period, return on investment, net present value, internal rate of return, discounted cash flow methods, factors affecting analysis.

Lecture: 45, Tutorial: 0, TOTAL: 45 Hours

TEXT BOOKS:

1. N.V.Suryanarayana, "Utilisation of Electric Power", New Age International (P) Ltd., 1994.
2. J.B.Gupta, "Utilization of Electric Power and Electric Traction", S.K.Kataria& Sons, 2012.

REFERENCES:

1. R.K.Rajput, "Utilisation of Electrical Power", Laxmi Publications (P) Ltd., 2006.
2. S.Sivanagaraju, M.Balasubba Reddy, D.Srilatha, "Generation and Utilization of Electrical Energy", Pearson, 2010.
3. C.L.Wadhwa, "Generation, Distribution and Utilisation of Electrical Energy", New Age International Pvt. Ltd., 2003.
4. General Aspects of Energy Management & Energy Audit, Bureau of Energy Efficiency, Government of India.

U15EE702R POWER SYSTEM OPERATION AND CONTROL 2 2 0 3

COURSE OUTCOMES:

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

1. Explain the economic operation of power system, cost of electrical energy and types of tariff.
2. Explain Economic dispatch and Unit Commitment solutions to power system.
3. Model the single and multi-area systems and to analyze the system performances.
4. Model the various excitation system components, analyze the system performance and voltage control methods.
5. Explain the various components used in computer control of power systems and state estimation.

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3										2	3	
CO2	3	3		3	2		2			2		2	2	3
CO3	3	3	2	3	3					2		2	2	3
CO4	3	2		3	2			2		2		2	2	3
CO5	3	2	2		2	2	2	2	2		2	3	3	2

UNIT - I ECONOMIC OPERATION 9

System load variation - System load characteristics - load curves – daily, weekly and annual, load duration curve, load factor, diversity factor – problems - Need for voltage and frequency regulations in power system - basic P – f and Q – V control loops – Overview of Power system control- Overview of system operation.

UNIT – II SYSTEM OPERATION 15

Unit Commitment – Introduction - Statement of Unit Commitment (UC) problem - constraints in UC: spinning reserve, thermal unit constraints, hydro constraints, fuel constraints and other constraints - UC solution methods: Priority-list methods, forward dynamic programming approach, numerical problems only in priority-list method using full-load average production cost.

Economic dispatch – Input-output curve of a generating unit - Optimum economic dispatch (lossless) - Economic load distribution (Including losses) - solution by direct method and λ-iteration method (No derivation of loss coefficients) - Base point and participation factors - problems.

UNIT-III REAL POWER - FREQUENCY CONTROL 15

Fundamentals of speed governing mechanisms and modeling - regulation of alternators – speed-load characteristics - concept of control area - LFC control of a single area - static and dynamic analysis of uncontrolled and controlled cases - multi-area systems – two area LFC system modeling - static analysis - uncontrolled case - tie line with frequency bias control of two-area system-problems.

UNIT-IV REACTIVE POWER–VOLTAGECONTROL 12

Excitation systems - Introduction - Types of excitation systems - DC, AC, Static - Recent developments and future trends – Modeling of typical excitation system – static analysis of AVR loop – dynamic analysis of AVR loop – AVR root loci.

Reactive power and voltage control - generation and absorption of reactive power - Methods of voltage control - Shunt capacitors, Series capacitors, Shunt reactors-Comparison- synchronous condensers – Tap changing transformer.

UNIT-V COMPUTER CONTROL OF POWER SYSTEMS 9

Introduction - Energy management system (EMS) - Energy control center - SCADA-system hardware configuration –Master station-RTU- functional aspects – Power system security-Security analysis and control — State estimation- Weighted Least Square Estimation- State transition diagram – control strategies.

Lecture: 30, Tutorial: 30, Total: 60 Hours

TEXT BOOKS:

1. OlleI.Elgerd, "Electric Energy and System Theory – An Introduction", Tata McGraw Hill Publishing Company, New Delhi. 2nd edition 2017.
2. Allen J.Wood, Bruce F.Wollenberg, "Power Generation Operation and Control", Wiley – India, reprint edition, 2015.

REFERENCES:

1. V.K Mehta "Principles of Power System" S.Chand& Co Ltd, 2016.
2. M. JeraldinAhila, "Power System Operation and Control", Lakshmi Publications, 2018.
3. Mahalanabis, A.K., Kothari, D.P and Ahson, S.I., "Computer Aided Power System Analysis and Control", Tata McGraw Hill Publishing Company, New Delhi, 1990.
4. Kundur "Power System Stability and Control", McGraw Hill Pub. Co., 1994.

U15EE703R POWER SYSTEM SIMULATION LABORATORY 0 0 4 2

COURSE OUTCOMES:

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

- Solve problems in bus admittance matrix, bus impedance matrix and parameter computation.
- Model and analyze load-frequency control for single and multi-area systems.
- Solve problems in unit commitment and economic dispatch.

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		2	2	2							2	2
CO2	3	3				2					2		3	2
CO3	2	3				2		3					3	2

LIST OF EXPERIMENTS

1. Formation of Y_{bus}
2. Formation of Z_{bus}
3. Computation of line parameters.
4. Symmetrical fault analysis.
5. Unsymmetrical fault analysis
6. Power Flow Analysis –I: Solution of Power Flow Using Gauss-Seidal Method.
7. Power Flow Analysis –II: Solution of Power Flow Using Newton Rapshon
8. Economic Dispatch in Power Systems
9. Unit Commitment
10. Transient and small signal stability Analysis: Single Machine Infinite Bus System.
11. Load Frequency Dynamics of Single and Two Area Power Systems.

Total Hours: 60

U15EE902R POWER QUALITY ENGINEERING 3 0 0 3

COURSE OUTCOMES

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

1. Introduce power quality terms and definitions.
2. Understand the concepts on Power factor.
3. Introduce the concepts of Harmonics.
4. Implicit the awareness of harmonics and to know about devices for controlling harmonic distortion.
5. Expose the students to various types of power monitoring equipment.

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		2		1							3	2
CO2	2	3	2	2	2									3
CO3	2	3	2	2	2									3
CO4	2		3	2	2									3
CO5	2			3	2	1							3	2

UNIT I INTRODUCTION 9

Definitions – power quality, voltage quality, power quality issues – short duration voltage variations, long duration voltage variations, transients, waveform distortion, voltage imbalance, voltage fluctuation, power frequency variations – sources and effects of power quality problems – power quality terms – power quality and Electro Magnetic Compatibility (EMC), IEEE and IEC standards.

UNIT II POWER FACTOR 9

Introduction – active and reactive power – displacement and true power factor – power factor improvement – power factor correction – power factor penalty – advantages of power factor correction – voltage rise due to capacitance – application of synchronous condensers – static VAR compensators.

UNIT III HARMONICS 9

Harmonic distortion - voltage versus current distortion - harmonics versus transients - harmonic indices - harmonic sources from commercial loads - harmonic sources from industrial loads - locating harmonic sources - system response characteristics - effects of harmonic distortion.

UNIT IV APPLIED HARMONICS 9

Harmonic distortion evaluations - principles for controlling harmonics - where to control harmonics - harmonic studies - devices for controlling harmonic distortion - harmonic filter design: a case study - standards of harmonics.

UNIT V POWER QUALITY MONITORING 9

Need for power quality monitoring, evolution of power quality monitoring, brief introduction to power quality measurement tools – planning, conducting and analysing power quality survey.

Lecture: 45; Tutorial: 0; Total: 45 Hours

TEXT BOOKS:

1. Roger C. Dugan, Mark F. McGranaghan and H.WayneBeaty, "Electrical Power Systems Quality", McGraw – Hill, New York, 2nd Edition, 2002.
2. Sankaran.C, "Power Quality", CRC Press, Washington, D.C., 2002.

REFERENCES:

1. G.T.Heydt, "Electric Power Quality", Stars in a circle publishers, 1994, 2nd Edition.
2. Barry W.Kennedy, "Power Quality Primer", McGraw – Hill, New York, 2000.
3. Math H.J.Bollen, "Understanding Power Quality Problems: Voltage Sags and Interruptions", IEEE Press, New York, 2000.
4. Arrillaga.J, Watson.N.R and Chen.S, "Power System Quality Assessment", John Wiley & Sons Ltd., England, 2000.

U15EE909R SPECIAL ELECTRICAL MACHINES 3 0 0 3

COURSE OUTCOMES:

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

1. Explain the types and operating principle of synchronous reluctance motor.
2. Categorize the stepping motors and various modes of excitation with its characteristic analysis and drive circuit design for stepper motor.
3. Explain the operating principle and control techniques for Switched Reluctance Motor.
4. Explain the working principle and control techniques for Permanent Magnet Brushless DC motor
5. Analyse the characteristics of Permanent Magnet Synchronous Motor and explain its working principle.

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	3	2	1	3	2	1	1	1	3	2	3
CO2	2	3	2	3	2	1	3	2	1	1	1	3	2	3
CO3	3	3	2	3	2	1	3	2	1	1	1	3	2	3
CO4	2	3	3	3	2	1	3	2	1	1	1	3	3	3
CO5	3	3	2	3	2	2	3	2	1	1	1	3	3	3

UNIT I SYNCHRONOUS RELUCTANCE MOTORS 9

Constructional features – types: axial and radial flux motors – operating principles – advantages and applications – voltage and torque equations –phasor diagram – performance characteristics.

UNIT II STEPPING MOTORS 9

Constructional features – principle of operation – variable reluctance, permanent magnet and hybrid motors – torque equations – modes of excitations – static and dynamic characteristics – drive circuits – logic circuits using JK flip flops – application.

UNIT III SWITCHED RELUCTANCE MOTORS 9

Constructional features – principle of operation – static torque production – energy conversion loop – effect of saturation – torque speed characteristics – power converters and their controllers – rotor position sensing – closed loop control of SRM –applications

UNIT IV PERMANENT MAGNET BRUSHLESS D.C. MOTORS 9

Permanent magnet materials – demagnetization characteristics – permeance coefficient – limitation of DC motor – construction – EMF and torque equations – six-step commutation – controller for BLDC motor drive – torque speed characteristics – applications.

UNIT V PERMANENT MAGNET SYNCHRONOUS MOTORS 9

Principle of operation – ideal PMSM – EMF, torque and inductance equations – sine wave motor with practical windings – phasor diagram – circle diagram and torque – speed characteristics – power controllers – converter volt-ampere requirements.

Lecture: 45; Tutorial: 0; Total: 45 Hours

TEXT BOOKS:

1. R. Srinivasan, "Special Electrical Machines", Lakshmi Publications, fifth edition 2013.
2. E.G. Janardanan, "Special Electrical Machines", PHI Learning Private Limited, Delhi, 2014.

REFERENCES:

1. T. Kenjo, "Stepping Motors and Their Microprocessor Controls", Clarendon Press London, 1984.
2. T.J.E. Miller, "Brushless Permanent Magnet and Reluctance Motor Drives", Clarendon Press, Oxford, 1989.
3. R.Krishnan, "Switched Reluctance Motor Drives – Modelling, Simulation, Analysis, Design and Application", CRC Press, New York, 2001.
4. Benjamin C. Kuo, "Theory and Applications of Step Motors" West Publishing Company. 1983.

U15EE1004R ENERGY CONSERVATION AND MANAGEMENT 3 0 0 3

COURSE OUTCOMES

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

1. Assess role of energy in global economic development.
2. Explain methodology of energy audit and concept of instruments used.
3. Discuss various lamps and design energy efficient illumination schemes.
4. Apply energy conservation concepts in buildings.
5. Identify the energy conserving opportunities in utilities.

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	3	3		2			2	3	3	3	2
CO2	2	2	3	3	3				2			3	3	2
CO3	2	2	3	3	3	3			3		2	3	3	2
CO4	2	2	3	3	3	2		3				3	3	2
CO5	2	2	3	3	3		3			3		3	3	2

UNIT- I ENERGY SCENARIO AND BASICS 9

Classification of Energy – Purchasing Power Parity – Energy Security – Strategy to meet future energy requirements – Objectives and features for electricity act 2003 – Energy efficiency standards and labeling – Study of Global and Indian primary energy reserves – Study of energy scenario for India – Energy and environment – Global environmental issues – Types of Energy – Electrical and Thermal energy basics – Energy units and conversions.

UNIT- II ENERGY MANAGEMENT AND AUDIT 9

Definition and objectives of energy management and audit – Need for energy audit – Types of energy audit – Methodology for conducting detailed energy audit – ENCON opportunities and measures – Energy audit report. Energy costs – Benchmarking – Energy performance – Fuel and Energy substitution – Instruments and metering for energy audit – Basic principles, components of material and energy balance – Sankey diagram – Financial analysis terms – Payback period, ROI, NPV, IRR.

UNIT- III LIGHTING SYSTEMS 9

Introduction – Terms in Lighting and Illumination – Light sources - Lamp types – Arc Lamps, Vapour lamps – Incandescent lamp, Fluorescent lamp – Energy saving lamps – CFL, LED – Lighting design for interiors – Indoor and outdoor lighting schemes – Energy saving opportunities – Energy efficient lighting controls.

UNIT- IV ENERGY CONSERVATION IN BUILDINGS 9

Energy conservation building code (ECBC) – Compliance approaches – ECBC guidelines on Building envelope, HVAC system, Service hot water, Water pumps – Energy consumption in Escalators and Elevators – Building Energy Management Systems – Star ratings – Energy Efficiency Measures in AC and Lighting system.

UNIT- V ENERGY EFFICIENT OPPORTUNITIES IN UTILITIES 9

Introduction to Compressed air system components – Heat transfer loops in refrigeration systems – Standards and labelling of room air conditioners – Introduction to Fans, Blowers and Compressors – Types of pumps, Pump curves – Efficient operation of pumps – Components of cooling towers and its efficient operation - Introduction to DG set system.

Energy Efficiency and energy savings in Compressed Air System, HVAC system, Fans and Blowers, Pumping system, Cooling towers, and DG sets.

Lecture: 45; Tutorial: 00; Total: 45

TEXT BOOKS:

1. "General Aspects of Energy Management and Energy Audit", Bureau of Energy Efficiency, Fourth Edition, 2015.
2. "Energy Efficiency in Electrical Utilities", Bureau of Energy Efficiency, Fourth Edition, 2015.

REFERENCE BOOKS:

1. Chakrabarti A, "Energy Engineering and Management", PHI, 2011.
2. Murphy W R, McKay G, "Energy management", Elsevier, 2009.
3. Rajput R K, "Utilization of Electrical Power", Lakshmi Publications, 2006.

U15EE1006R RENEWABLE ENERGY SYSTEMS 3 0 0 3

COURSE OUTCOMES

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

1. Describe the power demand scenario in world level and impact of various renewable energy sources in satisfying power demand.
2. Explain the principle of operation and the application of solar system.
3. Outline in the components and to find the suitability based on the performance of wind energy and Conversion system, biomass energy system
4. Describe the principle of operation and the application of geo thermal power tidal power generation scheme, wave energy and OTEC scheme.
5. Illustrate the emerging energy generation systems of MHD, Thermal and fuel cells applications.

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		2					2		2	3	3	3
CO2	3	3	3	2	1	3	3	1	2		3	3	3	3
CO3	3	3	3	2	2	3	3	1	2		3	3	3	3
CO4	3	3	3	2	2	3	3	1	2		3	3	3	3
CO5	3	3	3	2	2	3	3	1	2		3	3	3	3

UNIT I INTRODUCTION 9

World energy futures–Energy sources and their availability – Energy cycle of the earth – environmental aspects of energy utilization – Energy plantation- Renewable energy resources and their importance- Prospects of Renewable energy sources.

UNIT II SOLAR ENERGY SYSTEMS 9

Introduction –Solar radiation and measurements-Solar energy collectors-solar energy storage systems- Solar pond and applications- Applications of solar energy: solar pumping, solar cooking, solar distillation and solar greenhouse.

UNIT III WIND AND BIOMASS ENERGY SYSTEMS 9

Introduction – Wind Energy conversion- Wind speed and power relation – Power extracted from wind – wind distribution and wind speed predictions – types of Wind power systems.
Bio mass conversion technologies-Biogas generation-Types of biogas plants-Bio gas from plant wastes- Utilization of Bio gas and applications.

UNIT IV GEO THERMAL, TIDAL AND OCEAN ENERGY SYSTEMS 9

Geothermal energy – Estimates of Geothermal power- site selection for geothermal power plant- Applications of Geothermal energy.
Origin of tides – Basic principle of Tidal power- Operation of a Tidal power plant. Ocean Thermal Energy conversion system- Open and closed OTEC cycles- Prospects of ocean thermal energy conversion in India.

UNIT V EMERGING ENERGY SYSTEMS 9

Magneto Hydro Dynamic (MHD) Power Generation- MHD systems and its operation. Thermo Electric power generation- Basic principle- Thermo electric power generator.
Thermonuclear fusion energy-Nuclear fusion and reactions- Advantages. Fuel cell-classification of fuel cells- Fuel cell based electrical power generation scheme- Applications.

Lecture: 45; Tutorial: 0; Total: 45 Hours

TEXT BOOKS:

1. Rai, G.D., "Non-Conventional Energy Sources", Khanna Publishers, Sixth Edition 2017.
2. Khan, B.H, Non- Conventional Energy Resources", Mc. Graw Hill Education Ltd, third reprint 2017.

REFERENCE BOOK

1. Rao S. Paruklekar,B.B, "Energy Technology – Non Conventional, Renewable and Conventional", KhannaPublishers,1994.
2. F.Kreith and J.F.Kreider, "Principles of Solar Engineering", McGraw Hill.
3. T.N.Veziroglu, "Alternative Energy Sources", Vol 5 and 6, McGraw Hill.
4. Mukund R.Patel, "Wind and Solar Power Systems", CRC Press LLC.

PREAMBLE
TO
Innovation, IPR and Entrepreneurship Development

The open elective course syllabus has been framed by Entrepreneurship Development Cell of Sona College of Technology on above mentioned title for even semester. The course covers a wide range of topics from Innovation, Intellectual Property Right and entrepreneurial Competitiveness and competency, basic requirements of setting of an enterprise/startups, factors influencing entrepreneurship, Barriers to Entrepreneurship & Concepts, Issues of Entrepreneurship Failure, Idea selection, Innovation & creativity, design thinking.

The course also covers identifying and selecting a good business opportunity, market survey & research, techno-economic feasibility assessment and preparation of preliminary project reports, management of working capital, costing, break even analysis, taxation, income tax, GST, provision of incentives, subsidies & concessions, entrepreneurship finance and angels & ventures capital fund etc. Benefit out of Government policies to small scale industries and business incubators.

U15EE1007R INNOVATION, IPR AND ENTREPRENEURSHIP DEVELOPMENT

3 0 0 3

COURSE OUTCOMES

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

- Acquire the knowledge for establishment of an enterprise and management,
- Derive the innovative ideas, right approach to the problem and arrive solution for problem with IPR and its legal aspects.
- Prepare the project report preparation and assessment of Business.
- Acquire the knowledge on costing, Techno-economic aspects, find out the sources of finance and opportunities in business.
- Identify the support system for Entrepreneurs by Government and venture capitals.

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1			3			3	3		3	3	3	3		3
CO2			3			3	3	3	3	3	3	3		3
CO3			3			3	3	3	3	3	3	3		3
CO4			3			3	3	3	3	3	3	3		3
CO5			3			3	3	3	3	3	3	3		3

UNIT I ENTREPRENEURSHIP & MOTIVATION 9

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth. Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self-Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

UNIT II INNOVATION, CREATIVITY, DEVELOPMENT PROCESS AND LEGAL ASPECTS 9

Innovation and Creativity- An Introduction, Innovation in Current Environment, Types of Innovation Sources of new Ideas, Methods of generating innovative ideas, creating problem solving, product planning and development process. Legal aspects of business (IPR, Labor law).

UNIT III BUSINESS 9

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

UNIT IV FINANCING AND ACCOUNTING 9

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, GST.

UNIT V SUPPORT TO ENTREPRENEURS 9

Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures - Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

Lecture: 45; Tutorial: 0; Total: 45 Hrs

TEXT BOOKS:

1. Khanka. S.S., "Entrepreneurial Development" S.Chand & Co. Ltd., Ram Nagar, New Delhi, 2013. 99
2. Donald F Kuratko, "Entreprenuership – Theory, Process and Practice", 9 th Edition, Cengage Learning, 2014.

REFERENCES:

1. Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill, 2013.
2. Mathew J Manimala, "Enterprenuership theory at cross roads: paradigms and praxis" 2 nd Edition Dream tech, 2005.
3. Rajeev Roy, "Entrepreneurship" 2 nd Edition, Oxford University Press, 2011.
4. EDII "Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development", Institute of India, Ahmadabad, 1986.
5. Innovation and Entrepreneurship Book by Peter Drucker,
6. James Larminie and John Lowry, "Electric Vehicle Technology Explained " John Wiley & Sons, 2003.

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VIII 2015R (CBCS)
Branch: Electrical and Electronics Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Practical							
1	U15EE801R	Project Work	0	0	24	12	360
					Total Credits	**12**	

Approved By

Chairperson, Electrical and Electronics Engineering BoS
Dr.S.Padma

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-

HOD/Electrical and Electronics Engineering, Eighth Semester BE EEE Students and Staff, COE